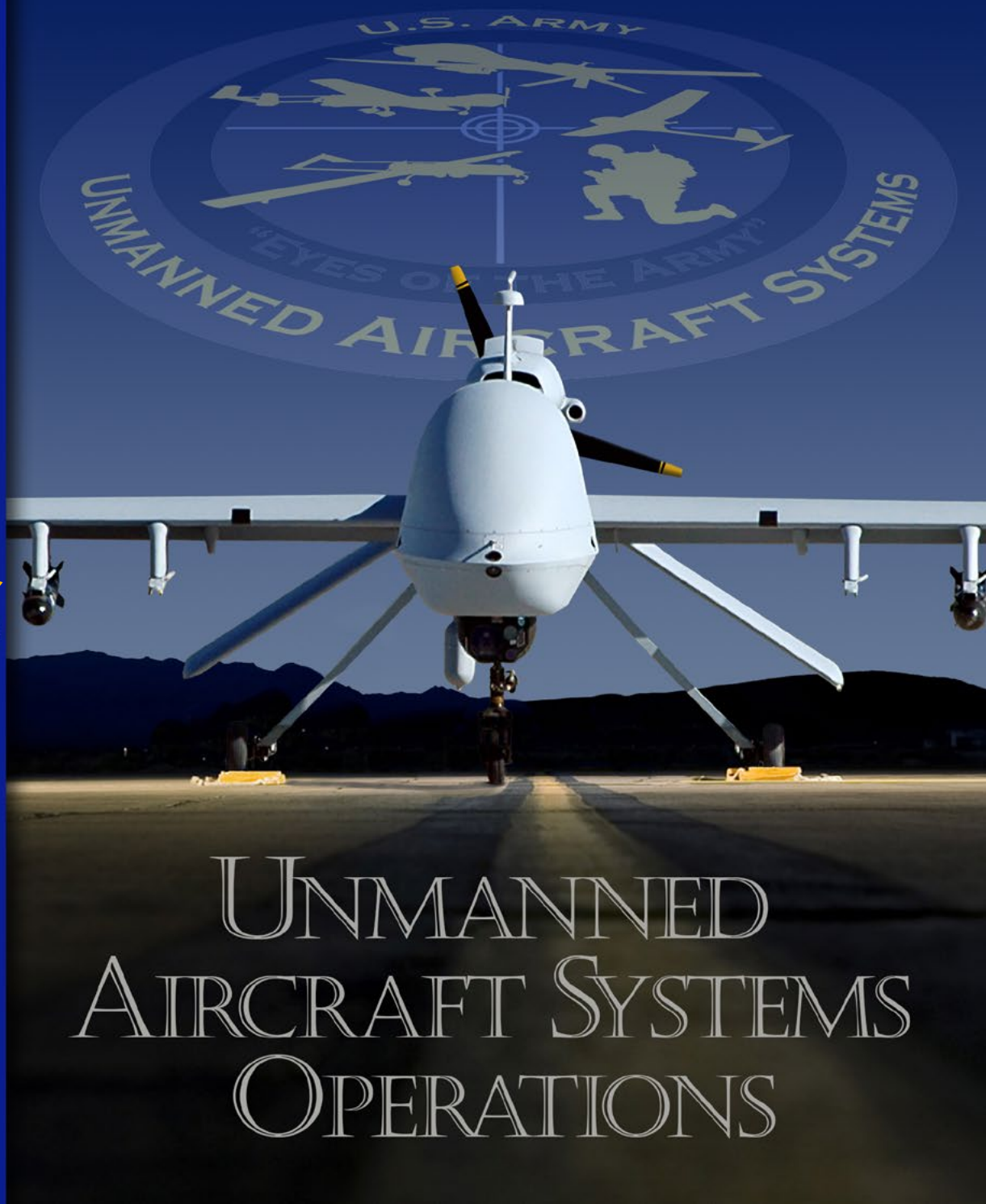
Aviation DIGEST
UNITED STATES ARMY
April - June, 2017
Volume 5 / Issue 2



Unmanned Aircraft Systems Operations

UNITED STATES ARMY
Aviation Digest
April - June 2017
The Professional Bulletin of the Army Aviation Branch, Headquarters, Department of the Army, PB 1-17-2

Commanding General, USAACE
MG William K. Gayler

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ABOUT THE COVER

An MQ-1C Gray Eagle sits on the flightline

The Command Corner

In this edition of Aviation Digest, we continue to examine how emerging changes in the global geopolitical environment are driving changes in the way our branch must prepare to fight and win in future conflicts as part of the combined arms team. Over the past two decades, the Army has worked to integrate unmanned aircraft systems (UAS) into units at virtually every echelon. In that same timespan, we have observed the proliferation of UAS technology and employment both in the civilian sphere and in the arsenals of adversaries around the world. Our Army and our branch are evolving rapidly to meet the ever-growing demand for the capabilities UAS can provide, but while our achievements have been considerable, the task is far from complete. Our UAS scouts have achieved much and earned a great deal of respect across the military for providing mission-critical capabilities to ground commanders, ranging from Gray Eagle systems flying in support of continuous long-term operations in the Central Command Area of Responsibility, to the integration of Shadows into our armed reconnaissance squadrons and brigade combat teams. We can assert with certainty that demand for these systems to serve as decisive combat multipliers will continue to expand. Because of this trend, we must maintain our shared sense of urgency to improve how we train our formations and how to most effectively employ UAS on the modern battlefield.

My challenge to our Aviation formations is to embrace our 15W (Unmanned Aircraft System Operator) and 15E (Unmanned Aircraft Systems Repairer) Soldiers, fully integrate UAS into all home station training, leverage the combat training centers to validate our tactics, and maximize the use of UAS to win decisively, no matter what mission our nation calls upon us to perform. The only way that we are going to do this is to take advantage of our manned aviation expertise to train our UAS operators in all aspects of aviation operations supporting unified land operations. I know that we have made great strides in doing just this, but we still have a long way to go to realize the full potential that UAS enables our branch to provide to the Army.

In this issue, you will find several articles that address this challenge and provide recommendations for continued UAS integration into our formations. COL Robert Ault's article, "Beyond Manned-Unmanned Teaming," addresses the need to develop operating concepts that expand future capabilities, while COL Paul Cravey and MAJ Ariel Schuetz's article examines the principles of manned-unmanned teaming (MUM-T) and the ways in which we will integrate MUM-T into the Army's concept of multi-domain battle. These two articles are just a glimpse into the many challenges to UAS integration that Soldiers are finding ways to improve and test through rigorous thought and dialogue. As we work to optimize UAS employment techniques, it is important to remember that our enemies are doing the same, and we must evolve even more rapidly to stay ahead of the pace of this change. I know that our branch is up to the challenge, and I look forward to witnessing the ingenuity and innovation this cohort will harness to set conditions to fight and win in a complex world.

Above the Best!

William K. Gayler
Major General, USA
Commanding

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By Order of the Secretary of the Army:
Official:

GERALD B. OKEEFE
Administrative Assistant to the Secretary of the Army
1707602

MARK A. MILLEY
General, United States Army
Chief of Staff

Managing Editor
Bruce Miller

Art Director
Henry Williford

Contact
usarmy.rucker.avncoe.mbx.aviation-digest@mail.mil

Comments & Discussion

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The Aviation Digest will publish once a quarter with distribution on or about the 15th of February, May, August, and November of each year. In order to receive information for publication and allow appropriate time for editing and layout, the deadline for submission of articles is the 1st of December, March, June, and September.

BEYOND MANNED-UNMANNED TEAMING

An Operating Concept for Future Autonomous Unmanned Systems

By COL Robert T. Ault

Impacts of Moore's Law on Unmanned Technology

Moore's law, the predictor of computer processing capability, states that the number of circuits on a chip doubles every 5 years and, with it, an exponential increase in computing power. For the Army, this means the capabilities in today's unmanned systems (only in their second or third generations) are barely infants in the world of high technology warfare. In just 5 to 10 years (a Program Objective Memorandum [budget] Cycle or two), it is conceivable that the Gray Eagle II and F35 capabilities will be considered a marginally acceptable standard versus the cutting edge they are today. With the exponential growth in both manned and unmanned systems and their capabilities, it is imperative the Army think beyond just simple manned-unmanned teaming (MUM-T) of an AH-64 and a Gray Eagle. Without an evolved operating concept for unmanned aircraft systems (UAS) that includes the role of artificial intelligence (AI) and autonomous weapon systems, the Army not only risks stumbling its way into its most capable future weapon system, but also potentially the future's most powerful technology.

Current Use of UAS, Too Boring, Too Dangerous, Too Long

Army Aviation is a branch that is potentially the closest to developing anything that approaches an operating concept for unmanned systems and artificial intelligence - MUMT. Unmanned systems are used for those missions that require endurance, attention to detail, and risk beyond what is considered acceptable either from a safety or economic perspective. This means UAS finds its niche mainly in reconnaissance or surveillance and the occasional release of munitions. From explosive ordinance disposal robots to Gray Eagles, the technology is viewed as freeing humans from the mundane in order to see more, present more information, and act more decisively. This is perfectly logical and acceptable given the current capabilities of the technology. However, given the rate of change and advances in artificial learning, the old paradigm may not prove useful as our UASs become more capable, faster, smarter and accurate than the humans that "control" them.

Blending Cyber Technology with Maneuver and Fires

There is a drive for parity in warfare that demands a swifter and stronger response to an opponent's action. For example, the appearance of tanks in World War I by the German Army demanded a similar response from the Allies. A few short years later in World War II, entire battles (Kursk) were fought in which the objective was the destruction of the enemy's tanks. With the introduction of UAS, the drive for parity created the counter-UAS mission. As UAS and the AI that powers them become more capable, the obvious response will be to fight unmanned systems with other unmanned systems.

Indeed this future is here today. Witness aviation counter missile technology already onboard Army aircraft. The AI in the system identifies, categorizes, and responds to incoming missiles autonomously once turned on. In fact, the U.S. Navy's ship board Phalanx defense weapon engages on its own to protect the ship.

These examples represent a merging of cyber technology with both maneuver and fires, domains once thought completely independent. Future unmanned systems will most likely accelerate this trend. The future UAS will be a piece of technology that will act autonomously and intelligently to protect itself or its mission while operating as a peer (or near peer) partner to its human wingman. Human aviators and Soldiers will not use the network to analyze information; the network will be thinking and fighting well before the human enters the fight. From intelligence gathering, anti-access, and deception operations, unmanned systems (in conjunction with the network) will be setting conditions and learning faster than any human is capable. Future UAS will not operate independent of the larger networked conflict to the point of the

fight; they will instead represent merely a node of the larger learning network that involves both humans and machines.

The Role of Artificial Intelligence in Army Aviation Operations

Fully integrated AI capabilities will be able to plan the best routes through enemy integrated air defense systems, fly the aircraft to its optimal efficiency to insure maximum time on station, defend the flight from enemy fire, and allow the manned crew to see farther, act sooner, and think faster than the enemy. However, as a concept this may not be enough; future UAS will be able to think not only faster but potentially more clearly and logically. This would bring the unmanned system to the level of peer or near peer with its human wingmen. While this may sound far-fetched, it is not. Already, AI systems are able to read MRIs and X-Rays, examine biopsy samples, and make more accurate diagnoses than their human doctors on a consistent basis. Why should combat operations be any different?

Current operations are a deliberate MUM-T effort. An AH-64 establishes a data link with a Gray Eagle and is able to see what its operators are observing. During Level IV control, the human front seater/gunner is able to fly the Gray Eagle. This is merely a demonstration of remote control, a relatively banal expression of teaming. Current MUM-T operations are characterized by a critical factor - there is no question where the intelligence power lies. The human crew is the most intelligent being on the team. The Gray Eagle UAS is slaved to the humans. There is no question over who makes the decisions. This is because the human is the best informed, best positioned, and most capable at making decisions.

Future Operations Will be Partnered

Future unmanned systems will be just good technology without an advanced AI that is able to learn and understand. Indeed, this is critical to any future unmanned system's operating concept; the technology must be able to understand its environment and act appropriately and timely. As an operating concept, future operations will not find humans slaving machines to their actions but will find humans partnering with machines that, in some cases, are more capable than their human teammates.

There are several components to this future unmanned operating concept. Future AI will enable shared workload between humans and machines. This increased machine decision-making capability will result in shared intelligence as both human and machine work to see, learn, and understand in order to act in concert.

A future operating concept will include an augmentation of human capability. This is a linear progression of the current MUM-T concept giving humans farther reach, better sight, and faster response. Interesting to note is that this augmentation characteristic can, and will, exist within the broader characteristic of peer to peer teaming with machines.

There will be places that only machines can go. There will be battles fought where the location and conditions are too dangerous such as extreme high altitudes, temperatures, or high speeds and G-Forces. There will be battles fought where the battlefield is too small for humans such as inside networks or the code within a system's program itself. In these instances, unmanned systems will be needed to carry the fight to the enemy. As with the fielding of armor and helicopters, AI will be needed to attack AI.

Conclusion

In the end, warfare remains (at least for the foreseeable future) a human affair. The evolution of deep AI, learning technology, and autonomous systems will shape the world within the next 5-10 years. Warfare will be no different. The use of AI and autonomous machines in combat is not that far-fetched. Look at our current capabilities in remote surgery, antivirus software, driverless vehicles, Apple's Siri, I-phones, and anti-air defense technology where machines are used to not only augment human performance but also expand human capability. As the technology emerges, an operating concept for its development is imperative. There is no copyright or intellectual property label that will prevent this technology from being exploited by ally, competitor, or enemy. Given the implications of both cyber and autonomous warfighting technology, the actor that comes out ahead will be the one that gets the operating concept close enough. It is interesting to consider that it does not so much matter that the U.S. adopt a limited or benign operating concept for unmanned autonomous technology. A marginally capable enemy can employ such technology for pennies on the dollar with wide-reaching impacts. Today, MUM-T might very well be to the future of autonomous warfighting technology what the Wright Flyer was to powered flight in the 19th century. Such potential demands a correct operating concept. It will evolve much like tank technology in the inter-war years. As one such model of this concept demonstrates: Germany understood the tank was not a magic bullet but a technology to integrate and enhance its battlefield formations to enable the operational concept of the blitzkrieg. France, on the other hand, took a different operational concept and viewed the tank in isolation of the larger system. History records the results clearly in the Battle of the Ardennes.

Colonel Robert T. Ault is currently serving as the United States Army Aviation Center of Excellence (USAACE) Chief of Staff. Previous assignments include Director, Directorate of Training and Doctrine and Commander, 4th Infantry Division Combat Aviation Brigade. COL Ault is a graduate of the National War College.

Acronym Reference

AI - artificial intelligence
MUM-T - manned-unmanned teaming
UAS - unmanned aircraft system

UAS TRENDS

During Division and Corps Decisive Action Operations

By COL Eric S. Puls and
LTC Erick "Zeke" Sweet

The use of unmanned aircraft systems (UAS) is growing exponentially in our military, especially in support of decisive action (DA) operations where the flexibility and effectiveness of UAS have made them nearly indispensable. While crucial to intelligence, surveillance, and reconnaissance (ISR) missions, UAS have expanded well beyond ISR into new roles that enhance operational success. Armed reconnaissance and attack, where UAS identify and engage their own targets; digital or voice communications re-transmission; and manned-unmanned teaming (MUM-T) are but a few of these emerging operational roles. Yet, despite the proliferation of UAS and the subsequent expansion of their roles, units continue to struggle to synchronize and maximize the effects of UAS during DA operations. The Mission Command Training Program (MCTP) executes multiple simulation based warfighter exercises (WFX) annually with a training focus on divisions, corps, and down trace functional and multi-functional brigades using a DA training scenario. In the absence of any real world sustained DA engagements ongoing at this time, WFXs provide some unique and informative observations on the proliferation of UAS use in a DA environment. During recent WFXs, the MCTP identified two specific emerging trends with respect to UAS in support of DA operations:

1. Lack of UAS experience and expertise on combat aviation brigades (CAB), division and corps staffs.
2. Limiting UAS to the singular role of ISR.

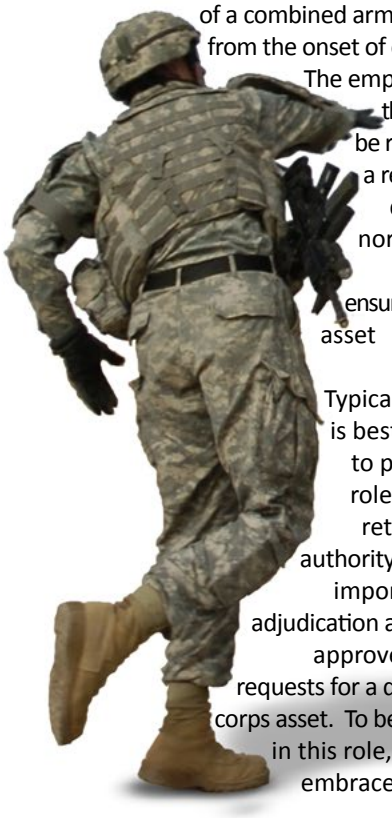
Lack of UAS Experience and Expertise

Who is the UAS expert on the division or corps staff? This seems like a straight forward question, but depending on which corps or division headquarters you visit, you may get a wide variety of answers. Some may say the G-3 (operations officer), while others may say the G-2 (intelligence officer) or G-2 collection manager. What about the division G-3 Air? Still others point to the CAB commander. As the senior aviator in the division, the CAB commander definitely provides valuable input on how best to use UAS, but how many CAB commanders have previously commanded Gray Eagle companies, Shadow platoons, or have had UAS task organized under their battalion as battalion commanders? Do any of the division staff officers mentioned have prior UAS experience? The point is that UAS experience and expertise are presently limited in our aviation force and particularly so on our division and corps staffs. As Army Aviation brigades continue to field UAS, this experience base will grow quickly and the trends identified by the MCTP will correct themselves. Until that time comes, however, the lack of UAS in many formations is certainly a contributing factor on the UAS lack of knowledge with respect to UAS capabilities, limitations, and employment considerations on how to effectively employ UAS at the higher echelon staffs. This creates a void on division and corps staffs as they seek to maximize UAS employment in support of operations.

Combat aviation brigades, division, and corps staffs should identify the resident expert on UAS employment and position that individual on the staff to maximize UAS capabilities. The CABs designate a UAS warrant officer to provide UAS employment expertise to the staff; however, divisions and corps struggle to assign UAS employment oversight to any specific staff section or staff member. As such, solutions vary significantly from unit to unit as to who has primacy with respect to UAS operations. Once the UAS staff member is identified, the designee often brings a degree of bias on how best to employ the UAS assets with him.

Recent WFX trends show that if the G-2 or G-2 collection manager is designated as the UAS employment expert, UAS employment tends to gravitate toward ISR collection, sometimes at the expense

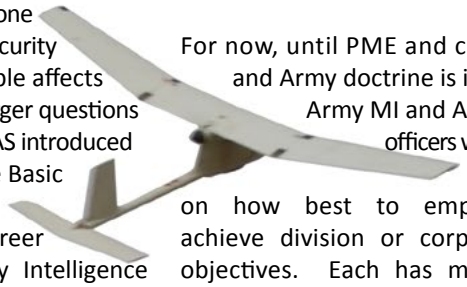
of other uses such as MUM-T or armed recon and attack.[1] If the G-3 or G-3 Air acts as the UAS employment expert, then ISR may suffer in order to facilitate recon, digital communications re-transmission, MUM-T, or attack missions. *Field Manual (FM) 3-04, Army Aviation*, designates five primary missions for the Gray Eagle UAS when operating in support of the division or corps: surveillance, zone/route/area reconnaissance, attack, battle damage assessment, and mission command support (i.e. re-transmission for voice and digital communications).[2] In reality, these missions are not mutually exclusive, and the right UAS role depends on the division's operational priorities and how division or corps UAS assets can best achieve the desired end state. In most mission profiles, a mix of UAS roles across the warfighting functions is the best solution in meeting the commander's needs. To achieve the optimal mix, division and corps leaders must designate UAS ownership to a staff entity with the directive to weigh the benefits and risks of employment in its various roles. In other words, the division or corps must "operationalize" UAS employment and ensure infusion of a combined arms approach from the onset of operations. The employment of the UAS must be reviewed on a regular basis during the normal battle rhythm to ensure optimum asset utilization.



Typically, the G-3 is best equipped to provide this role since they retain tasking authority and, more importantly, the adjudication authority to approve and deny requests for a divisional or corps asset. To be successful in this role, G-3s must embrace UAS as an operational asset and not relegate it to purely a single mission profile.

