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UNITED STATES ARMY
April–June 2020
Volume 8/Issue 2

DENIED, DEGRADED, AND DISRUPTED SPACE OPERATIONAL ENVIRONMENTS

Table of Contents

UNITED STATES ARMY Aviation DIGEST
The Professional Bulletin of the Army Aviation Branch, Headquarters, Department of the Army, PB 1-20-2
April–June 2020
Volume 8/Issue 2

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About the Cover:

An Alaska Air National Guard HH-60 Pave Hawk, from the 210th Rescue Squadron, performs a simulated search and rescue pattern near the Little Susitna River in Alaska. The primary mission of the HH-60G Pave Hawk helicopter is to conduct day or night personnel recovery operations into hostile environments to recover isolated personnel during war. U.S. Army photo by LT Bernie Kale

The Command Corner

Our pacing and proximate threats pose risks to how we operate as aviators across the force. One way to counter these threats is to bring our aircraft lower to the terrain. Flying low and using terrain will certainly be to our advantage. However, this also brings inherent risks to our aircrews. We've discussed the necessity for deliberate training required across the force to execute these operations safely and effectively. We're taking steps every day to improve training for our combat aviation leaders and set conditions for the future—one example is the publication of the Terrain Flight Training Support Package. Another example, which is introduced in this issue, tackles how we will react to emergency procedures in the future.

An article I would like to highlight is the Emergency Response Methodology overview article as originally published in the *Flightfax* Special Edition #2 (April 2020) on page 4. This two-phased approach is a fundamentally new way to train and evaluate our crews in emergency procedures. It will build thinking aircrews who respond in context to the emergency, instead of relying on rote memorization of underlined steps. I'm excited to see the collective growth of our aircrews and branch as we adopt this new, informed approach to training.

Above the Best!

David J. Francis
Major General, USA
Commanding

Back to Table of Contents

U.S. Army photo by SGT Effie Mahugh

Aviation DIGEST

contents

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October–December 2020 issue articles due September 1, 2020 (magazine published on or about November 15, 2020)

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Authors are asked to observe posted deadlines to ensure the *Aviation Digest* staff has adequate time to receive, edit, and layout materials for publication.

*This article was originally published in Flightfax Special Edition #2 (April 2020) titled Introduction of the Emergency Response Methodology written by MG David Francis, Commanding General, U.S. Army Aviation Center of Excellence.

Flightfax
SPECIAL EDITION #2
2020
Online Newsletter of Army Aircraft Accident Prevention

Introduction of the Emergency Response Methodology

For more than 50 years, Army Aviation instructors have trained and evaluated crewmember responses to aircraft emergencies the same way. Central to this training was memorization and rapid execution of emergency action steps, and today's Army aviators are products of this approach. This methodology undoubtedly saved lives over the last half century, especially in earlier generations of aircraft lacking redundant systems and requiring constant inputs to maintain control. However, as our aircraft have evolved to become more capable and sophisticated, our approach to training flight crews must evolve as well.

In 2019, the United States Army Aviation Center of Excellence (USAACE) initiated a review of the Aviation branch's current emergency training approach. As Aviation formations continue to train for large-scale combat operations (LSCO) where crews must routinely operate close to obstacles and terrain, we have experienced several mishaps that highlight the need to update our approach to preparing aviators for emergencies. In all instances, but especially in the terrain flight environment, it is essential to respond to aircraft emergencies in context with the aircraft's flight profile. To help mitigate the risk associated with operating in these complex flight environments, USAACE developed a two-phased approach to change how crewmembers react to aircraft emergencies: the Emergency Response Methodology (ERM).

> **"Analysis from recent aviation mishaps indicates training deficiencies exist in crew reactions to emergencies, particularly in LSCO flight profiles with junior aircrew — Army Aviation branch identified the need for change."**

Phase 1 focused on revising Shared Rotary Wing Task 1070, Respond to Emergencies, to define a fundamental approach all helicopter crews use to survive any emergency. The emergency response method in the updated version of Task 1070 (known as FADEC-F) provides a fundamental logic appropriate for any emergency; it creates a construct for crews to communicate and respond to the emergency while prioritizing aircraft control above all else. This ensures crews respond in context to the situation rather than simply applying rote memorization in stressful situations where specific steps could be confused or accidentally omitted.

In all instances, crews must fly the aircraft first. This follows the old aviator adage of Aviate-Navigate-Communicate, but Task 1070 now codifies a formal, trainable response process for crews to follow. USAACE recently released all products related to Phase 1: Task 1070, as part of the 2020 publishing of all helicopter aircrew training modules; a standardization communication (STACOM) to clarify implementation guidance; and a training package to standardize training across the force. While priority for this effort focused on rotary-wing aircrew training modules first, the USAACE Directorate of Training and Doctrine will ultimately publish updated versions of

Back to Table of Contents

Task 1070 for all Army aircraft. By implementing an overarching emergency handling logic across the Aviation branch, Army aircrews will be better prepared to respond to emergencies in context with the profiles required in LSCO.

F ly the aircraft
A lert the crew
D iagnose the emergency
E xecute the emergency procedure
C ommunicate
F ly the aircraft

Phase 2 of this effort is ongoing and complements the emergency response method in Task 1070 by updating the look, design and content of current aircraft checklists. After a thorough analysis of sister-service and partner-nation aviation products, USAACE developed smarter and more intuitive crewmember checklists in a flight reference card (FRC) format, which include normal and expanded procedures as well as emergency procedures. The emergency section of the FRCs includes logically grouped, tabbed and color-coded sections for warnings, cautions, advisories and mission equipment malfunctions. The FRCs feature simplified emergency procedures and pertinent amplifying information supporting specific situations to aid in fault diagnosis and crew decision-making. By enabling our crews with updated FRC-format flight crew checklists, we will resource them with the intuitive and purpose-designed products necessary to expedite access to pertinent information during demanding flight conditions. Whereas Task 1070 (FADEC-F) will contextualize the crew's response to emergencies, FRCs will expedite access to pertinent information during an emergency, facilitating informed diagnosis and execution of emergency action steps.

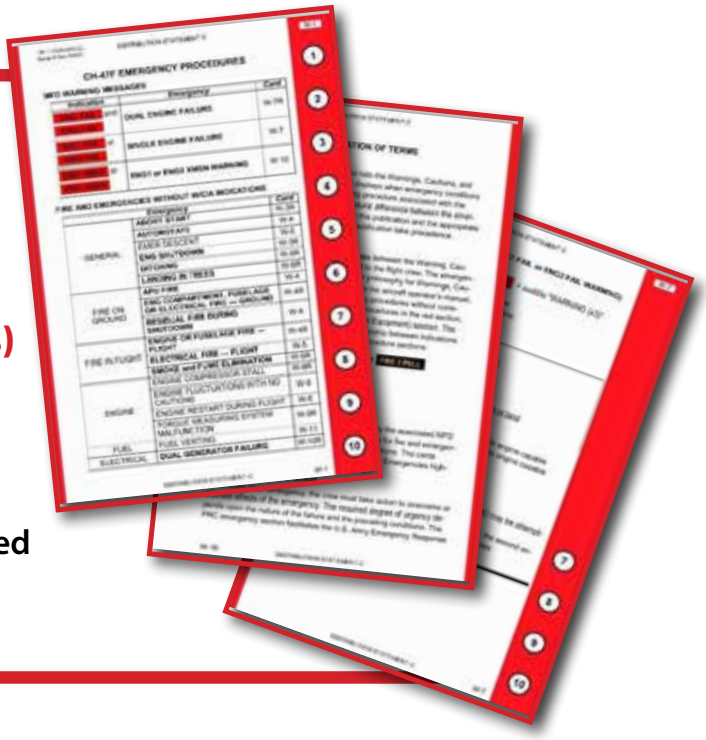
By redefining the approach we use to train crewmember responses to emergencies, Army Aviation will develop thinking crews that prioritize safe flight profiles over rote execution of underlined emergency procedures. This will enhance survivability and create a cultural shift in Army Aviation. This enterprise-wide change will not take hold unless we all commit to rethinking how we train and evaluate our crewmembers. Just as we want our crews to evaluate an emergency in the context of the situation, we must evaluate them the same way — in context. We must move past the days of associating

Phase 1: ATM Task 1070 Update

- April 2020 Rotary Wing ATMs
- Emergency Response Method

Phase 2: Aircrew CL Revision (FRCs)

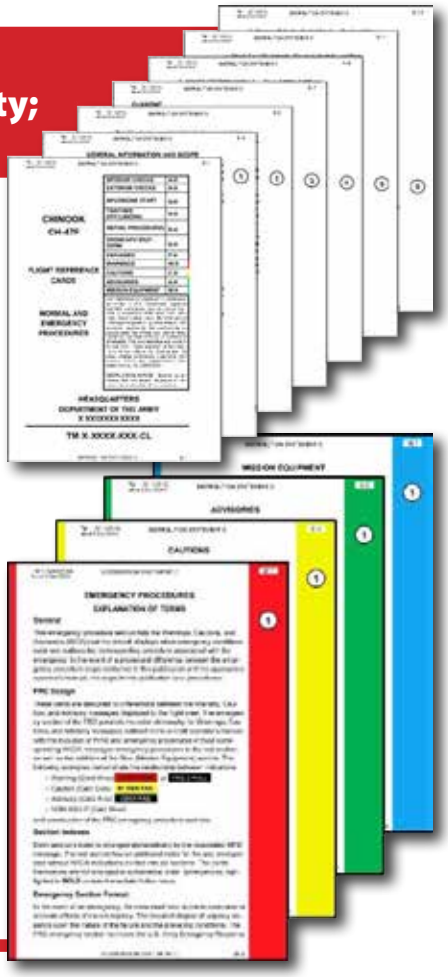
- FY21 deliver to the field
- Updated/simplified emergency procedures
- Quick-access tabs/colors with expanded information



proficiency with the speed of a crewmember's verbatim recitation of emergency procedures. Speed of execution does not necessarily equate to survivability. We must focus on developing thinking flight crews who, above all else, always fly the aircraft. ■

MG David J. Francis
Commanding General
U.S. Army Aviation Center of Excellence
Fort Rucker, Ala.

FRCs are subdivided into two books. Sections are color coded and tabbed, listed in order of intensity; organized by index on the cover page.



FRC Format

- Name of emergency
- Indications of emergency
- Immediate Actions/Action steps
- Subsequent actions
- Additional considerations

Book 1 - Normal and Expanded Procedures

- Exterior Checks
- Interior Checks
- APU/Engine Start Checks
- Taxi/Take Off/Landing Checks
- Engine/APU Shutdown
- Expanded Procedures

Book 2 - Emergency Procedures

- Warnings (Red)
- Cautions (Yellow)
- Advisories (Green)
- Mission Equipment (Blue)

Flightfax

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Back to Table of Contents

Amir Husain, author of "The Sentient Machine," speaks about artificial intelligence at USSOCOM headquarters on MacDill Air Force Base, Florida, Jan. 25, 2019. Husain's speech was part of the USSOCOM Commander's Speaker Series designed to inform and engage senior special operations forces leaders. Photo by U.S. Air Force MSgt Barry Loo

Artificial Intelligence and Machine Learning Implications for Army Aviation

By MAJ Jeff Warren (Ret.)

The changing operational environment (OE) continues to accelerate for United States Army forces, and in particular, for Army aviation. As peer threats proceed with artificial intelligence (AI) and machine learning (ML) research and advancement, the Army has adjusted its efforts in concert with the Department of Defense (DoD) direction to move forward with increased research and development of AI and ML. How will the advent and progression of AI and ML impact Army aviation in its efforts to overmatch competitors who have transitioned to force structures based on AI and ML? How does it impact risk to force and mission?

The answer to these questions is not an easy one. Since the technical ability to create and integrate AI and ML into our systems is moving faster than the human ability to define objectives, control measures, moral decision making, ethics, and biases for these systems, there are risks. While AI and ML are stated to provide a faster decision and action cycle compared to human beings, it is not without risk. Some of these risks involve unexpected and currently unknowable consequences that developers can overlook in the rush to produce the systems the DoD wants. In the case of Army aviation, one could see the progression from manned-unmanned teaming to fully unmanned aircraft utilizing AI and ML to execute missions. While there would be a "man" in the loop, the unmanned systems would in one instance reduce the risk to Soldiers, since none would be on board the aircraft. It could be said that this reduction in risk to humans would provide an increased capability, as the AI/ML-operated aircraft could accept more risk and take on missions that commanders would be hesitant to unleash manned systems to execute.

In this article, I have attempted to detail some implications of incorporating AI/ML into aviation systems, including:

- The need for defined and clear objectives before applying AI/ML into aviation systems;
- Proper mission training for AI/ML execution;
- Lack of moral decision making in AI/ML-led missions; and
- Programmed bias management.

IMPLICATION I

Charging forward to incorporate AI and ML into aviation systems without a clear objective.

To fully appreciate the application of AI/ML to aviation systems requires leadership to determine exactly what the objective is. The development and details of the how, what, who, when, and where of what we will use the AI/ML for must come first.

In aviation systems, if the objective is to reduce risk to force and mission while functionally speeding up the decision process to strike before the enemy, we need a detailed definition.

Some reasonable questions that will surface in building the objectives could be: Are Army aviation systems going to switch to unmanned systems? What decisions will the AI/ML be allowed (deciding what targets to attack/deciding what individuals are civilian or enemy/deciding acceptable risk)? Will AI/ML-controlled aircraft be able to carry humans? How will the algorithms be reviewed and tested to ensure they meet the objectives? How will we determine if the algorithm used is biased? With a human in the loop for control, will the decision process still be faster?

IMPLICATION II

Controlling AI/ML decision making, which commanders and operators don't understand, while executing missions.

The Army does not currently have a training program to teach full comprehension regarding the use of AI/ML in aviation systems and its associated implications. To execute missions utilizing assets with AI/ML systems, Army leaders and operators must be trained. The course content requires an Army aviation objective of what the AI/ML systems mission is. From this information, the course materials and requirements are derived just as in any others we currently train.

Pushing forward in AI/ML and not producing the necessary training first can only lead to poor results. In this case, the results can prove catastrophic to the combined arms team mission success.

IMPLICATION III

AI/ML moral decision-making design challenges.

This is self-explanatory for any Army aviation leaders who brief missions and/or approve missions and launch aircraft. Artificial intelligence-operated aircraft don't have the luxury that non-AI missions have, which is the value of a human being on board who is well trained to make the best decisions possible and who understands the consequences of a bad decision for the crew, mission, or supported unit.

The AI makes its decisions based on algorithms and feedback loops. If those algorithms or feedback loops are biased, the AI may not be able to make moral decisions, such as when a target should or shouldn't be engaged or to determine if it should leave Soldiers behind in a hot pickup zone to preclude loss of life and aircraft.

These decisions are hard ones, and the human element typically produces the best decision making when confronted. Left to its own data and feedback loops, AI may or may not make the best decision. This is a challenge for the leaders, and much effort should be put into making sure it has been thoroughly adjudicated at senior levels.

IMPLICATION IV

AI/ML programmed bias management.

The systems that will promulgate in the race to match or overmatch our peer threats' AI/ML capabilities may not be fully designed to minimize the bias in programming and algorithms. One must remember that these systems are based on humans programming the instructions and algorithms they use, whether in a very narrow, limited task or for advanced systems in very wide and difficult task.

For advanced systems that are expected to dominate the OE of the

Back to Table of Contents

near future, competition of the actors to have systems that think faster, decide faster, and act faster may not have the reduction in bias necessary to preclude unforeseen consequences. If we move too fast, it can certainly be possible that systems and biases may not be well thought out, resulting in systems failing to act in our best interest. Biases that might be integrated could be from the person programming the code—or in the case of AI/ML autonomous systems—improper feedback loops that just reinforce a bad decision made by the AI.

An analogy of programmer bias can be found in the 2003 movie, Tron 2.0. The programmer creates two algorithms, which he instructs to support his effort to create a perfect computer system. The unforeseen consequence of his programming is that the algorithm realizes humans are not perfect; therefore, it took on the task of destroying them.

An example of an improper feedback loop bias would be if your unmanned aircraft operating under AI is tasked with a mission to destroy a narco-terrorist drug manufacturing building. The AI executes the mission and receives feedback from its sensors, the building is destroyed, and it reinforces the decisions it made. What it doesn't gain feedback on is from external source data. Following this attack, a ground team checks the compound for battle damage assessment. They find that there were no chemicals or machines in the building, but there was an indigenous family of 12 using the building as shelter. The feedback data of the building being occupied by civilians and no active drug operation do not make it back into the AI algorithm; therefore, without external data being used to make improvements to the algorithm, the AI just continues to reinforce improper decision making.

WHERE DO WE GO FROM HERE?

Artificial intelligence and ML are hot buzz words that dominate our discussions of future systems and how they will operate. They certainly can bring more to bear in the future OE with threats from peer and near-peer competitors who are rapidly moving forward in developing the technology now. Will competitors be any better at identifying and overcoming the implications of their AI/MI use? Probably not, but they may have a different perspective based on their geopolitical environment and as such, may not care if AI requires a steep learning curve with losses to personnel and equipment.

For Army aviation, we must ensure we take the right actions so that our learning curve is shallow. We should develop the objectives of what AI/ML will provide to aviation and the supported unit in combined arms maneuver. Within this scope, the training development and courses should go hand-in-hand with development and testing of AI/ML aviation systems. Artificial intelligence requires more than just a new equipment training session at unit locations. Artificial intelligence training must encompass institutional courses that provide the commanders, staff, and operators the necessary information so they can effectively manage and control operations in understanding what AI can do and what its limitations are.

If we are going to join the race to establish AI/ML into our aviation systems for use in the future OE, Army leadership has an imperative to ensure the appropriate training programs are built and incorporated now so that aviation commanders and units can effectively execute their decisive action mission in combined arms maneuver.

Jeff is a retired Army Master aviator with over 20 years of service. He conducted operations as a maintenance test pilot, maintenance manager, and instructor pilot in the UH-60. He served in air cavalry, assault helicopter, and MEDEVAC units throughout his career. He served division assignments with the 7th ID (LIGHT), 2ND ID, the 101st Airborne Division (AIR ASSAULT), and the Aeromedical Research Laboratory. He has worked with the Directorate of Training and Doctrine producing doctrinal publications, MEDEVAC proponency as a subject matter expert, and the Combat Readiness Center as an aviation technical writer. Additionally, Jeff holds a master's degree in management.

Back to Table of Contents

The History and Impact of the Militarized Space Domain

By CW4 Leonard Momeny

A Soyuz booster rocket launches the Soyuz MS-11 spacecraft from the Baikonur Cosmodrome in Kazakhstan on Monday, Dec. 3, 2018, Baikonur time, carrying Expedition 58 Soyuz Commander Oleg Kononenko of Roscosmos, Flight Engineer Anne McClain of NASA, and Flight Engineer David Saint-Jacques of the Canadian Space Agency (CSA) into orbit to begin their 6 1/2 month mission on the International Space Station. Photo credited to NASA/Aubrey Gemignani

Many of us in the Army, along with members in every other branch of the military, have historically focused on just three operational domains: air, land, and sea. As Army aviation, our primary domain of focus is the land, and this is because our very existence is tied to the support of the Ground Force Commander. However, the reality of an ever-changing world has given senior leaders reason to shift the attention of us all to the "interrelationship of the air, land, maritime, space, and the information environment (including cyberspace)" and better develop "cross-domain understanding" of the greater operational environment (Department of the Army, 2017, p. 1-6). The goal of this article is to enhance the cross-domain understanding of the aviation branch as a whole through the focusing on the specifics of the space domain and its history. No, not the glamourized history of space exploration, but the seldom-discussed history of the militarized space domain and both the growth and impact of those capabilities on military operations.

Back to Table of Contents

THE BIGGEST CONNECTION FOUND BETWEEN THE MILITARY AND SPACE BEGAN IN THE CLOSING MOMENTS OF WORLD WAR II DURING OPERATION PAPERCLIP.

THE SPACE DOMAIN

Space is considered to be the ultimate high ground. More so than that, our global society has become absolutely dependent upon the space domain. This dependence extends well beyond simple mundane things, as space influences areas such as communications, weather forecasting, banking, navigation, and research. Sure, there are wonderful areas in the space domain that relate to exploration and the advancement of science; however, to lose one of those assets, while terrible, would not be considered catastrophic to national or even global security. Science-oriented assets aside, the loss of satellite communication or even global positioning system (GPS) navigation assets could be enough to spark national- and global-spread calamity. That is because senior leaders recognize and acknowledge both the importance and our ever-growing dependence on the space domain.

Field Manual 3-14 (2019), *Army Space Operations*, defines the space domain in the following manner, "the space domain is a physical location where military, civil, and commercial space activities are conducted and the upper limit extends infinitely outward" (p. 1-1). Though not kinetic in nature, the military does conduct operations within the space domain to achieve U.S. national security objectives. It will shock some readers to know that these activities are not a recent development through the advent of the sixth branch of the military, the United States Space Force, or USSF. Instead, the U.S. military, and yes even the Army, have been in the space business for quite some time, and it all began during World War II.

THE WAR FOR SPACE BEGINS: 1940S–1970S

The biggest connection found between the military and space began in the closing moments of World War II during Operation Paperclip. Operation Paperclip was the codename given to the program focused on the acquisition and transportation of German rocket scientists back to the United States (Nelson, 2009). As the war in Europe was ending, the United States and Soviet Union began sweeping through Germany in an effort to potentially reap benefits in technology pioneered by German rocket scientists. The even-

The chief of space operations for the U.S. Space Force displays the service's uniform nametapes in the Pentagon Jan. 17 in Arlington, Virginia. The Space Force is the sixth branch of service that was established during the signing of the National Defense Authorization Act on Dec. 20, 2019. U.S. Air Force photo by TSgt Robert Barnett

tual bounty was to be split between the United States and Soviet Union, with Wernher Von Braun, the head of the famed Nazi Germany's "Peenemunde scientists" going to the United States (Nelson, 2009, p. 103).

It is thought that the "German scientists taken back to the United States comprised the heart and soul of Hitler's V-2 weapons program" (Hervey & Momeny, 2019, p. 38). The scientists in question had created the V-2 (Vergeltungswaffen-2–Vengeance Weapon 2), which at the time was the most sophisticated rocket ever built. Though not incredibly successful, the V-2 marked the beginning of what has been termed the "Rocket Age" (Nelson, 2009). Still, it's important to note that not all the scientists went with the United States Army, and very skilled personnel that aligned with Soviet Union following the conclusion of World War II would eventually accompany Sergei Pavlovich Korolyov in an effort to build rockets for the then Soviet Union. Rocketry was being heavily pursued by the Soviets in an effort to have something comparable to the American H-bomb and this effort would eventually lead to the development of Sputnik, the world's first orbiting satellite (McDougall, 1997, p. 46–56).