To address the experience and expertise gap at the division and corps staff requires vigor in our education base. Exposure to UAS knowledge and operational capability across all warfighting functions will prove paramount until we can expand our UAS expertise over time. Educating UAS employment is slowly infiltrating the Army's professional military education (PME) training structure. For example, the United States Army Aviation Center of Excellence Air Cavalry Leaders Course teaches integration of UAS into recon and security operations reflecting the mission of the Shadow in the attack reconnaissance squadrons. This course outlines UAS capabilities, limitations, and employment considerations to achieve the best mission result; in this case, use of UAS to support a screen, zone recon, or other recon and security missions.[3] While this example affects selected aviation officers, larger questions should be asked: How are UAS introduced to maneuver officers in the Basic Officer Leadership Course or respectively the Captain Career Courses? How do Military Intelligence (MI) officers learn about operational UAS roles such as MUM-T, attack, or reconnaissance in their PME? How do field grade officers, other than those coming from CAB assignments, gain familiarity with UAS capabilities prior to serving on division and corps staffs?

Although slowly being corrected, the lack of Army and joint UAS doctrine contributes to our expertise vacuum. Much like the proliferation of aviation assets across service branches in the pre-World War I era, all services struggle to categorize UAS and assign branch proponents in a way that maximizes their flexibility and versatility. For the Army, *FM 3-04* does a good job of explaining Shadow and Gray Eagle UAS capabilities, limitations and employment considerations, and *FM 3-04.1, Aviation Tactical Employment* details the integration of UAS in all aspects of aviation operations which bodes well for aviation units and how they employ UAS. But what doctrine outlines how best to maximize brigade combat team (BCT) Shadows in support of a screen or guard? What helps squads or platoons employ their Raven UAS effectively during patrols? Other than existing ISR doctrine, what doctrine helps division and corps staffs employ Army and joint UAS to their fullest extent? The answer to each of these is that there is very little published Army or joint doctrine to create shared understanding on how best to maximize the use of UASs at the BCT, division, and corps levels. This creates challenges for UAS planners at higher echelon staffs to achieve the most optimal mission mix. The MCTP observers often witness these challenges during WFXs. While shared tactics, techniques, and procedures are useful, they rely on word of mouth and combat training centers' after action reviews to expand their use, instead of codifying in doctrine for all to share and understand.



For now, until PME and cohesive joint and Army doctrine is in place, select Army MI and Aviation Branch officers will have to carry the message on how best to employ UAS to achieve division or corps operational objectives. Each has more exposure to UAS operations than their non-UAS educated or experienced peers, but each of these branches see UAS through different lenses. For instance, the MI officer tends to lean heavily toward ISR, while the Aviation officer has a better understanding of operational uses for UAS such as MUM-T, re-transmission capabilities, and attack reconnaissance mission sets. Deciding the right mix of mission roles will likely be made by the G-3 with input from both communities. The CAB staffs and commanders should be prepared to act as the primary UAS experts, advising their higher headquarters on how best to employ divisional UAS assets from the Raven to the Gray Eagle to joint UAS assets. To this point, recent WFXs show that when CAB commanders and staffs do take an active role in the employment of UAS, units successfully exploit opportunities and gain optimal use of UAS in support of the division or corps' DA fight.

Limiting UAS to ISR

In recent WFXs DA scenarios, division and corps staff typically used UAS primarily for ISR with occasional forays into MUM-T and attack roles. The UAS would fly in support of the division or corps collection plan and answer or refine priority intelligence requirements to drive various decision points and triggers on the division/corps decision support matrix. This is an appropriate use of UAS. In order to destroy the right enemy weapon systems and capabilities, we must find them first. This fits neatly into the "Detect" phase of the targeting methodology. However, once ISR assets identify a desired target array and the mission proceeds to the "Deliver" and "Assess" phases of the targeting methodology, the roles of UAS may shift. This is where UAS can expand beyond normal ISR to achieve synergistic effects with other combat systems. The result provides the division/corps with expanded capabilities to achieve mission success.

For example, as the Commanding General, U.S. Army Forces Command, Robert B. Abrams stated during the June, 2016 Combat Training Center Commanders Conference, "Anytime you link UAS with another combat system, you are executing MUM-T." His statement expands the existing *FM 3-04* definition of MUM-T of pairing UAS with manned Army Aviation assets,[4] to address a growing trend in military operations where UAS can pair with any number of combat systems or units in a variety of roles. Manned-unmanned teaming is only one example of this. Other examples include UAS paired with medical evacuation missions as force protection, UAS paired with ground units to better enhance maneuver options, and UAS paired directly with fires assets as an aerial observation platform. To achieve the maximum effect on the target, we must explore other roles for UAS beyond ISR.

What if we were to fly an Air Force Reaper UAS forward of advancing AH-64 aircraft to identify air defense artillery systems and designate for laser guided munitions to engage them before the AH-64s ever fly within range? What if we use the Gray Eagle UAS over the objective area during an air assault to identify and reduce threats to the approaching aircraft? What if we employ joint UAS in the deep area while linked directly to the division artillery digital fires systems to expedite deep lethal fires in support of a joint air attack team or other close air support engagement? What if we dedicated UAS after an offensive engagement to "assess" (in accordance with the detect,

decide, assess targeting methodology) battle damage to better inform re-attack decisions or to truly count that target array out of the fight? The possibilities are endless, but not if the UAS are relegated to ISR only. The ISR mission is crucial, but expanding UAS usage beyond the traditional roles assigned is the only way to truly maximize UAS effectiveness.

We should explore other UAS employment options to achieve a desired end state. New uses for UAS emerge daily and it would be smart to explore each of them as another option in the tool box for use in a given tactical or operational scenario. This may provide improved lethality, survivability, and situational awareness to better shape follow on operations.

Conclusion

As UAS roles continue to expand, expertise and experience base will expand with them. To maximize the effectiveness of UAS in support of the division or corps DA fight, we must operationalize UAS employment, exploring all UAS mission roles to gain the best advantage for our forces to find, engage, and defeat the enemy. In so doing, we enable friendly forces to exploit opportunities and mitigate the enemy's ability to adversely affect our objectives to achieve victory. As aviators, the task falls to us to educate, advise, and shape how to best employ UAS at the division and corps level. In short, if we expand UAS employment beyond its traditional roles, the outcome will far exceed the sum of its parts.

[1] Victor S. Hamilton, Colonel, U.S. Army, MCTP OG-F COG, Email message to author dated 26 AUG 2015.
[2] *FM 3-04 Army Aviation*, (HQ DA, Washington DC, 29 JUL 2015), Pg 2-8, Para 2-33.
[3] Michael Gourgues, Major, U.S. Army, Director, Air Cavalry Leader's Course, Email message to author, 22 MAR 2017.
[4] *FM 3-04 Army Aviation*, (HQ DA, Washington DC, 29 JUL 2015), Pg 1-2, Para 1-7.

COL Eric S. Puls serves as the Mission Command Training Program (MCTP), Operations Group – Foxtrot Deputy Chief of Operations Group, Fort Leavenworth, KS. His previous assignments include Division Plans Officer, United Nations Peace Keeping Mission, Liberia, West Africa; Chief, Operations and Plans, Center for Army Lessons Learned, Fort Leavenworth, KS; Commander, 2-291st Aviation Training Support Battalion, 1st Army, Division West, Fort Hood, TX; and Executive Officer, 1st Squadron, 6th Cavalry, 1st Combat Aviation Brigade, Fort Riley, KS (OH-58D). He has 27 years of Army Aviation service. COL Puls has deployed to Sinai, Egypt; Liberia, West Africa; and twice to Iraq.

LTC Erick "Zeke" Sweet serves as the Mission Command Training Program (MCTP), Operations Group – Bravo Deputy Chief of Operations Group, Fort Leavenworth, KS. His previous assignments include Deputy Chief of Staff - G-5, Chief of Plans, 10th Mountain Division; Commander, 6-6th Cavalry Squadron (OH-58D), Fort Drum, N.Y.; and Brigade S-3, 10th Combat Aviation Brigade, 10th Mountain Division. He has nearly 23 years of Army aviation service. LTC Sweet has deployed to Macedonia, Kosovo, twice in support of Operation Iraqi Freedom and once in support of Operation Enduring Freedom (Afghanistan).

Acronym Reference

CAB - combat aviation brigade	**MI** - Military Intelligence
DA - decisive action	**MUM-T** - manned-unmanned teaming
FM - field manual	**PME** - professional military education
ISR - intelligence, surveillance, and reconnaissance	**UAS** - unmanned aircraft system
MCTP - Mission Command Training Program	**WFX** - warfighter exercise

MODERNIZING THE COMBAT TRAINING CENTER PROGRAM

By CW3 Eric S. Cooper

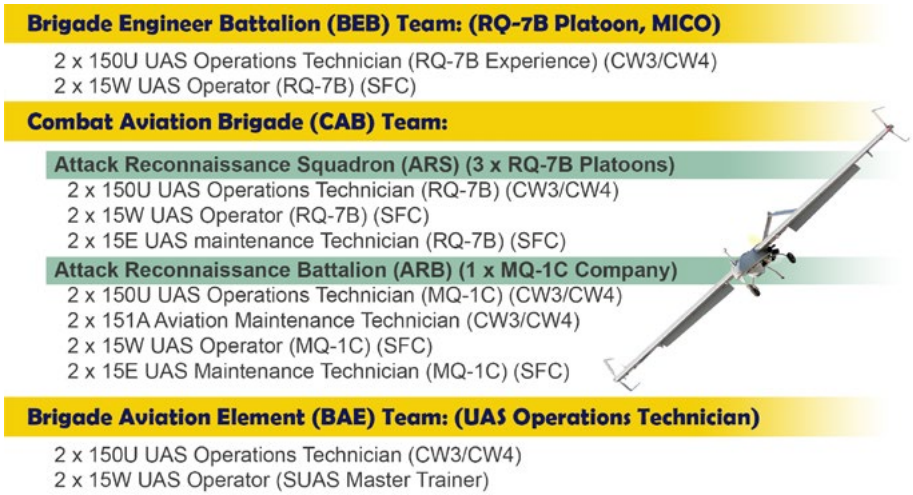
INCREASING UNMANNED AIRCRAFT SYSTEM OBSERVER COACH TRAINER DENSITY

With the proliferation of unmanned aircraft systems (UAS) in the U.S Army's inventory comes the duty and responsibility to train and evaluate readiness and capability. One of the important ways that the U.S. Army accomplishes this mission is through the utilization of experienced observer coach trainers (OCTs) who facilitate realistic scenario-based training in simulated operational environments at our combat training centers (CTCs). The ability to train and evaluate UAS operations, however, has become increasingly more difficult with each new addition of systems to the Army's inventory. In a relatively short period of time, the Army has moved from a small number of UAS in the early 2000s to our current situation of small UAS, tactical UAS, and extended range multipurpose UAS capabilities embedded at the company, brigade combat team (BCT), combat aviation brigade (CAB), and division level echelons. The problem is that there has not been a matched increase in the density of UAS OCTs at the CTCs. The result is a degraded assessment of UAS operations which commanders and their staff need to shape future operations processes, and improve integration of UAS in their unit's manned-unmanned teaming and air-ground operations.

According to *Army Regulation 350-50, Combat Training Center Program*, one of the critical pillars of the Combat Training Center Program is the Operations Group staffed by highly qualified "observer coach trainers, qualified to conduct an analysis of a unit and leader's performance while facilitating a meaningful AAR [after action review]… are critical to the success of the CTCs. The AARs will reinforce Army doctrinal standards and emerging lessons learned from ongoing operations..."[1] Based upon personal experience as an UAS OCT at the Joint Multinational Readiness Center and a recent conversation with the UAS Warrant Officer Career Manager, there are currently a total of two UAS warrant officer and three UAS operator OCT positions for the three CTCs. Historically, this has resulted in OCT augmentees being pulled from already task saturated operational units in order to complete a condensed OCT train-up in preparation to support a rotational unit's exercise. By necessity, the substitute UAS OCTs tend to be singularly focused on one or two core competencies and functional areas while ignoring many others. Meanwhile, the CTC allocation for manned aviation provides OCT expertise that focus on all of the aviation core competencies as well as their tracked functional areas of standardization, maintenance, safety, and tactical operations. The disproportionate number of allocated positions for UAS OCT warrant officers, operators, and maintainers as compared to manned aviation at the CTCs sends the wrong message regarding the priority and credibility of UAS operations in the Army. Left unchecked, this continued

disparity will exacerbate the struggle to build future capacity and confidence with UAS readiness.

In order to meet current requirements and to build future capacity at the CTCs, it is recommended that the UAS OCT positions be manned at the level and grades shown in Figure 1.



Fugure 1. Recommended CTC UAS OCT manning

The increased availability of UAS OCT subject matter expertise at the BEB, CAB, and BAE, will provide the depth and adaptability necessary to provide quality assessment of UAS integration into the operational structure.

An additional benefit to building UAS OCT capacity within the CTC program is the individual OCT's opportunity for personal leader development and its implication on the overall health and resiliency of the total Army. The OCTs are provided the unique opportunity to be immersed in the continuous analysis of the *oper*ations process, operational framework, and warfighting functions that make-up the structure of unified land operations. This translates into building up confidence and expertise in the art and science of mission command. Operational units that absorb these CTC professionals will be able to leverage their experience to further improve UAS readiness.

Modernizing our CTCs by improving UAS OCT density is a critical element in maximizing unit readiness, strengthening leader development, and informing the future force.[2] By resourcing positions for UAS OCTs at the company, BCT, CAB, and BAE, the Combat Training Center Program will be better postured to support its vision "to generate ready units and agile leaders who are confident in their ability to operate in complex environments."[3] The second order effects of improved UAS OCT density is that it translates to strengthened leader development, mastering of fundamentals, and improved health and resiliency of operational units. A cost-to-benefit analysis should be devoted to finding ways to bridge the gap of UAS OCT density at our combat training centers.

[1] Headquarters, US Department of the Army (HQDA), Army Regulation 350-50 The Combat Training Center Program, (Washington, DC: HQDA, 2015) p4.
[2] Headquarters, US Department of the Army (HQDA) United States Army Forces Command, FORSCOM Command Training Guidance (CTG) - Fiscal Year (FY) 2017
[3] Headquarters, US Department of the Army (HQDA), The Combat Training Center Program, Army Regulation 350-50 (AR 350-50) (Washington, DC: HQDA, 2015), 1-5a

CW3 Eric Cooper is presently serving as the Unmanned Aircraft Systems (UAS) Operations Officer, 1st Combat Aviation Brigade, 1st Infantry Division. CW3 Cooper's previous duty positions include UAS Flight Platoon Leader, F/1st Aviation Regiment; UAS Observer Coach Trainer (OCT), Joint Multinational Readiness Center (JMRC); Shadow Platoon Leader, 2nd Cavalry Regiment; Quick Reaction Capability 2 Flight Platoon Leader, 160th Special Operations Aviation Regiment; Chief Instructor, UAS Training Battalion, 2-13th Aviation Regiment; Tactical UAS Operator, 3rd Infantry Division; Cavalry Scout Bradley Gunner, 3rd Armored Cavalry Regiment; Recruiter, Seattle Recruiting Battalion; Combat Engineer, 9th Engineer Battalion, 1st Infantry Division. He deployed in support of Operation Joint Guardian, Operation Iraqi Freedom I, Operation Iraqi Freedom III, Operation Enduring Freedom V and Operation Inherent Resolve and Operation Spartan Shield. CW3 Cooper has over 19 years of service. He is qualified on MQ-1C, RQ-7B, RQ-20, and RQ-11 Unmanned Aircraft Systems.

Acronym Reference

AAR - after action reviews	**CTC** - combat training center
BAE - brigade aviation element	**MICO** - military intelligence company
BCT - brigade combat team	**OCT** - observer coach trainers
BEB - brigade engineer battalion	**UAS** - unmanned aircraft system
CAB - combat aviation brigade	

Understanding the Maintenance Engineering Call/Order

By CW2 Francis Zeigler

While attending the Aviation Maintenance Officer's Course, I learned about a maintenance process that can be used to cut down on unnecessary spending, expedite unusual aviation related maintenance repairs/tasks and, if used correctly, increase overall equipment readiness rating. It is not a new process. In fact, it has been available for many years but in six years of experience as a 15E, Unmanned Aircraft System (UAS) Repairer, I was not aware of the practice and suspect that there may be many aviation maintenance practitioners who also may not be familiar with the Maintenance Engineering Call/Order (MEC).

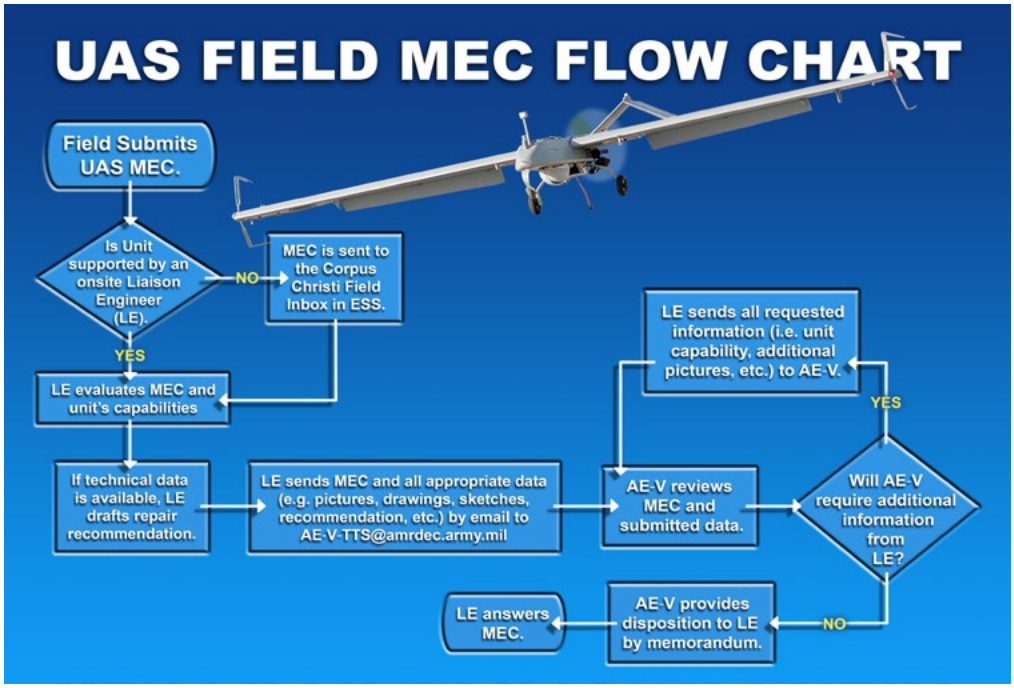
The 15E that arrives at your unit attends 17 weeks of advanced individual training (AIT) at Fort Huachuca, AZ. Course subject material includes airframe, power-plant, aircraft electrical, avionics, radio frequency, propulsion, fuel systems, and systems troubleshooting. The courses do well in preparing the 15E Soldier. However, once on the job, the interactive electronic technical manual (IETM) does little to allow the Soldier to make full use of and validate that training received during AIT. The amount of actual maintenance and troubleshooting permitted by the IETM does not reflect the Soldier skills attained during training. The majority of the maintenance and troubleshooting procedures described in the IETM simply refer the 15E to the next higher level maintenance. In the case of the UAS, this happens to be a field service representative (FSR). Once on site, even he is limited on the maintenance that can be provided.

The outcome for most items found unserviceable is to remove, requisition, package, ship, receive, and replace. Requisitioning parts through the current UAS supply network is anything but pleasant. Often, once the requisition is submitted, there is a backlog, items are out of stock, or the manufacturer cannot keep up with the demand. Meanwhile, the unserviceable component is packaged and shipped back to the manufacturer or distributor. This practice, in many circumstances, is unnecessary and expensive – especially when many of these "unserviceable" items can simply be repaired by 15E personnel or by the aviation support battalion using general aircraft maintenance procedures and regulations. Unfortunately, Soldiers and the majority of the leadership within the brigade combat team UAS organizations are unaware of this maintenance practice. "We don't know what we don't know." This is costing the Army unnecessary shipping costs, UAS down time, and lost opportunities for the 15Es to develop and use the skills for which they are trained.

An MEC permits the organization's maintenance personnel to conduct maintenance tasks or procedures that are not prescribed within the IETM but are within the repairer's realm of knowledge and expertise. If a Soldier has received training in specific areas, regardless of whether the procedure is detailed in the IETM, and unit leadership determines that the Soldier is capable of performing the task, an MEC can/should be submitted. This, in itself, gives reason for the UAS leadership and community to take interest and invest time in learning this process and its benefits. Exercising this option can dramatically increase equipment readiness, save money on costly shipping charges, and cut down on unnecessary replacement of repairable components and parts.

The process for submitting and gaining approval for the MEC can be achieved with the completion of a few forms, pictures of the effected component/unserviceable part, and a few emails. The MEC request process starts with a conversation between the UAS leadership and the Aviation and Missile Command (AMCOM) Logistics Assistance Representative (LAR), an individual typically assigned at the brigade or division, on the proposed repair. The AMCOM LAR considers the proposed task, the Soldier's training, and assesses the feasibility of getting an approval for the one time repair of the effected part, component, or end item. The LAR will provide an MEC request form that, when completed by the requestor, will be sent to an AMCOM engineer. The engineer will review the supporting documentation and determine whether the Soldier has the proper knowledge and is capable of performing the repair.

If the MEC is approved, the engineer will return the approved MEC and supporting documents required to complete the repair to the AMCOM LAR who, in turn, provides the information to the original requestor and the maintenance personnel performing the repair. Once the repair and the maintenance operational check, if required, is accomplished, a copy of the MEC will remain in the end items historical records, an entry is added to



the Department of the Army (DA) Form *2408-15, Historical Record For Aircraft*, and the DA Form *2408-13-1, Aircraft Inspection and Maintenance Record* is signed off. While the process may sound complicated, in reality, it is easy and beneficial.


Damaged sleeve on tail assembly.

An example of an MEC is a repair recently completed on an RQ-7b Shadow. A Soldier was conducting a pre-flight inspection and identified that the empennage servo was not functioning. Troubleshooting procedures determined that a bent connector's outer shielding and two pins between the tail boom and empennage were bent preventing power from getting to the servo. The troubleshooting procedures referred maintenance personnel to the next higher level. The final determination was that the empennage would have to be replaced because of the bent connector. Following these procedures would have cost thousands of dollars to remove the entire empennage, package, and ship it to depot or back to the manufacturer, have it repaired, repacked and returned, and then re-installed. In this particular case, a replacement empennage was not available that would have resulted in extensive down time on the aircraft.

We recognized that this relatively simple repair could be performed by unit Soldiers with skills they learned in AIT. We followed the procedures to submit an MEC. Once the MEC was approved, the connectors were available and immediately sent to the unit at a fraction of the price of the empennage.


Repaired connector on tail assembly.

In less than a week, the MEC was approved by the engineers, wiring diagrams were provided, and the connectors were replaced. The maintenance personnel were able to validate their skills, money was saved on the cost of a new empennage and shipping costs, and the non-mission capable (NMC) time was minimized which increased the unit readiness.

In conclusion, the MEC process is straight forward, minimizes non-mission capable time, provides valuable training to unit maintenance personnel, and saves the Army much needed money. If units continue to request these type of repairs, it validates the pool of knowledge that Soldiers have attained in AIT and demonstrates that they are capable of a lot more than what is currently prescribed within the IETM. Requested often enough, the hope would be that these repairs could eventually be added to the IETM. I urge the UAS community to take a closer look at what training is provided to the Unmanned Aircraft Systems Repairer and the next time equipment is NMC for supply take a closer look and determine if this is in the scope of our Soldiers capabilities. We can do them justice by utilizing that talent.

CW2 Francis Zeigler is currently serving as the Unmanned Aerial Systems (UAS) Operations Technician (150U) for 3rd Infantry Brigade Combat Team, 25th Infantry Division. CW2 Zeigler previously served as an OH-58D/Armament/Electrical/Avionics Systems Repairer and an Unmanned Aircraft Systems Repairer. He has deployed twice with the RQ-7b. CW2 Zeigler has attended the Aviation Safety and Aviation Maintenance Officer Courses and has 10 years' service.

Acronym Reference

AIT - advanced individual training	**IETM** - interactive electronic technical manual
AMCOM - Aviation and Missile Command	**LAR** - logistics assistance representative
DA - Department of the Army	**MEC** - Maintenance Engineering Call/Order
FSR - field service representative	**UAS** - unmanned aircraft system

MANNED - UNMANNED TEAMING

in a Multi-Domain Environment

By COL Paul Cravey and
MAJ Ariel Schuetz

Sergeant (SGT) Fox lay hidden behind a rocky outcrop. His job was to overwatch the landing zone (LZ) and make sure that any artillery or anti-aircraft systems were identified, targeted, and neutralized before the air assault initiated its inbound leg from the release point. He had gone into the area by covert means and had limited communications due to his location and mission but echeloned fire support was just a tap away on his tablet device. While he observed the LZ, he also watched the full motion video feed of the unmanned aircraft system (UAS) tasked to over watch the objective and landing areas. Occasionally he would key in on something of interest on his tablet, like a moving vehicle, and would zoom in to positively identify the target. So far, he had not seen any air defense artillery (ADA) and no icons had been added to his tablet identifying threat he may have overlooked from the other Soldiers watching the same feed from the staging area. As mission time drew close, he monitored the execution checklist calls from the messages on the screen and chatted with the assets checking in for the mission target engagement areas. He drew fire support control measures with his finger on the tablet and messaged them to an on call attack aircraft team and artillery unit prepared to support with suppressive fires. He also confirmed that cyber effects were in place to degrade the threat integrated early warning radar. The silence was suddenly broken by the sound of tracked vehicles rolling through the brush and SGT Fox immediately slewed the UAS sensor and identified an ADA system emplacing close to the tree line along the LZ. It was heavily camouflaged, so he messaged a request for another platform to confirm its heat signature. He received a message that it appeared to be a ZSU (self-propelled antiaircraft gun) so he dropped a pin to mark the target and sent it to the fires cell and the attack aircraft. The air assault was just departing the staging area so he needed to neutralize this target before it visually identified the formation. He sent a message on his tablet to the fires cell for an electronic warfare effect to ensure that the air assault remained clear of radar detection. He tapped the "FIRES" app on the tablet and the target pin and sent a 9-line call for fire to the attack aircraft.

"Manned-unmanned teams enable operational fire and maneuver efforts, enhance mission command, and increase reconnaissance capabilities available to the commander."[1]

Figure 1. "Example of 9 line on Video terminal is from USMC fielded software on the Target Handoff System"

The attack aircraft pulled up the UAS feed on their cockpit displays, confirmed the target location and 9-line information, and made sure to add a no fire area over SGT Fox's location. As the air assault approached the release point, the air mission commander (AMC) confirmed the activation of the cyber and electronic warfare effects from his cockpit display and acknowledged that the flight would be clear of the engagement area based on time. As the air assault assets crossed the release point, SGT Fox ensured the UAS laser designated the target for the attack aircraft and the cooperative engagement went off flawlessly with the ZSU exploding moments before the aircraft landed in the LZ. SGT Fox continued to scroll the UAS payload around from the tablet and identified a second tracked vehicle rapidly moving from the former ADA location toward the LZ area. There was no time to request a fire mission so he took full UAS payload control, double tapped to lock onto the vehicle and with the press of a button engaged the vehicle with a missile. He launched a handheld UAS to confirm battle damage on both targets and ensure that there would be no further threat to the air assault. He didn't need to monitor or control the device once he drew the reconnaissance squares on his tablet; if the UAS spotted movement it would lock-on and notify him instantly. As the last of the air assault Soldiers cleared the LZ, SGT Fox remained in communication with the AMC and let him know that all the troops had made it safely off the LZ. He shouldered his pack and messaged the ground force commander a pin with a link-up location nearby.

Figure 1. "Video Terminal display screen capture is from USMC fielded software on the Target Handoff System"

This may sound like a scene from a Hollywood movie, but soon it will become a reality for the Army. The Army is developing new ways to enhance how Soldiers shoot, move, and communicate on the battlefield. Technology already exists to share control of payloads, platforms, and even weapons from integrated handheld controllers not much larger than the computer tablets and phones we currently all carry. In a few short years you will not have to lug a bulky Single Channel Ground and Airborne Radio System in a backpack hoping you will have line of sight communications with an aircraft or other mission support assets. You won't need a ground control station and a tactical vehicle's worth of support equipment just to fly a UAS. From anywhere on the battlefield, you will be able to message, draw, and point and click your way through a live fire engagement from a single device just as if you were playing the Mobile Strike video game on your phone.

The core concept behind streamlining this sensor to shooter linkage is manned-unmanned teaming (MUM-T). Manned-unmanned teaming is the synchronized employment of Soldiers, manned and unmanned air and ground vehicles, robotics, and sensors to achieve enhanced situational understanding, greater lethality, and improved survivability.[2] Manned-unmanned teaming combines the inherent strengths of different platforms to produce synergy and overmatch with asymmetric advantages. Today, as the Army is faced with enhanced

anti-access and area denial threats, it is imperative that we integrate UAS into the multi-domain battle to maintain the asymmetric overmatch they currently provide. Multi-domain battle revolves around a "*combined arms methodology to include not only those capabilities of the physical domains, but also greater emphasis on space, cyberspace, and other contested areas such as the EMS [electro magnetic spectrum], the information environment, and the cognitive dimension of warfare.*"[3]

Emerging threats are such that battlefields of the future will require synchronized cross domain teaming to create windows in space and time for Army Aviation to execute its core competencies. One of the guiding principles of the multi-domain battle "*is they [formations] must be able to employ multi-domain combined arms capabilities at the lowest practical echelons to enable dispersed operations, thereby reducing vulnerabilities to enemy massed fires while maintaining the ability to rapidly aggregate to mass at decisive points to create overmatch.*"[4] We must be able to easily task Army UAS and they must be expected to be responsive in an austere environment. They must be digitally integrated into a common signal architecture; possess a control interface that integrates and enables all aspects of decide, detect, deliver, assess (D3A); and have the degree of autonomy required to function in spectrum and space degraded environments.

Maneuver units on future battlefields will use cross domain fires in the traditional realms of air, land, and sea and information warfare means to enable windows of advantage where the Army can decisively and rapidly defeat the enemy. Lethal targeting is inherent in this concept and UAS teamed with maneuver, fires, intelligence, and cyber assets will result in the integrated, synchronized, and sequenced ability to find, fix, and finish enemy forces in abstract and physical domains. Due to the standoff distances required to engage threats in the physical domain, UAS payloads and munitions will be the key to both creating and exploiting windows of advantage. Army Aviation and ground maneuver forces will be constrained by deterrent forces unless enablers are utilized to make the environment permissive enough to achieve temporary dominance or overmatch. The key to success for joint combined arms maneuver and targeting in this type of environment begins today with the development of integrated and interoperable systems specifically enhancing the links that exist between the Army's attack and reconnaissance aircraft, lethal fires, and the Army Battle Command Systems that control and integrate them.

To achieve the type of integrated targeting required on the multi-domain battlefield, the Army plans to develop the scalable control interface (SCI) as the foundation of the family of UAS. The SCI will move the current portfolio of Army UAS control systems from differentiated and aircraft-centric systems to a common, operator qualification-based framework that reduces training time and expands the tactical employment of Army UAS across all echelons. The SCI will be based on an open architecture software that will support "Apps" allowing users to access different UAS payload and control features based on their level of training. Handheld mobile and static variants of this device will replace both the one system remote video terminal and the universal ground control station beginning in FY22. Each variant will allow users to access payload information like full motion video (FMV); have digital messaging, airspace, integrated targeting features; and will allow Soldiers to control the system under differing levels of interoperability. For all variants, software will include improved cognitive aiding to reduce user workload, signature management to avoid detection, and hardened data links.

The foundation of the Army's future MUM-T strategy is the cooperative integration between the payloads and weapons resident in the Army's family of UAS, the SCI, the AH-64D/E Apache, future vertical lift, and brigade combat team and division fires. A tactical common signal architecture will interconnect all these systems resulting in the ability to expedite fire missions, streamline sensor inputs, and cross cue between platforms. Embedded metadata, symbology, and messaging between all systems will support maneuver and fire elements with the ability to rapidly and decisively conduct D3A in multiple domains. Use of emerging spectrum capability will permit the dissemination of more

mission information at higher fidelity and greater speed with less bandwidth resulting in enhanced real time shared understanding. Rather than simply viewing FMV from Army UAS and rotary-wing platforms as "kill TV", Soldiers will be able to control the payloads and weapons on UAS platforms themselves, thereby, shortening the kill chain and enabling mission command at decisive points in the battle. Army aircrews will be able to enhance their situational understanding from places of security and even conduct cooperative engagements from outside of threat areas as part of a developing lethality strategy. Fire supporters will be able to digitally call for fire, deconflict airspace, and conduct battle damage assessment all on one consolidated screen. Intelligence analysts will have multi-modal payload ability, enhancing the ability to layer and cue cross domain intelligence summaries in real time, resulting in intelligence driving the operations process.

While all of this seems light years away from the current systems capabilities the Army currently possesses, units can access some of these interoperable features short term. Bandwidth efficient common data link will more than double spectrum capacity in the near term resulting in more aircraft able to operate in closer proximity with higher fidelity FMV. The AH-64E, Gray Eagle, and Shadow platforms are already conducting cooperative engagements and sharing feed and payload control into the Apache cockpit. Improved digital messaging will significantly shorten traditional timeline for call for fire 9-line missions. Multi-mission UAS are in development with new payloads, munitions, and capabilities that will change the way that the Army fights. To achieve this integration and synergy, today's leaders and Soldiers must integrate MUM-T into collective unit training and look at ways that unmanned systems can enable operations across all domains. The key to winning on the battlefield of tomorrow is integrated collective training with effects and systems from all domains at home stations today.

[1] United States Army. Army Techniques Publication 3-04.1 Aviation Tactical Employment. 2016. Print.
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[4] 2017. p.7. Print

COL Paul A. Cravey is the Director, Training and Doctrine Command Capability Manager, Unmanned Aircraft Systems, Fort Rucker, AL. His previous assignments include S-3, Brigade Modernization Command, Fort Bliss, TX; Commander, 1st Squadron, 6th Cavalry Regiment, Fort Riley, KS; Security Force Assistance Team Leader for the Afghanistan Border Police; S-3, 25th Combat Aviation Brigade, HI; Observer Coach Trainer, National Training Center, Fort Irwin, CA; and Commander, C Troop, 1st Squadron, 17th Cavalry, Fort Hood, TX. COL Cravey is a graduate of the Aviation Officers Basic Course, Initial Entry Rotary Wing Course, U.S. Army Ranger Course, U.S. Army Jumpmaster Course, Aviation Officers Advance Course, the Army Command and General Staff College, and the U.S. Army War College.

MAJ Ariel M. Schuetz is the S-3, Training and Doctrine Command Capability Manager for Unmanned Aircraft Systems, Fort Rucker, AL. Her previous assignments include G-3 Air and Aviation Planner at the Joint Readiness Training Center, Fort Polk, LA; Commander, A Company, 206th Military Intelligence Aerial Exploitation Battalion, Mazar- Al- Sharif, Afghanistan; and Assistant S-3 and Platoon Leader, 3-158th Assault Helicopter Battalion, Katterbach, Germany. MAJ Schuetz is a graduate of the Aviation Officers Basic Course, Initial Entry Rotary Wing Course, Fixed Wing Multi-Engine Course, and the Aviation Captains Career Course.

Acronym Reference

ADA - air defense artillery	**LZ** - landing zone
AMC - air mission commander	**MUM-T** - manned-unmanned teaming
D3A - decide, detect, deliver, assess	**SGT** - sergeant
FMV - full motion video	**UAS** - unmanned aircraft system

Joint Unmanned Aerial Vehicle Swarming Integration Quick Reaction Test

By F. Patrick Filbert

As technology improves, so does the capacity to expand a defensive perimeter to ever increasing ranges both horizontally and vertically. Identifying ways to penetrate this perimeter with assets and capabilities that do not require increasingly more expensive solutions requires creative use of current and emerging technological advances. Potential adversaries understand the United States (U.S.) is extremely technologically advanced with its warfighting systems. This requires a thinking enemy to develop ways to keep America's advanced systems outside their sphere of influence, specifically, to both deny and create an inability to gain access to specific areas of operation. In the current vernacular, this is called creating an anti-access/area denial (A2/AD) environment which has, as its backbone, advanced integrated air defense systems (IADS).

A Bit of History

Being able to provide a "layered" offensive capability with manned kinetic/non-kinetic payload armed aircraft has been done for some time. One example is how a joint Army-Air Force helicopter team (Task Force Normandy: comprised of U.S. Air Force (USAF) MH-53J/PAVE LOW III and Army AH-64/APACHE attack helicopters) blinded Iraqi IADS early warning radars with non-kinetic electronic attack (PAVE LOW IIIs) and destroyed the radars (APACHES) with kinetic weapon's strikes (i.e., HELLFIRE missile, HYDRA rocket, and 30mm cannon fire) in the opening minutes of Operation Desert Storm. This allowed follow-on USAF strike aircraft access through "holes" in Iraqi IADS to attack key targets further into Iraq.[1] Similarly, future use of an advanced wave of unmanned aircraft (UA) equipped with electronic warfare (EW) payloads leading a subsequent wave of attacking aircraft from carrier strike groups is one potential way to enter and counter a potential adversary's A2/AD environment.

While emerging EW payload testing on UA is occurring, mating electronic attack (EA) payloads onto a coordinated semi- or fully-autonomous swarm of smaller UA is still an emergent test environment effort. However, once such capabilities mature, being able to employ them requires that a foundational concept be in place. The Joint Unmanned Aerial Vehicle (UAV) Swarming Integration (JUSI) Quick Reaction Test (QRT) was directed on February 27, 2015 by the Deputy Director, Air Warfare under the authority of the Office of the Secretary of Defense, Director, Operational Test and Evaluation to address such a foundational approach.

The JUSI QRT, established on July 29, 2015 and completed its efforts on July 28, 2016, developed, tested, and validated a

concept of employment (CONEMP) for the integration and synchronization of swarming UA performing EA in support of the joint force against an advanced IADS. The JUSI QRT effort focused on a 2015-2020 timeframe to research and identify previous and ongoing swarm related efforts while building a swarming UA community of interest, concurrent with CONEMP development.

Artist Concept of a Swarm, (Defense Advanced Research Projects Agency)[3]

Advanced Integrated Air Defenses and How to Address Them

Modern surface-to-air missile (SAM) systems are an integral part of advanced IADS. These IADS are, in turn, integral parts of a potential adversary's networked A2/AD environment. For the purpose of the JUSI QRT effort, IADS referred to a networked system of adversary capabilities (e.g., a series of detection and tracking radars coupled with SAMs) and not just specifically to one platform (i.e., an air defense system on a warship by itself or a specific individual SAM system such as an SA-20). The joint forces do not currently have adequate ways to fully plan, integrate, or synchronize the effects delivered by UA swarms. This required development and testing of a foundational CONEMP offering an effective, albeit initial, planning methodology for delivering integrated effects of UA swarms against advanced IADS protecting targets with threat SAM arrays.

Notional Integrated Air Defense System[2]

The joint force is currently over-reliant on standoff weapons (SOW) and 4th/5th generation strike platforms to address the A2/AD challenge. Unmanned aircraft swarms represent a potential additional approach to complement existing platforms and weapons systems. Despite rapid technical advances in UA swarming development and demonstrations, at the time of the JUSI QRT's establishment (mid-2015) the joint force lacked a CONEMP for operations requiring UA swarm-delivered effects. The lack of such a CONEMP or other supporting documentation for swarm employment hindered requirements development, A2/AD countering, research and testing, and academic topic development that precluded integration and synchronization of such a capability with the rest of the joint force.

Addressing the Problem

Combat capable and survivable UA with the capability to perform swarming functions are a new but quickly growing aspect of modern warfare. The JUSI QRT took the first step to characterize, develop, and evaluate a CONEMP for use of multiple UA of various sizes with varying EA capabilities to deliver coordinated non-kinetic effects to enable other weapons and platforms (i.e., various types of SOWs, decoys, jammers, and 4th/5th generation platforms) access to counter A2/AD approaches. With the short lifespan of the JUSI QRT—one year—the effort focused on CONEMP development utilizing a series of modeling and simulation (M&S) runs over the course of three test events.

Integrated support by Johns Hopkins University's Applied Physics Laboratory's (JHU/APL) experienced M&S personnel during each of the test events enabled the QRT to conduct data collection for the equivalent of hundreds of swarm flights providing a cost saving aspect concurrent with data analysis to support CONEMP development. The JHU/APL provided M&S and analysis of the execution of UA with EA payloads against scenarios developed to test the UA's ability to deliver desired effects against an advanced IADS as part of an A2/AD environment.

After analysis, the resulting qualitative and empirical data allowed the JUSI QRT Team to assess findings, conclusions, and recommendations to revise the CONEMP between each test event. The QRT

conducted three tests spanning a time period from November 2015 to May 2016. Upon completion of each test event, a Joint Warfighter Advisory Group (JWAG) was convened to receive test event results and provide guidance and input to the larger QRT process resulting in the finalization of a swarming UA CONEMP.

The Way Ahead

The results of the JUSI QRT's efforts, synopsized in a final report, and the CONEMP itself, were provided to the over 30 transition organizations supporting the larger JWAG and community of interest in August 2016 for continued effort expansion. The CONEMP provides a link to requirements development and capability integration for the joint force to have a distributed approach to complement existing solutions, which focus on 4th/5th generation strike platforms and SOW.

The CONEMP provides an effective operational context to inform requirements development, roadmaps, and eventually, tactics, techniques, and procedures (TTP) development in several areas, including communication, automation, UA, and EA to deliver intended effects. The CONEMP also serves to help focus future Department of Defense and industry investment in areas of consideration related to swarming UA with EA payloads to include development, testing, and validation of TTP for UA with EA payloads. Such TTP will further reinforce the use of swarming UA by empowering the commander to develop standards in the areas of manning, equipping, training, and planning in the joint force. In the interim, the JUSI QRT's CONEMP provides planners, trainers, and supporters with a start point for employment of this capability.