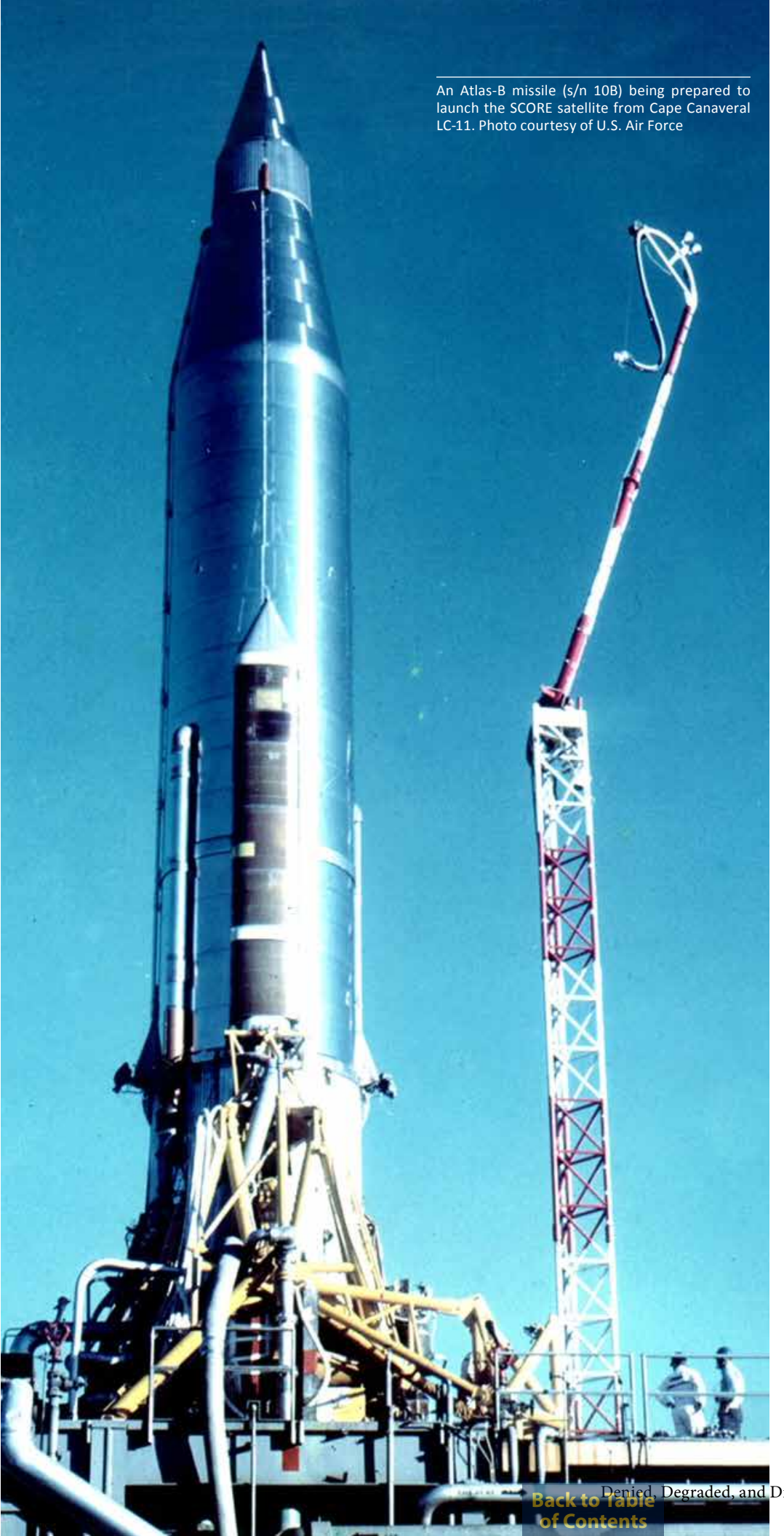
Sputnik sent a scare through the United States, and by 1958 it motived then President Eisenhower to create the National Aeronautics and Space Administration, an agency to exist outside of the military that would pursue space exploration (Brzezinski, 2007). The mere act of orbiting an artificial satellite seemed impossible during those days and yet, the Soviets had accomplished the task all the same. This effort by Soviet Union motivated every facet of the United States government to pursue space. Rockets were being created, one after another, and both military and intelligence agencies saw the potential of space-based capabilities to somehow increase their agencies' potential to better fulfill their national security-oriented roles.

The three men responsible for the success of Explorer 1, America's first Earth satellite which was launched January 31, 1958. At left is Dr. William H. Pickering, former director of JPL, which built and operated the satellite. Dr. James A. van Allen, center, of the State University of Iowa, designed and built the instrument on Explorer that discovered the radiation belts which circle the Earth. At right is Dr. Wernher von Braun, leader of the Army's Redstone Arsenal team which built the first stage Redstone rocket that launched Explorer 1. Photo Credits: NASA

This action, first initiated by the launch of Sputnik, was spurred ahead after the success of the first United States satellite, Explorer 1 (Nelson, 2009). Explorer 1 made everyone realize that data could be collected and even transmitted via vehicles in orbit rather than relying on traditional medium for gathering information, e.g., aerial reconnaissance flights. Hervey and Momeny (2019) note that "following the success of the Explorer missions, the U.S. Army went on to contribute to the U.S. space program through efforts such as the Signal Communications by Orbital Relay Equipment (SCORE)" (p. 40).

Flights by the U-2, a Central Intelligence Agency/Air Force spy plane, an aircraft known for its ability to reach extreme altitudes from which to conduct aerial reconnaissance,

Back to Table of Contents



An Atlas-B missile (s/n 10B) being prepared to launch the SCORE satellite from Cape Canaveral LC-11. Photo courtesy of U.S. Air Force

was finally receiving competition from the first spy satellite, Corona. Corona was a very early version of space vehicle that would become known as a remote sensing satellite. The Corona series of vehicles could conduct satellite-based photographic reconnaissance via a polar orbit, utilizing over half a mile worth of film, thus providing valuable intelligence concerning other nations' activities without putting vehicle or pilot at risk. This is because Corona was not detectable by ground-based stations, nor did it require a pilot to operate.

It was intelligence gathering without the risk though initially, it could not peer through obscurations at altitude, and offered both the United States military and intelligence organizations a distinct advantage over their Soviet counterparts. This was an obvious boon for national security, and though nonkinetic in nature, marked a beginning militarization of the space domain. Funny enough, the struggle to see through obscurations with intelligence assets so concerned senior leaders that the Air Force had been considering creating a manned orbital observation post via a little known program called MOL, or Manned Orbiting Laboratory (McDougall, 1997; Nelson, 2009). Thankfully, that program would eventually be canceled, thereby putting a stop to the most complicated rotating guard duty known to man.

It is clear that the space domain went through an obvious explosion of technological capability, beginning in the 1940s but lasting well into the early 1970s. The most obvious military benefits had been seen in the gradual shift between total reliance on high-risk aerial reconnaissance flights to the more risk-averse Corona missions. From early efforts into satellite communications, as seen through SCORE, to risk-mitigated intelligence gathering, it was this period that marked the initial militarization of space. Our utter reliance on the space domain was not quite present, as many remained distrust-

Back to Table of Contents

ful of unknown or limited technology. Still, the potential threat and various advantages found in space were, by the close of the 1960s, becoming obvious to everyone, so much so that international attention was drawn to the need of governing laws regarding the domain. While the eventual Outer Space Treaty of 1967 was drawn up and approved by many different nations, thereby providing an "obligation to use space for peaceful purposes," it did not prevent leaders from continuing to seek military-enhancing capabilities from space-based assets (Sellers, Astore, & Giffen, 2005, p. 667).

SPACE-BASED ENABLERS OF MODERN WARFARE: 1980S–1990S

If the previous period of history surrounding the space domain was about rapid evolution and exponential growth, then the period of the 80s and 90s was about product refinement. It was no longer a question of whether or not one could utilize space but instead, how well. During these decades, the world would marvel when the *STS, or Space Transportation System*, finally took flight in 1981 (Sellers et al., 2005). The casual reader would recognize the *STS* as the *Space Shuttle*, but even the shuttle flew missions that were specific to the Department of Defense, or DoD, e.g., *STS-4, STS-51C, STS-51J*, and about eight other flights (Howell, 2016).

Hard to believe the venerable shuttle was running DoD missions, but there it is, and very little information is available even today. Crews would simply take off and deploy various vehicles into orbit from the very same cargo bay that released the Hubble Space Telescope to peer into the deepest reaches of the universe. One such vehicle deployed during this time closely resembled the Hubble and was dubbed, KH-9 Hexagon, or Keyhole-9. This "particular KEYHOLE was declassified in 2011 and put on view for one whole day at the Smithsonian's Air and Space Museum" (Tyson & Lang, 2019, p. 228). Famed Astrophysicist, Neil deGrasse Tyson notes in his book, "*Accessory to War*," that "KH-9 looked like a twin of the Hubble," and "the biggest differences between the two were that the Hubble focuses at infinity and takes prolonged exposures of extremely dim and distant objects, while the KH-9 focused mostly between 100 and 200 miles down on Earth's surface and took quick exposures" (Tyson & Lang, 2019, p. 228–229). If that does not grab a reader's attention then nothing will, as a DoD big brother of the Hubble certainly sounds like a unique contribution to the early militarization of space. Again, things to this point had maintained a non-kinetic state, but the next element would later go on to enhance the future of kinetic strike capability on Earth, GPS, and the forthcoming constellation.

Space Shuttle Columbia lands at Edwards Air Force Base runway 22. Photo Credits: NASA

Back to Table of Contents

THE FIRST SPACE WAR

The value of the space domain came to full actualization during the Gulf War. By 1991, the idea of fighting in a desert seemed initially intimidating. To make matters worse, the constellation of GPS satellites was not quite up to its full complement, fielding only 16 of an intended 24 (Tyson & Lang, 2019, p. 332). The initial mission analysis for the coming invasion of Iraq focused heavily on the potential challenges surrounding navigation of desert terrain under night conditions. Planners knew that Iraqi EW, or early warning assets, had to be taken out very quickly to weaken the effectiveness of Iraqi air defense. Only Apaches could take out the sites, but MH-53J Pave Lows were selected to execute flight lead duties because of their GPS-enabled airframes. This deep operation would eventually be launched by Task Force Normandy, a compilation of assets from both the Air Force and the Army (Berg & Tilley, 2019, p. 139–152). To this day, it remains a tremendous example of how to properly plan and execute a successful deep operation, and it was only enabled by Precision, Navigation, and Timing (or PNT) provided by space-based assets.

Due to the success of Task Force Normandy, specifically the space-based PNT utilized by the MH-53J, GPS assets and capability are now considered mission essential. Navigation for aircraft was not the only component of space-based capability on display during this fight. B-52Gs would launch "thirty-five GPS-equipped cruise missiles at key parts of the communications infrastructure" and "GPS-equipped Air Force F-117A(s)" would deploy various munitions as well (Tyson & Lang, 2019, p. 333). The Gulf War, what many consider to be the very first space war, was a showcase of space-integrated technology. This moment in history clearly demonstrated that though currently supported by vehicles lacking kinetic capability, "the space domain supports and enables all other domains" and "space operations are fundamental to all domains" including "all aspects of planning, preparation, integration, and execution" (Field Manual 3-14, p. 2-1). Those who owned space controlled the high ground in a fight, and with that revelation came the next evolution in space warfare: offensive measures to counter a perceived advantage of an enemy force.

DYNAMIC LEAPS IN SPACE-BASED MILITARY CAPABILITIES: RISE OF ANTISATELLITE WEAPONS

With the incredible benefits of space made clear to all by the execution of precision strikes during the first space war, it was not long until the world was to bear witness to the first offensive weapon of the space domain. The search for ASAT technology, or antisatellite weapons, began as early as 1962 through the advent of early interceptor technology (Tyson & Lang, 2019, p. 258). However, it was not until October 1985, "an American ASAT-a small missile launched from an F-15 fighter jet—took out an aged American scientific satellite, spreading debris throughout low Earth orbit" (Tyson & Lang, 2019, p. 258).

It's shocking to think that as early as 1985 there has been technology able to intercept vehicles in orbit moving at speeds of about 17,500 miles per hour. The idea of a satellite being taken out of service through a deliberate attack does not at first sound completely intimidating; however, on second thought, it's easy to change one's mind. After all, satellites run the majority of navigation systems, communication systems, global transactions, etc., and to lose one could in fact throw military operations and even day-to-day activities of global governments into complete chaos. Readers will not be surprised to hear that the United States is not the only country with ASAT technology. Tyson and Lang (2019) noted that the "most striking demonstrations of ASAT power in recent years" were carried out by various countries on their own satellites and include the

A B-52G Stratofortress bomber aircraft of the 1708th Bomb Wing takes off on a mission during Operation Desert Storm. Photo courtesy of Secretary of the Air Force Public Affairs

likes of the following: China (2007), United States (2008), Russia (2015), and most recently, India (2019) (p. 259). The problem with these weapons and the threat of losing a satellite is far outweighed by the dangers of secondary effects as a byproduct of the kinetic intercept vehicles. Debris has been added with every ASAT test to various levels of orbits surrounding the Earth, ultimately contributing to a potential future space domain that is completely denied.

The U.S. Air Force began developing this air-launched anti-satellite missile (ASAT) to destroy enemy satellites after the USSR demonstrated its ability to attack satellites in space. At the tip of this two-stage missile was a Miniature Homing Vehicle (MHV). Once it separated from the missile, the MHV homed in and destroyed a satellite by direct collision, rather than by detonation of a warhead - a concept known as "hit-to-kill." The ASAT's maximum intercept altitude was at least 560 kilometers (350 miles). Five ASATs were flight tested, with the one launched from an F-15 fighter in September 1985 successfully intercepting and destroying an orbiting NASA satellite. The Air Force cancelled the ASAT program in the late 1980s. Boeing made this un-flown ASAT, and the U.S. Air Force transferred it to NASM in 1990. Picture taken at the National Air and Space Museum's Steven F. Udvar-Hazy Center in Chantilly, Virginia, USA

SPACE: THE CONTESTED DOMAIN

The modern world is not prepared to deal with the threat of a contested space domain and yet, we continue to inch closer and closer to such a potential future. The initial challenges of simply operating in space seemed insurmountable just a few decades ago, and then the domain was quickly militarized. The ASAT then rose to become a capability easily duplicated by any spacefaring nation, thereby challenging the notion of space supremacy. Still, completely ignoring the threat of a contested space domain various industries and their technologies continued to integrate space-based assets into the designs of everything. Revisions of equipment to be better and faster using space assets ultimately led to the creation of entire generations of people almost completely dependent upon the utilization of the space domain for facets of their very survival.

Space dependency means that nations, to include their militaries, cannot sit idly by and watch others surpass them in space supremacy. To do so would mean that those who win in space will also be those who enjoy supremacy on Earth. Precision, navigation, and timing from space-based assets provide nations and their militaries the ability to arrive at the right place, at the right time, and to do so without getting lost, thus achieving a tactical advantage. A contested domain insists that the advantage of space has been removed from use in a fight, and if not via ASAT, then how? The next evolution is far scarier than anything previously covered.

Russia has demonstrated tremendous spacefaring capability ever since the early days of the Rocket Age. Their prowess for achieving tremendous feats in space has not changed one degree. On August 23, 2017, a Russian satellite named Kosmos 2519 seemed to "give birth to a smaller sibling, dubbed Kosmos 2521," which seemed to deploy and maneuver all on its own (Sciutto, 2019, p. 179). Later on in 2017, Kosmos 2521 released "its own smaller sibling, Kosmos 2523," dubbed again as another inspector satellite. There they were, Russian satellite nesting dolls, simply orbiting around other vehicles…conducting unknown activities. This was not the only occurrence, as recently explained by General Raymond, commander of the USSF, on 10 February 2020. At a press conference, General Raymond remarked about recent actions by Russia, similar to the aforementioned activities of 2017, were occurring again, but this time the sibling satellites were caught orbiting a U.S. spy satellite (Hennigan, 2020). It is safe to say that Russia now has the ability to actively contest the perceived space supremacy of the United States. The

Back to Table of Contents

militarized domain of space appears to be evolving.

CONCLUSION

The militarization of the space domain is not new. The intent of this article is to educate readers on the fact that the USSF does not represent our nation's initial step into a militarized space domain. Instead, a broad and dynamic history has been laid before the reader in an effort to educate on the topic of space. Army aviation, just like every other element of the joint force, cannot afford to turn a blind eye to our space dependency, and must instead act to sharpen skill sets that would ultimately allow for continued operations, even in a denied space domain. Why, you ask? The proliferation of ASATs and other technologies, such as the Russian nesting doll-like satellites operating unchallenged around American space-based assets, should give all warfighters within the U.S. military pause to consider the idea that the contested space domain is a serious issue. Simply learning about the history of the militarized space domain is an important initial step. Multidomain operations are the new reality, and knowledge is the first step in understanding the complexity of the problem set surrounding the space domain. We cannot ignore the challenges of the contested space domain, but instead must continue to rise above the best in order to meet these new challenges with vigor and creativity.

United Launch Alliance's Atlas V rocket carries the Solar Orbiter into space as it launches on Feb. 9, 2020, at Cape Canaveral Air Force Station, Florida. The Solar Orbiter is a Sun-observing satellite, which is intended to perform measurements of the inner heliosphere and perform close observations of the polar regions of the Sun. U.S. Air Force photo by Joshua Conti

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Back to Table of Contents

HOW PREPARED IS YOUR UNIT TO OPERATE IN AN IADS ENVIRONMENT AT THE NATIONAL TRAINING CENTER?

By CPT Wesley D. Henderson

Eight AH-64 helicopters (Apache Attack helicopter), one UH-60 helicopter (Black Hawk helicopter), one CH-47 helicopter (Chinook helicopter), three Gray Eagle UAS (unmanned aircraft systems), and four Shadow UAS totaling more than $688 million of damage were notionally destroyed during one 14-day training rotation at the National Training Center (NTC) by an Opposing Force's (OPFOR) Integrated Air Defense System (IADS) replicating a myriad of the United States' most capable peer adversaries. Think about those numbers (which do not include the notional loss to human life), and consider if you and your aviation task force (ATF) are prepared to enter the operational environment of an adversary who has prepared for decades to face one of its worst fears, U.S. air superiority.

This enemy/adversary, which at the NTC, is represented by a ruthless, free-thinking, freewill OPFOR, replicates one of the densest, multilayered, redundant, and overlapping IADS environment that U.S. forces can face while still in a training environment. The statistics previously listed are not unique to that one training rotation; unfortunately, they are a reoccurring observation at the NTC. Why is that? How can a unit who trains for months to face such a daunting threat depart after 14 days of intense fighting with such devastating numbers? As can be imagined, the answer is not simple and involves a multitude of issues that this article will seek to examine.

This article will limit discussions to observations and lessons learned that can be applied to planning processes and procedures occurring before aircraft initially launch for missions. I will start the discussion with an overview of the threat, intelligence, and fires support in an IADS environment, continue with how ATFs utilize the military decisionmaking process (MDMP) to enable operations, and end with aircrew debriefs following conclusion of a mission.

OPFOR REPLICATION OF AN IADS ENVIRONMENT AT THE NTC

What is an IADS environment? How do the OPFOR at the NTC replicate that environment at the tactical level? What is an IADS purpose and end state? As stated in Training Circular (TC) 7-100.2, "Opposing Force Tactics," "The objective of OPFOR tactical air defense efforts is to reduce the effectiveness of enemy air attacks and prevent enemy air action from interfering with maneuver force operations" (Department of the Army [DA], 2011, p. 11-1). In this instance, IADS can be described as the overlapping; redundant; and multilayered protection of critical infrastructure, equipment, and personnel from an air threat. Sounds simple and straightforward, right? However, the OPFOR at the NTC are charged with replicating a threat similar to a military force whom Dr. Lester Grau, one of the foremost experts on Russian warfare, describes as well

A Pantsir-S1 (foreground) and an S-400 (background) at a Russian Military base in Syria, December, 16, 2015. Photo courtesy of the Russian Ministry of Defence

Back to Table of Contents

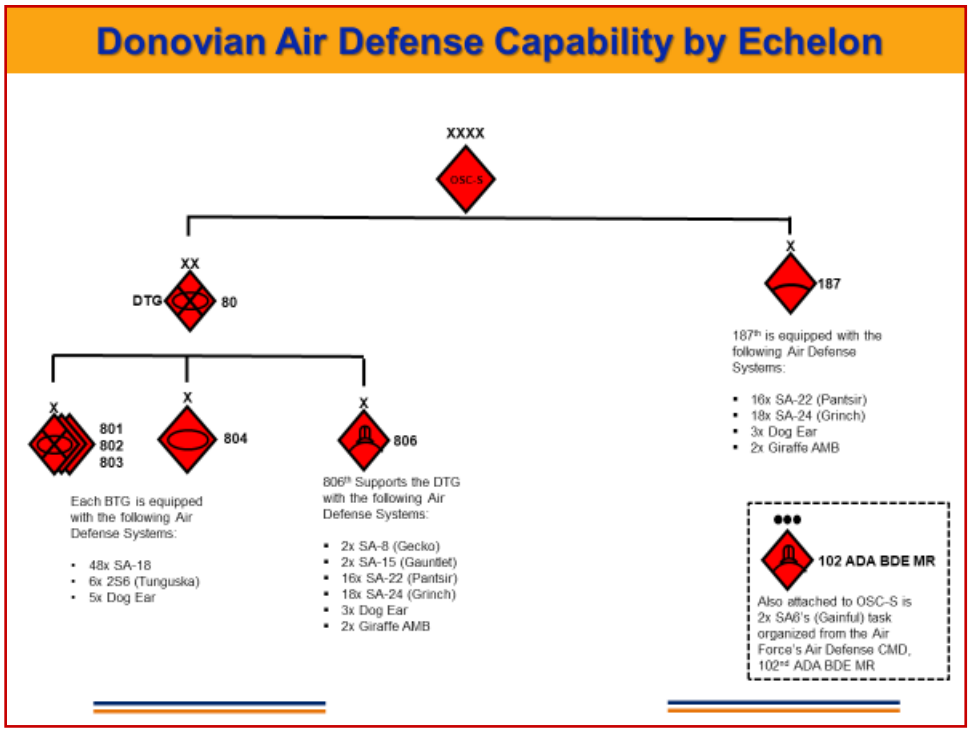


Figure 1. Donovian air defense capability by echelon (Henderson, 2019a).

having "...fielded the most modern integrated ground-based tactical air defense system on the planet" (Grau & Bartles, 2017, p. 101). In order to replicate an IADS environment as capable as that described by Dr. Grau, the OPFOR follow three key and related concepts described in detail in TC 7-100.2:

(1) ...every unit is immediately responsible for defending itself from aerial observation and air attack by whatever means are available;

(2) ...air defense is an integral part of combined arms combat; and

(3) ...air defense weapons, radars, and associated equipment cannot be regarded as single pieces of equipment or even units engaged in combat actions but as parts of an IADS (DA, 2011, p. 11-1).

The key intent of an IADS, and often a pitfall for rotational training units (RTUs) at the NTC, is the concept of an all-arms effort by the OPFOR to protect itself utilizing any means available. Most units are comfortable assessing and understanding the OPFOR threat from tracked or wheeled air defense systems such as the SA-6 Gainful, SA-8 Gecko, SA-15 Gauntlet, 2S6M Tunguska, etc., but they fail to account for the threat from direct fire systems such as anti-tank systems or even main battle tanks.

Figure 1 is a snapshot I prepared of the Donovian Air Defense order of battle that RTUs could face when confronting the Donovian Armed Forces.

As shown in Figure 1, the IADS environment replicated at the NTC is both multilayered and dense. Understanding the air defense order of battle is only the beginning. The S-2 (intelligence officer) and the aviation mission survivability officer (AMSO) must also describe to the TF commander and staff how the OPFOR are likely to employ these assets to protect themselves. Have the S-2 and AMSO created threat templates on which to base their assessments? Where can you expect the OPFOR to place their 2S6Ms while on the attack? What is the 2S6M's defended asset? What are the OPFOR more likely to do with a more maneuverable asset such as the SA-15 or SA-22? Will the OPFOR push the SA-15 or SA-22 forward into the disruption zone during an anticipated movement to contact to protect critical reconnaissance assets, or is the SA-15 or SA-22 needed in the support area to protect a critical command node? These are all questions that the S-2 and AMSO must identify and answer during MDMP prior to course of action (COA) development to enable effective staff planning. These questions start with a doctrinal understanding of how the OPFOR are likely to fight. Two examples of threat templates are

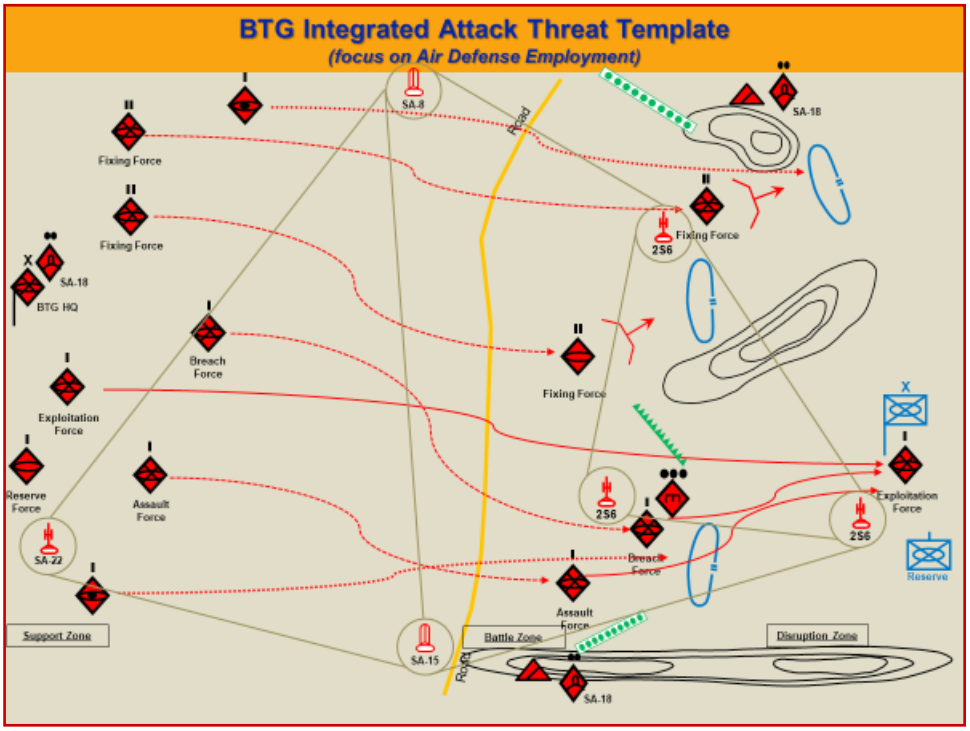


Figure 2. Threat template example (Henderson, 2019b).

Back to Table of Contents

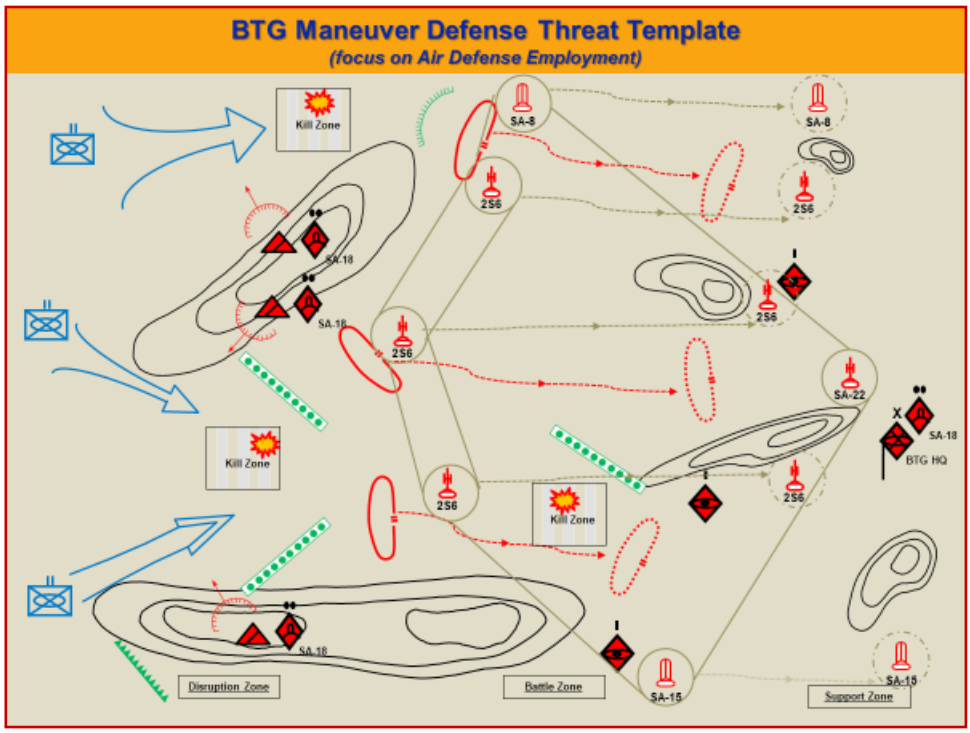


Figure 3. Threat template example (Henderson, 2019b).

provided in Figures 2 and 3 for the OPFOR in the offense and defense with a focus on air defense assets.

Understanding the IADS threat is just the first step. Doctrinal knowledge of the IADS threat as described in Figures 2 and 3 can all happen prior to a unit's arrival at the NTC. Challenges an intelligence section will face are no excuse for not to being able to support the operations process; however, these **challenges for an intelligence section** are listed for context, and ways to mitigate these challenges will be discussed further:

- Aviation task forces support both the division and rotational brigade combat team's (BCT) operations, meaning the S-2 must keep a pulse on the enemy in an area of operations (AO) larger than the actual training area at the NTC;

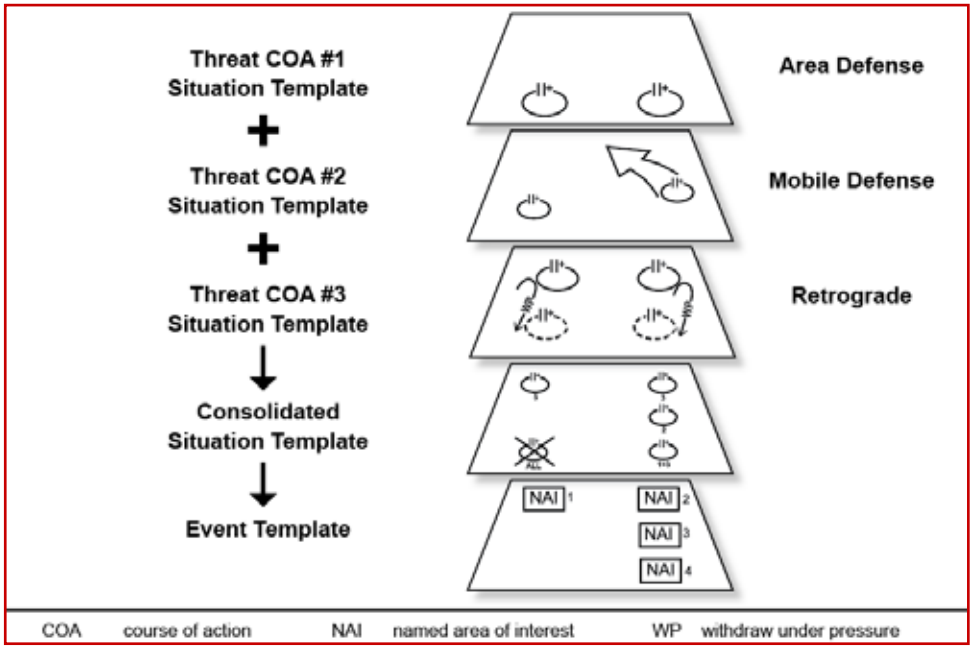


Figure 4. Example of developing an EVENTEMP (DA, 2019, p. 6-21).

- Aviation task forces are short staffed and inexperienced. Most ATFs are allocated five personnel in the S-2 section (O3-15B, O2-35D, 35F30, 35F10, 35F10), but rarely do S-2 sections arrive fully staffed;
- There is a lack of doctrinal understanding in intelligence preparation of the battlefield, specifically in the development of an event template (EVENTEMP);
- The need to synchronize information collection management into the operations process;
- The need to understand and develop intelligence-driven triggers to provide to the S-3/TF commander that enables decision making; and
- Coordinate with adjacent and higher intelligence sections to create a shared common intelligence picture (Henderson, 2019c).

THE IMPORTANCE OF THE EVENTEMP

The single most important product the S-2 will bring to any planning session, working group, or briefing is the EVENTEMP. This document alone places the enemy on the terrain (map) in time and space with clearly identified enemy decision points, phases, and named areas of interest (NAI). If the S-2 cannot describe the threat in time and space through an EVENTEMP, the staff suffers from an inability to plan on where and when it will fight the enemy. If the S-2 provides a doctrinally correct EVENTEMP, the staff is then able to visualize how to anticipate, detect, identify, and target the enemy. The S-2 should drive the operations process. This doesn't necessarily mean the S-2 needs all the right answers. Intelligence preparation of the battlefield is a continuous process, and updates are naturally expected to occur throughout all of the MDMP. However, most

Back to Table of Contents

commanders will say that the S-2 needs to bring a detailed enough read to the table that enables planning. This level of detail will vary based on staff experience, but if the S-2 is not providing an EVENTEMP at COA development or even worse, the S-3 or TF commander provide an enemy-directed COA, then the S-2 has already failed.

In an IADS environment, the EVENTEMP must be thorough and detailed (Figure 4). Do not annotate only the air defense systems on the map and leave out all other enemy capabilities (this happens often). Annotating only the air defense systems does not account for the myriad of direct fire systems and capabilities that the enemy has at its disposal to target aircraft. Imagine being an AH-64 platoon that avoided the 2S6M's target acquisition range, but instead set-up in a battle position directly overhead of a dismounted anti-tank platoon.

In addition, maybe the S-2 only accounted for one of the enemy's 2S6M's on the battlefield protecting a mechanized infantry company (MIC) forward; however, there are no reporting/indications of the additional three 2S6M's left on the battlefield. A thorough EVENTEMP will show where the remaining MICs are potentially arrayed by the enemy, and the S-2 could logically deduce that the remaining 2S6Ms are likely protecting those formations. The S-2s may not have an eight-digit grid, but they could provide the crews with expected locations and narrow the focus of information collection assets to those locations. Understanding the OPFORs' IADS umbrella is not just understanding range rings on a map. The S-2 must portray how enemy commanders intend to protect their formations with all assets available.

SYNCHRONIZING INFORMATION COLLECTION MANAGEMENT INTO THE OPERATIONS PROCESS

While the EVENTEMP is the single most important product the S-2 creates, it ultimately drives information collection, which is arguably the second most important process the S-2 can develop to support operations. Information collection is a complex process that typically overwhelms aviation S-2 sections at the NTC. Inherent to this complexity is the fact that aviation S-2s are the only battalion-level TF at the NTC allocated its own lines of echelons above brigade (EAB) intelligence, surveillance, and reconnaissance (ISR) assets. These **aviation S-2 challenges** can be overcome by:

- Integrating early and repeatedly with the staff planners to understand upcoming mission requirements;
- Synchronizing with the BCT collection manager to deconflict/capitalize on information collection strategies;
- Utilizing organic collection capabilities first and as the primary source, specifically for operations within the BCT's close fight (manned-unmanned teaming);
- Focusing EAB ISR assets in the deep fight for early detection and identification; and
- Synchronizing with the fire support officer (FSO) for detection of IADS capabilities to enable targeting efforts (Henderson, 2019d).

UNDERSTANDING AND DEVELOPING INTELLIGENCE-DRIVEN TRIGGERS

In the aviation world, nothing is more disheartening than launching an AH-64 section or platoon to battle positions utilizing unclear triggers. In an IADS environment, this is especially true as the risk exponentially increases the longer aircraft are on station. As dense and overlapping as the enemy's IADS capabilities are portrayed, it is challenging to account for every possible ground-to-air system in an ATF's AO. This means the timing of launch and displacement of aircraft is critical for aircraft survivability. The S-2 and S-3 establish triggers based on enemy actions (crossing a phase line, entering an NAI, retrograde from a battle position, etc.) "...with strict consideration given to *triggers* driving readiness condition (REDCON) levels" (Eagle Team, 2019).

As discussed earlier, through a detailed EVENTEMP and information collection plan, the S-2 can determine anticipated enemy actions in time and space. The S-2 can then conduct a rate of march analysis to determine estimated time before trigger is met and the subsequent launch of aircraft into a battle position. This level of detailed planning minimizes aircraft exposure to the IADS threat, reducing the overall risk.

DEVELOPING A SHARED COMMON INTELLIGENCE PICTURE

The importance of having a shared common intelligence picture with adjacent and higher units cannot be overstated. The challenge is always the communication architecture and one of the key aspects that the NTC can stress (primary, alternate, contingency, and emergency [PACE] plans) as units fight dozens of kilometers separate from each other. Understanding some of the challenges that aviation S-2s contend with, to include being short staffed and operating in a division-sized AO, these S-2s could overcome some of those challenges by simply communicating with adjacent and higher units. The best aviation S-2s rotating through the NTC maintain constant communication either through a Warfighter Information Network-Tactical (WIN-T) communications such as Upper Tactical Internet, a tracking system such as Joint Battle Command Platform, or voice communications with adjacent S-2 sections through a well-executed PACE plan. This allows for the sharing of each section's intelligence picture, truly creating a common intelli-

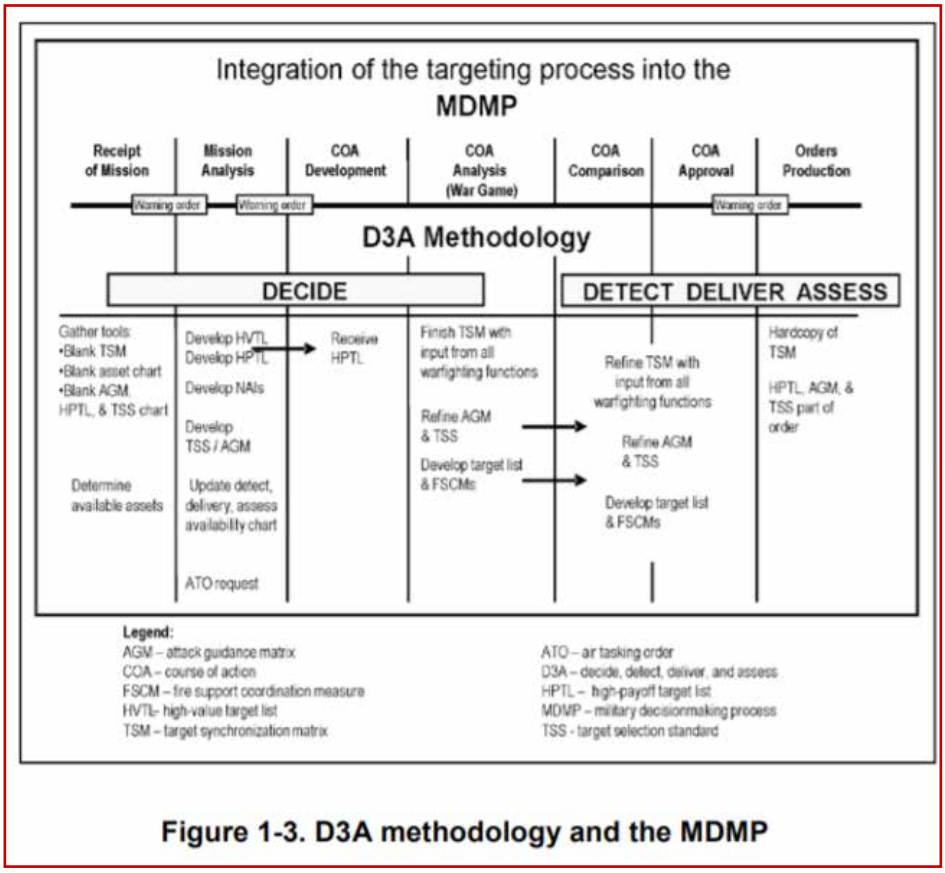


Figure 1-3. D3A methodology and the MDMP

Figure 5. Decide, detect, deliver, and assess (D3A) methodology and the MDMP (DA, 2015, p. 1-7).

gence picture across all formations. Some would argue that communications is the hardest problem set for units to overcome at the NTC. For ATFs, this is especially true as ATFs can be 20–30 kilometers away from the adjacent unit. The simplest way to overcome this challenge is to fly routinely (once or twice a day) to the BCT tactical assembly area and conduct a face-to-face meeting with counterparts at echelon across staff sections. The short- and long-term benefits of those engagements will often pay dividends in planning efforts once you return to the aviation tactical assembly area.

FIRES SUPPORT PLANNING IN AN IADS ENVIRONMENT

Another often underutilized member of the staff is the FSO. Is the planner, S-2, and FSO synchronizing efforts to target air defense systems prior to each mission either through a targeting working group or closely resembled synchronization effort? Often forgotten or limited in scope of responsibilities, the FSO is a critical staff officer of an ATF, especially during large-scale combat operations (LSCO). Field Manual 3-04, "Army Aviation," states "To achieve superiority over the enemy force, the commander must take advantage of the range, precision and lethality of all available fires…" (DA, 2015, p. 3-11). As shown in Figure 5 from Army Techniques Publication 3-60, "Targeting," the targeting process overlaid against the MDMP framework highlights the inputs/outputs the FSO should provide to an ATF commander. However, this level of fidelity is rarely seen from ATF FSOs except for a few instances of stellar FSOs who injected themselves early and often into the planning process.

HOPE TIMELINE

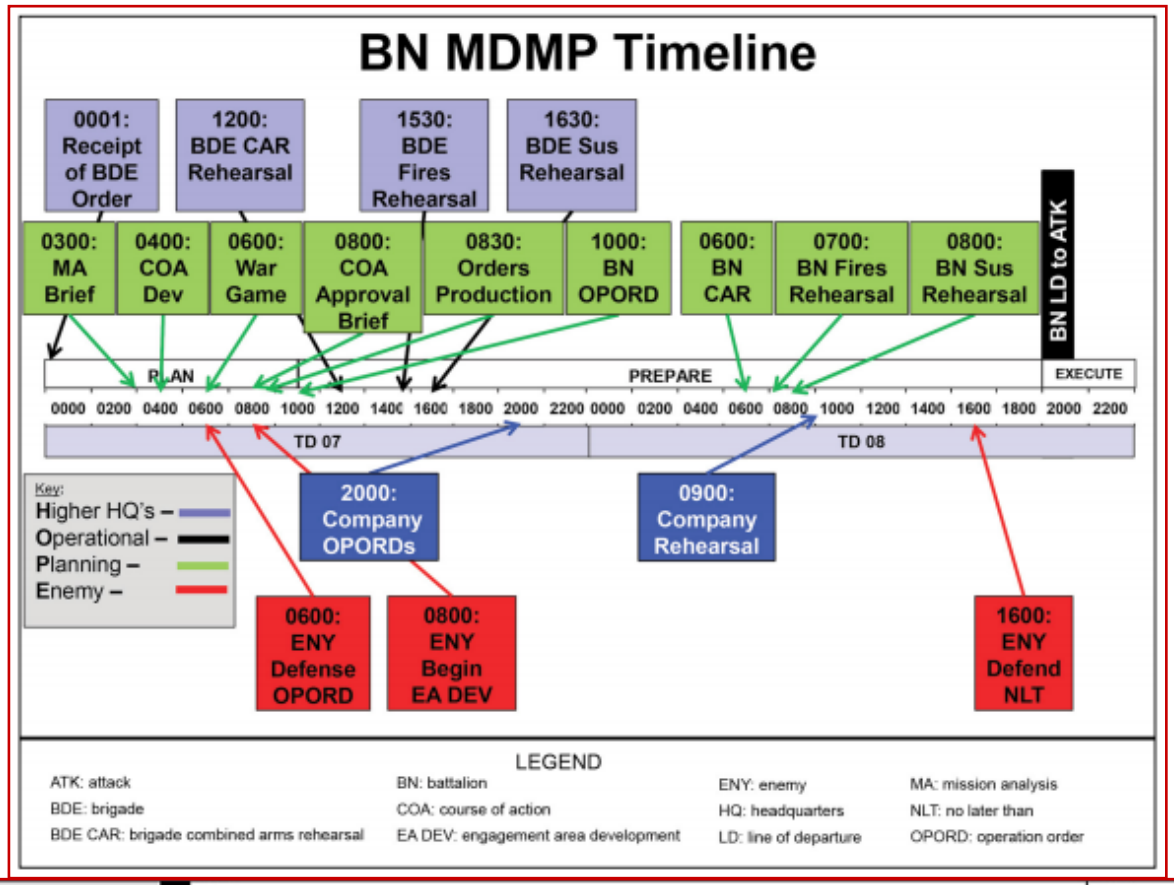
The S-2 and FSO are but two contributors to the staff whose contributions are particularly important to ATFs operating within an IADS environment. Emphasizing planning efforts at the TF staff level along with parallel planning efforts at echelon cannot be overstated. Most of the risks associated with operating in an IADS environment can be mitigated with thorough staff planning before the first missile or bullet is fired at an aircraft. LTC Cameron Gallagher (Commander, 1-501 Aviation Regiment) described ATF staff challenges best by stating "As the wave continues to build in the decisive action environment with multiple operations on the near horizon, compounded by limited or incomplete information from a ground force that is either in contact or preoccupied with its current mission, many aviation TFs resort to focusing their planning effort on the next event (i.e., the 10-meter target) instead of the most important mission" (Gallagher, 2019, p. 43).

Often at the NTC, this lack of emphasis on planning and developing thorough COAs that address/understand the threat and ways to target the threat lead to aircrews operating in an environment more at risk than it should be. Aircrews must then resort to relying on maneuver techniques for survival, as opposed to being enabled by the ATF with intelligence collection and a fire support plan. An effective technique for synchronizing multiple planning efforts is the utilization of a 'HOPE' timeline (Figure 6) that "…incorporate[s] considerations of higher headquarters' key times, operational requirements, planning and TLP times, enemy considerations, and light/weather data" (Hilliard, Krippel, & Moore, 2016, p. 27).

CREW DEBRIEFS

Now that the threat has been examined and planning processes have been emphasized with a heavy focus on S-2 and FSO involvement, how do we close the loop once the mission is complete? Aircrew debriefs following missions have become a lost art at the NTC, or at the very least, they resemble a debrief from missions against insurgent forces similar to experiences in Afghanistan or Iraq. Debriefing "…places the information into the intelligence system sooner, increasing the likelihood that it can be used for further

Back to Table of Contents



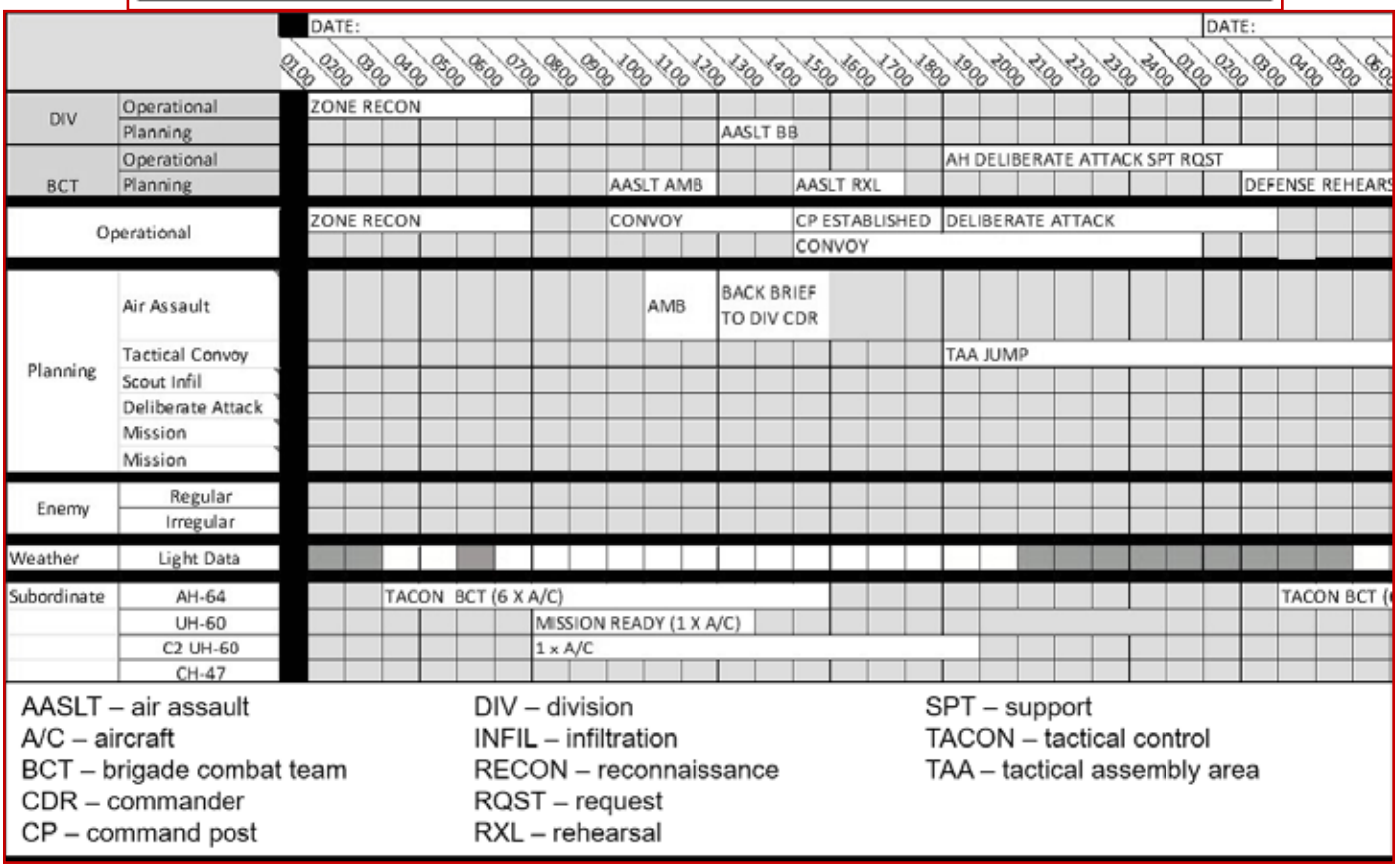


Figure 6. Example battalion MDMP HOPE timeline (Hilliard et al., 2016, p. 28).