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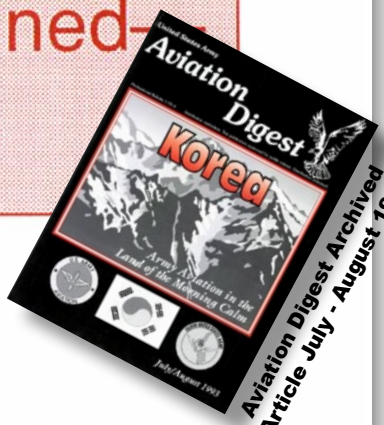
[3] Palermo, Elizabeth, "Fairy-Tale-Inspired 'Gremlin Drones' Could Spy in Swarms," www.livescience.com, September 2, 2015, http://www.livescience.com/52073-darpa-gremlin-drones-program.html, accessed October 7, 2015.

MAJ F. Patrick Filbert USA, (Ret) was the JUSI QRT Subject Matter Analyst for Unmanned Aircraft Systems (UAS) until July 2016. His post-military career has included assignments as Overseas Scenario/Threat Analyst Planner for the Office of the Secretary Defense Joint Counter Low, Slow, Small UAS Joint Test; USAF intelligence squadron intelligence analyst; contract team lead in a USAF UAS Wing Operations Center; and Project Manager for the US Pacific Command J-2 Socio-Cultural Analysis effort. Commissioned an Armor Officer in 1986, he transitioned to Military Intelligence in 1990 serving as an assistant brigade S-2 during Operation Desert Shield/Desert Storm. He has held command and staff positions from platoon through joint staff levels in the U.S., Europe, Balkans, Korea, and the Middle East during a 24-year army career. He is a 1986 graduate of the University of Hawaii-Manoa and earned his Master's Degree in Strategic Intelligence with Honors in 2009 from the American Military University.

Acronym Reference

A2/AD - anti-access/area denial
CONEMP - concept of employment
EA - electronic attack
EW - electronic warfare
IADS - integrated air defense systems
JHU/APL - Johns Hopkins University's Applied Physics Laboratory
JUSI - Joint Unmanned Aerial Vehicle Swarming Integration
JWAG - Joint Warfighter Advisory Group
M&S - modeling and simulation
QRT - quick reaction test
SAM - surface-to-air missile
SOW - standoff weapons
TTP - tactics, techniques, and procedures
UA - unmanned aircraft
UAV - unmanned aerial vehicle
U.S. - United States
USAF - U.S. Air Force

Alone, Unarmed, and Unmanned—UAVs in Korea



Major Marilee D. Wilson
Aviation Officer
501st MI Brigade
Republic of Korea

Lessons learned from Team Spirit '93 will make the fielding of UAV–Short Range far smoother for the U.S. Army and host nation allies.

Pioneer, the Army's unmanned aerial vehicle (UAV), deployed to Korea to support Team Spirit '93 exercises 7 through 18 March 1993. This annual U.S.–Korean exercise marked the first time an Army UAV system had been deployed to the Korean theater for other than demonstration purposes It also was the first overseas deployment for the Army's Pioneer since Operation Desert Storm.

With virtually no prior notice, Company C, 304th Military Intelligence (MI) Battalion, the Army's only UAV company, packed up their UAVs at the Joint Readiness Training Center (JRTC), Fort Chaffee, AK, and headed for the "Land of the Morning Calm."

CAPABILITIES

Pioneer can significantly enhance the commander's view of the battlefield through its capability to provide near–real–time reconnaissance, surveillance, target acquisition, and battle damage assessment. Driven by a pusher propeller, and powered by an aviation gasoline–fueled engine, Pioneer can reach out 185 kilometers (kms) from its ground control station (GCS). It carries a payload designed to obtain and relay high–quality video imagery, using either a daytime television camera or a forward–looking infrared (FLIR) system that can be used effectively both in day and night conditions (see chart).

Characteristics of the Pioneer	
Maximum Gross Weight	429 pounds
Wing Span	16.9 feet
Launch Methods	a. Rolling Takeoff--210 m meters b. Rocket-Assisted Takeoff
Recovery	Rolling Recovery with Arresting Gear
Endurance	6 hours
Maximum Range	185 kms
Maximum Altitude	15,000 MSL

TEAM SPIRIT OBJECTIVES

Team Spirit objectives for this deployment were—

- Integrate the UAV into Combined Forces Command (CFC) and U.S. Forces–Korea (USFK) operations as a corps–level intelligence and targeting asset.
- Identify operational issues and logistical support requirements, unique to the UAV, to anticipate the planned fielding of UAV–Short Range (UAV-SR) to Korea in the mid–1990s.

CONCEPT OF THE OPERATION

Pioneer was used in a direct support role for the Corps conducting the defense and in general support to other Team Spirit forces, as tasked through the command and control/joint staff intelligence collection process. The UAV company was placed under the operational control of the 3d MI Battalion (Aerial Exploitation) to facilitate the coordination of intelligence taskings and airspace usage.

MISSION EXECUTION

Team Spirit tasking consisted of point and route reconnaissance. Liaison officers from the supported corps (I Corps and 2d Republic of Korea Corps) observed near–real-time target imagery on a remote monitor in the UAV Operations Center established near the GCS. These liaison officers could evaluate the imagery presented and redirect the UAV in-flight over the maneuver area, if necessary. Pioneer successfully imaged Team Spirit targets over 75 kms from the GCS.

INTELLIGENCE REPORTING

Communications equipment organic to the aerial exploitation battalion was used to disseminate the intelligence collected by Pioneer. Products generated for the supported maneuver units included—

- In–flight spot reports transmitted over STUIII and the tactical commander's terminal.
- Post–mission message summaries (reconnaissance exploitation reports).
- Immediate hard copy images, printed in the GCS during the mission.
- Taped imagery of the entire mission, copied onto standard video cassette recorders.

LIMITATIONS

Despite its exceptional capabilities, Pioneer is, by design, strictly a fair-

weather system. Missions cannot be flown in icing conditions nor during significant rainfall. This proved to be a significant limitation during Team Spirit, given the inclement weather often encountered in Korea, particularly in late winter early morning hours. To deconflict UAV traffic from air missions previously scheduled over the Team Spirit '93 ground maneuver area (GMA), Pioneer was limited to flying between 0130 to 0600 hours daily. Combination of system design, mission schedule, and adverse winter weather significantly restricted our use of the UAV.

UAV CONTROL AND AIRSPACE MANAGEMENT

In coordination with the air component command and air traffic services (ATS), a combination of positive and procedural control measures were established to separate the UAV from other air traffic within and outside the GMA.

The UAV pilot maintained communications with ATS during the entire mission. Pioneer's launch from and recovery to the airfield runway was handled similar to normal instrument flight rules operations.

A discrete transponder beacon code was assigned to allow radar approach control to monitor the UAV position in flight. The Pioneer transponder lacked, however, Mode C capability for altitude reporting. Loss of the transponder signal during any phase of the mission would have required the UAV to return to base.

An air corridor was established between the launch/recovery airfield and the Team Spirit maneuver area. While this 1 nautical mile-wide corridor followed a strictly defined route, it was necessary to have maximum flexibility to maneuver over the exercise area to respond to the corps commander's intelligence requirements.

Hunter , the next generation UAV–SR

Once over the designated maneuver area, the UAV was allowed to fly as necessary between 2,000 and 6,000 feet mean sea level (MSL), although the mission was flown primarily at 6,000 feet. Mission altitude was dictated by considerations for video image quality and the absolute requirement to maintain line-of-sight data link between the UAV and the GCS. Rotary– and fixed–wing traffic continued operations both above and below the UAV restricted operations zone.

SAFETY

Elaborate technical safeguards are built into the Pioneer system and local procedures were put in place during Team Spirit to safely recover the UAV in case of an emergency like a lost data link or an aerial vehicle malfunction.

THE PAYOFF

Although proven in Operation Desert Storm and successfully flown at the JRTC and the National Training Center, the UAV is still a relatively new addition to the aviation community and our MI architecture. The exposure to Pioneer during Team Spirit '93 paid great dividends toward successfully integrating UAVs into intelligence collection operations and the Korean theater airspace management process.

The 3d MI Battalion's interest in the UAV went far beyond Team Spirit '93, as it will be among the first units to receive the next generation UAV (UAV–SR), known as Hunter. Army fielding plans call for a UAV–SR company to be assigned to each corps under the aerial exploitation battalion of the MI brigade.

Pioneer in the Gulf

Army Aviation and the Multi-Role Trap

By Major John Q. Bolton

I beg of you, to know yourself and your weapons, and to be frank among yourselves and with the rest of the Army. The Army will believe what the Air Corps says. If its prowess is exaggerated, disillusionment surely will come. —LTG Lesley McNair, Address to Graduating Airmen, 1938

Army Aviation stands at a crossroads. As the operational environment changes, how should the branch prepare for future conflicts after over a decade supporting operations in the Middle East? The major issues revolve around doctrine—is Army Aviation directly tied to ground forces or is it an independent force?—and aircraft design—what factors should drive development of new aircraft? The service faced similar challenges after Vietnam, when it developed effective aircraft but nearly abandoned air-ground integration as a key tenet.[1] In this environment, Army Aviation would be wise to consider lessons from its past as well as the contemporary struggles of the other services, particularly those of the Air Force. Foremost among these challenges are problems with multi-role aircraft (MRA). Considering these challenges will help Army Aviation remain true to its existential mission of air-ground operations while developing practical, reasonably priced aircraft capable of leading the force forward.

History of Multi-Role Aircraft

There are no solutions, only trade-offs.
– Economist Thomas Sowell

Common sense dictates that new equipment will more effectively perform its designed purpose better than other missions, but the history of American military aircraft is littered with wonder weapons that have failed to deliver promised capabilities. Perennial promises of new aircraft accompanied with all-weather capability, stealth, longer ranges, or greater payloads because of technical improvements mitigating the fog of war or "producing synergy", more often than not, fail under combat conditions when friction plays a realistic role.

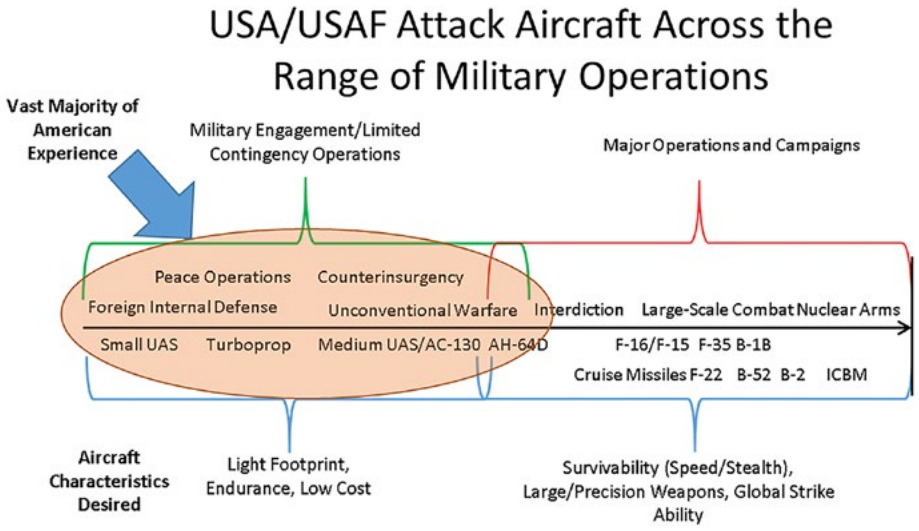


Figure 1.

Almost invariably, however, these aircraft not only fail to live up to expectations, but also result in what I call the *Multi-Role Trap*. Nevertheless, technological concepts, advertised as simple solutions to the complexity of war remain popular, even after recent conflicts should have shattered idealized, high-tech views of war. Fascination with technological advances drastically increase aircraft costs. In turn, the increase in costs means fewer aircraft produced, driving up unit cost. Consequently, units must execute the same missions with fewer aircraft and pilots must train for multiple missions, rather than becoming experts at a single task. This reduces individual and organizational effectiveness. Despite projections of low-cost and savings due to technological advances, MRA/joint aircraft nearly always cost more, perform below original expectations, and result in fewer aircraft procured than originally forecasted.[2]

One of the reasons this situation arises is that MRA are not actually designed for multiple roles—they are designed for a few high-tech threat roles and then have other missions piled on them as increasing costs reduce the number of aircraft produced. Secondary missions—nearly always close

air support (CAS)—are an afterthought. Along the spectrum of conflict outlined below, MRA design inevitably focuses on the high-end, to the detriment of the low-end.

Figure 2. T-6 Forward Air Controller and F-51 at Forward Landing Strips in Korea

Nevertheless, at low-end is how American forces have spent the vast majority of their time fighting. Consider the information in Figure 1 and notice the relative absence of any aircraft designed for low-intensity conflicts, despite the fact that this is exactly the kind of conflict in which American forces have most often found themselves. Traditional war is our paradigm for doctrine, force structure, and weapons design, but low-intensity conflicts are the norm.[3]

American forces first experienced major problems with MRA in Korea. GEN Almond, commander of X Corps argued against the use of jet aircraft for CAS, stating, "Although [propeller planes] were generally adequate, the jets were not."[4] Owing to limited fuel and an inability to fly from Korean airstrips, jets often had only 10-20 minutes on-station before returning to Japan. Their higher speed and limited endurance made them less accurate and prone to make tragic errors. In fact, the F-80, America's first jet fighter, originally could not carry bombs. Korea's mountainous terrain also contributed to difficulties by inhibiting ground force communications and visual contact with fast moving jets.

Eventually the Air Force fielded legacy aircraft for service as airborne controllers. By the end of the war, these units had controlled "90% of Air Force CAS sorties."[5] Modified trainers like the T-6 could sprint at over 200kts, yet operate at slower airspeeds to provide effective on-scene coordination and more precise fires. Additionally, as opposed to jets, T-6s could take-off in just 700 feet from dirt runways in Korea. In the late summer of 1950, the Air Force rapidly switched six jet squadrons to F-51s - upgraded World War II (WWII) P-51s. The F-51s operated from rugged forward bases, had loiter times measured in hours, not minutes like jets, and had a large, variable payload.

After the lopsided coalition victory in Desert Storm, new military concepts were the rage, led by the so-called Revolution in Military Affairs (RMA). Analysts pointed to the emergence of stealth aircraft and precision weapons as evidence that only high-tech aircraft were now necessary. The RMA proponents advocated a future in which American technology would allow us to see first, decide first, and shoot first; technology would eliminate the fog of war and make war simple and less bloody. It was "Clausewitz Out, Computers In."[6]

A 1997 Government Accounting Office (GAO) study shattered these delusions, though the invasion of Iraq would invite a full accounting, by sharply criticizing the Air Force's boasts about its effectiveness and just how good stealth actually was. The GAO found "no clear link between the cost of either aircraft or weapon systems and their performance in Desert Storm. Neither relatively high-cost nor low-cost air-to-ground aircraft demonstrated consistently superior performance across a range of measures such as sortie rate, survivability, amount of munitions delivered, and participation in successful target outcomes."[7] It turned out the cost of a system was in no way a guarantor of success. In fact, you could safely make the claim that aside from CAS, the air campaign actually made little difference in the outcome of the war.[8] Technology only exacerbated Iraq vs. American differences in terms of leadership and effectiveness; it did not create those differences. The GAO concluded: "The evidence from Desert Storm points to the usefulness of single-role aircraft in their respective missions and the usefulness of multirole aircraft most predominantly in the air-to-ground mission."[9]

We should build Droids not Death Stars. Death Stars are about as practical as a metal bikini. Sure, they look cool, but they aren't very sensible. Specifically, Death Stars can't possibly be built on time or on budget. Also, nobody can build enough of them to make a real difference in the field.[10]
- LTC Dan Ward

The MRA Design Process

While current attention focuses on reported poor performance and expense of the F-35, it is only the most recent MRA failure.[11] The first major MRA failure was the F-111, a joint Air Force-Navy program began in the 1960s. Designed to perform air superiority, CAS, all weather attack, nuclear attack, and high-speed intercept, while being aircraft carrier-capable, the F-111 weighed in at over 70,000lbs—twice a WWII B-17.[12] Designers hoped F-111 features such as multimode radar, advanced avionics, and variable-sweep wings would allow the F-111 to support a wide-range of missions. In reality, however, the F-111 was complicated, overweight, and a pricey hodgepodge of questionable technology and competing designs.[13]

Figure 2. The F-111 Ardvark[14]

Like the F-35, the F-111 had to meet both Air Force and Navy requirements. In theory, this should have saved money, if not during design and testing, then at least in joint production. However, designing an aircraft for multiple missions meant incorporating maneuverability, bombing, and carrier landing capability into a single airframe. Every capability simply added weight to the aircraft, reducing its ability to perform other missions while also increasing complexity. This inevitably created a Frankenstein, capable of doing much (on paper), but nothing particularly well.[15] Another F-35 similarity: F-111 initial performance requirements were reduced as the aircraft failed to perform.[16]

The high-tech systems designed to make the F-111 all-weather and night-capable, as well as cheaper and more reliable, had the opposite effect. Avionics "failed more often than predicted, and the time and costs to repair their failures were far greater than expected."[17] Radar bombing proved practically useless absent the perfect conditions.[18] By 1979, average maintenance hours per sortie were 23x times higher than forecasts and failure rates were so high that cannibalizing parts was common.[19] Like the F-35, the F-111 became an albatross, a sinkhole into which the services poured time, manpower, and the lost opportunity cost of millions that could have been better spent.

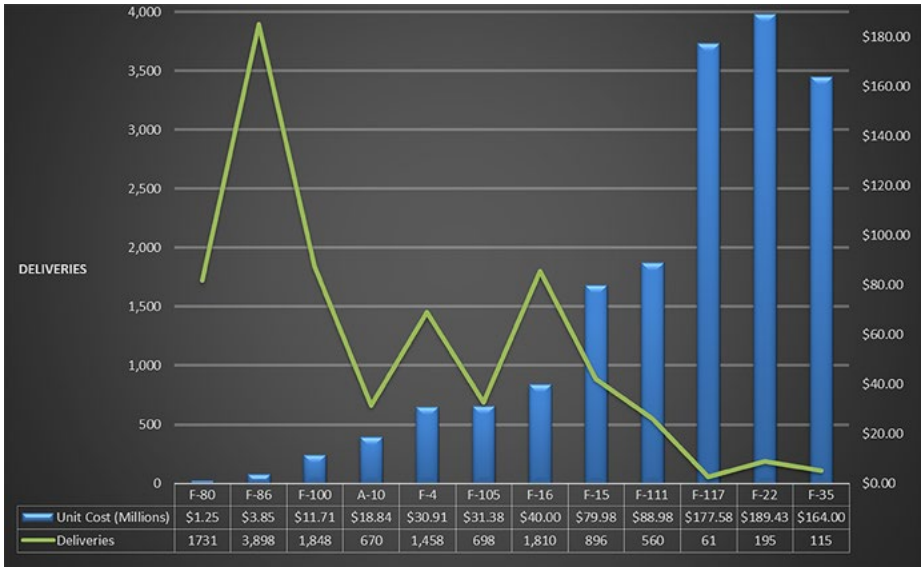


Figure 4. USAF Aircraft Delivers & Unit ost (2014 Dollars)[20]

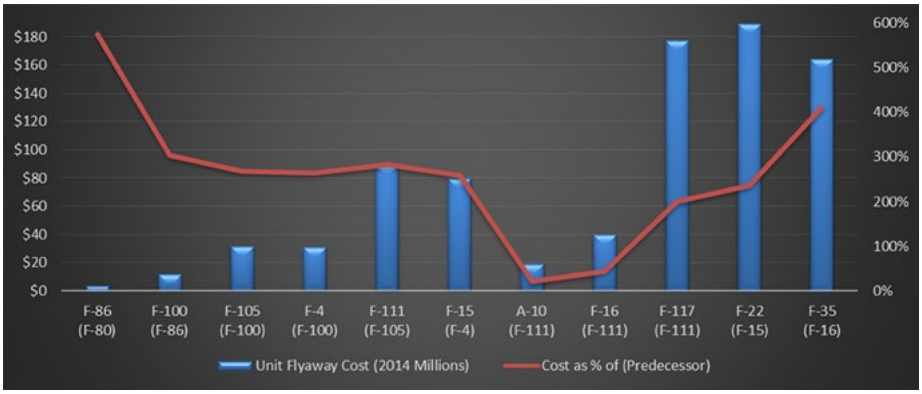


Figure 5. USAF Aircraft Unit & Marginal Cost (2014 Dollars)[23]

Increasing Complexity Drives up Cost

Not only did the F-111 prove less capable than advertised in its wide array of missions, its cost was grossly higher than predecessors. As a result, the Department of Defense (DoD) bought fewer aircraft. Cost and complexity quickly devolved into the pernicious *Multi-Role Trap* - technologically advanced aircraft costs that reduce the number of aircraft eventually produced that increase the mission set for each aircraft that requires further additions to the avionics and airframe that make each new aircraft more expensive.