Back to Table of Contents

action" (DA, 2014, p. 8-1). The S-2 must have the crews describe in detail enemy forces identified and those targeted. Crews should also describe if any indications of air defense systems were present on the battlefield that could enable future targeting efforts. This information is critical to understanding what enemy capabilities are left on the battlefield, if the enemy has reached its threshold to begin a retrograde, if reinforcements are likely, and if those reinforcements are likely to bring additional air defense capabilities. All this information could be gained from crews providing numbers of personnel and equipment targeted, location, and time of incident. Additionally, the location of friendly forces is often forgotten. Operations at the NTC and in an LSCO environment are so dynamic that locations of friendly forces could change during a mission and is often not tracked by the ATF command post.

CONCLUSION

Conducting operations in an IADS environment during LSCO has its own unique set of challenges that ATFs have not faced routinely in recent years. The threat is daunting and continuing to adapt to our tactics, techniques, and procedures. Understanding the threat, detecting/identifying air defense assets through timely information collection, integrating with counterparts at echelon, emphasizing the importance of planning processes at the staff level, empowering the FSO, and conducting thorough post-mission crew debriefs are but a few of the ways to improve Army aviation lethality and survivability in LSCO.

CPT Wesley Henderson is currently serving as an S-2 observer-coach-trainer at the National Training Center, Fort Irwin, California. He enlisted in the Army in 2007 and commissioned as a Military Intelligence Officer in 2010 through Officer Candidate School. He completed two deployments in Afghanistan, each as a Battalion S-2. Previous assignments include Company Commander, Army Departmental Requirements Officer for GEOINT, and Battalion S-2.

International Military Technical Forum "ARMY-2017" on August 25, 2017. Live demonstration of Russian Armed Forces equipment at the Alabino Range near Patriot Park outside Moscow. This is a 2S6M1 combat vehicle with a 2K22M1 Tunguska M1 30 mm self-propelled air defence gun and missile system (NATO designation SA-19 Grison). Stock photo image

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CONCEPTION OF THE "PHASE MAINTENANCE RISK COMMON OPERATING PICTURE"

By MAJ Gregory S. Sterley and CPT Matthew R. Johnson

The Army is a wealth of knowledge and experience encompassing a multitude of differing viewpoints. Each Soldier stems from vastly different operational environments and offers varying observations, insight, and lessons learned to the Army's growth and development. While serving as the B Company Maintenance Platoon Leader in Afghanistan, my command identified a significant lapse in the P4T3 (Problem, Plan, People, Parts, Tools, Time, and Training) process that neglected to pointedly consider personnel risk factors of assigned helicopter maintenance personnel during phase. Before redeploying from Afghanistan, with the input of my platoon and commanding officer, I created the phase maintenance risk common operating picture and mitigation Brief (RCOP). Still used to this day by units in Camp Dahlke, Afghanistan, the phase maintenance RCOP addresses the doctrinal, training, and personnel analytical gap that exists in the P4T3 process when evaluating personnel risk associated with helicopter phase maintenance.

Soldiers of B Company, 96th Aviation Support Battalion, 101st Combat Aviation Brigade, 101st Airborne Division (Air Assault) performing phase maintenance. U.S. Army photo credited to CPT Shane T. Hinton, Executive Officer, B Company

It is arguable that aircraft maintainers have the most crucial job in Army aviation. Their attention to detail, constant scrutiny, and ability to torque to the smallest micrometer harvest some of the most demanding circumstances. Amidst heavy workloads, personal/family issues, and unending daily struggles, maintainers uphold the highest standards and adhere to a zero-tolerance policy for mistakes. The smallest margin of error can cost millions of dollars in damage to aircraft and severely reduce the maneuver capability to the ground force commanders relying on us. With this scrutiny from the highest levels of the Army in mind, the maintainers of the B Company, 96th Aviation Support Battalion (ASB), set out to develop a method to easily brief/display the P4T3 process, associated risks, and impacts to completion timelines associated with Army helicopter phase maintenance. As it evolves, this product will further enable a commander's ability to understand personnel constraints and mitigate calculated risk the P4T3 alone cannot accurately capture.

U.S. Army National Guard Soldiers with New Jersey's Detachment 2, Charlie Company, 1-171st General Support Aviation Battalion (MEDEVAC) perform phase maintenance on a UH-60L Black Hawk helicopter at the Army Aviation Support Facility on Joint Base McGuire-Dix-Lakehurst, Lakehurst, New Jersey, Jan. 22, 2020. U.S. Air National Guard photo by MSgt Matt Hecht

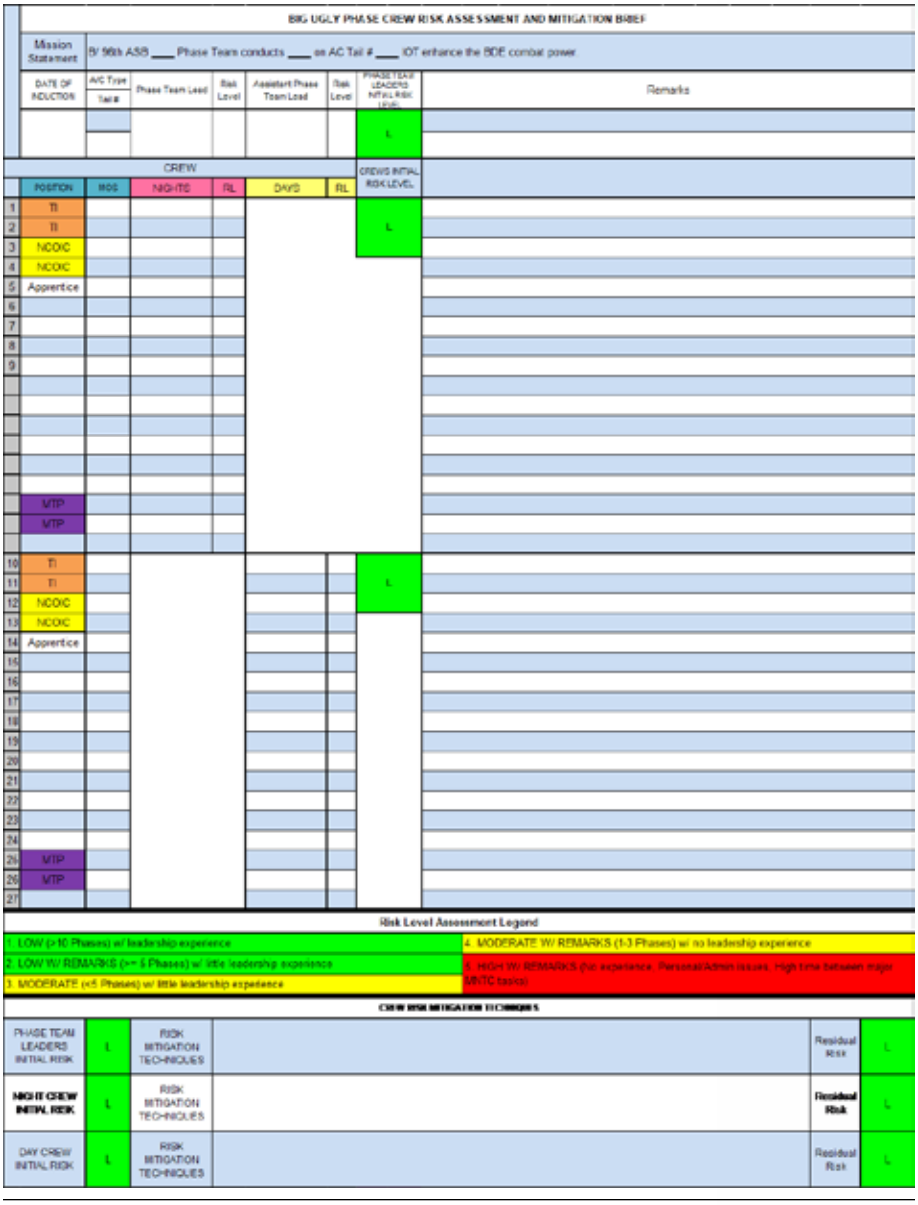
U.S. Army National Guard Soldiers with New Jersey's Detachment 2, Charlie Company, 1-171st General Support Aviation Battalion (MEDEVAC) perform phase maintenance on a UH-60L Black Hawk helicopter at the Army Aviation Support Facility on Joint Base McGuire-Dix-Lakehurst, Lakehurst, New Jersey, Jan. 22, 2020. U.S. Air National Guard photo by MSgt Matt Hecht

U.S. Soldiers assigned to Company D, 1st Battalion, 3rd Aviation Regiment (Attack Reconnaissance) conduct 500 hours phase maintenance on an AH-64 Apache helicopter at Katterbach Army Airfield, Germany, Nov. 14, 2019. Phase maintenance inspections occur at regular intervals on all aircraft in order to keep them operational. U.S. Army photo by Charles Rosemond

The necessity to establish the phase maintenance RCOP originated in late July 2017, after a rather lengthy CH-47 200HR phase on AC Tail# 458. During this phase, many warning signs were present, but missed, in the initial phase brief. The P4T3 did not capture these warning signs or formally present an opportunity to brief potential risks in a more concise and user-friendly medium. If phase leaders had further scrutinized their personnel deficiencies, senior leaders would have easily recognized the unit's constraints to completing the phase within U.S. Forces Command-dictated timelines. A completely inexperienced crew, lack of guidance, task-saturated Soldiers, lack of parts and tools, and leader oversight were only some of the contributing factors to the failure of this phase, all of which a more comprehensive diagnostic tool could accurately capture.

Doctrinally, the P4T3 defined the quantity or personnel required to complete a task but did not address the quality of the personnel assigned. If a task called for eight Soldiers, units assigned eight Soldiers to the task and met the requirement, "checking the block." Often, this process generated a plug-and-play ideology, where units met the requirement to assign eight personnel but neglected to evaluate the daily rigors or stressors encompassed in a garrison or combat environment and intertwine that with the supervisor's assessment of that Soldier's work ethic. The result was eight Soldiers assigned on paper; however, lack of training requiring additional supervision, external obligations, or poor work ethic often resulted in five quality maintainers performing the task of eight.

This plug-and-play ideology would initially receive the final approval authority's signature to initiate the phase but rarely included a reassessment of phase team strength when there were any changes to the assigned personnel. Anyone utilizing the plug-and-play tactic knows that when a Soldier comes up on a


BIG UGLY PHASE CREW RISK ASSESSMENT AND MITIGATION BRIEF

Mission Statement: B/ 96th ASB ___ Phase Team conducts ___ on AC Tail # ___ IOT enhance the BDE combat power

DATE OF INDUCTION	A/C Type / Tail #	Phase Team Lead	Risk Level	Assistant Phase Team Lead	Risk Level	PHASE TEAM LEADERS INITIAL RISK LEVEL	Remarks
						L	

	POSITION	MOS	NIGHTS	RL	DAYS	RL	CREWS INITIAL RISK LEVEL	
1	TI						L	
2	TI							
3	NCOIC							
4	NCOIC							
5	Apprentice							
6								
7								
8								
9								
	MTP							
	MTP							
10	TI						L	
11	TI							
12	NCOIC							
13	NCOIC							
14	Apprentice							
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21								
22								
23								
24								
25	MTP							
26	MTP							
27								

Risk Level Assessment Legend

1. LOW (>10 Phases) w/ leadership experience
2. LOW W/ REMARKS (>= 5 Phases) w/ little leadership experience
3. MODERATE (<5 Phases) w/ little leadership experience
4. MODERATE W/ REMARKS (1-3 Phases) w/ no leadership experience
5. HIGH W/ REMARKS (no experience, Personal/Admin issues, high time between major MWTC tasks)

CREW RISK MITIGATION TECHNIQUES

PHASE TEAM LEADERS INITIAL RISK	L	RISK MITIGATION TECHNIQUES		Residual Risk	L
NIGHT CREW INITIAL RISK	L	RISK MITIGATION TECHNIQUES		Residual Risk	L
DAY CREW INITIAL RISK	L	RISK MITIGATION TECHNIQUES		Residual Risk	L

Figure 1. Phase maintenance RCOP (front view) (101st Combat Aviation Brigade, 2018).

training "hit list" or has appointments, the phase team leader tasks whomever is available to assist. This completely negates the initial risk assessment, mitigation measures of the phase crew, and changes the overall mitigated residual risk briefed to the final approval authority, typically the company commander for a low risk phase, or the task force commander (deployed) for a moderate risk phase.

Without a rebrief to the approval authority, you are operating under false pretenses and assuming the approval authority still accepts and approves the initial, mitigated, and overall risk to the phase. Creation of the phase maintenance RCOP (Figure 1) entirely negated having to rebrief the approval authority of personnel changes. By outlining all possible scenarios, it provided a methodical assessment of the initial phase team, isolated any underlying stressors posing a risk to the team's work, detected training shortfalls requiring oversight of another maintainer, and identified alternates to replace individuals as necessary. This allowed the approval authority to properly scrutinize all possible phase team configurations and their associated risk.

The phase maintenance RCOP and mitigation brief ensured that eight quality maintainers were dedicated to the phase, even if it meant 10 personnel were rostered to perform maintenance or to coach, super-

Back to Table of Contents

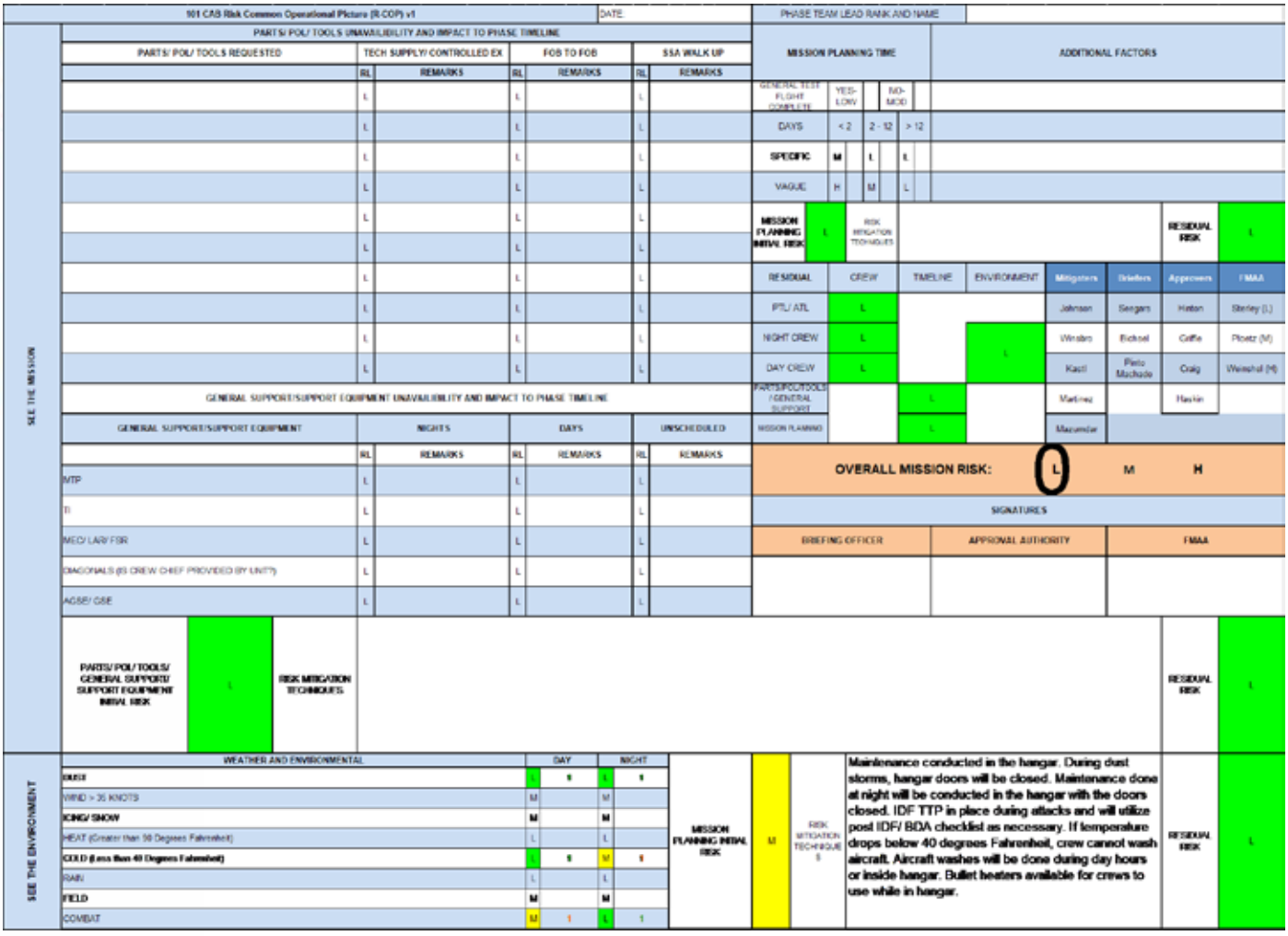


Figure 2. Phase maintenance RCOP (back view) (101st Combat Aviation Brigade, 2018).

vise, and train junior maintainers on that aircraft. This tool is a forcing function for subordinate leaders at the section level to critically manage their personnel and think through to whom they assigned the phase. Unless the subordinate leaders were forward-thinking enough to plan for alternates and mitigate low proficiency maintainers by pairing a senior maintainer, the P4T3 tool does not require you to make those underlying assessments. The phase maintenance RCOP became a tool that accurately assesses and pictorially conveys the prudent risk of maintainers' personal qualities, technical proficiency, and daily stressors that Army leaders would ultimately accept before inducting an aircraft into phase.

The phase maintenance RCOP tool (Figure 2) is a single page briefing document closely resembling the flight RCOP utilized by every aviator across the 101st Combat Aviation Brigade (CAB). By mirroring the flight RCOP, the leaders of B Company, 96th ASB sought to achieve a shared understanding across the CAB via a single source document. This document provided a means to honestly and accurately assess the unit's capability to complete phases to standard and on time. The phase maintenance RCOP quickly became a system providing key leaders with a pictorial overview of the phase's shortcomings while further analyzing, but not detracting, from the P4T3 principles.

The phase maintenance RCOP tool is a necessary adaptation to the P4T3 process. This process does not fully encompass the examination of the human factor. What P4T3 fails to define is whether the maintainer has the necessary experience or resident expertise, defined on the spectrum from apprentice to technical inspector (TI), in accordance with Training Circular (TC) 3-04.71, "Aviation Maintenance Training Program," to perform the task at hand (Department of the Army, 2018). When used correctly, the phase maintenance RCOP tool can help detect these inadequacies rapidly.

During the creation of the phase maintenance RCOP tool, the "Aviation Maintenance Training Program" (TC 3-04.71) began its circulation (Fiscal Year [FY] 18) and still encompassed a lag time relying heavily on the unit's proper and timely integration of training to sufficiently backlog maintainers' records (FY20) before its implementation as "...a program of record (FY21)" (Department of the Army, 2018, p. v). Specific to my unit while forward deployed to Afghanistan, we did not have ac-

Back to Table of Contents

cess to the proper facilities to accredit our higher level maintainers. The inability to stop maintenance in a combat zone to facilitate training severely hindered our ability to backlog training records and accredit our more senior maintainers. In my initial assessment of the new TC 3-04.71, if I failed to properly accredit my TI shop in accordance with the list of mandatory prerequisites, the unqualified Soldiers could not formally perform duties as a TI. On paper, there remained ample time after deployment to accomplish the accreditation, but experience shows that garrison training requirements, field problems, Army Regulation 350-1 training ("Army Training and Leader Development"), and a multitude of personal matters would severely encroach on the planned time to accomplish these tasks.

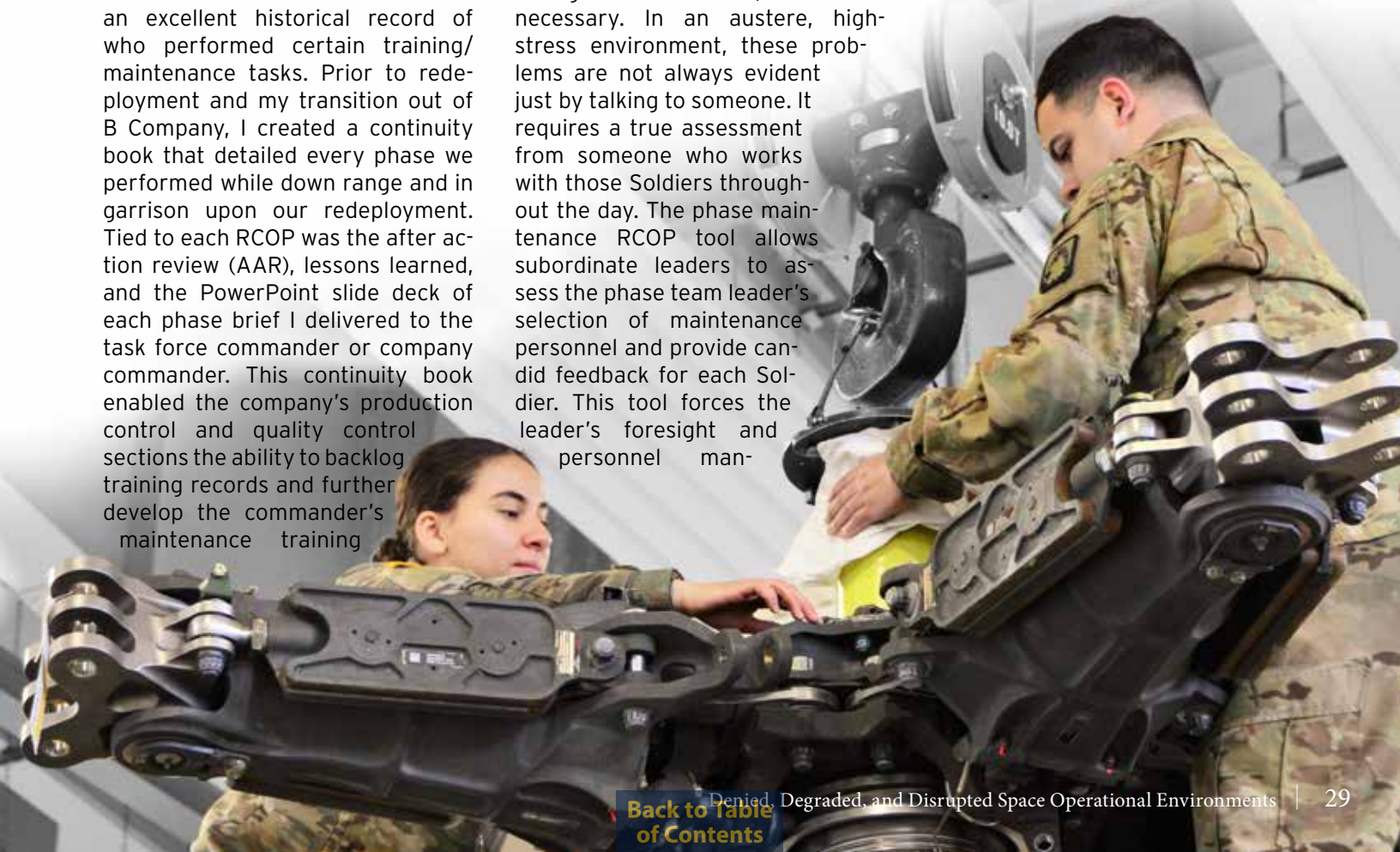
With the "Aviation Maintenance Training Program" defined as the new way forward for maintenance training plans at the unit level, I faced the challenge of finding a way to record aviation maintenance in an austere environment. The phase maintenance RCOP tool served as an excellent historical record of who performed certain training/maintenance tasks. Prior to redeployment and my transition out of B Company, I created a continuity book that detailed every phase we performed while down range and in garrison upon our redeployment. Tied to each RCOP was the after action review (AAR), lessons learned, and the PowerPoint slide deck of each phase brief I delivered to the task force commander or company commander. This continuity book enabled the company's production control and quality control sections the ability to backlog training records and further develop the commander's maintenance training program in garrison by establishing a better historical understanding of the maintainers' strengths and weaknesses.

Understanding personnel strengths and weaknesses is crucial when accepting prudent risk as a commander. In a company with more than 400 Soldiers, it is impossible for the commander to converse with every Soldier. Commanders are heavily reliant on their subordinates to make sound judgment calls and operate within their intent. The goal is to handle at the lowest level of leadership. The practice of not "airing dirty laundry" in front of the commander is acceptable, but severely inhibits commanders from understanding their company's deficiencies and capabilities. This phase RCOP tool truthfully analyzes the strengths and weakness of each maintainer and provides commanders with a holistic snapshot of their force.

It is not reasonable for a task force commander or company commander to know each Soldier, but when it comes to accepting risk and ensuring mission success, it becomes necessary. In an austere, high-stress environment, these problems are not always evident just by talking to someone. It requires a true assessment from someone who works with those Soldiers throughout the day. The phase maintenance RCOP tool allows subordinate leaders to assess the phase team leader's selection of maintenance personnel and provide candid feedback for each Soldier. This tool forces the leader's foresight and personnel management to offset external requirements, allows them to mitigate risk by pairing senior maintainers with junior maintainers, or allows them to make adjustments when a possible risk appears. It does not serve to call out any one Soldier; instead, it opens a frank conversion with every echelon of leadership to plan, rehearse, and implement risk mitigation practices accordingly from the maintainer through the approving commander.

The vision of the phase maintenance RCOP tool was generated from the failures of the July 2017 Tail# 458 phase. It came to fruition during 101st CAB's deployment in support of Operation Freedom's Sentinel 18-19. As an aviation support company deployed to Afghanistan, the company's sole purpose is to perform scheduled maintenance

Private Jessica Olmedo and SPC Michael Carreiro assigned to Company D, 1st Battalion, 3rd Aviation Regiment (Attack Reconnaissance) conduct 500 hours phase maintenance on an AH-64 Apache helicopter at Katterbach Army Airfield, Germany, Nov. 14, 2019. Phase maintenance inspections occur at regular intervals on all aircraft in order to keep them operational. U.S. Army photo by Charles Rosemond



and assist the CAB with any unscheduled maintenance overtaxing the aviation maintenance companies. The existence of unpredictability in combat severely hinders the commander's ability to foresee complications. Readiness is key in all portions of phase maintenance. That readiness became a repetitive undertone in many AARs. Often, phase delays occurred due to lack of preparation preceding phase induction. It was not long after its inception into the unit that the phase maintenance RCOP tool started to pay dividends. The tool preserves the ability to immediately recognize, report, and mitigate risk by any aviation leader, regardless of previous maintenance experience. With the aid of the phase maintenance RCOP tool, unit leadership quickly recognized any inadequacies and drastically improved phase completion timelines throughout the duration of the deployment.

The phase maintenance RCOP tool simply provides fidelity, predictably, and foresight where other analytical tools and traditional phase briefs do not. It is a holistic tool encompassing numerous factors to mitigate risk and prevent maintenance-related accidents, catastrophic damage to aircraft, and loss of life. As a developmental tool, the phase maintenance RCOP serves as a forcing function for leaders of all levels, from the phase team leader who determines the initial risk to the phase, the maintenance platoon leadership who mitigates the risk, and the appropriate command level accepting the risk to initiate the phase. Most importantly, the phase maintenance RCOP tool abundantly restores the commander's ability to forecast setbacks and anticipate solutions prior to inducting the aircraft into phase. Further, the tool restores the analytical gap created through doctrine, training, and personnel that previously existed with the P4T3. Although the phase maintenance RCOP tool requires constant revision to continually adapt to the future of aviation, it is serving as a practical application across the 101st CAB and in all spectrums of aviation maintenance.

A AH-64D Apache Longbow helicopter assigned to 1st Battalion, 3rd Aviation Regiment (Attack Reconnaissance), sits inside an aircraft maintenance hangar during repairs on Nov. 14, 2019, at Katterbach Army Airfield in Ansbach, Germany. U.S. Army photo by Charles Rosemond

MAJ Greg Sterley commissioned from Bowling Green State University as an Ordnance Officer in 2005. In 2008, MAJ Sterley branch transferred to aviation. His courses include Ordnance Officer Basic Course, SERE, Dunker, Initial Entry Rotary Wing Training, Aviation Maintenance Officer Course, rating as an AH64 D/E pilot, and AH64 D/E Maintenance Test Pilot Course. His assignments include Fort Hood, Texas (2 ABCT, 4-227 ARB and 615th ASB) and Fort Campbell, Kentucky (3-101 ARB, 96th ASB and 1-101 ARB) with 44 months deployed to Iraq in support of Operation Iraqi Resolve and Afghanistan in support of Operation Enduring Freedom/Freedom's Sentinel/Resolute Support. He is currently assigned as the S3 for 1-101 ARB at Fort Campbell, Kentucky. His awards and decorations include the Bronze Star (2OLC), the Meritorious Service Medal (2OLC), the Air Medal, the Air Assault Badge, the Combat Action Badge and the Senior Aviator Badge.

CPT Matthew Johnson commissioned from the University of Tennessee–Knoxville as an Aviation Officer in 2013. His courses include Basic Officer Leaders Course, SERE, Dunker, Initial Entry Rotary Wing training, and a rating as a UH-60 A/L/M pilot. His assignments include K-16, Korea (2-2 AHB) and Fort Campbell, Kentucky (5-101 AHB and 96th ASB), with 9 months deployed to Afghanistan in support of Operation Resolute Support and Operation Freedom's Sentinel 18-19 (96th ASB). He is currently assigned to Fort Rucker, Alabama as a student at the Aviation Captains Career Course with a follow on assignment to Fort Bliss, Texas (1 AD). His awards and decorations include the Meritorious Unit Citation, the Air Medal, the German Armed Forces Badge in Gold, the Air Assault Badge, the Airborne Badge, the Pathfinder Badge, and the Basic Aviator Badge.

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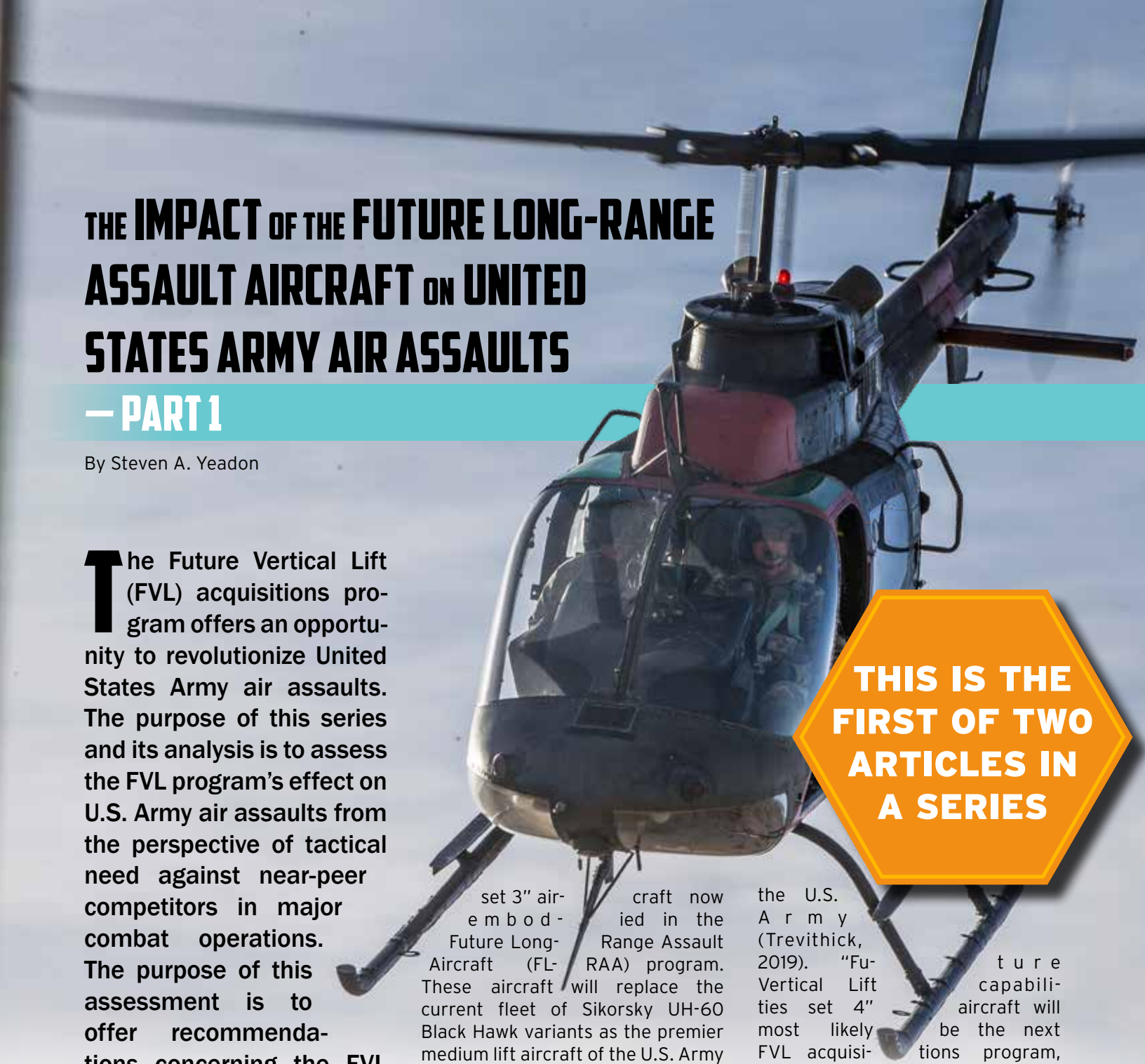
THE IMPACT OF THE FUTURE LONG-RANGE ASSAULT AIRCRAFT ON UNITED STATES ARMY AIR ASSAULTS — PART 1

By Steven A. Yeadon



THIS IS THE FIRST OF TWO ARTICLES IN A SERIES

The Future Vertical Lift (FVL) acquisitions program offers an opportunity to revolutionize United States Army air assaults. The purpose of this series and its analysis is to assess the FVL program's effect on U.S. Army air assaults from the perspective of tactical need against near-peer competitors in major combat operations. The purpose of this assessment is to offer recommendations concerning the FVL program to maximize its potential for the warfighter while providing a primer on air assaults using FVL aircraft.

In the FVL program, there are five "capabilities sets," each designating different aircraft fulfilling different roles (Coll & Hunter, 2019; Hirschberg, 2016, p. 25). This first article concentrates on "FVL capabilities set 3" aircraft now embodied in the Future Long-Range Assault Aircraft (FLRAA) program. These aircraft will replace the current fleet of Sikorsky UH-60 Black Hawk variants as the premier medium lift aircraft of the U.S. Army (Judson, 2019).

However, this series will mention all five 'FVL capabilities set' aircraft as they relate to the broader subject of U.S. Army air assaults. "Future Vertical Lift capabilities set 1," now embodied by the Future Attack Reconnaissance Aircraft (FARA) program, will replace half of the current fleet of Boeing AH-64 Apache attack helicopters, which are serving in the role of retired Bell OH-58 Kiowa Warrior aircraft to become the premier attack reconnaissance aircraft of the U.S. Army (Trevithick, 2019). "Future Vertical Lift capabilities set 4" aircraft will most likely be the next FVL acquisitions program, and they will replace the U.S. Army's Boeing CH-47 Chinook helicopters to become the premier heavy lift aircraft of the U.S. Army (Freedberg, 2019b). Further into the future are both the "FVL capabilities set 2" aircraft, a heavy attack reconnaissance aircraft to replace

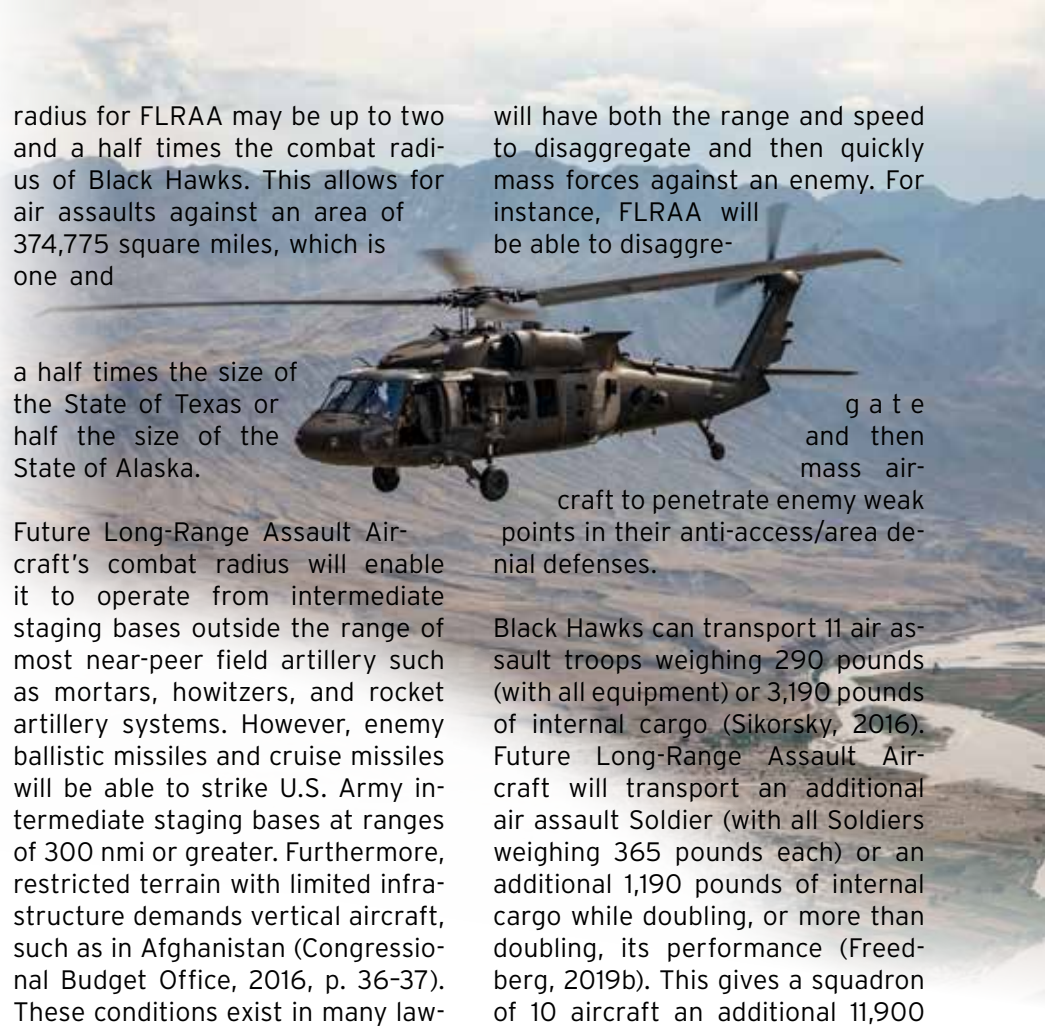
The competition to design, build, and test the Future Attack Reconnaissance Aircraft Competitive Prototype is underway and, upon completion, will fill an existing capability gap created by the divestiture of the U.S. Army Bell OH-58 Kiowa OH-58. Photo by Cpl Koby Saunders, 2nd Marine Aircraft Wing

the Army's Apache attack reconnaissance helicopters (Whittle, 2015), and "FVL capabilities set 5" aircraft, which will be a new ultra-heavy lifter with Vertical Take-Off and Landing (VTOL) performance between a Lockheed Martin C-130J Super Hercules cargo plane and an Airbus A400M Atlas cargo plane (Trimble, 2011).

Again, this first article concentrates on "FVL capabilities set 3" aircraft now embodied in the FLRAA program. I began the analysis of this first article with an examination of FLRAA's effect on future U.S. Army air assaults with the introduction of the aircraft. Second, I examined the aircraft's external payload capability for moving equipment in support of air assaults. Third, I examined FLRAA's effect on aeromedical evacuation during air assaults. Fourth, I examined some key limitations to air assaults using FLRAA, despite these revolutionary capabilities. That completes my analysis in this first article. In the second article, there will be a broader look at how all five aircraft in the FVL program may affect U.S. Army air assaults, especially considering the continued use of legacy aircraft for decades to come.

FLRAA'S REVOLUTIONARY CAPABILITIES IN SUPPORT OF U.S. ARMY AIR ASSAULTS

Simple math shows just how revolutionary FLRAA is to the Black Hawks it will replace. Black Hawks have a 121.5 nautical mile (nmi) combat radius allowing air assaults against an area of 61,417 square miles; an area around the size of the State of Washington. Future Long-Range Assault Aircraft will have a combat radius of 200–300 nmi (110 nmi with external payload). Two hundred nmi is the minimum, or 'threshold,' capability demanded by the U.S. Army and 300 nmi is the objective range desired by the U.S. Army (Freedberg, 2019a). The objective combat radius for FLRAA may be up to two and a half times the combat radius of Black Hawks. This allows for air assaults against an area of 374,775 square miles, which is one and a half times the size of the State of Texas or half the size of the State of Alaska.



Future Long-Range Assault Aircraft's combat radius will enable it to operate from intermediate staging bases outside the range of most near-peer field artillery such as mortars, howitzers, and rocket artillery systems. However, enemy ballistic missiles and cruise missiles will be able to strike U.S. Army intermediate staging bases at ranges of 300 nmi or greater. Furthermore, restricted terrain with limited infrastructure demands vertical aircraft, such as in Afghanistan (Congressional Budget Office, 2016, p. 36–37). These conditions exist in many lawless regions around the world from where terrorists may seek to operate. In such conditions, the range of FLRAA will result in fewer forward operating bases and provide the ability to arrive in force against remote locations.

Black Hawks have a cruising speed of 145 knots (120 knots maximum with external payload). Comparatively, FLRAA will have a threshold cruising speed of 250 knots and an objective cruising speed of 280 knots (140 knots with external payload) (Freedberg, 2019a; Department of the Army, n.d.). Thus, FLRAA will have a comparable cruising speed when transporting external payload to Black Hawks while transporting air assault troops. Additionally, the objective cruising speed for FLRAA is double the cruising speed of Black Hawks. Future Long-Range Assault Aircraft's cruising speed will allow it to swiftly take advantage of short-lived tactical situations, such as suppressed enemy air defenses, to strike at an enemy's critical vulnerabilities. Additionally, FLRAA will have both the range and speed to disaggregate and then quickly mass forces against an enemy. For instance, FLRAA will be able to disaggregate and then mass aircraft to penetrate enemy weak points in their anti-access/area denial defenses.

Black Hawks can transport 11 air assault troops weighing 290 pounds (with all equipment) or 3,190 pounds of internal cargo (Sikorsky, 2016). Future Long-Range Assault Aircraft will transport an additional air assault Soldier (with all Soldiers weighing 365 pounds each) or an additional 1,190 pounds of internal cargo while doubling, or more than doubling, its performance (Freedberg, 2019b). This gives a squadron of 10 aircraft an additional 11,900 pounds of internal cargo or at least 10 Soldiers, all weighing more than before.

By possessing a self-deployable range with a threshold of 1,725 nmi and an objective of 2,449 nmi (Department of the Army, n.d.), FLRAA will be able to deploy to any intermediate staging base in a theater of operations. This allows for the rapid massing of assault aircraft where needed for air assaults. Future Long-Range Assault Aircraft will also be able to transit the Atlantic and Pacific Oceans via their shortest possible routes (Department of the Army, n.d.).

Last, additional goals of FLRAA are a reduced logistical footprint, improved survivability, all-weather capability, improved functionality in degraded visual environments, and an Integrated Mission Equipment

A UH-60 Black Hawk Helicopter from Task Force Heavy Cav flies over Afghanistan in support of the 48th Infantry Brigade Combat Team during Operation Freedom's Sentinel and NATO Operation Resolute Support. U.S. Army photo credit to SGT Jordan Trent

Back to Table of Contents

for Vertical Lift Systems to provide a digital backbone of open architectures that will enable the Army to update and modernize equipment much faster and more effectively than currently fielded systems (Wins, 2019; Lopez, 2012). This will make it easier to upgrade the hardware and software for FVL aircraft and will keep the fleet of aircraft relevant faster. Additionally, it will be easier to sustain aircraft in austere environments and will also mitigate two limitations of current air assaults: both the effect of adverse weather and the presence of battlefield obscurants limiting visibility (Department of the Army, 2015a, p. 8-5 to 8-6).

THE IMPACT OF FLRAA'S EXTERNAL PAYLOAD CAPABILITY IN SUPPORT OF U.S. ARMY AIR ASSAULTS

The current medium lift aircraft, the Black Hawk, can carry up to 9,000 pounds of external payload a combat radius of 35 nmi (Staff Writer, 2009). This allows the external transport of Avenger Short-Range Air Defense (SHORAD) vehicles; M119 105 millimeter (mm) towed howitzers; M120A1 120 mm towed mortars; many curb weight variants of High-Mobility Multipurpose Wheeled Vehicles (HMMWVs), including some "up armored" HMMWVs; tandem fuel blivets; in-development Ground Mobility Vehicles (GMVs); and the in-development Small Multipurpose Equipment Transport. This means that soon, Black Hawks with externally transported GMVs of a very limited range will mitigate one limitation of air assaults for light infantry formations, and inserted forces will have reduced ground mobility (Department of the Army, 2015a, p. 8-5 to 8-6). However, 9,000 pounds is not enough weight for HMMWV ambulances (or most "up armored" HMMWVs), nor is it enough weight for the M777A2 155 mm towed howitzers.

Future Long-Range Assault Aircraft will carry a threshold of 8,000 pounds, up to an objective of 10,000 pounds, as an external payload up to a revolutionary distance of 110 nmi (Department of the Army, n.d.). Thus, at its threshold external payload, FLRAA will be capable of transporting GMVs, Avengers, M119 105 mm towed howitzers, and M120A1 120 mm towed mortars up to 110 nmi. This means that air assaults up to 110 nmi will mitigate their vulnerability to air strikes due to the availability of Avenger air defense weapon systems (Department of the Army, 2015a, p. 1-21). However, a caveat to enhanced air defense capabilities is that both terminal high-altitude area defense units with a range of 108 nmi and MIM-104 Patriot surface-to-air missile launchers with a range of only 37.8 nmi, will be too far away to be of use to an air assault with a 110 nmi range. This leaves U.S. forces at a range beyond vulnerable to near-peer ballistic missiles, cruise missiles, and aircraft at medium altitude or high altitude. In addition, the transport of towed M120A1 120 mm mortars and towed M119 105 mm howitzers up to 110 nmi will help overcome a dependency on fires from aircraft and ships (Department of the Army, 2015a, p. 1-21). Such field artillery could also have some mobility through the transport of M998 HMMWV prime movers.