Since WWII, (see figure 4) every new tactical aircraft brought increased costs resulting in fewer airframes. These costs were not just marginal increases; they were orders of magnitude greater. Consider Figure 5. With only two exceptions, the A-10 and F-16, marginal costs exceeded 200%. The result is that, in constant dollars, by 1980 an average flight hour cost 80x its 1950 equivalent; today it is over 120x.[21] Though an F-22 may be leagues ahead of a P-51 in certain parameters and may employ formidable technology, this does not necessarily result in commensurate improvements in effectiveness. Bombing a bridge, hitting a tank, or supporting ground troops requires roughly the same abilities today as it did during WWII. Moreover, the development time for MRA continues to increase. The F-22 took nearly 15 years to enter service, while the F-35, still not operational, will take over 20. For perspective, the F-35 program began in 2001, the same year 8 megabyte hard drives were considered large.[22]

Additionally, there is the problem of numerical symmetry. Even if MRA aircraft could perform as advertised, if they could stealthily penetrate air defense systems, if they could seamlessly integrate with global air and ground networks, it would not make that big of a difference because there are simply too few of them. If the airframe has limited flight hours and there are limited available airframes, the service cannot produce an effectively trained and *deployable* force. For example, the F-22 may be the world's premier air-to-air fighter, but with an end strength less than 200, it is "yet another low-density, high-demand asset to be managed…F-22 units often deploy in small 4-6 plane increments whereas more plentiful [F-15s and F-16s] deploy in groups of 12-18. F-22 four-ship tactics gave way to more realistic two-ship formations."[24]

The development of MRA has created a massive force gap in our tactical aircraft inventory. While some aircraft are certainly required to operate in high-threat environments, they cannot realistically operate effectively across the spectrum of

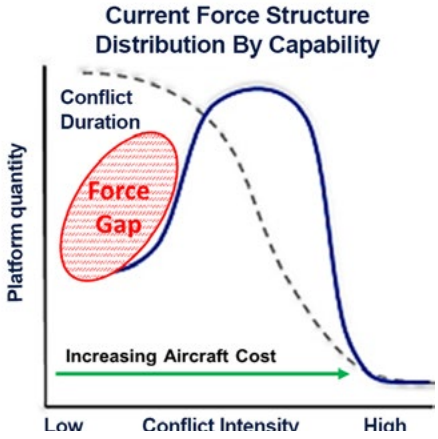


Figure 6.

conflict. Nevertheless, because MRAs cost so much, we rely on them for all missions. Deployments since 2001 have decimated this fleet, resulting in "an under-utilized specialized force and an over-utilized multi-role force that has led to greater expense."[25] Using aircraft for long-duration, low-intensity missions has essentially "flown-up" USAF tactical airframes, which as of 2009, averaged over 20 years old and past 50% of service life.[26]

Consequently, MRA may be irrelevant because they are so few in number. Like the French knights at Agincourt defeated by English bowmen, they are expensive tools incapable of adapting to low-tech threats. Likewise, aircraft are useless if grounded for maintenance. Defense Analyst Pierre Sprey, who is considered the "father of the A-10 Warthog," says an important factor of any military aircraft is the sortie generation rate, how many missions it can fly per day. While legacy aircraft, including Army helicopters, often fly multiple missions per day, the F-35 only flies every four or five days.[27] Sprey calls the paradox of expensive weapons failing despite huge investment "Cheap Winners, Expensive Losers."

MRA Refinement is Folly

Though expensive losers make the news, cheap winners are not hard to find. The P-51 Mustang dominated the skies of Europe during WWII as a fighter, fighter-bomber, and reconnaissance aircraft, and, as described above, performed CAS in Korea.[28] The F-16 and A-10 are both "pure expressions of function," designed to perform a specific mission very well.[29] Despite being 40 years old, both airframes are still in high-demand and both models have accommodated multiple modifications and upgrades. Efficiencies (margins) in their single-purpose designs allowed these aircraft long-term flexibility. A 2009 *Small Wars Journal* captured this phenomenon perfectly:

> The further one moves away from specialization the less efficient the tool becomes. The result is that the scissors on Swiss army knives are not used by tailors… The process of refinement makes any equipment better at one job but less generally applicable to a range of situations. [MRA] can be contrasted with Abrams and Bradley. Despite being purchased 30 years ago for an entirely different scenario against an entirely different enemy, both these vehicles continue to be enormously applicable to the operating environment we are facing today. This is because 60 tons of steel is 60 tons of steel.[30]

Another example: the AH-64A was designed for a single role, namely destroying Soviet tank formations from a hover. However, because its design was so focused, the airframe had the weight, power, and space margins to accommodate the Longbow upgrades 20 years after the AH-64A entered service. We also see this pattern with the C-130, B-52, and CH-47.

Relevance to Army Aviation

To date, Army Aviation has mostly avoided the *Multi-Role Trap*. There are logical lines of development between the UH (Huey-Blackhawk) and AH (UH-1 Gunship, AH-1, AH64) aircraft series. Diverging from this model and adopting the MRA model threatens 60 years of success. Multi-role aircraft have come only with the *promise* of reward at a massive cost in terms dollars. A move to MRA will up-end Army Aviation's successful reliance on mission-specific airframes. Army Aviation must avoid, with all possible effort, the tendency to envision single-source platform as solutions to disparate battlefield problems. To be more direct, we cannot afford to follow the Air Force down the high-tech, wonder weapon path. We must not fly away from our ground brethren as the Air Corps did.

There are many people that believe that through technology advancement, we can solve all of the issues of warfare. I absolutely reject that concept…Human interaction in a complex environment is the key to our success in the future.[31]
- GEN Raymond Odierno

Given the historical issues with MRA costs and capabilities, Army Aviation must proceed cautiously down the path toward procurement of future vertical lift (FVL) aircraft. Initial FVL documents envisioned a few common aircraft models performing multiple missions. However, MG Lundy clarified this in early 2015: "We're probably not going to have one aircraft that's going to be able to do all the missions…I need to see where [the technology] goes."[32] Army Aviation is also wisely seeking iterative technology demonstrations (fly-offs) as part of an iterative development process. Doing so will ensure only the best concepts move forward after real-world validation.[33] The proposed procurement of FVL does seek commonality in terms of drivetrains, cockpit design, and avionics.

Maintaining a balanced fleet, both cost effective and tailored to specific roles, must be the foremost goal of Army Aviation during future aircraft development. Army Aviation must balance the benefits of technology with the harsh reality of budgets, while understanding that more platforms and pilots are generally better than fewer high-tech wonder weapons. Critical to this is a capable pool of pilots, aircraft with a high flyability rate, and relatively simple aircraft.[34] After all, it is the Army Aviator "in the box," not the "box" that matters in the end.

Survivability Concerns

It goes without saying that slower, non-jet aircraft are less survivable against enemy planes or air defense artillery systems. However, these so-called high-threat environments represent the worst-case scenario for the employment of American air power. They do not reflect the preponderance of combat environments in which we have fought since WWII. While high-threat environments will exist, they should drive the design of aircraft employed in these situations, not every aircraft. We must have aircraft across the spectrum of conflict, not a few platforms designed for every contingency; likewise, aircraft designed for the worst-case (high-end) will perform poorly at the low-end, where, if history is a guide, they will most likely operate. Just as no one expects a NASCAR vehicle to act as a taxi, we should not expect our aircraft to operate equally well in both high and low threat scenarios. Similarly, the Army has several different formations designed for different types of fighting and terrain. An infantry brigade combat team cannot defeat an armored brigade combat team just as the armored brigade combat team cannot operate in mountains; they

are fundamentally different. Aircraft design and doctrine must follow a similar pattern in order to provide options, flexibility, and effectiveness to field commanders.

Conclusion

This article began with a quote from GEN McNair, commander of Army Ground Forces during WWII. McNair went through the bitter separation of ground forces from Army Air Corps during the early part of that war. He implored an Air Corps dedicated to bombing its way to success to remember that ultimate victory is won on the ground by "putting men into the mud." McNair watched as the Air Forces focused nearly all their organizational effort toward strategic bombing, leaving integration with ground forces as an afterthought. By 1944, even after three years of fighting, ground forces could not effectively communicate with tactical aircraft and there was virtually no integration between bombers and ground forces. Tragically, McNair was killed by an errant bomb from an Army Air Forces B-24 bomber in Normandy prior to the Avranches breakout. Let us not squander the hard-won trust Army Aviation earned over the last 15 years by forgetting our ultimate objective: to support the ground force. Our doctrine, organizations, and aircraft must yield to this overriding concern.

Note on methodology: Aircraft costs are notoriously difficult to pinpoint. This article utilized a variety of sources, mostly USAF and DoD documents to compute costs. When an aircraft had multiple variants, the most produced was used. All costs are displayed in 2014 dollars, adjusted 2014 year-end average Consumer Price Index.

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[32] Richard Whittle, "Army Looks to Build Two Forms of Future Vertical Lift," *Breaking Defense* (January 2015), accessed September 28, 2015, http:///breakingdefense.com/2015/01.
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MAJ John Q. Bolton is the Brigade Aviation Officer, 4/25 Infantry Brigade Combat Team (Airborne) at Joint Base Elmendorf-Richardson. He holds a Bachelor's of Science Degree in Mechanical Engineering, a Master's of Business Administration, and Masters of Military Arts and Sciences from the Command and General Staff College where he participated in the Art of War Scholars Program. His operational assignments include 1-1 Attack Reconnaissance Battalion and 1st Engineer Battalion. He holds Certified Flight Instructor – Airplane and Certified Flight Instructor - Instrument ratings and is an AH-64D/E Pilot-in-command/Air Mission Cmmander with deployments to Operation Iraqi Freedom and Operation Enduring Freedom.

Acronym Reference

CAS - close air support
DoD - Department of Defense
FLV - future vertical lift
GAO - Government Accounting Office
MRA - multi-role aircraft
RMA - Revolution in Military Affairs
WWII - World War II

WINNING IN A COMPLEX WORLD:

Applying the Army Operating Concept to the Modern Battlefield in Iraq

By LTC George A. Hodges

The Army Operating Concept (AOC) is described in the *Training and Doctrine command Pamphlet 525-3-1, The U.S. Army Operating Concept: Win in a Complex World*. The document describes future conflict and the challenges of employing future capabilities against anticipated threats in the 2020-2040 timeframe.[1] Our recent experience in Iraq, however, shows that the future is now, as there has never been as complex an operating environment as what our Soldiers are experiencing in Operation Inherent Resolve (OIR).

As Da'esh* swept across northern and central Iraq in 2014, the national capital region of Baghdad was in danger of being overrun. The presence of an aviation task force in Iraq began as a result of a U.S. Department of State request for forces to defend the embassy complex. The sourcing solution was a single AH-64D company and an aeromedical evacuation (MEDEVAC) platoon stationed at the Baghdad International Airport on a two week emergency tasking. The task force was manned at the minimum level needed for what was anticipated as a short duration mission. The task force has never left Iraq. The mission has grown from a company level contingency mission to a battalion-plus full-spectrum task force executing missions across the entire spectrum of aviation branch core competencies. The mission command responsibilities for the OIR aviation mission have fallen upon the Operation Spartan Shield rotational attack battalion, whose previous mission had been theater reserve, joint security cooperation missions with Middle East region partner nations, and overwater interoperability training in the North Arabian Gulf with the U.S. Naval Forces Central Command. The 10th Combat Aviation Brigade's 1-10th Attack Reconnaissance Battalion "Dragons", is currently performing the mission.

The rapidly evolving fight against Da'esh by the previous aviation units required a gradual and incremental expansion of the aviation support requirements. Subsequently, Task Force (TF) Dragon was formed upon arrival in theater by augmenting the 1-10th ARB with utility, heavy lift, and additional MEDEVAC assets.

The AOC states that the central Idea of "Win in a Complex World" is that:

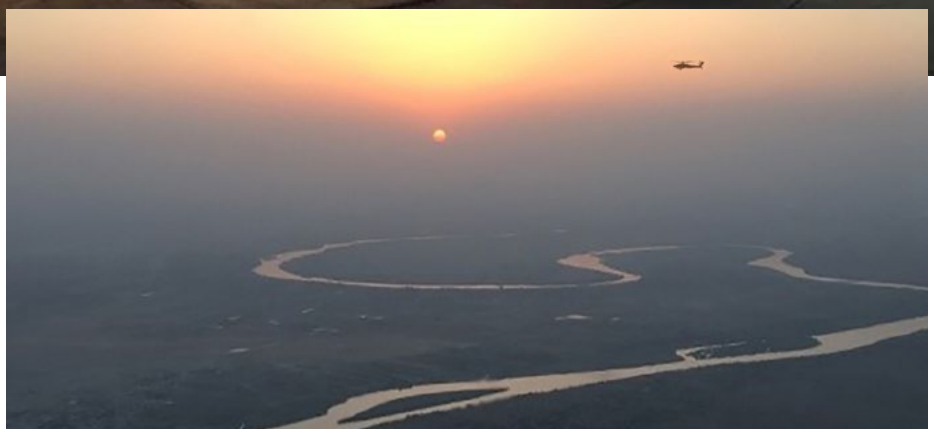
> *The Army, as part of joint, inter-organizational, and multinational teams, provides multiple options to the Nation's leadership, integrates multiple partners, and operates across multiple domains to present adversaries with multiple dilemmas and achieve sustainable outcomes.*

The AOC goes on to state that this central idea is executed through Joint Combined Arms Operations.[2]

Task Force Dragon integrated operations with all of the Department of Defense organizations during OIR. The TF coordinated airspace deconfliction and clearance of fires with U.S. Air Force (USAF) joint terminal attack controllers while engaging Da'esh with the AH-64D Apache; conducted mobility operations by teaming with the USAF to move aircraft, people, and parts throughout the area of operations; supported the U.S. Marine Corps fire support elements in the Euphrates River valley and areas south of Mosul; and coordinated the intricacies of the Iraqi customs process with the U.S. Navy and the U.S. Coast Guard.

The AOC's goal is to achieve decisive action, which the Coalition Joint Forces Land Component Command (CJFLCC) enabled through support to the Iraqi Security Forces. Task Force Dragon participated in decisive operations that led to the capture of Ramadi, Fallujah, and Quayyarah. Operations into Quayyarah included an opposed wet gap

*An acronym increasingly used in lieu of the term "ISIS."



crossing; the first such operation in the Middle East in generations. To seize the city of Mosul, TF Dragon Soldiers participated in offensive, defensive, & support operations across the entire area of operations at the height of the deployment.

The AOC enables victory by means of the Army's Core Competencies. As the sole Army Aviation component of the CJFLCC, TF Dragon supported the commander in each of the Army Aviation competencies with multiple aircraft of each type on a daily basis. This included:

1) Providing accurate and timely Information collection about the enemy, terrain & local populations.
2) Providing reaction time and maneuver space.
3) Destroying, defeating or disrupting enemy forces.
4) Conducting air assault of ground maneuver forces.
5) Conducting air movement of personnel, equipment and supplies.
6) Evacuating wounded or recovering isolated personnel.
7) Enabling mission command over extended ranges and complex terrain.

Aerial weapon teams (AWT) provided timely & accurate information about the enemy while they simultaneously engaged to destroy, defeat, and disrupt them through direct fire engagements. The AH-64s of the TF often teamed with unmanned aircraft systems to engage the enemy.

Task Force Dragon's utility and cargo crews moved personnel, equipment, and supplies across the theater, and air assaulted maneuver forces and fires assets that included one of the first gun raids that have taken place in Iraq in many years. The MEDEVAC crews responded to daily missions to evacuate contested point of injury patients with AWTs providing quick reaction force (QRF) security. With force protection being the CJFLCC Commander's highest priority, TF Dragon also retained a 24-7 QRF and an aerial reaction force capable of projecting an Infantry platoon's combat power onto the battlefield for any contingency.

Finally, TF Dragon enabled winning in this complex environment by providing the tools for the commander to exercise mission command. By fostering mutual trust and a shared understanding, junior leaders were able to make decisions within the commander's intent to achieve decisive action victory in a complex combat environment.

[1] Director, Army Capabilities Integration Center. TRADOC Pamplet 525-3-1. The U.S. Army Operating Concept. Win in a Complex World. Department of the Army, 2014.
[2] Ibid

LTC George A. Hodges is the Commander, 1-10th Attack Reconnaissance Battalion, 10th Combat Aviation Brigade (CAB), Fort Drum, NY. Prior assignments include Brigade Aviation Officer, 4-4th Infantry Brigade Combat Team; S-3, 4th CAB, Ft. Carson, CO; S-3 and Executive Officer, 1-227th Attack Reconnaissance Battalion (ARB), Ft. Hood TX; Instructor, United States Military Academy, West Point, NY; Commander, Headquarters and Headquarters Company, 4th CAB; Commander, B Troop 1-6th Cavalry Regiment; and Platoon Leader, 1-227th ARB, Fort Hood, TX.

Acronym Reference

AOC - Army Operating Concept	**OIR** - Operation Inherent Resolve
ARB - attack reconnaissance battalion	**MEDEVAC** - aeromedical evacuation
AWT - aerial weapons team	**QRF** - quick reaction force
CAB - combat aviation brigade	**TF** - task force
CJFLCC - Coalition Joint Forces Land Component Command	**USAF** - U.S. Air Force

THE INTELLIGENCE STAFF OFFICER'S ROLE:

Air Assaults in an Asymmetric vs. Linear Battlefield

By CW2 J. Phil Geraci

The air defense capabilities of our near peer adversaries makes it imperative that the intelligence staff officer (S-2) becomes intimately involved in the details of the air assault planning process. Although successful air assaults have been conducted during recent counterinsurgency (COIN) operations, conventional war against a near peer threat will necessitate a more disciplined approach and more involvement by the S-2. The type and tactical employment of sophisticated weaponry currently fielded requires thorough S-2 analysis and reliable prediction in order to protect helicopter assault forces. The S-2 must understand the threat's capabilities and identify known air defense positions or predict most likely locations based on terrain analysis and confer with the aviation mission survivability officer (AMSO) and flight lead during the route selection process. From receipt of mission through mission execution, the S-2 must work closely work with air assault mission planners to devise a sound plan against a highly lethal near peer enemy.

The insurgents that the United States fought for the last fifteen years used unpredictable tactics to shoot down helicopters with mostly small arms fire and rocket propelled grenades. These weapons are cheap, easy to use, and widely proliferated on the battlefield. They are, therefore, very difficult to predict during threat course of action development. Updated infrared counter measures installed on Army helicopters were effective in countering man-portable air defense systems once they were identified as a threat.

To deal with the primary threat of small arms fire, air movement plans were planned and flown at higher altitudes out of small arms range. The emphasis on using terrain to mask the aircraft from enemy weapon system detection was not as critical in the existing COIN environment air assault. The landing plan was usually conducted with a final landing zone update provided minutes before landing by security elements conducting visual reconnaissance on the landing zone. Their primary focus was on enemy armed with point and shoot weapon systems.

As we make the transition from the Iraq and Afghanistan COIN operations to the decisive action environment, our mission planning intelligence becomes more significant. By and large, intelligence on the specific effects of the enemy's weapon systems is vague and not as useful in planning on an asymmetric battlefield. Accurate weapon systems analysis and reliable information on its location will be much more significant during air assault planning when fighting an enemy armed with advanced weapons and tactics on a linear battlefield.

The United States' near peer adversaries are armed with sophisticated radar guided anti-aircraft guns, radar guided missiles, and MANPADS that are not easily defeated by infra-red counter measures. For example, on entering Syria, Russia's first order of business was installation of integrated air defense system. They are equipped with advanced systems, frequently train on their systems, and create a concern for the United States. With batteries of the S-300 missile, Russia's air defense system covers an area of over 250 miles in all directions from western Syria. The Russian S-300 air defense missile system is able to track and lock 100 targets at the same time, engage targets at altitudes as low as 25 meters, and launch 2 missiles simultaneously per target. These capabilities are on the opposite end of the spectrum of weapons systems that we have defended against during recent operations in Iraq and Afghanistan.

While the S-300 missile may not be a typical threat to Army Aviation rotary wing operations, it forewarns of the emphasis Russian, and surrogates supplied by Russian armaments, place on air defense. It would be unrealistic to expect systems more narrowly defined to engage rotary wing aircraft to be any less sophisticated. The S-2 must intimately understand these weapon capabilities, predict their locations, and along with the AMSO, scrutinize the flight lead's air movement plan. Detailed and accurate intelligence is essential in order to conduct air assaults undetected by the enemy to seize the initiative through the element of surprise.

The S-2's involvement in the air assault planning process is changing as the Army shifts its focus from the COIN environment to focus on decisive action in support of unified land operations. Route selection based on terrain and threat must be more exact due to the enemy's target detection, acquisition, tracking, and shoot down capabilities. During the ongoing intelligence preparation of the battlefield process, the S-2 must corroborate his analysis of the enemy by leveraging the intelligence enterprise in order to reduce risk to an acceptable level and ensure mission success.