The objective external payload for FLRAA is for 10,000 pounds transported a combat radius of 110 nmi, with a maximum payload of 13,100 pounds transported a shorter distance. This is well beyond the capabilities of the Black Hawk and more comparable to the CH-47F Block I Chinooks, which can carry 16,000 pounds 50 nmi (Department of the Army, 2015b, p. 5-6). If FLRAA achieves its objective external payload, it will be capable of transporting M777A2 155 mm towed howitzers, all non-"up armored" HMMWV variants, and more "up armored" HMMWVs a distance of 110 nmi. However, a caveat of having enhanced field artillery capabilities is that while the M119 and M777A2 howitzers are useful against the infantry-centric forces the U.S. Army has warred with in the Global War on Terrorism, they will likely be insufficient against near-peer forces that possess longer-ranged artillery, surveillance drones, and advanced counterbattery fires.

An important aspect of FLRAA is the mission radius of external payloads above 10,000 pounds. Long-range artillery, like the M777ER developed for the extended-range cannon artillery program, will be necessary in near-peer conflicts. The M777ER howitzer weighs no less than 1,000 pounds heavier than the M777A2 (Poindexter, 2017). This means that the M777ER weighs around 11,000 pounds. Thus, three FLRAA, assuming an external payload of 11,000 pounds, can transport such a howitzer and both can

An AN/TWQ-1 Avenger missile system from C Battery, 1st Battalion, 174th Air Defense Artillery Regiment, fires a stinger missile at a moving target as part of a Short Range Air Defense Exercise as part of Tobruq Legacy in Utska, Poland, June 17, 2019. Tobruq Legacy is a 21-day exercise that focuses on multi-national partnerships with shared understanding and demonstration of Air Defense capabilities by the United States Army and 12 other partner and allied countries. U.S. Army photo by Private Joanna Gaona Gomez

Back to Table of Contents

transport more than 100 rounds of 155 mm ammunition and the gun's crew. The objective maximum external payload of FLRAA, may incentivize the purchase of light self-propelled artillery like the Hawkeye Mobile Weapon System to provide air assaults with mobile artillery. The Hawkeye Mobile Weapon System is a soft recoil 105 mm howitzer transported by vehicles as light as an HMMWV. Currently, the Hawkeye 105 mm soft recoil howitzer weighs 2,550 pounds, and its prime mover is the M1152A1 w/B2 HMMWV that weighs 8,760 pounds, for a total of 11,310 pounds (AM General, n.d.a, n.d.b). The Hawkeye could provide a more mobile option for infantry brigade combat teams than their M119 105 mm howitzers towed by HMMWVs.

Additionally, FLRAA's objective maximum external payload of 13,100 pounds, if achieved, will allow the transport of all HMMWV variants, including "up armored" HMMWVs, at gross vehicle weight. Thus, given the Block I Chinook's combat radius of 50 nmi with 16,000-pound external payload, a revolution in air assault and air movement capabilities will happen if more numerous medium lift FLRAA are able to transport "up armored" HMMWVs and all the infantry brigade combat team's artillery the same (or larger) combat radius as Block I Chinooks. However, depending on the combat radius of FLRAA with maximum external payload, there may be a reliance on forward arming and refueling points (FARPs), which can rearm and refuel vertical aircraft, to extend the range of FLRAA and Block I Chinooks performing heavy cargo hauling.

THE IMPACT OF FLRAA ON AEROMEDICAL EVACUATION FOR AIR ASSAULTS

Future Long-Range Assault Aircraft will enable aeromedical evacuation with extraordinary range and speed, providing the ability to swiftly pick up wounded troops and transport them to a medical facility. The 'Golden Hour,' a U.S. Secretary of Defense mandate to get the wounded to appropriate medical care within 60 minutes of injury (McKinney, 2018), will be possible with aeromedical evacuation up to 100 nmi from a medical facility (this assumes an aircraft speed of around 280 knots). This will be up from 40 nmi currently (Robinson, 2014, p. 31).

However, even with the large combat radius of FLRAA, if a Soldier becomes wounded more than 100 nmi from the nearest medical facility, then it will require more than an hour to transport a wounded Soldier to a medical facility for treatment. Thus, it would not be possible to meet the 'Golden Hour' mandate. Should FLRAA fly out to an objective closer to the edge of its combat radius of 200–300 nmi, it could take well over an hour for a Soldier to reach a medical facility. For instance, a wounded Soldier 240 nmi from a medical facility responded to by an aircraft traveling around 280 knots will require 90 minutes to arrive at a medical facility. This assumes 15 minutes for a FLRAA to get airborne and 5 minutes to load a wounded Soldier (Robinson, 2014, p. 31). Another inherent problem is that only FLRAA will have the range and speed to respond to such long-range emergencies. Ultimately, this means that during a long-range operation, there will be a need for forward medical treatment in-field away from a medical facility to attempt to meet the 'Golden Hour' mandate.

LIMITATIONS OF LONG-RANGE AIR ASSAULTS UTILIZING FLRAA

There are four key limitations to U.S. Army air assaults to note when discussing the revolutionary capabilities of FLRAA. First, long-range air assaults will require an at-

SGT Joshua Bourbonnais of Test Platoon, 2nd Battalion, 122 Field Artillery, Illinois Army National Guard sights in the Hawkeye 105mm Mobile Weapon System while SSG Thomas Ragan receives instructions from the fire direction control during a simulated drill on Camp Grayling, Michigan, 23 July. The test platoon is testing the Hawkeye as part of Exercise Northern Strike 19, one of the largest reserve component exercises supported by the U.S. Department of Defense. Its mission is to maximize the full-spectrum combat readiness of National Guard units through realistic, cost-effective joint fires training in an adaptable environment, with an emphasis on cooperation between joint and coalition forces. U.S. Army photo by MAJ W. Chris Clyne, 41st Infantry Brigade Combat Team Public Affairs

tack reconnaissance aircraft team with FLRAA. The reason for this is so that, attack and reconnaissance units, utilizing MUM-T [manned-unmanned teaming], conduct a range of tactical and enabling tasks in support of the air assault, to include: air route reconnaissance, LZ/PZ [landing zone/pickup zone] reconnaissance, attacks prior to and during the landing phase, attacks as shaping operations prior to the assault, and attacks, screens and reconnaissance operations in support of the GTF [ground tactical force] after landing. (Department of the Army, 2015b, p. 3-24)

Additionally, attack reconnaissance aircraft will be necessary to ensure "…an [air assault task force] must arrive intact at the LZ. The force must be tailored to provide en route security and protection from the PZ, throughout the entire air route, and at the LZ" (Department of the Army, 2015b, p. 3-27).

The two currently planned choices for attack reconnaissance support and protection for FLRAA in a combat aviation brigade in the early 2030s will be the Apache attack helicopter and FARA. Apaches have a combat radius of 65 nmi (Department of the Army, 2015b, p. 5-1), which is not even enough range for the support and protection of FLRAAs with 8,000–10,000 pounds of external payload. In addition, the cruising speed of the Apache is only 110–120 knots compared to the FLRAA's 250–280 knots (140 knots with external cargo payload) (Department of the Army, 2015b, p. 5-1). This means Apaches are too slow and have too small a range to support and escort FLRAA, either when transporting external payload, or taking full advantage of their speed and combat radius. Thus, the introduction of FLRAA will immediately make the age of the Apache design apparent, which will not be able to keep up with FLRAA. The Improved Turbine Engine Program may help alleviate these problems for Apaches when they get the more powerful engine. Yet, even if the mission radius of Apaches were to double, then such aircraft may only be useful for the support and protection of FLRAA transporting external loads.

As for the possibility of FARA escorting, supporting, and protecting FLRAA, FARA's minimum requirements are smaller in range and cruising speed than for FLRAA. Future Attack Reconnaissance Aircraft will have a minimum speed of 205 knots and a minimum combat radius of 135 nmi (Freedberg, 2018). This means that unless industry delivers an aircraft with capabilities far in excess of the minimum requirements, FARA will not be able to effectively support and protect FLRAA taking full advantage of their range and speed. However, FARA may be able to escort and protect FLRAA transporting external loads. A recommendation concerning this problem will be forthcoming in part 2 of this series.

Second, any type of air assaults using FLRAA will have many of the same vulnerabilities of air assaults in Field Manual 3-99, "Airborne and Air Assault Operations" (Department of the Army, 2015a, p. 8-5 to 8-6). Of special concern is a vulnerability to increasingly sophisticated integrated air defense systems in the movement phase to the landing zones. Air defenses that could rule out long-range operations unless there is the suppression of enemy air defenses, an objective that may require the use of joint fires. Or, unless FLRAA and its attack reconnaissance escorts possess the survivability to defeat sophisticated enemy air defenses.

Third, taking full advantage of the combat radius of FLRAA will still leave air assaults dependent on fires from ships and aircraft. This is due to operating outside the reach of even the longest-ranged U.S. Army field artillery, such as Army Tactical Ballistic Missiles, which have a range of 162 nmi. In the wake of the collapse of the Intermediate-Range Nuclear Forces Treaty, new opportunity presents itself to develop land-based ballistic missiles and cruise missiles with a range to support air assaults operating at a radius of 300 nmi. However, air assaults of up to 200–300 nmi will be without land-based tactical fires.

Fourth, while intermediate staging bases hosting FLRAA conducting long-range operations will be beyond the range of most near-peer field artillery, such bases will still be within the range of opposing cruise missiles; tactical fixed-wing aircraft; short-range, medium-range, and intermediate-range ballistic missiles; and hypersonic missiles. Inter-

A U.S. Army UH-60 Black Hawk helicopter assigned to 16th Combat Aviation Brigade flies overhead during Decisive Action Rotation 16-03 at the National Training Center, California, Jan. 26, 2016. The Soldiers and aircraft from 16th CAB joined other units from 7th Infantry Division to prepare for future missions. U.S. Army photo by CPT Brian Harris

Back to Table of Contents

mediate staging bases may also be within range of tactical ballistic missiles and strategic multiple rocket launchers, such as the Chinese Weishi rockets. Thus, intermediate staging bases hosting FLRAA will need a robust air-defense; indirect fire protection capability, especially against rockets; cruise missile defense; and ballistic-missile defense. This will require that Patriot air defense systems and later, medium extended air defense systems; terminal high-altitude area defense systems; and indirect fire protection capability systems protect intermediate staging bases. In addition, enemy tactical low-observability aircraft and hypersonic missiles will both pose a significant threat to such bases due to their ability to either avoid detection or outmaneuver current air defenses.

CONCLUSION

Future Long-Range Assault Aircraft will transform U.S. Army air assaults with an overview of a range of characteristics. These characteristics are self-deployable range, combat radius, cruising speed, internal payload, external payload, logistical footprint, survivability, all-weather capability, improved functionality in degraded visual environments, and open architectures. Future Long-Range Assault Aircraft will also revolutionize the range and speed of aeromedical evacuation.

Yet, there are several limitations to the kinds of long-range operations created by FLRAA. The 'Golden Hour' mandate may be impossible to meet when exploiting the full capabilities of FLRAA. There will be a need for intermediate staging bases within range of enemy cruise missiles, ballistic missiles, and possibly strategic multiple rocket launchers. This will require these bases to have adequate integrated air and missile defenses to mitigate these threats. Even then, there will still be a vulnerability to both low observability aircraft and hypersonic missiles. Air assaults utilizing the full combat radius of FLRAA will be dependent on ships, aircraft, and in-development long-range fires. Many of the doctrinal limitations and vulnerabilities of an air assault will still stand. Lastly, there will be a need for attack reconnaissance aircraft to escort FLRAA. In the second article, there will be a broader look at how all five aircraft in the FVL program may affect U.S. Army air assaults.

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IN DEFENSE OF CURRENT WARRANT OFFICER PROFESSIONAL MILITARY EDUCATION

By CW5 Jeremie Zabko

The opinion article, "Reinventing the Warrant Officer Professional Military Education Wheel," discussing the need to reform both aviation professional military education (PME) and the air mission survivability officer training, recently appeared in the January–March 2020 edition of *Aviation Digest*. It is my opinion that the author's arguments were fundamentally flawed, and the recommendations were vague and lacked proper analysis. This article will primarily focus on refuting the comments made to the warrant officer education system.

The contested article asserts, "...the current professional military education (PME) system is not tailored to the needs of warrant officers in general and aviators in particular" (Boehler, 2020). I postulate that the design of the current warrant officer education system meets aviation warrant officers' educational requirements. With a background in course analysis; design; development; implementation; and evaluation, I will attempt to clarify the status; purpose; and direction of our warrant officer education system.

Additionally, the article states, "By patterning the current PME courses after O-grade courses, the Army is not putting its aviators in a position to grow in their profession" (Boehler, 2020). First, there are two types of commissioned officers: warrant officers (CW2–CW5) and officers. Commissioned officers are broken down further to company grade, field grade, senior field grade, and general officers. For clarification, Department of the Army Pamphlet (DA PAM) 600-3, "Officer Professional Development and Career Management," states "the term 'officers' encompasses warrant officers (warrant officers are appointed by commission at the grade of chief warrant officer two (CW2)), company grade officers, and field grade officers" (Department of the Army, 2019, p. 1). Unfortunately, many administrative publications seem to muddy the waters of the issue. To clarify, there is no such thing as an "O-grade;" therefore, the assumption is that the author is referring to officers. Second, we must speculate as to what "patterning" implies. Either warrant officer courses are deigned to mirror the Captains Career Course; Intermediate Level Education; and Command General Staff College, or perhaps "patterning" refers to the content within each of our warrant officer PME courses. In any case, warrant officer courses are neither of those possibilities. Army Regulation (AR)

611-1, "Military Occupational Classification Structure Development and Implementation," paragraph 5-2 states:

Warrant Officer Education System, October 1993, established an initiative of WOLDAP [warrant officer leader development action plan]. This system provides for the following five levels of military education of warrant officers:

(1) Preappointment Level-Warrant Officer Candidate School.

(2) Entry Level-Warrant Officer Basic Course for warrant officers in the grade of CW2.

(3) Advanced Level-Warrant Officer Advanced Course for warrant officers in the grade of CW3.

(4) Senior Level-Warrant Officer Intermediate Level Education for warrant officers in the grade of CW4.

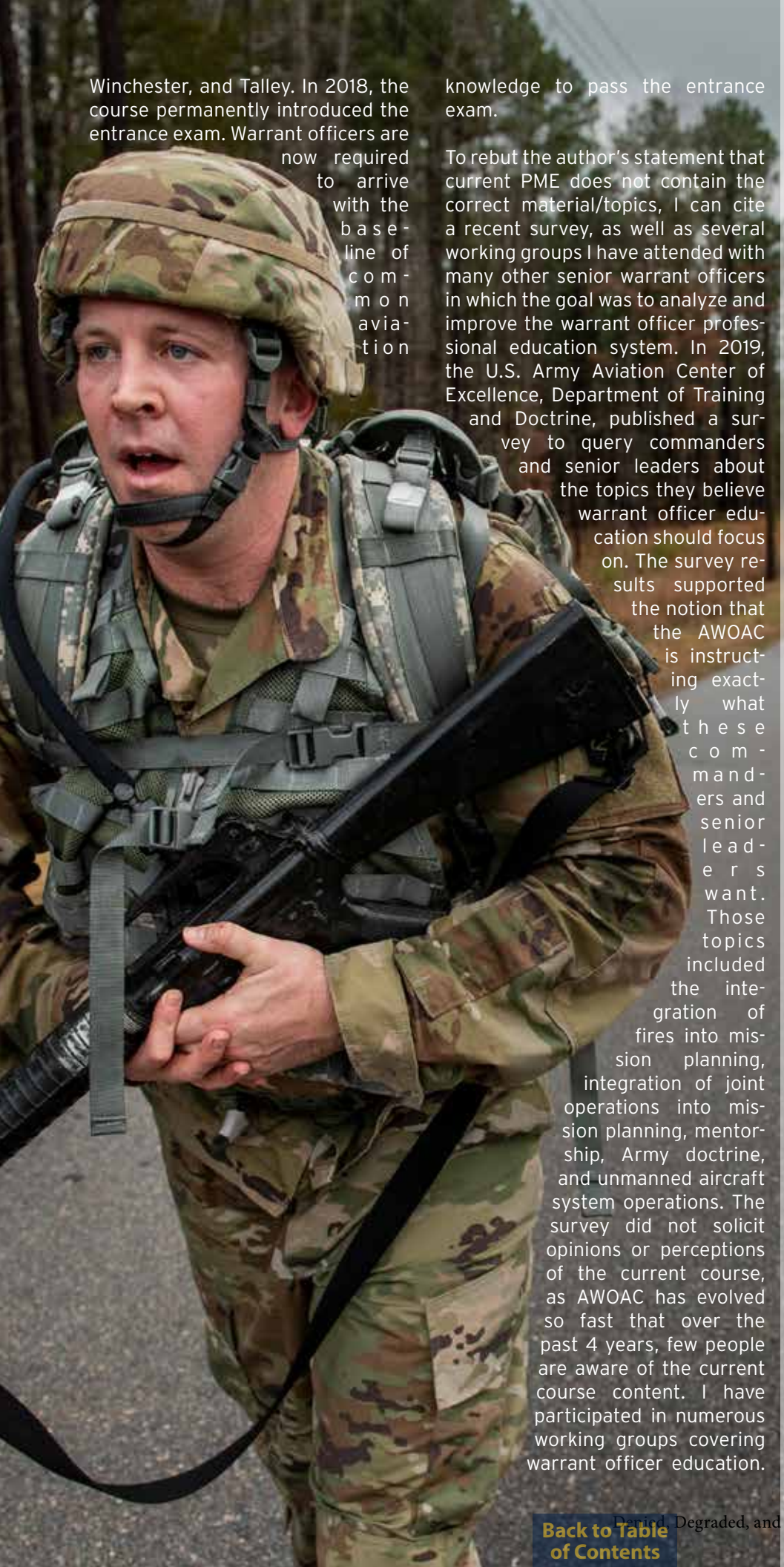
(5) Senior Level-Warrant Officer Senior Service Education for warrant officers in the grade of CW5. (Department of the Army, 2019, p. 20)

Anyone who opens AR 611-1, AR 350-1, "Army Training and Leader Development," AR 600-3, or DA PAM 600-3 will quickly realize that warrant officer PME is designed to move a warrant officer from one rank to the next. Aviation delays the attendance and completion requirements of PME (152–155 area of concentration [AOC]) due to the length of flight school and projected echelon of assignment. One of the key concepts discussed within DA PAM 600-3 is that "Junior warrant officers' (WO1s and CW2s) main developmental focus is on their primary military occupational specialty (PMOS) or AOC. As they gain more experience and training, their focus and expertise shifts from their PMOS or AOC to integrating other systems within their branch or FA [Functional Area] to Army, joint, and national-level systems" (Department of the Army, 2019, p. 17). In other words, the Aviation Warrant Officer Advanced Course (AWOAC) is the transition point where aviation warrants learn to apply their expertise across the formation.

Beginning in 2013, the AWOAC began transitioning from staff training toward technical and tactical training to enable warrant officers to become better warfighters. During this period, the course replaced topics such as the military decision-making process; command post of the future; and the weeklong memorandum writing class with track-specific training, threats to aviation, and aviation core competencies. From 2016 to 2018, the course refined its focus to target the senior company CW2 to CW3. This change of focus increased the relevancy of the course. An increase of assessments, practical exercises, and a prerequisite verification exam (entrance exam) resulted in an intensification in academic rigor rarely found in military courses.

The 2017 entrance exam results (average score of 24%) illustrated the need to further enhance the technical and tactical focus of the course. According to the initial exam results, less than 25% of our Soldiers could identify a threat graphic (difference between an antenna and a threat), nor did aviators understand basic joint terminology such as Bingo,

U.S. Army Chief Warrant Officer 2 Timothy Locklear, an aviation mission survivability officer with 2nd Squadron, 6th Cavalry Regiment, 25th Combat Aviation Brigade, stationed at Wheeler Army Airfield, Hawaii, conducts a routine run-up during Exercise Cobra Gold 2020 on Camp Akathotsarot, Phitsanulok province, Kingdom of Thailand, Feb. 26, 2020. U.S. Air Force photo by SSgt Dhruv Gopinath



Winchester, and Talley. In 2018, the course permanently introduced the entrance exam. Warrant officers are now required to arrive with the baseline of common aviation knowledge to pass the entrance exam.

To rebut the author's statement that current PME does not contain the correct material/topics, I can cite a recent survey, as well as several working groups I have attended with many other senior warrant officers in which the goal was to analyze and improve the warrant officer professional education system. In 2019, the U.S. Army Aviation Center of Excellence, Department of Training and Doctrine, published a survey to query commanders and senior leaders about the topics they believe warrant officer education should focus on. The survey results supported the notion that the AWOAC is instructing exactly what these commanders and senior leaders want. Those topics included the integration of fires into mission planning, integration of joint operations into mission planning, mentorship, Army doctrine, and unmanned aircraft system operations. The survey did not solicit opinions or perceptions of the current course, as AWOAC has evolved so fast that over the past 4 years, few people are aware of the current course content. I have participated in numerous working groups covering warrant officer education. During these meetings, our senior warrant officers have deliberated over what topics they believe our educational system should include. In every recent instance, I have happily informed them that the current PME topics they listed are the ones already taught in these courses.

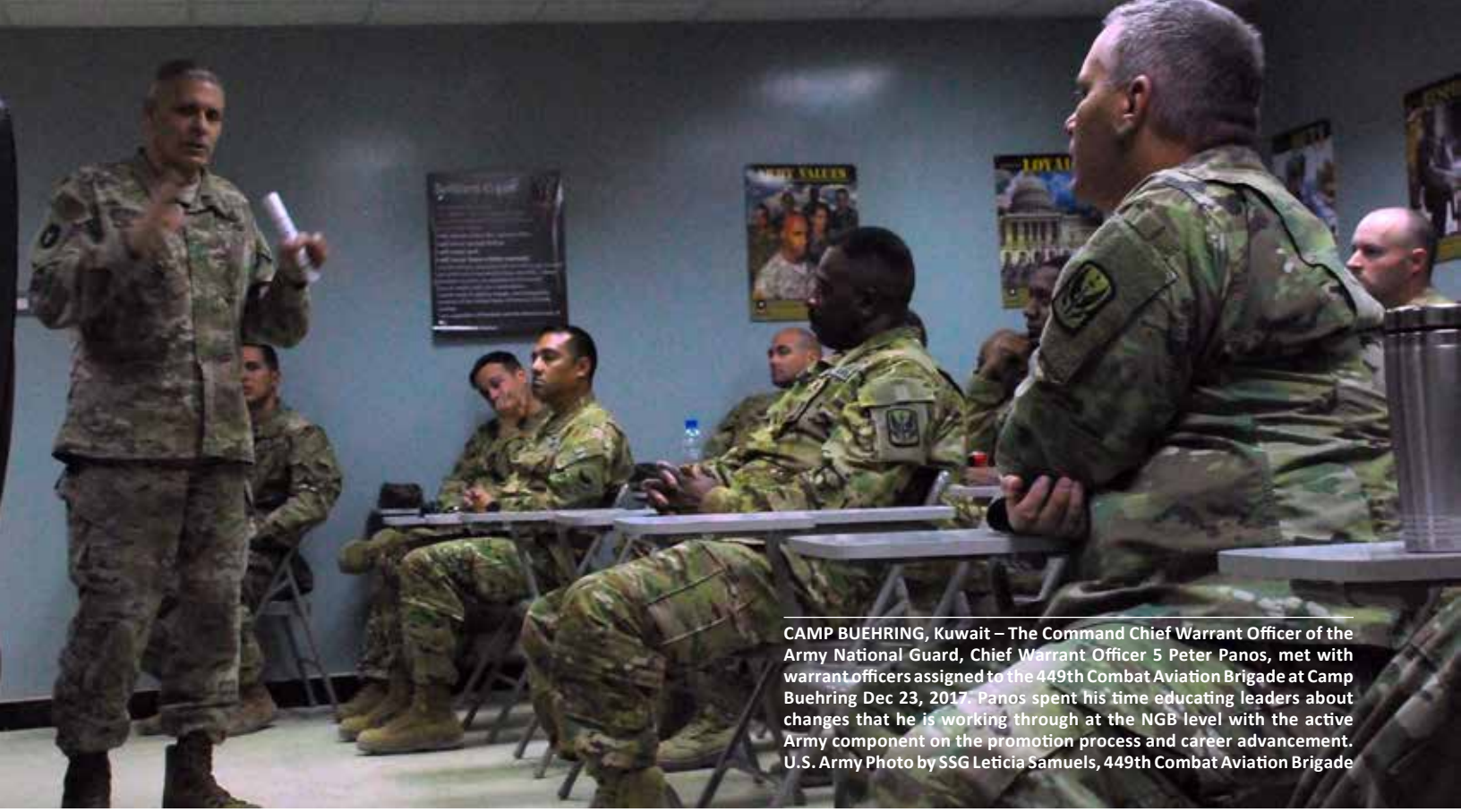
The contested article further states, "there is a clear need to have continuing education for aviators-aviator training-not battalion commander training. There are no true post-graduate Army aviator courses in existence today" (Boehler, 2020). First, as discussed earlier, warrant officer PME is a continuous process. Second, anyone who believes a 12-day Reserve Component (RC) AWOAC or perhaps the 53-day Active Component AWOAC, plus a 5-week Warrant Officer Intermediate Level Education course is equivalent to the education a battalion commander receives is mistaken. Third, it is not exactly clear what the author means by "aviator training."

The author attempts to expound upon "aviator training" to denote topics such as cockpit leadership, airmanship, and air mission commander training. This type of training is not graduate-level training, nor is it something that should occur in an institutional setting. This type of aviator training is basic unit training covered during progression from pilot to pilot-in-command (PC). The author alludes to his unit needing more aviator training when he mentions an issue of CW3s not becoming PCs and suggests allowing them to attend track courses as pilots (Boehler, 2020).

The aviation branch portion of DA PAM 600-3, 2014 version, does a fine job at explaining why a warrant officer should make PC prior to pro-

Christopher Dayton, a U.S. Army Reserve staff sergeant and warrant officer candidate from the 516th Sustainment Brigade, leads the front of a 10-kilometer ruck march along fellow U.S. Army Reserve and U.S. Army National Guard Soldiers as part of a graduation requirement for their candidate school at the Regional Training Institute at Fort Pickett, Virginia, Jan. 25, 2020. U.S. Army Reserve photo by MSG Michel Sauret

Back to Table of Contents



CAMP BUEHRING, Kuwait – The Command Chief Warrant Officer of the Army National Guard, Chief Warrant Officer 5 Peter Panos, met with warrant officers assigned to the 449th Combat Aviation Brigade at Camp Buehring Dec 23, 2017. Panos spent his time educating leaders about changes that he is working through at the NGB level with the active Army component on the promotion process and career advancement. U.S. Army Photo by SSG Leticia Samuels, 449th Combat Aviation Brigade

motion. Warrant officers, military occupational specialty (MOS) 152-155 in DA PAM 600-3 states, "These are basic level tactical and technical experts who should expect to serve in platoon, or company-level positions. Attaining pilot-in-command status is a goal..." (Department of the Army, 2014, p. 95). Chief Warrants, MOS 152-155 in DA PAM 600-3 states "These officers should concentrate on attaining pilot-in-command status, complete career track training courses..." (Department of the Army, 2014, p. 96). The RC section of this DA PAM states, "RC Aviation warrant officers are managed in the same manner as the RC commissioned officer" (Department of the Army, 2014, p. 100). The RC commissioned officer section essentially states, "RC Aviation officer development objectives and qualifications parallel those planned for their AA [Active Army] counterparts" (Department of the Army, 2014, p. 82). Finally, the key developmental objective of officers graduating flight school per DA PAM 600-3 (2014) is to make PC.

The author mentions that warrant officers are unable to conduct proper home station training. He states, "In addition, many trainers simply do not have the knowledge base to provide advanced training" (Boehler, 2020). The evidence provided by the author is simply his observation of poorly conducted pilot classes that are a "regurgitation of flight school material" (Boehler, 2020). First, if your unit's pilot classes are subpar, the problem rests squarely on the standardization pilot and other trainers. Second, pilot classes are academic precursors to practical training, and are not where the bulk of home station training occurs. Third, PME already covers the issue of home station training in detail. Home station training became a critical task during the 2017 AWOAC Critical Task Site Selection Board (CTSSB).

The Aviation Warrant Officer Advanced Course covers home station training, mentorship, and leader development. The focus of this training is specifically to prepare rising senior company-grade warrant officers with the knowledge base to prepare and conduct advanced unit training. Unlike the contested article would suggest, all of the modifications to warrant officer PME have been intended to create a successive and progressive learning plan. In this context, the Warrant Officer Basic Course would be undergraduate education and the AWOAC would be graduate-level education.

The Aviation Warrant Officer Advanced Course conducts graduate-level aviation training by providing warrant officers with an advanced understanding of how aviation integrates into current and future operations. It covers threat training, to include tactics simulation training. As a result of its academic rigor, adherence to standards, and course outcomes, the American Council of Education awarded the 53-day AWOAC the same college credit (12 BA and 3 MA) as the 21-week Aviation Captains Career Course in 2018.

From 2016 through 2017, a USAACE-led working group identified training gaps within the warrant officer education system. As a result, USAACE successfully received funding to create an Aviation Warrant Officer Intermediate Level Education Follow On (AWOILE F/O) course in

order to provide post-graduate level education.

In 2017, the AWOAC conducted its CTSSB. During this board, track-specific critical tasks were also determined. Following the board, USAACE began to take a holistic approach toward its track courses. The CTSSBs for track courses now determine the tasks and outcomes for the track training within AWOAC, in addition to the learning levels and outcomes for the track course itself. This change has revolutionized track training both within the track courses and PME. The AWOAC should now be considered part of the progression from platoon-level functions to senior company-grade positions, such as instructor pilot to senior instructor pilot or maintenance pilot to maintenance evaluator, etc. For example, the AWOAC maintenance track training covers every task found within the current Maintenance Evaluator Training Support Package (other than flight tasks).

The author makes a statement about how broadening assignments are important, and yet the "current PME courses don't adequately prepare warrant officers for positions at upper echelons outside of aviation" (Boehler, 2020). The author continues by stating AWOAC PME "should be focused on making us the best aviators and tacticians possible" (Boehler, 2020). It is unclear if the recommendation is to change the PME to prepare Soldiers for broadening assignments or focus on branch-specific training. Since I have already discussed how AWOAC trains branch-specific tasks, I will focus on the broadening issue.

There is a common misunderstanding of the term "broadening." Many assume broadening implies working outside the aviation branch; however, broadening occurs when one is assigned outside the aviation brigade. As an aviation warrant officer progresses from WO1–CW5, the potential assignments within a combat aviation brigade quickly diminish, and senior warrants can expect assignments at places like Futures Command, the Capability Development Integration Directorate, the U.S. Army Training and Doctrine Command Capabilities Manager, the Aviation Survivability Development and Tactics Team, the Department of Training and Doctrine, the Combat Training Center (CTC), the Department of Evaluations and Standardization (DES), etc. The expectation is that these officers will provide expertise to the aviation enterprise and then return to the aviation brigades. The AWOAC is NOT intended to provide a warrant officer the ability to serve in these positions. The newly developed AWOILE F/O course (mentioned earlier) fills this education gap. The AWOILE F/O provides senior CW3–CW4s with the baseline knowledge of how the aviation enterprise works and how their technical expertise can be applied in developmental and cross-functional positions that have great impact on the aviation enterprise and Army. The article titled "Training, Education, and Readiness" in the October 2019 issue of Flightfax online newsletter is a good source of further information on this subject (Knox, 2019).

Chief Warrant Officer 5, David Williams, the first Army staff senior warrant officer, speaks in front warrant officers from across Fort Bragg, N.C., during a warrant officer professional development seminar, Feb. 27. Williams stressed that maintaining technical proficiency in a continually and rapidly changing environment through education is at the core of keeping the Warrant Officer Corps relevant. U.S. Army photo by SPC Paige Behringer, 10th Press Camp Headquarters

Talent management within the PME system is the next topic the author discusses. Other than stating that PME should provide "a path for growth, as well as an outlet for the very best to succeed…" (Boehler, 2020), I am unsure of the exact recommendation and problem statement. Again, AR 611-1, DA PAM 600-3, and AR 350-1 clearly articulate a path for growth. Professional military education provides the knowledge required for the next level of responsibility. Although AWOAC is not required for promotion to CW3 (Compo 1&2), warrant officers may attend as CW2s (if certain criteria are met). This allows commanders to send the right warrant officers early. With promotion boards favoring those who have completed PME, this process sets the warrant officer up for success.

Compo 2&3 utilize talent management when it comes to which version of AWOAC they send their warrant officer to. Historically, the full-time Compo 2&3 Soldiers attend the 53-day AWOAC as opposed to the 12-day RC version of AWOAC.

This is likely due to the 12-day RC AWOAC being not equivalent to the 53-day version and being in violation of the One Army School System. The 12-day course is the only nonequivalent version of warrant officer PME in the entire Army. The 12-day course, even with the accompanying 75-hour distance learning, pales in comparison to the instruction delivered in the 53-day AWOAC.

The article goes on to state the "Professional military education student evaluations should be incorporated into OERs" (Boehler, 2020). The inference from the article is that the author would like PME to play a greater role in a Soldier's potential for promotion. Every Soldier is required, per AR 350-1, to receive a service school academic evaluation report (Department of the Army Form 1059) upon completion of PME (Department of the Army, 2017, p. 55; Department of the Army, 2019). This evaluation report is part of the Soldier's permanent file and available for promotion board members to review. The 2019 version of the Department of the Army Form 1059 even includes the Soldier's class ranking (Department of the Army, 2019, p. 1). Additionally, the Form 1059 does not preclude a commander from mentioning his Soldiers' PME accomplishments in the annual officer evaluation report.

Last, the contested article recommends the creation of a "Jedi Master Course" at Fort Rucker, Alabama. The Jedi Master Course would essentially be a weapons and tactics instructor course. The article's assumption that there are resources and funding available at Fort Rucker seems to indicate a lack of knowledge on how courses are developed, budgeted, manned, and funded. This is an education gap that the WOILE F/O course will seek to address. Such a course (assuming an existing and validated gap) would require a detailed doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy analysis. Additionally, the course would require significant growth in infrastructure, instructors, developers, support personnel, travel, and pay & allowances (just to name a few considerations). I can attest that the benefit of such a course does not outweigh the costs. We exist in a zero-growth fiscal and manning environment, and implementation of a new course would mean taking away from another. We should all be looking for ways to reduce time spent in institutional training environments, while improving the content in the courses we already have. Reduction of institutional training occurs when Soldiers are provided the right equipment coupled with the right education at the right time, not when training is at an expensive course only a few will ever attend. In fact, the goal to improve home station training is one of the reasons why the AWOAC and the current Air Mission Survivability Course are changing.

Over the past 7 years, USAACE has devoted a tremendous amount of effort redesigning Army warrant officer PME. The AWOAC is and will continue to evolve in order to provide the right training to the force. The course continuously changes based on recommendations from various sources (e.g., CTC, DES, and senior leaders) to improve the course. Recent changes over the last few years have focused on improving readiness, survivability, and adherence to standards through increased technical and tactical knowledge. As the only course to provide aviation warrant officers with formal instruction on multi-domain and large-scale combat operations, the need to retain this course is greater than ever.

"Professional military education should consist of subject matter that makes us better warfighters" (Boehler, 2020). Luckily for aviation warrant officers, our warrant officer basic course, AWOAC (53-day version) and upcoming AWOILE F/O courses produce a better warfighter. By eliminating staff-related training while integrating common core material within technical- and tactical-focused training, our education system provides a progressive training environment from WO1–CW4. Focusing PME design and development to specific demographics, while nesting track outcomes within PME (track specific); aviation is driving change in advanced schooling.

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CREATING A CULTURE OF TACTICAL EXCELLENCE IN ARMY AVIATION

By CW4 Tim Brundage, in collaboration with CW5 John R. Kennedy

We preserve peace by preparing for war. Are your aircrews prepared to operate across the forward line of own troops against a peer/near-peer adversary? Are they trained to plan a mission through an integrated air defense system (IADS), then react to the unplanned threat system? The National Defense Strategy and U.S. Army Aviation Center of Excellence (USAACE) have issued guidance to prepare for future large-scale combat operations (LSCO). Army aviation is rapidly becoming more survivable today in preparation for the future fight. Our enemies aren't resting, and neither can we.

More than 40 pilots and crew members from the 2-285th Assault Helicopter Battalion perform a 12-ship formation flight during training March 8 in Phoenix. U.S. Army photo by SGT Lauren Twigg

Back to Table of Contents

The current aviation force has been in a counterinsurgency fight since 2001. Most of the aircrew members in today's Army started their military careers after that time and have neither recollection of the "Cold War" nor the concept of massive force on force operations. Since 2003, most aircrews have had multiple combat tours; all of which involved operating in areas where U.S. forces "owned the skies" and did not fear radio detecting and ranging threats or IADS. Our greatest threat has primarily been the man-portable air defense system or small arms threat by the random insurgent. Army aircrews, with the help of aircraft survivability equipment and complementary tactics, have gotten good at that fight.

THE PAST

The culture in Army aviation units has been one where tracked warrant officers managed isolated programs that did not necessarily integrate with each other. The commander's programs (standardization, safety, maintenance, or survivability) could support the doctrine by meeting the requirements without supporting the commander's other programs. How do tracked programs best support the commander? Equally important, how do they support Army aircrews? Tracked programs support the commander, the formation, and the mission best by supporting each other.

The first publication that defined the aviation mission survivability program was Training Circular [TC] 3-04.9, "Commander's Aviation Mission Survivability Program,"[1] published in 2015. Prior to that, the aviation mission survivability officer (AMSO: previously called tactical operations officer) was generally relegated to performing menial tasks rather than being seen as the commander's tactical expert and trainer for aviation tactics. Those tasks included updating mission planning computers, performing duties as the personnel recovery officer (PRO), and other duties as assigned. Additionally, many commanders chose their AMSO by default. If the individual was not trusted to be an instructor pilot (IP) or to manage another track program, they were typically assigned as an AMSO. It was an easy position that needed to be filled. The commander had no reportable requirements for the AMS program and it was only inspected during an arms inspection. It became a self-fulfilling prophecy. The AMSO didn't have to do anything, so the commander could put a nonperformer in the position. The result was an ineffective program with little accountability.

CHANGING THE CULTURE

Army aviation has changed the paradigm. Aviation leaders are looking to the future and are actively preparing for the next fight. In order to force the change, requirements to train and evaluate tactical proficiency have been established. Doctrine and training have been transformed to provide the capabilities and shape what tactical readiness looks like. The Army has invested in our tactical proficiency by funding the testing of aviation tactics. To date, the survivability branch has coordinated three iterations of quick reaction tests to validate tactics (Battlespace Simulations Inc., 2020).

The primary leap forward is the shift in culture. The vast chasm between aviation tracks (specifically standardization and survivability) is closing rapidly. The requirements established to increase tactical readiness were developed so that the standardization and survivability tracks have to integrate and support each other for either one to be successful. Additionally, the qualification courses for both tracks include mutually supportive content. Survivability instructors come to the IP course to teach students how to train the maneuvers required to execute evasive flight tactics. During the AMSO course, students are trained on the fundamentals of instruction and methods of instruction. In reality, all tracks serve a single purpose: To ensure that aircrews can safely and effectively fulfill the mission. The tracked warrant officer's job is to add capabilities to the commander's arsenal. The most effective way to do so is to integrate across the tracks and add our capability in a way that supports the other tracked programs.

SURVIVABILITY CAPABILITIES

Current doctrine (Army Regulation [AR] 95-1, "Flight Regulations," TC 3-04.9,[2] and TC 3-04.11, "Commander's Aviation Training and Standardization Program") defines an effective survivability program and holds leaders accountable for their survivability program. This doctrine permeates across tracks and should be part of the culture in an Army aviation unit. Effective leaders have adapted to the paradigm shift and ensure that they have the right people in the right positions, then support them.

A good AMS program is one where every ACM is proficient in the three tenets of survivability. The three tenets of survivability include: understanding threat, fused mission planning, and evasive flight tactics. The AMSO is primarily responsible for training those tenets to the force and evaluating the tactical strengths of the organization. The standardization community plays a critical role in the training and evaluation of the maneuvers required to perform evasive flight tactics. Safety and maintenance are also critical to all aspects of aviation and are critical to executing the mission.

Personnel recovery (PR) is a critical Army program and must be supported. "Personnel Recovery," (2010) is an Army program defined by AR 525-28 and joint doctrine as, "'The sum of military, diplomatic,

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Back to Table of Contents

and civil efforts to prevent or effect the recovery and return of U.S. military, [Department of Defense] DOD civilians, and DOD contractor personnel, or other personnel as determined by the Secretary of Defense, who become IP in an operational environment"' (Department of the Army, 2010, p.8).

In accordance with the doctrine, the brigade and higher headquarters must assign a PR officer (PRO) in the grade of E-6 or above. Army Regulation 525-28 defines the responsibilities of elements of the commander's staff to support PR. In aviation units, the precedence has been set that the AMSO will be the PRO and perform all of the functions necessary to support PR (Department of the Army, 2010, p. 9). Personnel recovery duties include the tedious administrative function of managing the information for all of their personnel and training their personnel to react to a PR event. During a PR event, the PRO is responsible for transmitting the personal information of the isolated individuals through the PR architecture and advising the commander and his staff (Department of the Army, 2010, p. 9).

The commander's most tactically proficient aviator is more suited to train aircrews in tactical application of aircraft rather than performing administrative duties. During a PR event, the AMSO (if not isolated himself) is better employed planning and executing the mission to recover personnel instead of performing administrative duties. The best person to perform duties as a PR manager (PRM) or PRO is someone in the commander's staff who isn't expected to be "on mission," but is tied in to the current status of mission execution. As of this writing, TC 3-04.9[3] dictates that the AMSO will perform duties as the PRO.

RESERVE COMPONENT CHALLENGES

The reserve component (National Guard and Army Reserves) face many unique resource shortages. Some of those resource are in the form of time and access to information. Reserve component aircrews receive the same initial training and have all the same requirements as the active component.

Traditional reserve component AMSOs are generally available 5 days per month and 2 weeks each year for annual training. When reserve component AMSOs are available to train, they spend the majority of their time meeting flight minimums, attending required training, or fulfilling other requirements. There is very little extra time available to spend searching for information.

Many reserve component aviation units have limited access to the SECRET Internet Protocol Router Network (SIPRNET) at their place of duty. The AMSO may have to travel across the state in order to access an operational SIPRNET terminal. The AMSO should be the subject matter expert and the primary trainer for threat systems, fused mission planning, and evasive flight tactics. It is critical that the AMSO has access to the information.

In order to be successful, reserve component AMSOs need additional assistance. The assistance could be in the form of advanced training and packaged information products. The challenge is to provide all the information and training an AMSO needs. Doing so enables AMSOs to spend time training their aircrews and managing an AMS program, rather than having to build a program.

GOING FORWARD; THE FUTURE

An effective survivability program will maximize survivability, lethality, and mission success. The results are the preservation of combat power and, even more importantly, more of our brothers and sisters coming home with us. The commander is the most critical part of their survivability program. They must support their survivability program, fill the survivability positions with trusted aviators who are capable of training the force to survive LSCO, and establish a culture that incorporates survivability in all training and operations.

For ACMs to survive on the future battlefield, commanders at all levels must continue to shift with the paradigm. All the capabilities that are provided by the tracked programs are critical to success in the LSCO mission against a peer/near-peer threat in an IADS environment. Each of those capabilities must be mutually supportive in order to maximize the potential of the organization and mitigate combat losses.

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CW5 John Kennedy is the Standardization Officer for the National Guard Bureau. He has served 32 years in the National Guard as a Standardization Officer at the Detachment level, through Division/Group levels. His deployments include Kuwait, Iraq, and Afghanistan.

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Back to Table of Contents

DENIED, DEGRADED, AND DISRUPTED SPACE OPERATIONAL ENVIRONMENT

By CW4 Leonard Momeny and LTC Mike Gourgues

Every branch of the military is extremely dependent upon the space domain for both day-to-day and combat operations. The space domain is home to assets that provide things such as *precision navigation, and timing* (PNT); *over-the-horizon communications; intelligence, surveillance, and reconnaissance* (ISR) assets; and even battle tracking. As the Army moves toward matured perspective of the reality of multi-domain (air, land, sea, space, and cyber) warfare, it becomes necessary to build basic knowledge of those "new" domains and better understand what it means to operate with or without them. This article seeks to explain the basics of the space environment and what it means to experience a *Denied, Degraded, and Disrupted Space Operational Environment*, or D3SOE.

DOMAINS

Domains are where war happens and are concerned with what considerations are applied during such moments. The traditional domains recognized by most military include air, land, and sea. However, due to the growing dependence upon various technologies to execute military operations, considerations had to be extended to both cyber and space to be recognized as relevant domains. As mentioned within the introduction section, many aspects of the space domain have an influence upon what we utilize

U.S. Army AH-64 Apache attack helicopter assigned to 2-6 Cavalry Regiment, 25th Combat Aviation Brigade sits on the flight line while a shooting star falls in the sky on FARP 17, Pōhakuloa Training Area, Island of Hawaii, Hawaii, April 13, 2019. AH-64 Apaches are an integral part of Lightning Strike, a division led, joint live-fire exercise that is conducted under the direction of the multi-domain operations concept. U.S. Army photo by CPT Keith Kraker

Back to Table of Contents

to execute and otherwise monitor and track combat operations. This requires us to increase our "cross-domain understanding" as it applies to the modern operational environment and what it means to operate within an environment (Department of the Army, 2017, p. 1-6).

Denied domains are fairly easy to understand. While an integrated air defense system, or IADs, attempts to deny entry within the air domain, various obstacles can be placed to degrade or deny entry via the land domain. The space domain is just a little different. For the past 19 years, the Army's adversaries and competitors "have not tried to deny or disrupt our access to space in any large manner" (CALL, 2018, p. 1). While our access to the space domain has not been actively denied or disrupted, our adversaries and competitors "have observed, learned, and planned for the U.S. Army's heavy reliance on space-enabled devices and associated assured access" (CALL, 2018, p. 1). It should be known that many of those potential adversaries that have observed us maintain "numerous capabilities designed to deny assured access to space-enabled capabilities" and are "developing, improving, training and – in some cases – executing in battle, their own systems which may affect our assured access to space" (CALL, 2018, p. 1).

Global positioning systems (GPS) are exceptionally susceptible to such interference. Aside from denying PNT through jamming, it is also possible to spoof or manipulate that same signal. In a GPS-denied environment, attempting to execute precision navigation in support of an air assault or some other operation enabled by aviation forces becomes problematic. In an article for *Politico* (2 Sep 2017), Wesley Morgan said that the challenge with an enemy equipped with various Russian "jammers and other electronic warfare tools" is that they "'could effectively neutralize a GPS system from 50 miles away.'" The result of such capability to deny or degrade such key space-based assets as GPS means that "'we should assume that GPS will be either unavailable or unreliable for the duration of the conflict if the [brigade] faces a near-peer threat or sophisticated non-state actors'" (CALL, 2018, p. 2).