[1] Gould, Joe. "Protecting Rotorcraft." Army Times, July 19, 2010: 22.
[2] DeYoung, Karen. The Washington Post. October 17, 2016. https://www.washingtonpost.com/world/national-security/russian-air-defense-raises-stakes-of-us-confrontation-in-syria/2016/10/17/85c89220-948c-11e6-bb29-bf2701dbe0a3_story.html?utm_term=.faafba2a13c4 (accessed February 12, 2017).
[3] Cantin, John. World Wide Equipment Guide, Volume 2: Air and Air Defense Systems. Fort Leavenworth: TRADOC G-2 ACE - Threats Integration, 2015.

CW2 J. Phil Geraci is currently serving as a UH-60M Instructor Pilot, 3-501st Assault Helicopter Battalion (AHB), 1st Armored Division Combat Aviation Brigade (CAB). His previous assignment was as a UH-60L instructor pilot with 3-158th AHB, 12th CAB. CW2 Geraci deployments include Afghanistan in support of Operation Enduring Freedom and Europe in support of Operation Atlantic Resolve. He has just over 7 years' service.

"WICKED PROBLEMS"

An Invitation to Read, Think, Speak, and Write

By MAJ Michael C. Shaw and
Mr. Justin M. Witty

Complexities of the Branch

The art and science of warfighting is an amazingly broad and deep subject with complexities that bridge the technical aspects of war and the social interactions that win them. Whether we discuss tactical intricacies of the battlefield or bureaucratic complexities at the Pentagon, multi-faceted problem sets bombard our branch. The government directed Budget Control Act of 2011 in concert with sequestration, the Holistic Aviation Assessment Task Force, the Aviation Restructure Initiative, and a significant operational transition from counterinsurgency to decisive action are just some of the complex, ill-structured, or so-called "wicked problems" that exist.[1] The second and third order effects of these programs and the consequences of decisions derived because of these events are still unknown. Still, the solutions on how the branch will solve these current problems along with new and increasingly complex undefined ones are out there. We, as members of the Aviation Branch, are those solutions. We have the capabilities and capacities; we only need to apply ourselves.

Open and honest discussions about these "wicked problems," are critical when trying to capitalize on existing opportunities (seizing the initiative) and mitigate branch fratricide. Solutions regarding force structure and technological advancement or development of Soldiers capable of meeting global challenges are issues that affect all members of the branch. Senior leaders can not be the only ones acknowledging and attempting to understand the complexities that face our formations. Often, those not in command or performing a leadership role are the ones who can see the problems most clearly and have the time and energy to help define them. Soldiers at all levels must obtain a broader perspective of the branch to see how their unit, airframe, track, or specialties are affected. We have a responsibility to bring those ideas forward to work on these complexities together as a unified and synchronized team.

For many of these "wicked problems," there is no definite consensus on what the problem is, let alone whether the owning unit, proponent, or directorate can solve them in isolation. Rather, individuals from across the Aviation Branch (Forces Command, Army Aviation and Missile Command, Training and Doctrine Command, etc.) must commit themselves as the resources to attain a solution. Definition of what the problem is, and the subsequent answers, will come from officers, warrant officers, non-commissioned officers, enlisted Soldiers, and Civilians who are willing to step forward, take personal risk, and express ideas and constructs. If we, as a branch, are going to emerge out of the past two decades of counterinsurgency-centric warfare and prepare ourselves for the "unknown and unknowable" future that General Perkins often refers to, all of us must be able and willing to contribute to the larger branch unified body and not just our individual jobs.

Model - R T S W

In order to help facilitate this "call to arms" we present the Read, Think, Speak, and Write (RTSW) model.[2] It is a straightforward four-step process that we suspect many of you are already following without knowing it. It starts with consuming information, processing it individually, discussing it collectively, and finally, putting some ideas on paper for others to think about or use.

First, we must begin to Read. Although the aircraft operator's and technical manuals are necessary reading topics, the reference to "Read" here means the

material that goes beyond us, as either an individual or as an aviator. We should consume information in Army doctrine, we should read professional periodicals, and we should select books and articles about subjects that support not only our skill sets but also those that expand our general knowledge base. These should include a broad range of topics such as organizational design, problem solving, or how the mind works. There is no shortage of military related reading lists, which are a good place to start; but, the key is to pursue topics that are interesting to you personally. Even an unrelated topic, sometimes will provide insight into your daily job or personal life. Through readings, such as this article, we obtain data needed for further processing.

Second, after reading on various topics, you are challenged to Think critically (beyond your initial emotional reactions). Few of the subjects presented or written about are simple in nature. Redefining known problems may be necessary to find solutions. Solutions proposed by others may be more complicated than initially intended and the actions currently being undertaken to solve them may not be the best for Army Aviation. The intent is for you to become engaged – to think. The noted astrophysicist Neil deGrasse Tyson said that to better understand the environment in which we operate, we must turn "fact into knowledge, knowledge into wisdom, and wisdom into insight."[3] Through thinking, we obtain the ability to turn facts into understanding.

The third step in this intellectual progression takes place after consuming (Read) new information and processing (Think). Now is the time to Speak to others. All too often, we go straight from data consumption to talking. As one anonymous quote goes, "Before engaging your mouth, first ensure that your brain is in gear." Words that have not been thought through, organized, and targeted at the subject and to the audience are simply noise. This practice is, unfortunately, commonplace in daily societal interactions on Twitter, Facebook, and email entries. Even within the aviation profession, this quick return or "first mover advantage" translates into cheap leadership soundbites, digital tasking processes, and operational critiques to name a few. Whether speaking takes the form of a formal sit down within your organization or is composed solely of cold beverages and friends around a table, the result is the same. A dialogue born of individual thought that can then gain alternative perspectives, ideas, or potential solutions. To speak and speak well, one must certainly think.

The fourth and arguably most difficult part for the Aviation Branch, within this construct, is to Write. After Reading, Thinking, and Speaking on the topic with friends, coworkers, mentors, or seniors to debate your thoughts, comes time to put those words onto paper. Capturing the insights, thoughts, new models, or proposed alternate ways of operating are what both completes the process for one individual and begins the process anew for many others. Whether the words support, oppose, or propose an entirely new approach, we collectively grow as a branch because of the effort. What you are reading here is the final step (Write) for the authors, which has occurred after years of those first three steps (Read, Think, and Speak). This introductory article is your invitation to become an active participant – a conduit to professional engagement.

Movement to Contact

This article is a prologue that serves as a challenge to every individual serving the Aviation Branch. Over the next year, the authors will introduce six topics within subsequent issues of the *Aviation Digest* to address and encourage discourse on the Aviation Branch's "wicked problems." The intent of this written endeavor is to spark interest, touch a nerve, or generate a desire to discuss the topics with your colleagues and then - respond. The bottom line: your "buy-in" to this project as a professional in the Aviation Branch is required to solve the challenges we face. Your experience and unique perspectives are essential input.

The authors will present future topics themed as either a challenge or an opportunity. We believe these topics have numerous facets and multiple possible answers. Just like a four-sided seesaw, pressure, counter pressure, or no pressure, all action or inaction contributes to the direction and pace of possible solutions. Moreover, without the application of RTSW, these complex and dynamic problems receive Band-Aid fixes for the visible wounds, while the fundamental issues are never appreciated, let alone mended.

Opportunity structured topics will present the audience with greater potential for clearer, or more direct solutions. Do not let the potential of a more immediate solution blind you to the complexity involved in obtaining that solution. Nor does this infer that solutions to the opportunity articles presented will be unanimously agreed upon; rather the authors who participate will address their discussion points and collectively derive a negotiated settlement. Opportunity topics to be presented in future issues of the *Aviation Digest* are: 1) Army Aviation requires two Warrant Officer Tracks at the Company level: Trainers and Maintainers, 2) We think we understand Leadership, and 3) What happened to the scholar in "Warrior Scholar."

Challenge topics will possess greater uncertainty and increased ambiguity in their understanding, dissecting, and solutions. Articles that will fall under the heading of a challenge are: 1) Is Army Aviation a Profession, 2) Overestimated Self-

perceived Command Abilities of Captains Career Course Graduates, and 3) Lacking Perspective: The Perceived "Incompetence" of my Higher Headquarters.

The Final Straw

Today, Soldiers are proud of their aviation skills and rightfully so. We beam with pride reflecting on the accomplishment of both training and missions. We flaunt skill identifiers, schools attended, and airframe qualifications. Nonetheless, we have lost visual contact with the pride that once existed around being part of the larger Aviation Branch, more specifically the *Aviation Profession*. The actual growth and strength of our branch resonates from the Aviation Soldier and their contributions to the aviation profession, not to themselves.

The final impetus for writing these articles is an attempt to bring back professional discussions to the *Aviation Digest*, and by default, to the Aviation Branch as a whole. Without sharing creative ideas, successful tactics, techniques, and procedures, or stories that show all the positives and negatives of our branch, how can we possibly find a way forward against future challenges? *Aviation Digest* is the forum for operators, planners, and requirement writers to share ideas on challenges and opportunities they battle on a daily basis - a true grassroots campaign.

First published in 1955, *Aviation Digest* was focused mainly on safety and accident prevention. It has expanded throughout the years to cover "new hardware, increasingly complex problems in material, air traffic control, aviation medicine, flight training, and emerging...tactics, etc." and grew to a 48-page monthly professional periodical.[4] *Aviation Digest* was discontinued due to budget constraints in 1995 but reformed in a digital medium in 2013. With a loss in continuity and readership, it is time to rekindle the professional discussion within the Aviation Branch and what better place than our Army Aviation Professional Bulletin?

The End is Merely the Beginning

Over the next year, we will attempt to tackle several of these complex problems. Some topics will simply be descriptive in nature, allowing you, the reader to read, think and speak about the constructs presented. Other subjects will offer potential organizational redesigns and will talk about the ways in which we as a profession can potentially gain efficiencies. Still, other topics will be argumentative in nature, taking a position of opposition to our organizational culture. As our environment changes, we must adapt and as Nobel Prize-winning physicist Ernest Rutherford once famously said, "Gentlemen, we have run out of money; now we have to think."[5] The goal of this year-long journey is an attempt to once again open the doors to critical thought and communication. We hope you will join us.

Acronym Reference

RTSW - read, think, speak, and write

[1] General Perkins and Lieutenant General Lundy utilize the term "wicked problem" to describe problems of such complexity that no single answer exists nor may provide the solution.

[2] Benjamin Armstrong, "Charting a Course for our Professional Writing," *The Military Writers Guild*, www.militarywritersguild.org/rtsw-charting-course-professional-writing/. Accessed 13 Feb. 2017

[3] Rogan, Joe. "JRE #310 - Neil deGrasse Tyson." Video blog post. *The Joe Rogan Experience*. 9 Jan. 2013, podcasts.joerogan.net/podcasts/jre-310-neil-degrasse-tyson-brian-redban. Accessed 27 Feb 2017

[4] *Aviation Digest*, "History of Aviation Digest", www.rucker.army.mil/aviationdigest/history_avnDigest.html. Accessed 5 Mar. 2017

[5] Quote attributed to Ernest Rutherford and occasionally, variations attributed to Sir Winston Churchill, *Goodreads*, www.goodreads.com/author/quotes/437411.Ernest_Rutherford, Accessed 19 Feb. 2017

Major Michael C. Shaw is currently serving as the United States Army Aviation Center of Excellence Deputy G-5. Previous assignments include Executive Officer and S-3, 3-159 Attack Reconnaissance Battalion (ARB) and Commander, A Company, 4-4 ARB. MAJ Shaw is a graduate of the Army's Command and General Staff College at Fort Leavenworth and has a Ph.D. in Human Resource Education and Leader Development from Louisiana State University.

Mr. Justin Witty is currently serving as a Senior Instructor at the Aviation Warrant Officer Advanced Course, Fort Rucker, AL. His previous aviation experience includes Commander, C/3-101 in 2008/09. Mr. Witty has deployed twice in support of Operation Enduring Freedom.

Is Army Aviation Truly a

By MAJ Michael C. Shaw and
Mr. Justin M. Witty

Profession is More Than a Title

With the publication of *Army Doctrine Reference Publication (ADRP) 1, "The Army Profession"* it may be silly to ask if Army Aviation is a profession, after all, we have doctrine right? Perhaps calling ourselves "professionals" is simply a self-nominated descriptor, like someone giving themselves a nickname. However, like self-given nicknames, they do not stick if the name does not match one's personality. Possibly the Army and Army Aviation calling itself a profession merely masks its true bureaucratic nature. The reality is that there is more to being a professional than the title itself.

The Army started out as a government institution like any other. Its first movement towards professionalization took place more than 100 years after its inception, beginning with the officer corps. The Army's next period of professionalization came after the Vietnam Conflict, with the non-commissioned officer and warrant officer corps.[1] Our most recent period of professionalization came with the production of *ADRP 1* in 2013. Presently, the Army Profession defines its essential characteristics as Trust, Honorable Service, Military Expertise, Stewardship, and Esprit de Corps.[2] This construct parallels most civilian definitions of a profession that include: specialized skills, members who use judgment when exercising specialized knowledge, continuing education, missions that benefit society as a whole, and ethical standards.[3]

Using either of these definitions, we must ask ourselves, do we within the Aviation Enterprise meet these professional objectives laid out before us? The battle between bureaucracy and professionalism within Army Aviation ebbs and flows, as do conflicts and periods of recovery. Even *ADRP 1* identifies the dual character that exists as "...both a military department of government and a military profession."[4] Such a balancing act requires constant vigilance. Dr. Don Snider, a professor at the Army War College, points out several categorical criteria in Figure 1 that differentiate a profession from a bureaucracy. These measures will help us gauge where we are as a branch, and this paper will identify where we can apply pressure to keep our organizations from slipping further into mediocrity.[5]

Comparison	Profession	Bureaucracy
KNOWLEDGE	Expert, requires life-long learning, education, and practice to develop expertise	Non-expert skills based, learned on the job and/or through short duration training
APPLICATION	Knowledge applied as expert practice through discretion and judgment of individual professional;commitment based	Work accomplished by following SOPs, administrative rules and procedures; compliance based
MEASURE OF SUCCESS	Mission effectiveness	Efficiency of resource expenditure
CULTURE	Values and ethics based; granted autonomy with higher degree of authority, responsibility and accountability founded trust; a self-policing meritocracy	Procedural compliance based; closely supervised with limited discretionary authority, highly structured, task-driven environment founded on low-trust
INVESTMENTS	Priority investment in leader development; human capital/talent management; investment strategy	Priority investment in hardware, routines; driven by cost
GROWTH	Develop critical thinking skills to spur innovation, flexibility, adaptability; broadened perspectives	Develop tactical and technical competence to perform tasks
MOTIVATION	Intrinsic - Sacrificial service, sense of honor and duty, work is a calling	Extrinsic - Ambition to get ahead, competition; work is a job

Figure 1.

As the first of three "challenge" articles in this series, we believe the inter-war period we are now entering provides a substantial challenge for the Aviation Enterprise with regard to core professional components. For example, how has the title of subject matter expert (SME), affixed to every job assignment/ course certification, hindered actual learning and development? Do we act as stewards of our field or is the reflection in the mirror one of inherent selfishness or a lack of greater perspective? Do we help, coach, mentor, or challenge each other to be better than we already are? Other components of professionalism, such as self-policing, continue to be taught and talked about as part of our inherent military aviation culture. However, if people fail to meet standards of intelligence, effort, or Army values are they reprimanded and rehabilitated, or asked to leave the profession? From our perspective, encroaching bureaucracy and our willingness to pass along a problem rather than right a wrong neuters our force.

Earning and maintaining the organizational title of "profession" is not easy, nor should it be. We use the word "aviator" to describe ourselves versus "pilot." What is the difference? There is little difference according to Merriam-Webster; however, to many inside the branch, being an aviator includes not only the act of manipulating aircraft controls but, includes the large volumes of knowledge required to conduct missions in all environments. That knowledge, in addition to the information needed to be a professional Soldier, combines to make our professional aviation challenges strikingly apparent. Master Aviator Wings should represent much more than flight hours or years in service.

Knowledge: Military Expertise vs. the Subject Matter Expert

Do Aviation Soldier's possess the necessary knowledge and expertise in both the art and science of warfare to win today's engagements and meet the challenges of tomorrow's battlefields? We often discuss our formations being a mile wide and an inch deep, yet we identify every individual or position within the organization as an SME. It has become standard practice that anyone returning from a qualification course or simply had one experience that others have not, becomes the SME in that area. Our flippant usage of the term SME diminishes real expertise gained through years of training, experience, and education in their field. We use this term as a catch-all that inevitably impedes lifelong learning, inflates egos, and gives us all a false sense of professionalism.

The Army recognizes the essential nature of continuing education and lifelong learning to build expertise. However, just because we have professional military education (PME) and course certifications, that doesn't mean they are producing expertise. Other professional organizations require continuing education credits on an annual basis to ensure its practitioners are current on changes in their operating environment and encourage expansion of one's foundational knowledge. Why does Army Aviation bestow the title of SME on anyone with an elementary understanding on a subject? The danger becomes, if the learning stops and the newly earned qualification does not demand an additional learning component, the title of SME is baseless.

There is no question that the Army and Army Aviation have a well-designed PME and self-certification program. What other career gives their members months or years off from their "day job" to learn and hone their craft? Professional military education prepares us to understand greater organizational workings and also prepares us for positions of increased responsibility and complexity. Because of the programmed nature of these courses, a lack of intellectual rigor, and a "no Soldier left behind" mentality, a common student perception is that this window of educational growth is wasted time. If PME course material is not challenging, does not facilitate personal growth and development, and is not adding to the unit's operational capacity, then, what is the return on investment?

Other than the initial qualification courses at Fort Rucker, the remaining PME courses are often referred to as graduate level instruction. If you attend any PME block beyond the basic courses, you most likely have heard the adage "It's only a lot of work/reading if you do it." Such sentiment is a sad perspective from a cohort of proposed professionals. Graduate work typically requires 3-4 hours of reading and study for every hour spent in class. Even a bachelor's degree described by Dianna L. Van Blerkomhe's book, "College Study Skills," suggests that for every hour of class work a student should expect to study for two hours.[6] Aviation PME includes practical exercises and is considerably more classroom intensive than a typical college class but are officers, warrant officers, or Soldiers investing even a fraction of those hours in post-classroom self-study? Most individuals who attend PME treat the entire experience as nothing more than

a break from deployments or a check the block on the road to retirement. There is little professionalism in such attitudes.

Another point to the military expertise versus the SME debate hovers around the difference between training and learning. Training is what the bureaucratic nature of the Army does best. Knowing procedures, regulations, limitations, and even doctrine requires little thought, and the only challenge is either remembering the information or remembering where to reference it. Training of this kind is what many Soldiers are accustomed to and what they come to expect. However, PME should not be about training a student how to do something but rather students learning **how to think**. Many times, the process of critical and creative thinking is much more important than the product produced. The learning that occurs when a professional is challenged and meets that challenge by gathering new information, conducting research, and reading or self-study is invaluable. The self-confidence to overcome adversity, rely on one's creativity, and apply the technical and tactical knowledge we possess in new and innovative ways is what makes us agile and adaptive warriors.

Application: Commitment for the Real World

Application of our aviation knowledge primarily occurs in operational units, either in combat or while training. Army Aviation uses a systematic method for measuring technical competence. Aircraft maintainers must be high performers before they move on to become technical inspectors. An aviator is progressed, according to predetermined tasks, from Readiness Level 3 to 2 to 1 depending on their level of competence in their airframe. While these are effective means to demonstrate proficiency, they reflect the ability to memorize regulations, aircraft minutiae, and the current unit standard operating procedures (SOP). How are we supposed to apply judgment in combat if our training focus is on following checklists and SOPs with only the rarest of opportunities encouraging Soldiers to think critically?

For the aviator, there is also the progression from pilot to pilot-in-command to air mission commander. This progression is not only based on technical competence but discretion, judgment, and decision-making skills. These criteria acknowledge the individual's need to have a high degree of mission authority. However, any tasks with a slight degree of difficulty are monitored and tightly controlled from multiple command posts via today's technology (Blue Force Tracker, live video from aerial platforms, satellite communications, etc.). The potential strategic implications relating to small mishaps in the current defense and political environments have further exacerbated the control aspect of command and control. A few senior leaders have recognized these points of friction and are pushing the concept of mission command to reframe the need of autonomy for leaders. Still, it is telling that even when a junior leader excelled in executing mission command while in combat, that responsibility and autonomy is quickly stripped away when they return to garrison with crushing micromanagement and compliance. Especially when training, our formations must encourage increased responsibilities and wider latitude with decision makers, not less. In training, sometimes failure is the best teacher.

The aviation business is regulation heavy, and if rules are not followed or checklists not used, mishaps occur, and accidents happen. We are exquisite at memorizing facts and following rules, but not as good at employing knowledge under varying circumstances. We know answers to simple problem sets, we can recite limitations and emergency procedures, but we have trouble applying ourselves in uncertain environments. What do we do when the environment does not match our training scenario, or the enemy changes their tactics in the middle of our operation? Can we adapt and out think them? We can if we place importance on the most deadly weapon on the battlefield, the discretion and judgment of a critically thinking Soldier.

Culture: Can Army Aviation's Concept of Professionalism Survive First Strike?

The ideal Soldier is someone protective of his unit but also one who has a widespread concern for the overall welfare of the Army. There are substantial obstacles to being that professional Soldier. Some obstacles include deployment schedules, busy training calendars, high personnel turnover rates, increased competition for promotions, and the individual's lack of commitment to self-development. The Army does not offer much in the way of alleviating these challenges. The results are short attention spans (5-meter targets), a focus on the individual rather than the team (my tent is up), and concerns of career advancement (my job, my efficiency report).

Leadership today (Year Group 1998 - Year Group 2016), struggles with training management resulting in a fight to align resources with time. This struggle often equates to the execution of single iteration training events. There are no

documented instances where proficiency or expertise develops through a single iteration. Repetition is a necessary part of learning. If there are no resources or time allotted to re-train, then we develop a zero-defect mindset that punishes individuals. Single iterations set an expectation mismatch that communicates, "If you make a mistake, there are no do-overs." Major General Gayler, Commanding General, United States Army Aviation Center of Excellence, recently told a class of PME students, "The sincerest form of trust is to give white space to a subordinate commander for use in training."[7] Not everyone will get things right on the first try, which is OK in a rigorous training environment. If there is no white space allocated for retraining, counseling, or honest feedback, then we cease to be professionals and slip further into bureaucracy.

Soldier counseling typically never finds its way onto the training calendar. Many times subordinates have to schedule appointments with their raters to get the counseling they deserve. Soldier development takes time, a resource not readily relinquished by leaders continuously trying to knock down one 5-meter target after another. Such an investment requires time to observe and evaluate a subordinate's performance, the time to sit down for the face to face developmental discussions, and the skill to effectively organize and discuss strengths and shortcomings. These interpersonal skills do not come naturally for most of us and require continual refinement. How often have you been counseled? Has the dialogue taken place early enough in your rating period that would allow you to realign performance before your next scheduled efficiency report? How many times has that session critically addressed your strengths and weaknesses? How often have you been told to your face that you may not be part of the unit's top 10%, 20% or 30%? This professional avoidance has become Army Aviation culture.

In 1996, *Military Review* published an article that stated: "85% of lieutenants reported that they receive support form counseling less than one week before their OER [officer efficiency report] was due."[8] Despite the age of the citation, Training and Doctrine Command, as recently as October 2016, published an execution order that requires all raters and senior raters to record in a memo or spreadsheet the dates they performed their required counselings. Training and Doctrine Command's subordinate commands will submit this information through the G-1 on a semiannual basis.[9] One could ask, if we are professionally developing Soldiers as prescribed, why was this additional task levied, especially since all annual evaluation reports capture such information in their support forms?

Investments and Growth: Two to Make One

Are we the stewards of the Army profession that we should be? *Army Doctrine Reference Publication 1* describes stewardship as "the responsibility of Army professionals to strengthen the Army as a profession and to care for the people and other resources entrusted to them..."[10] In other words, to be good stewards, we must care for those around us while building and developing them as professionals. *Army Doctrine Reference Publication 7-0, "Training Units and Developing Leaders"* speaks to the continuous process of leader development in everything that we do and train. Many Soldier experiences include hasty and ill-formed professional development sessions. Between high operational tempos, personnel turnover, and the multitude of other operational tasks we are required to complete on a daily basis, there never seems to be time to invest in stewardship. We use the developmental terms, "teach, coach, and mentor" and yet struggle to perform these at the frequency or level of detail to have any meaningful effect. Specifically, the core concept of mentorship is misunderstood and misused (more on that in a later article).

Professional development briefs well. However, it is rarely protected training and is usually the first thing cut when daily requirements get in the way. Reading is often assigned as professional development but rarely followed up with contemplation and discussion (Step two and three of the RTSW model).[11] Preparation of a developmental event takes time, so in the absence of time, we rely on hip pocket training. Still, there is no hiding the lack of forethought and preparation. The transmitted message is that professional development is a low priority. Nevertheless, according to the training calendar, the event is complete, and the block is checked.

Pilot briefings and sergeant's time training rarely differ from other professional development sessions. Typically scheduled later in the week and often in the afternoon, the scheduling highlights the least amount of importance thus resulting in the low scale production and turnout. These events lend themselves to be mainly a check on learning for junior Soldiers, a rehashing of emergency procedures and annual briefing requirements rather than a learning forum. These formats also consist of the lowest form of learning -

repetition of knowledge, not detailed discussion or analysis.

These briefings should be a forum to turn knowledge into wisdom and wisdom into insight.[12] Detailed discussions of enemy capabilities; weapon systems; regional tactics, techniques, and procedures; or collective mission analysis from other units after-action reviews are a few of the topics that could create excellent professional development discussions. Admittedly, some of these subjects could be over the heads of some junior Soldiers, but these are issues that must be addressed by more people than the commander, intelligence officer, and operations officer. Most of these problems are incredibly complex and cannot be viewed in isolation. Our power resides in our collective discussion.

The Ball is in Our Court

If we are to call Army Aviation a profession, we cannot hope that everyone recognizes our professionalism simply because we say we are - we must continuously demonstrate those qualities that define our profession. Choosing development of expertise over calling ourselves SMEs, committing to the quality and relevance of Army education, and deliberately and intentionally investing in professional development will push us firmly into the professional category. The further we slide away from these ideals, the further we erode into an organizational bureaucracy. It also starts with each of us making a concerted effort to make the most of our PME, to continually self-develop, to have open and honest discussions, and to redouble our efforts in stewardship. This is how we will make Army Aviation more of a professional organization. You cannot change others actions, only your own, but those actions may influence those around you to be more professional. The challenge is before us. We must use this period between conflicts to better prepare ourselves.

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Major Michael C. Shaw is currently serving as the United States Army Aviation Center of Excellence Deputy G-5. Previous assignments include Executive Officer and S-3, 3-159th Attack Reconnaissance Battalion (ARB) and Commander, A Company, 4-4th ARB. MAJ Shaw is a graduate of the Army's Command and General Staff College at Fort Leavenworth and has a Ph.D. in Human Resource Education and Leader Development from Louisiana State University.

Mr. Justin Witty is currently serving as a Senior Instructor at the Aviation Warrant Officer Advanced Course, Fort Rucker, AL. His previous aviation experience includes Commander, C/3-101st in 2008/09. Mr. Witty has deployed twice in support of Operation Enduring Freedom.

Acronym Reference

ADRP - army doctrine reference publication
PME - professional military education
RTSW - read, think, speak, and write
SME - subject matter expert
SOP - standard operating procedures

Leader Development with the Cavalry in the Pacific

By MAJ Mark O. Fulmer

Leader development is pivotal to the Army achieving and maintaining its number one priority of readiness. Over the past two years, the 25th Combat Aviation Brigade's 2-6th Heavy Attack Reconnaissance Squadron (HARS) has implemented a leader development program which contributed to a high level of readiness during decisive action training, deployment to support U.S. Forces Korea, divestment of the OH-58D, transition to the AH-64D, and integration into the joint maritime environment while supporting the Pacific Command with contingency response forces. The squadron's Leader Development Program (LDP) was critical to ensuring short term mission accomplishment, unit readiness, and driving long term organizational improvement. The three prominent areas that contributed to a successful LDP in this unit were a focus on character, nesting leader development throughout the unit training plan (UTP), and the commander's ownership of the program.

Individual character is the foundation on which trust and the team are built and why it is a critical component to the success of any LDP. The 2-6th HARS LDP program set character based learning objectives, provided a vocabulary for ethical discourse, and examined the experiences of others to encourage self-reflection during staff rides and in discussing written works such as Jim Frederick's *Blackhearts* and David Brooks' *The Road to Character*.

The LDP learning objectives were reinforced throughout the program. One early indicator of the program's success was a discussion of case studies and contemporary issues on ethical discourse outside the designated training periods by leaders throughout the unit. Beyond the guided discussion and self-reflection, a leader's words regarding character must be a reflection of their actions and be what others seek to emulate rather than avoid. A unit with leaders demonstrating character "grey areas" or nebulous ethical expectations is doomed to long term organizational failures regardless of their level of competence or commitment. In the character realm, there is little room for a gap between what is said and what is done – typically referred to in Leadership 101 circles as the "say-do gap." Put another way, it means saying that you are going to do something but never follow through, or more simply, it means, practice what you preach.

When nesting leader development throughout the UTP, beware of the say-do gap. Senior leaders stress the importance of leader development during quarterly training briefings, yet often sacrifice the LDP as the first casualty during schedule conflicts. Managing expectations and executing what was promised to your training audience are a must. The 2-6th HARS leadership identified leader development objectives, coordinated resources, and scheduled training time in conjunction with the annual and quarterly training plans to identify if and when competing events would require additional commander focus. Major unit events, such as deployments and unit level exercises, did not mean leader development was not occurring. It meant that the commander was observing the practical application of the key elements of the unit's LDP by his junior leaders within the operational environment.

The purpose built LDP training events consisted of monthly professional reading assignments with associated discussion, team building exercises, bi-weekly competence building sessions, and staff rides. The goal of the reading program was to encourage professional reading, improve critical thinking, foster a thirst for life-long learning, and create a dialogue on character between platoon leadership and their subordinates. The commander hand-selected thought provoking literature and mandated that leaders comment on the reading in a digital web based forum. This format encouraged the leaders to think critically in order to challenge each other and articulate their rebuttals in a written argument. After reading the comments, the commander would lead a team building exercise by guiding a verbal discussion of the subject.

The commander's team building increased cross talk amongst peer groups, built team confidence, and provided a forum for the commander to give voice and a vocabulary to character development. The follow-on guided discussion lead by the commander, often with support of the senior warrant officer of the battalion or command sergeant major, would further amplify the learning objective. The desired outcome was for the individuals to think critically and communicate a developed thought through written posts and verbal exchange with their peers and the commander. The books and literature selected for the program soon found their way into the unit's common areas, often circulating amongst

the ranks, spurring further discussion. Bi-weekly competence sessions and staff rides rounded out the program and focused on meeting learning objectives. The LDP also prepared leaders for impending events such as discussing property accountability prior to transitioning to the AH-64D or a staff ride focusing on command and control prior to executing the 2016 Rim of the Pacific Exercise.

The squadron commander's ownership of the program ensured the training audience was identified and LDP events were prioritized and resourced. In the both the 2nd and 25th Infantry Division's Combat Aviation Brigades, the leadership directed the limited resources of the squadrons to focus on developing platoon leadership. The development of platoon leadership was effective; however, an area for improvement was in tasking troop commanders and first sergeants is to implement formal programs to develop squad and team leaders.

The squadron commander's intent in the LDP was tailored to each leadership position. The commander's prioritization and resourcing of the LDP events emphasized the importance that he placed on these exercises. Space on the calendar was identified early to support LDP during development of the UTP and protected from competing requirements. The commander's ownership of the LDP, demonstrated by his protection of the resources and the training time, indicated to everyone within the squadron that leader development was a priority. His direct involvement in the LDP had a positive influence on the squadron's leadership.

The example set by the 2nd Squadron, 6th Cavalry HARS' LDP will benefit not only the leaders within the unit, but the Army Aviation enterprise as those leaders assume higher positions of command in future assignments. Three key factors highlighted the unit's development and execution of its LDP were a focus on character, nesting the program throughout the UTP, and the commander's personal ownership. Each of these elements advanced the development of the unit's leaders, attributed to the accomplishment of the unit's mission, and enhanced the unit's readiness. The 2-6th HARS LDP offers a worthy foundation for any unit to emulate and further improve upon.

2015-16 2-6 Cav Leader Development Plan

As of 29 Aug 2015

	March	April	May	June	July	August	September	October	November	December	January	March
Character Focused Reading Assignment	24-25 Mar - *We Were Soldiers Once... and Young* -LTG(R) Moore 	28-29 Apr - Professional Articles – Focus: FP and Military Strategy 	26-27 Mar – *Asia's Cauldron: The South China Sea and the End of a Stable Pacific* 	16-17Jun - *Starship Troopers* -Robert Henlein 	28-29 July - Leaders Eat Last -Simon Sinek 	2Sep– *Low Level Hell* -Hugh Mill Jr & Robert Anderson 	24-25 Sep - Professional Articles – Focus: Leadership and Ethics 	*Start With Why* By Simon Sinek 	3-4 Nov - *The War of Art* -Steven Pressfield 	1-2 Dec - *Blackhearts* -Jim Frederick 	13-14 Jan – *Leading Out Loud* By Terry Pearce 	1-2 Mar – *how* By Dov Siedman 
Character Learning Objective	Appreciate the savagery of combat, role of leadership and impact of RW aviation.	Examination of the good and bad of leadership that captures the focus of the press.	Increase understanding of the Pacific influencers to instability.	Fictional examination of leadership and the applicable lessons.	Civilian industry's application of a military adage.	Historical Air Cavalry tactics and heroism from the cockpit.	Discuss current examples of exceptional and poor ethical leaders in and out of uniform.	Greater understanding of the led and why they serve and how to tap into that intrinsic desire.	How to create the proper mindset for success and avoid the pitfalls.	Modern example of horrific decisions and the moral courage to do right.	Mastering Leadership commo to inspire.	Examine the value of how we behave, lead, and effect of value inspired hows of modern leaders.
Physical Activity / Team Building	Super Gym Athletic Competition	Ultimate Frisbee	Laser Tag	Talon 10K Race	Water Polo	LT/CPT Softball Game	Conference Room Discussion Only		SUP – Waikiki Magic Island	Dillingham – Kaena Point sunrise run	Hiking – Koko Head Stairs	Haka Class
LT/PSG Bi-Monthly Professional Competence Sessions		01 April - Evaluations	06 May – CSDP and LDR Roles	03 Jun – Counseling (AR and Chaplain led)	01 July – Training Management (S3 Led)	1 Aug – Leaders Role in the Barracks	16 Sep – High Risk Tracker and Leader Roles during transitions	RIP / TOA	11 Nov – PRT – how to develop a Soldier Athlete	2 Dec– NCOERs / OERs	13 Jan – CSDP and LDR Roles	11 Mar – Property Account. And property transfers
		Platoon EXEVALS	20 May – Army Programs (EO/SHARP) and LDR roles	17 Jun – Career Progression (Officer & NCO)	Troop EXEVALS	UFG	RIP / TOA	Block Leave	Thanks-giving	15 Dec - Counseling	27 Jan – Training Management (S3 led)	19 Mar – Soldier Athlete Concept/ Program
Staff Rides		Battlefield Tour of 1871 – US Invasion of Korea	Battlefield Tour – Jul 1950: TF SMITH	Battlefield Tour – Pusan Perimeter 2nd & 25th Infantry Division	Battlefield Tour – Sep 1950: Inchon Landings					Pearl Harbor Staff Ride	Defense in Depth of Oahu: Derussey, Waver, Barrett, etc	1795 Battle of Nu'uanu

Major Mark O. Fulmer is currently a Program Manager assigned to the Whitehouse Military Office. His previous assignments include S-3 for the first Army Aviation Taskforce integrated into the multi-national naval training exercise, Rim of the Pacific and S-3/Executive Officer for a rotational Attack Reconnaissance Squadron in South Korea. MAJ Fulmer has attended the Naval Postgraduate School and the British Army Advanced Command and Staff College. Major Fulmer has served for 16 years as a Kiowa Warrior aviator. He has deployed a total of over 40 months supporting Operation Iraqi Freedom and 7 months to the Republic of Korea.

Acronym Reference

AOC - Army Operating Concept
HARS - heavy attack reconnaissance squadron
LDP - Leader Development Program
UTP - unit training plan

Making Adaptable Warfighters.

Learning "How" To Think ... Not "What" to Think

By CW4 Jeremie J. Zabko

The Aviation Warrant Officer Advanced Course (AWOAC) remains a critical and relevant part of every warrant officer aviator's career. In 2016, the AWOAC administration identified three focus areas for perpetual improvement - instructors, students, and professionalism. The goal of these three focus areas is to maintain a steady state of innovation and ensure the relevancy of course material in the face of revised doctrine and changing operational environment. The AWOAC must be proactive at identifying and addressing tacit knowledge and technical gaps and inspire our warrant officers to look beyond their own foxhole and develop an insatiable taste for lifelong learning, and improvement of their unit and the cohort.

Soldier 2020 is one of many common core topics mandated for all military educational courses. The focus of Soldier 2020 is on talent management, gender integration, and creating a standard based Army. To improve the warrant officer educational system and address the training and technical gaps, we must embrace talent management. Soldier 2020 tells us that we must assign the right soldier to the right position. This is especially true when it relates to broadening assignments (within the Aviation Branch) where critical thinking and cognitive skills are required.

Recruiting the right instructors is essential to restructuring the AWOAC. Instructors at the AWOAC are hand selected. They must be the best in the field and are expected to possess the explicit knowledge, have the necessary hands on expertise, the cognitive ability, and the desire to mold the leaders of tomorrow. Potential instructors typically send Officer Record Briefs and letters of recommendation to the AWOAC Course Chief for initial review. The 1st Aviation Brigade Command Chief Warrant Officer and the Chief Warrant Officer of the Branch receive screened packets for review and provide input to a decision on the suitability of the candidate.

The AWOAC ensures instructors are trained on the latest instruction techniques, lesson/examination development, and that they remain technically adept in their functional areas. The typical instructor attends a minimum of four instructor development courses, observes one AWOAC cycle, writes examination questions, and creates lesson plans prior to proponent instructor certification. The qualification process often takes 3-4 months to complete. Instructors also receive continuing development in the form of courses and professional seminars. The goal is for each instructor to attend 1-2 additional training events per calendar year. Courses include the Joint Fires Course, the Surface to Air Missile University Course, the Defense Systems Information Analysis Center Live Fire Testing Seminar, the General Electric Engine Course, and other technical courses. These experiences lead to better facilitation of discussions in the classroom and dissemination of knowledge to students.

Students look to their instructors with high expectations. The expectations are that the AWOAC and the lessons learned here will be extremely beneficial to their careers as both aviators and officers. Officers attending the nine-week course are in a temporary duty status often just returning from a deployment, exercise, or other hardship tour. Course attendance results in officers being away from their unit and their family. Additionally, they will likely become non-current in their airframe. These realities amplify students' and their future commander's expectation that the course will not be a waste of their time. From the minute a student receives a course welcome letter, the course demands begin. The expectation is that on day one, students are familiar with basic aviation doctrine. A pre-test is administered to ensure they possess the foundational knowledge base required.

The success of the course cannot be measured by a graduate's response in an end of course critique. How could a student definitively tell you how well the course prepared them for positions and responsibilities they have not yet experienced? The question is the equivalent of asking your

teenager for parenting advice. Course success is measured quantitative and qualitatively via post-graduate surveys, senior mentors visit, and constant self-evaluations. The data is collected, analyzed, and synthesized to determine areas of refinement.

The AWOAC has made strides to eliminate lecture based learning and move toward student-centric facilitation. Facilitation allows the students to share experiences, and become more engaged thus improving retention of material. Numerous blocks of instruction such as ethics, mission command, and the military decisionmaking process are integrated as practical application exercises throughout the course rather than administered as standalone classes. This methodology of teaching results in scenarios where students apply lessons directly to an actual or theoretical experience. Students must apply themselves at the AWOAC as their success (or failure) directly relates to their desire to learn and develop as warrant officers.

From 2016 to the start of 2017, the AWOAC writing assignments increased from one to six. Testable blocks of instruction intensified from 11 to 45. Three separate exams were implemented, each building on previously learned material. Students conduct six evaluated briefings during the course and are expected to read an average of 30-60 pages of course related material per night. The goal is not to overwhelm the students, but to inspire them to learn. The scope of the course is to teach junior and mid-level aviation warrant officers "how to think, not what to think" thereby making them a more adaptable warfighter. No longer does everyone pass the course or receive an "A" on all assignments. The AWOAC challenges students to focus and apply critical thinking. They are given continuous mentorship and feedback along the way.

One of the many training gaps identified over the past year has been an inability of Soldiers of all ranks to write and communicate effectively. If you cannot effectively communicate your thoughts, you diminish your ability to contribute your expertise to the team. The AWOAC provides students with the ability to analyze, integrate, and apply knowledge. These core foundations provide the student with the tools required to effectively communicate in assisting the commander understand the threat and U.S. Army doctrine. Explicit knowledge comes from experience gained in the operational domain. The AWOAC does not directly make warrant officers tactical or technical experts but aims to make the warrant officer more technically and tactically competent. The warrant officer, above all, must be able to advise the commander on multiple aspect of unit activities. This requires warrant officers to understand doctrine, its application, and the decisionmaking process.