HOW TO PREPARE FOR D3SOE

We must accept the reality of a denied, degraded, or disrupted space operational environment for aviation forces. After all, most material within the standard combat aviation brigade, or CAB, is highly sophisticated and increasingly so. Ground force commanders often rely on either space-based assets or the CAB to provide them with the situational awareness necessary to conduct successful operations in a complex global operational environment. What follows are some potential suggestions on how to prepare for and negotiate the challenges of D3SOE. These suggestions focus on education and training in order to try and solve this problem before we are tested by the enemy.

WHO CAN HELP?

First, identify that your space domain experts are within your own formations and beyond. A functional area 40 (FA40) officer can be found at most division headquarters and are known as *Space Operations Officers*. These officers form the tangible core of Army Space Cadre and are usually more than happy to come to a CAB in order to provide informational training on aspects of the space domain and the challenges of D3SOE. Within the CAB may be individuals who are residing in billets that are considered non-FA40 space billeted positions. These Soldiers are typically identified by the additional skill identifier, 3Y. While not as highly specialized as traditional FA40s, these capable Soldiers can still provide introductory briefs and education on the space domain and challenges of D3SOE.

WHAT ARE APPROPRIATE PROFESSIONAL RESOURCES THAT DISCUSS D3SOE?

Two great resources come to mind when trying to learn about D3SOE:

1) FIELD MANUAL (FM) 3-14 (ARMY SPACE OPERATIONS), 30 OCTOBER 2019

2) CENTER FOR ARMY LESSONS LEARNED HANDBOOK (CALL) NO. 18-28, (OPERATING IN A DENIED, DEGRADED, AND DISRUPTED SPACE OPERATIONAL ENVIRONMENT), JUNE 2018.

Field Manual 3-14 serves as the foundational doctrine for space operations within the United States Army. The manual is a trim 126 pages and is very informative, even taking the time to

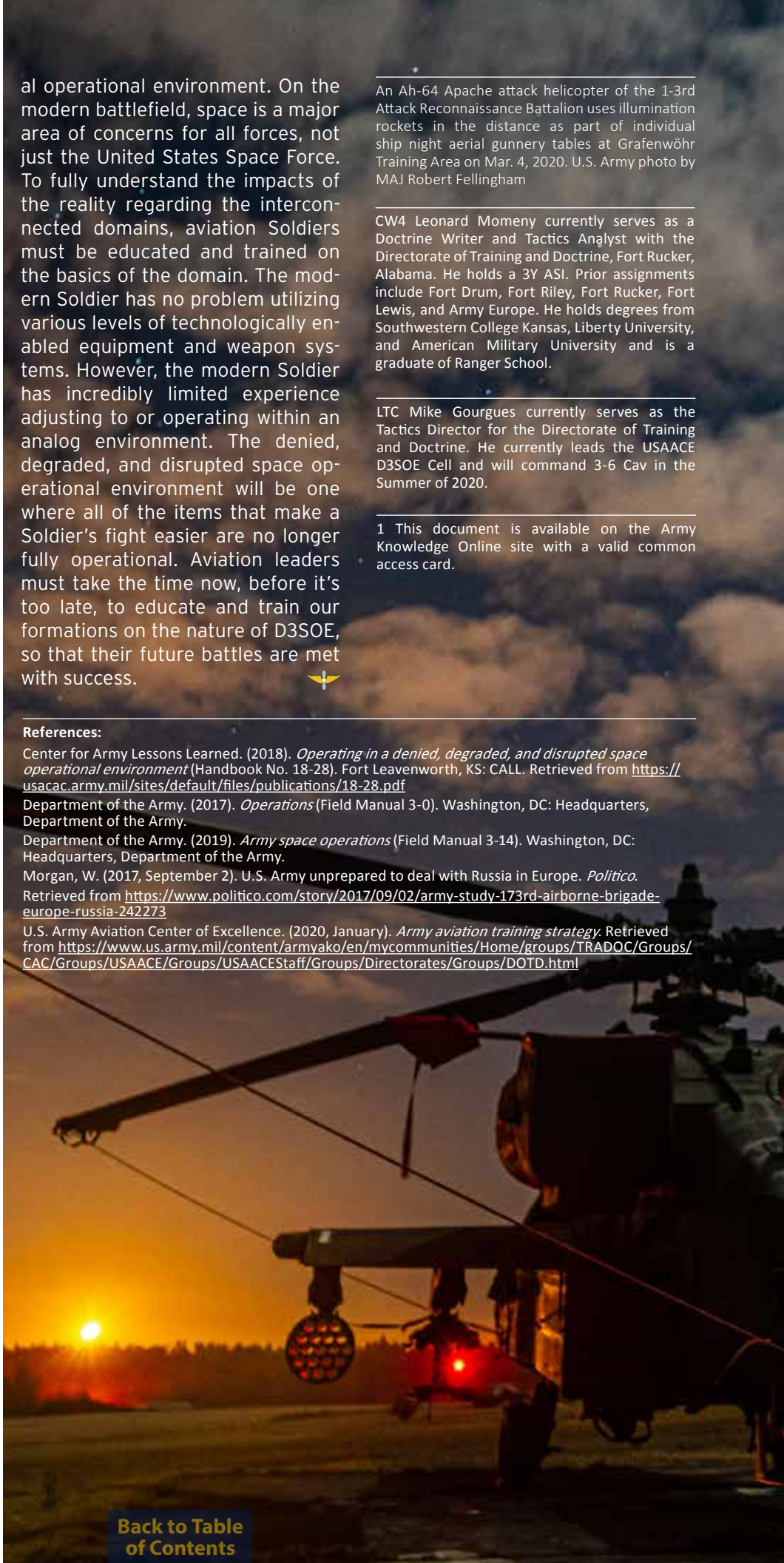
speak to the impacts of D3SOE on the efforts of Army aviation. The second text, CALL handbook no. 18-28, covers the "wave tops" in approximately 100 pages, providing data that are more informational to the specific impacts of D3SOE upon operations without going into incredible detail. Both serve as quick reads and tremendous resources for any Soldier hoping to learn more about the space domain.

HOW DO I TRAIN FOR D3SOE CONSIDERATIONS?

Training for D3SOE is no longer optional. The level of reliance upon space-based assets must be realized at every level of the CAB, and training must cover how to transition into and out of the denied environment. This reality is not easy to overcome, and it's even harder to train. Soldiers must be able to recognize the D3SOE and know what to do when encountering those conditions. Operating with reduced reliance on space-based capabilities is a great place to start and can include activities such as revisiting "pilotage and dead reckoning," exercising multiple levels of a PACE (Primary, Alternate, Contingency, and Emergency) plan in communications, and increased utility of analog battle tracking methods. Additionally, "Using training devices to replicate D3SOE [usually at training centers] conditions is critical to providing realistic operational training, especially for PNT and SATCOM" (Department of the Army, 2019, p. 4-15). More ideas for this kind of training are outlined in FM 3-14, and guidance is also provided within the Army Aviation Training Strategy (U.S. Army Aviation Center of Excellence, 2020).[1]

CONCLUSION

Land, sea, and air no longer dominate the various domains of war, as technology has simply made things far too complicated within the global operational environment. On the modern battlefield, space is a major area of concerns for all forces, not just the United States Space Force. To fully understand the impacts of the reality regarding the interconnected domains, aviation Soldiers must be educated and trained on the basics of the domain. The modern Soldier has no problem utilizing various levels of technologically enabled equipment and weapon systems. However, the modern Soldier has incredibly limited experience adjusting to or operating within an analog environment. The denied, degraded, and disrupted space operational environment will be one where all of the items that make a Soldier's fight easier are no longer fully operational. Aviation leaders must take the time now, before it's too late, to educate and train our formations on the nature of D3SOE, so that their future battles are met with success.



An Ah-64 Apache attack helicopter of the 1-3rd Attack Reconnaissance Battalion uses illumination rockets in the distance as part of individual ship night aerial gunnery tables at Grafenwöhr Training Area on Mar. 4, 2020. U.S. Army photo by MAJ Robert Fellingham

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LTC Mike Gourgues currently serves as the Tactics Director for the Directorate of Training and Doctrine. He currently leads the USAACE D3SOE Cell and will command 3-6 Cav in the Summer of 2020.

1 This document is available on the Army Knowledge Online site with a valid common access card.

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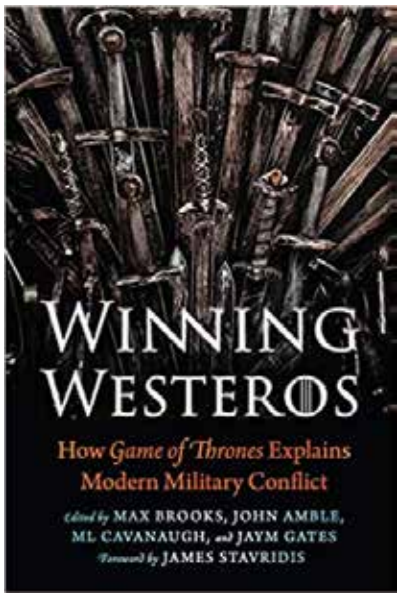
Back to Table of Contents



Winning Westeros: How Game of Thrones Explains Modern Military Conflict

Edited by Max Brooks, John Amble, ML Cavanaugh, and Jaym Gates. Published by Potomac Books of the University of Nebraska Press, 2019. 282 pages.

A book review by CPT Christopher Poppleton

When it comes to a novel or series that is developed for film and television, only a handful ever truly garner the large-scale attention and devotion by viewers as recently as that of HBO's *Game of Thrones*. Dragons; magic; and swordplay, along with an army of the dead are just a few popular subjects that have made this series a widely known show in America, whose original storyline hadn't even concluded before the show began filming. With a bit more of an adult theme than perhaps *The Lord of the Rings* drew, George R. R. Martins' *Game of Thrones* quickly became popular for its depth of characters, adult themes, violence, and intrigue in a magical world where vying for power and how those few who can obtain The Iron Throne achieve their objectives.

In the second installment of their modern discussions about popular stories in American film and literature, *Winning Westeros: How Game of Thrones Explains Modern Military Conflict* by Max Brooks, John Amble, ML Cavanaugh, and Jaym Gates bring readers a new ensemble of essays from a wide array of authors yet again. Ranging from military officers of many different branches and unique experiences, to fellow teachers at West Point and University of Kansas, this book is backed by incredible sources who lend great credibility to the many individual essays collected in this work. For those familiar with European and U.S. military history and warfare and those who are curling up to watch the conclusion of the dreaded White Walkers as they descend upon the harsh lands of Westeros, there are a multitude of topics addressed in this latest collection that any reader can take interest in. These ideas and theories are presented to us in four major sections, breaking down People; Technology; Combat; and Strategy, each respective to war. If there had there been a fifth section, taking a look at Religion and War might've been necessary given how deep a role religious characters and occurrences affected the decisions and outcomes for many of the show's characters.

First and foremost, readers who are hoping that the essays in this work will cover characters and events from the first episode to the very last need to know that at the time of publication, Season 8 of *Game of Thrones* had not aired yet. Since the novels were never finished and not knowing truly how this series was going to conclude, the essays in this work draw from the books and show only to the extent of what viewing audiences have seen up to the end of Season 7. That being said, there are still a great amount of characters, dead or alive, and events and strategies that this book fleshes out as straightforward and to the point as possible. As always in a publication such as *Winning Westeros*, a reader should not only understand the context of the show and what each individual author is referencing, but more so how they are trying to make you see something that maybe you didn't see before.

While George R. R. Martin may have drawn on the War of the Roses as the centerline for writing *Game of Thrones*, the ability to take narratives that have been written about before and make them compelling again for us is certainly a challenge in modern literature. As fantasy epics have demonstrated before, being able to wield a sword in the land of Westeros is a necessary skill; however, considering those characters who had to choose other weapons absolutely makes characters like Tyrion, or rather the Machiavelli of the series, one of the most intriguing characters of all. Nicolo Machiavelli's *The Prince* is a timeless authoritative piece of literature on both political and military stratagem that is at the heart of the incredibly witty, usually drunk dwarf who manages to find himself in the middle of just about every major event throughout the series and manages to survive. Some of the most critical essays to *Winning Westeros* help to identify to us that a line such as "I drink, and I know things," is simply the tip of the iceberg to the depth of a man who has had to find ways to survive not relying on one's ability to dominate a duel or survive a battlefield, but rather sharpen one's mind to outthink his enemies and achieve victory.

Most importantly, these essays tie in the strategies, successes, and failures that we see as *Game of Thrones* progresses, back to modern day events. Everything from climate change and its ability to drive humanitarian and cultural shifts, to why keeping a reserve as the most dynamic and flexible force in one's arsenal sheds light on not just the Battle of the Bastards, but give reason as to why such ideas are so profound today, just as they have been throughout centuries of warfare and change in our own world.

The Phantom Vietnam War: An F-4 Pilot's Combat over Laos

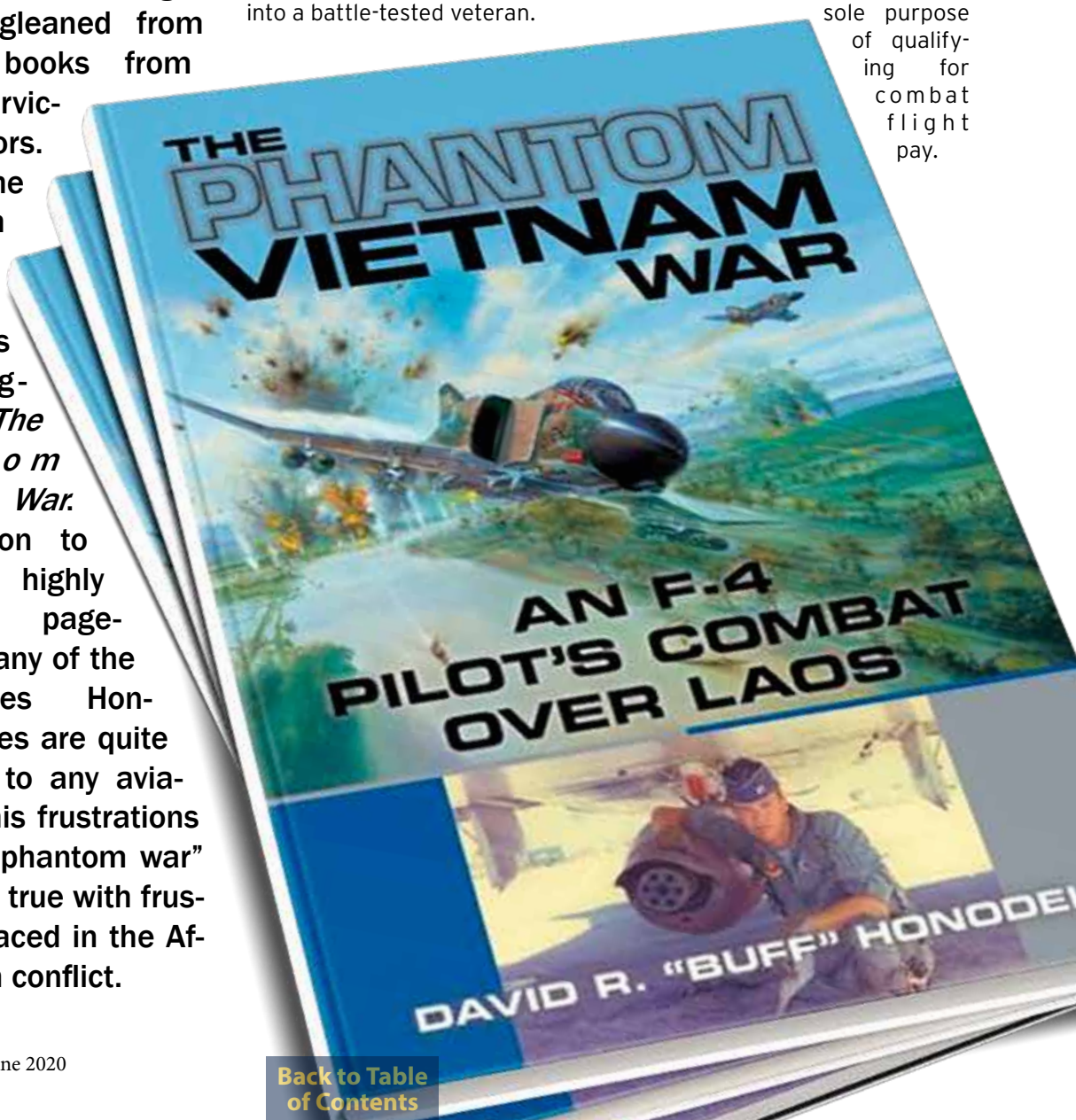
By David Honodel, University of North Texas Press, 2018, 306 pages

A book review by CPT Dallas Durham

When it comes to professional reading material, we as Army aviators might be inclined to seek out autobiographies by fellow Army aviators. While such books certainly provide valuable and important insight into our trade and history, much insight can be gleaned from reading books from other services' aviators. Such is the case with David "Buff" Honodel's autobiography *The Phantom Vietnam War*. In addition to being a highly enjoyable page-turner, many of the experiences Honodel shares are quite relatable to any aviator, and his frustrations with his "phantom war" often ring true with frustrations faced in the Afghanistan conflict.

Honodel's service started as a student at Penn State University when he volunteered for the Air Force. He soon found himself piloting the F-4 Phantom, then the U.S. Air Force's premiere fighter-bomber. After spending 4 years in various training assignments, Honodel was not only eager for combat, he felt overprepared. Upon deployment to Thailand in 1969, little did he know how challenging his first combat missions would be as compared to training flights. This is a key theme of his story: the transformation of an overconfident young fighter pilot into a battle-tested veteran.

One unique aspect of this Vietnam War memoir is that only a handful of Honodel's missions were actually in Vietnam. Based out of Udorn, Thailand, the vast majority of his missions took place in Laos. Since U.S. operations in Laos were still highly secretive, his war technically did not exist (hence the book's name, a reflection of both the "phantom war" he fought and the F-4 Phantom he flew). In fact, since Laos was not technically a combat zone, Honodel and his fellow pilots had to fly periodic missions over South Vietnam for the sole purpose of qualifying for combat flight pay.



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Back to Table of Contents

Honodel chronicles life and operations as a Phantom pilot, going into details on things as minute as the start procedure for the F-4. For the military aviation buff, this detail will be quite interesting. Honodel also shares his personal reactions to a number of scenarios with which many military aviators will relate, such as his stressful first combat missions. From his struggles to put on the aviation life support equipment unique to Southeast Asia combat missions, to his efforts attempting to remember the unit's basic standard operating procedures, Honodel reminds the reader of how difficult even the easiest aspects of one's first combat missions could be.

Perhaps the most interesting segment of the book is Honodel's recollection of his night missions. When reading about night missions of the past, we tend to envision such stories through the greenish hue of night vision goggles. Honodel's vivid descriptions of dark nights, formation flight, bombing runs, and severe spatial disorientation remind us that night adaptation and unaided night flight were a very real struggle not so long ago. In fact, Honodel went to such great lengths to protect his night vision as placing black tape over all warning and caution lights in the cockpit, since a sudden illumination during a bomb run could ruin his well-adapted night vision and result in spatial disorientation. Although the moon and ambient lighting aided flight some, the resulting silhouette of the aircraft made an easy target for enemy gunners on the ground. Such stories are a valuable reminder of our modern technology that mitigates risks of such dangerous missions.

The other key theme of Honodel's book is one common to memoirs from Vietnam: the frustration caused by the "limited war" strategy and the associated rules of engagement (ROE). In Honodel's case, these frustrations were multiplied due to the secrecy of the Laotian area of operations and the halt on bombing North Vietnam at the time. Honodel and his unit primarily targeted supply truck lines, which were difficult to target and rarely found in large groups while in Laos. By contrast, these same trucks could often be seen staging just across the North Vietnamese border, preparing to make the dangerous transition across the Laotian border. Although they massed during daylight hours in the open, ROE forbade U.S. Air Force crews from crossing the border to destroy the supply-laden trucks. Similar to the frustrations faced by aviators along the Afghan-Pakistani border over the last 18 years, Honodel and his peers watched helplessly as the North Vietnamese used the border restrictions to their own advantage.

While Honodel eventually completed two tours to Vietnam and amassed over 4,000 hours in multiple aircraft over a 22-year career, this book focuses on his "coming of age" as a combat fighter pilot. It is a purely enjoyable read for the aviation buff, a reminder to the modern combat aviator of the challenges faced by our predecessors, and a reminder that although the operating environment may change, many challenges and frustrations of combat aviation remain constant.

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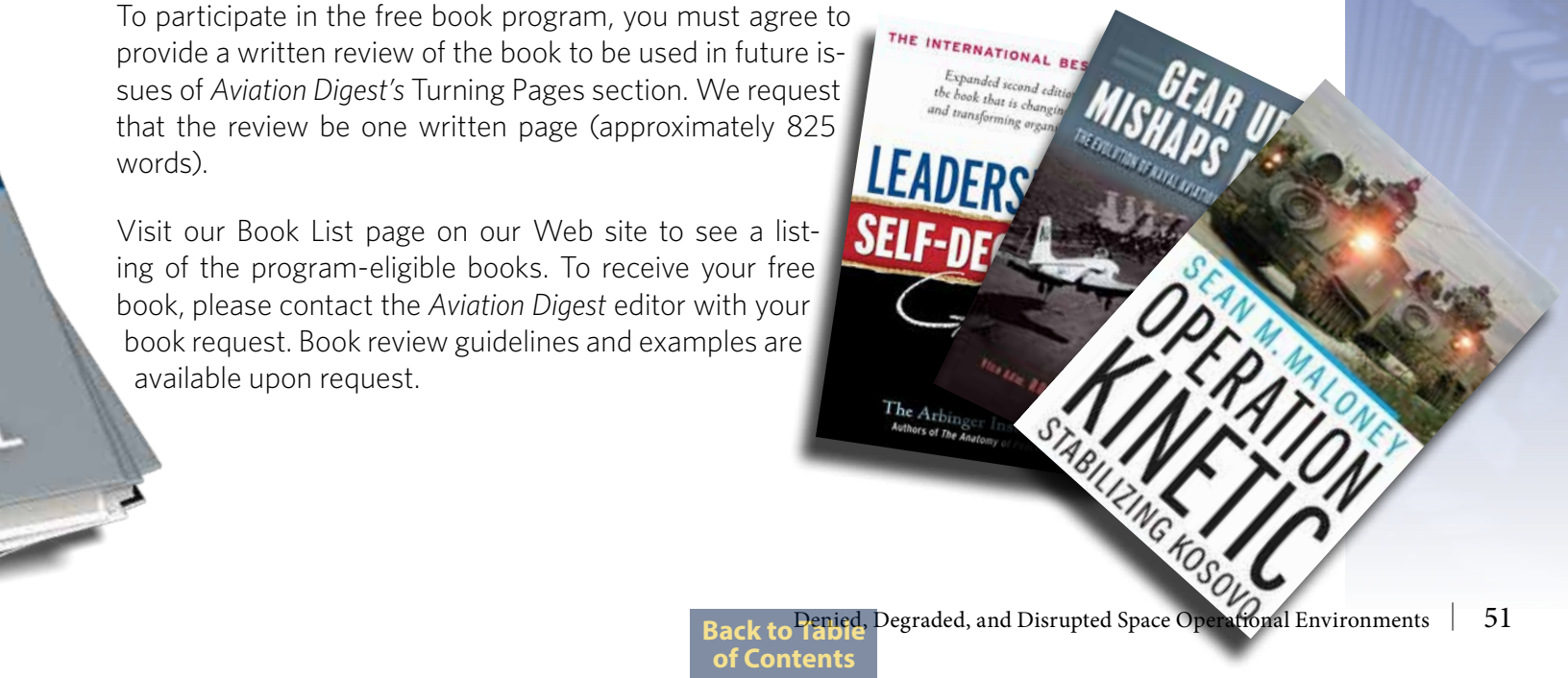

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Back to Table of Contents