The course's primary focus is on warfighting and home station training with integration of talent management, student/senior leader feedback, and professionalism. With talent management, the Aviation Branch ensures the most qualified and capable instructors are grooming our young officers. Perpetual refinement of the course will continue by addressing the learning needs of our students and the feedback from our senior leaders. With effective talent management and student focus, graduates are able to apply what they learn and continue to develop themselves professionally. More importantly, graduates become more enhanced professionals who are able to develop, coach, and mentor new warrant officers as they enter the fold. The holistic approach to ensuring the perpetual evolution of AWOAC should ensure its status as the benchmark for all warrant officer professional military educational courses.

Acronym Reference

AWOAC- Aviation Warrant Officer Advanced Course

CW4 Jeremie Jordan Zabko currently serves as the Aviation Warrant Officer Advanced Course Chief. CW4 Zabko is a prior combat engineer NCO who attended the Warrant Officer Basic Course in 2000. His aviation career has allowed him to serve in positions ranging from the company to division level as both a standardization pilot and tactical operations officer. He received the order of St. Michael in 2010 for developing the Army's CH-47F Flight Training Course. In 2015, he became the Army Tactical Operations Officer of the Year. CW4 Zabko has been recognized as either a distinguished or honor graduate in every professional military education course he has attended. His civilian education includes graduating magna cum laude with a Bachelor of Science and summa cum laude with a Master's Degree in Management focusing on logistics. He has served multiple tours in Iraq and Afghanistan with the 101st and 25th Combat Aviation Brigades.

Return of the RAM: A Flight Surgeon by Any Other Name

"There is a very interesting togetherness between medicine and aviation with which I have been fascinated over the years." —MG (Ret) Spurgeon Neel

By MAJ Courtney J. Hayes

Aviators tend to have a love/hate relationship with their unit flight surgeon. On one hand, a good flight surgeon will keep you healthy, tuned up, and fit-to-fly; on the other, there is the fear that you will come out of the doc's office with a dreaded down slip. What you may not know, however, is that not all flight surgeons are created equal. This is important because aeromedical risk decisions can be very complex.

All Army flight surgeons and aeromedical physician assistants attend the 6 week Army Flight Surgeon Primary Course conducted by the U.S. Army School of Aviation Medicine at Fort Rucker, AL. The physicians who become flight surgeons come from a variety of backgrounds. Some have only recently graduated from medical school and internship (first year of training); others have graduated from residency training in a specialty such as internal medicine, family medicine, or pediatrics and still others have been in practice in another field for many years. These doctors may have been motivated to volunteer for aviation service, or they may have been "voluntold" to attend training in order to fill critical vacancies in our aviation formations.

The training received in the 6 week course is adequate to attend to the day-to-day business of the aviation medicine clinic: flight physicals, sick call, and routine medical appointments. But what happens when complex aeromedical decisions need to be made that may exceed the training or experience of the average flight surgeon? Allow me to introduce you to the "RAM" and convince you why you want one for your own aviation formation.

What is a RAM?

The Residency in Aerospace Medicine (RAM) refers to a residency-trained, aerospace medicine specialist. Aerospace Medicine is a medical specialty certified by the American Board of Medical Specialties just like others with which you may be familiar (e.g., radiology, pediatrics, general surgery, etc.). Like other flight surgeons, RAMs come from a variety of backgrounds. They may be right out of internship or have been practicing for many years in another specialty. Most have been assigned as flight surgeons for at least one tour before. What sets the RAM apart is the completion of full specialty training, the Residency in Aerospace Medicine Program.

The Army RAM is a three year program. During this time, resident physicians complete a Master of Public Health degree and attend clinical rotations, operational courses, and training with industry to prepare them to provide expert care for Army aviators. Upon graduation from the program, Army RAMs are eligible for dual board certification in both Aerospace Medicine and Occupational Medicine.

What makes the RAM special?

First, consider this: Aviation is the only branch of the Army that has its own dedicated board-certified medical specialty. Not even Special Operations can make that claim. In fact, just as the U.S. Army originated modern military aviation, the roots of modern aerospace medicine also lie within the Army. Brigadier General Theodore C. Lyster, the Father of Military Aviation Medicine, originated the concept of the military flight surgeon by assigning dedicated physicians to aviation units during World War I, as well as publishing the first U.S. aeromedical standards. He later became a leader in civilian aviation medicine after retiring from the Army.

Secondly, of the six aerospace medicine programs in the United States, the Army RAM is the only one that produces dual aerospace/occupational medicine certified specialists and is the only program that is primarily focused on rotary-wing aviation. One of the unique aspects of the service and civilian RAM programs is that each one has a particular mission focus. The Navy and Air Force programs focus on fixed-wing and high-performance jets, the Mayo Clinic and Wright State's programs focus on civil aviation, and the University of Texas Medical Branch's program is geared to produce aeromedical specialists for America's Space Program. All of the programs share a core set of competencies,

so each program has instruction in fixed-wing, rotary-wing, and space operations. The Army is no exception. However, greater emphasis is given to rotary-wing operations in order to best support the Army Aviation mission.

This brings us to the last point of note: of the 68 medical residency programs in the Army, the RAM is most highly operationally focused. That is, most residencies are geared to produce physicians who are prepared to work in hospitals and clinics. There tends to be relatively little focus on operational knowledge and experience. The Army RAM program, on the other hand, has the express mission to produce aeromedical specialists to support operational aviation units, principally the combat aviation brigades (CAB). With this in mind, the Army RAM curriculum includes an emphasis on officership with the intent to produce graduates who are competent staff officers as well as clinicians. Additionally, the focus on occupational medicine prepares Army RAMs to protect the health of maintainers and non-aviation members within our formations as well as aviators and aircrew. In other words, an Army RAM is built from the ground up to take care of the medical needs of the entire aviation team.

Where Did the RAM Go?

Given that the Army ushered-in this new era of aviation medicine, it might surprise you to learn that the Army has not had its own independent aerospace medicine program in over a half of a century. In 1947, the U.S. Army Air Forces were formally divorced from the Army and became an independent armed service, the United States Air Force (USAF). When it left, it took the School of Aviation Medicine with it, along with all of the flight surgeons then on active duty. A single flight surgeon was left, as he was on reserve status at the time of the split. He began to rebuild the aviation program for the meager number of organic Army aviators left to the artillery at Fort Sill, OK in the early 1950s. The first new Army flight surgeon was MAJ Spurgeon H. Neel, who graduated from the Air Force Basic Aviation Medicine School in 1951. Neel, who would retire as a Major General, pioneered the use of helicopters for medical evacuation in the Korean conflict. His passion for aviation and aviation medicine was such that he returned to the USAF School of Aviation Medicine to complete training as an aerospace medicine specialist, becoming the first RAM in the Army.

This was the way of things for many years. Army flight surgeons were trained by the Air Force and Navy until 1963, when the Army Basic Flight Surgeon Course was established at Fort Rucker, AL. However, Army residency-trained aerospace medicine specialists continued to be schooled at the USAF School of Aviation Medicine. In recent years, Army RAMs have been trained by the Naval Aerospace Medicine Institute (NAMI) in Pensacola, FL. In exchange, the Army provided occupational medicine training at NAMI.

The Return of the RAM.

While the Navy RAM program is high quality, it is designed to produce Navy RAMs. Therefore the focus is on carriers, not CABs; Hornets and Harriers rather than 'Hawks and Hookers`. Therefore, a plan was put in motion to bring the Army RAM to its natural home at Fort Rucker, AL. It is only fitting that the home of Army Aviation should be the home of Army Aviation Medicine. These efforts bore fruit in July 2015, as the first class of residents began training at Fort Rucker - a homecoming nearly 70 years in the making.

What the residents lost in access to white sand beaches was more than made up for by access to the institutions at Fort Rucker: the School of Aviation Medicine, the Aeromedical Research Laboratory, the Combat Readiness Center, the Army Aeromedical Activity, and the U.S. Army Aviation Center of Excellence (USAACE). The residents have come to be regular fixtures at Fort Rucker. They teach new student pilots at the beginning of Initial Entry Rotary Wing, see patients at Lyster Army Health Clinic, help to staff the hypobaric chamber, and are embedded with the training battalions at the heliports and airfields, among other activities. This first class of "Rucker RAMs" will graduate in 2018 and head out to select units.

The RAMs are coming home to Fort Rucker in more ways than one. The USAACE now has a RAM in the new position of Command Surgeon. This gives the Aviation Branch Chief dedicated access to aeromedical expertise to help inform policy decisions and shape the future of Army Aviation. This investment represents the commitment of the Army aeromedical community to support Army Aviation at every level.

We Got a RAM. Now What?

If your organization gets a RAM assigned as its flight surgeon, it pays to know what you can expect to get from this resource. Do not expect or accept that a RAM will spend all of his time hanging out in the aviation medicine clinic. Any RAM worth his salt will be found regularly at command and staff meetings, training meetings, pilots' briefs, and safety and standards committees. They will be seen prowling around the flight line, maintenance bays, and shops (especially the ALSE shop). They will be in the back of your aircraft actively participating in the mission.

The RAMs are certified Army instructors, and can be found conducting formal and informal teaching wherever they go. This includes developing non-RAM flight surgeons, aviation physician assistants, flight and clinic medics, as well as pilots, crewmembers, maintainers, staff, and all other members of the organization. RAMs also spend as much time learning as they do teaching, you can expect them to be genuinely interested in all aspects of the aviation mission. They use the knowledge that they glean to refine the support that they provide to the unit and its commander.

The RAMs are qualified Aviation Safety Officers. They are natural extenders for the safety and standardization officers. The Army Aviation Medicine program is actually a risk mitigation tool for the aviation commander. RAMs fundamentally understand this and will ensure that the program is properly executed for maximal results.

The RAMs are scientists. They are trained to take an analytical approach to problems. This makes them very useful to have in the room during mission planning. Not only will they be able to speak to medical planning and human factors considerations, they frequently can have insights on other aspects of the mission that can be very eye-opening. Aerospace and Occupational Medicine are preventive medicine specialties. They focus on keeping the population healthy and combat effective rather than waiting to treat injuries and illnesses after the fact. Much of this work is done on the flight line rather than in the clinic. The RAM is constantly looking at injury and illness patterns, using epidemiology to find ways to keep as many Soldiers in the fight as possible. As always, readiness is priority one.

Finally, RAMs are aviation professionals, like you. They too have committed many years to training in order help fulfill Army Aviation's mission to find, fix, and destroy the enemy to win the nation's wars. Do not fear them, do not shun them. They are dedicated to the mission, and do not measure success by the number of pilots that they ground. Rather, success is determined by keeping the Army safely flying, so that we all can return home with the mission accomplished.

MAJ Courtney J. Hayes, MD is assigned to the U.S. Army School of Aviation Medicine at Fort Rucker, AL, in the Residency in Aerospace Medicine. He deployed to Afghanistan in 2014 with the 7-101st General Support Aviation Battalion, 159th Combat Aviation Brigade. He has over 20 years of Army service and has been qualified as a Flight Surgeon since 2010.

Acronym Reference

CAB - combat aviation brigade
NAMI - Naval Aerospace Medicine Institute
RAM - Residency in Aerospace Medicine
USAACE - U.S. Army Aviation Center of Excellence
USAF - United States Air Force

10 Not-so-Common Common Sense Keys to Success in Army Aviation

By CW3 Nicholas A. Koeppen

Ours is a world dominated by strict adherence to regulations and procedures; no type of information is sacred or immune to the organizational groupings of an Army aviator. The consistent use of checklists, flashcards, and PowerPoint throughout many years of aviation service has created a culture of aviators who are constantly organizing and re-organizing information into lists for everything imaginable. Thus, the following (Not-So-Common), Common Sense Keys to Success in Army Aviation distills decades of collective Army aviation knowledge and experience into a pilot-friendly checklist.

This is not another top-down checklist requiring rote memorization that you'll be tested on later. It is, however, a checklist you'll want to remember, and maybe even implement in your own career. This is compiled by a pilot just like yourself, who's been there, done that, learned things the hard way…and instead of designing another t-shirt, prepared this checklist to make all of us think, act, and in the process, become more successful as aviators and Soldiers.

1. Be Wary of the "Know-it-All"

We all know someone like this. Maybe he is the one always spouting off (about things he knows little about) or maybe he is the quiet one who always seems to have the answer (whether it is correct or not) and a quick "I told you so" when things go wrong. Arrogance is dangerous and has no place in Army Aviation. The presence of know-it-all attitudes within an organization may transcend subject matter and occupations, and this attitude can have a perilous impact on the organization and the people within it.

While the know-it-all may be viewed as a simple workplace annoyance, in reality, his behavior creates a culture where arrogance stomps out honesty, learning is stifled, and collaboration can cease to exist. The negative influence of a culture created or influenced by those who "know everything" does not originate from the wealth of knowledge an individual may or may not possess, but rather from the belief that he knows more than he does or that he is never wrong. Be wary. Attempt to harvest the positives from the know-it-all but remember to remain vigilant as you do so and do not perpetuate his behavior.

Break the cycle of arrogance and replace it with an environment where aviators are encouraged to ask questions, learn from their mistakes, and offer their opinions to give back to the future of their community.

2. The Last Thing is Always the Next Thing

To the aviation laymen this may not make much sense, but if you think about it from a mission execution standpoint, there is always a next step. Even when you are mission complete there is always another step to accomplish or another mission to prepare for and execute.

Aviation operations never end and require constant attention regardless of experience level or your organizational role. At the user level, knowing what the next thing is and proactively working to make it successful will, in turn, make you successful. If knowing is half the battle, knowing that the last thing is always the next thing is three fourths the battle. At the organizer or supervisory level, odds are that you already know what this next thing is. The ability to convey this and its importance to the masses is vital to your success and the effectiveness of your unit. If you are closing a meeting, briefing, or training event, the next "hard time" should always be the last thing discussed.

Shared understanding of the next thing and its associated timeline equals shared success.

3. Communication is Key

This key to success is largely over looked because there is an assumption that everyone is able to effectively communicate their thoughts. While it is true that people make noise and exchange words with one another, real communication rarely occurs or often fails or falls by the wayside in difficult or complex situations.

This refers to more than just the botched mission communication plan that had no chance of succeeding on your last training operation, although that fits into this category as well. Communication involves more than transmitting a barrage of words. As with the communication exchange between the aircrew and Federal Aviation Administration air traffic control facilities, communication has specific elements that must be satisfied in order for it to be more than just noise. There must be a clear message transmitted by the sender and there must be a receiver intent on accepting the message that is being transmitted.

Furthermore, in order for the message to be successfully conveyed to all parties, the receiver must indicate that some level of understanding has occurred by providing feedback to the sender. Feedback may be in the form of verbal affirmation that the elements of the communication are understood or questions, recommendations, or comments on the message itself. Consider the message unsuccessful if the audience responds with blank stares or if there is an undertone of confusion in any segment of the audience. If there is no feedback - communication did not take place.

If more emphasis was placed on cross-checking communications the way we cross-check our instruments in the aircraft, we would be more successful as individuals and as a community.

4. Don't Plan in a Bubble

Success in most endeavors requires leveraging the strengths of those around you, especially those with different worldviews, skills, and approaches to critical thinking, during the planning process. This is particularly true in Army Aviation where the elements of a mission plan and coordination with numerous other organizations are extensive and timelines define the mission.

When local subject matter experts, peers, and colleagues are not included in the planning process, we essentially create a restricted zone around us. Unintentionally, this practice serves to both exclude useful ideas and feedback and retain bad ideas that would have otherwise been dismissed with input from others.

All too often, individuals (and small groups) will spend countless hours formulating a plan with painstaking details that crumble under the scrutiny of others when given the opportunity to provide input. While it is not practical to expect everyone in the unit to "vote", it is important to recognize the talents that others might contribute. Encourage their participation.

To negate the trap of thinking we can do it all by ourselves, we must strive to be humble, actively participate in self-reflection, and consistently seek out collaboration with others. Collaboration is a powerful tool that is vital for the success of aviation operations at all levels.

5. Brief to Forrest Gump.

Every aviation unit is comprised of a variety of individuals with varying backgrounds, education levels, and experience. This diversity, if leveraged, can be a great benefit to the organization as a whole, but often creates a dichotomy that is often overlooked in briefing and training.

Those that are tasked with conducting mission briefings or giving classes are usually those that are most familiar with the subject matter or have the most recent experience with it. This is useful from the standpoint that they understand the subject matter, but expertise can sometimes hinder communication effectiveness. "Brief to Forrest Gump" or to the lowest common denominator is not intended to denigrate anyone, insult anyone's intelligence, or condone speaking down to anyone. It is a reminder that your audience is comprised of personnel with varying education and experience levels that require you to speak in the most clear, concise, and easy-to-understand manner. Failure to take these factors into consideration will likely jeopardize individual understanding and performance and, therefore, mission outcome.

The effective briefing will result in everyone implementing the elements of the briefing as instructed - nothing more and nothing less. The biggest mistake you can make while briefing is assuming that others have all of the information and understanding that you have. If you can adequately convey your intentions to Forrest Gump, you have successfully briefed.

6. You Can be Both Right and Wrong ... All at the Same Time.

This is one of those concepts that is often hard for aviators to grasp or accept. As Army aviators, we are well known for being highly competent and assertive. This helps us be effective but also makes it especially difficult as individuals to admit when we are wrong.

When I inquire why an aviator did a certain thing, and I get the answer "because there is nothing that says I can't," this key to success usually becomes the topic of conversation. Just because there are no rules or regulations stating that you can't explicitly do something, doesn't make your decision a smart one. This is where situational awareness, coupled with common sense and critical thinking come into play. Smart decisions take into account not just the regulations, but the current situation, inputs from colleagues, chain of command, subject matter experts, and, last but not least, common sense.

As a professional, you are expected to perform without continuous supervision. Evaluate the operating environment, follow your commander's intent, fly neighborly, include others in planning and decision making, and give each situation the benefit of critical thought. Simply put, just because you can doesn't mean you should.

7. No Window Licking Allowed

Aviators who strive to meet minimum requirements in Army aviation are often referred to as window lickers. While this euphemism seems to have originated to activities (or lack of) in the cockpit, it is more appropriately a reference to an individual's

lack of contribution to the unit's activities. The table of equipment and organization places a limited number of Soldiers in a unit and each one is expected to contribute to the unit's success.

A reference to an individual's lack of contribution is almost exclusively a reference to a lack of effort, rather than a lack of skill. Therefore, this key to success speaks to being a team player and contributing despite the task assigned. Organizational success is dependent upon all team members performing both inside and outside the cockpit.

Do the right thing, dedicate the time and put forth the effort to succeed in ALL aspects of your career. Window lickers are NOT the ones who diligently try to perform all their duties to the best of their abilities; they are folks that don't put forth the effort to be successful and tend to act as individuals instead of as members of the team. Don't shy away from tasks or challenges, and continuously challenge yourself to improve.

8. Have Another Cup of Coffee

No matter how many times as a junior pilot I was warned about flying in marginal weather and discouraged to do so, I fell into the trap and made the mistake and realized, far too late, the risk I had taken. Many times in those situations, I wished to be on the ground rather than in the air. This twist on the age-old adage of "better safe than sorry" could not be more true for aviators, as the cost of being sorry could be the lives of those onboard the aircraft. As history has taught us, this is a lesson that some people have learned the hard way, and one that has cost others their lives.

The key to success is not just accepting this adage as truth, but identifying the obvious signs that the weather is less than desirable. Our culture encourages aviators to lean forward and accomplish the mission, but in the face of less than ideal weather conditions, take pause for a more cautious approach.

While the weather report should say it all, look at the formations to the left and right prior to making your weather call. If the senior pilots in your unit are drinking a cup of coffee and discussing the weather rather than rushing out to their aircraft, odds are good that you should pour yourself another cup of coffee and start asking questions. Not even the most experienced among us can out-pilot the negative effects of weather … and it is dangerous to make decisions based on the belief that you are somehow more skilled, more experienced, more of a pilot than anyone else.

9. Always Take-off on Time.

If small disciplines set the conditions for a successful aviation unit, taking off on time is one of the most important of these small disciplines. This small action transcends the use of simple stop watches or countdowns; it speaks to the goal of flawless execution in all aviation operations. It is go-time all the time, not just when it is a real world mission. If the culture in your unit drives all members to take-off on time all the time, it is a culture I want to be a part of. The shared vision of mission execution and practicing the way we fight speaks volumes about the motivation, morale, and unity of that organization.

Avoid the trap of the all too common lackadaisical attitude that downplays the importance of the training session or "real" mission. Setting the conditions for successful aviation operations starts with taking off on time; this will set the stage for being on-time all the time, thereby making you more effective in your life and career.

10. Practice Until You Can't Get it Wrong

A saying that has been around in varying forms for many years goes something like, "professionals do not practice until they get something right; they practice until they cannot get it wrong." Accepted by the unit as standard operating procedure, this philosophy has the power to positively affect aviation culture. You have heard similar platitudes over the years - practice makes perfect, if at first you don't succeed, try, try again, nothing worth doing is easy – but unlike these clever sayings, this paradigm is more than just a saying; it is the key to success that can define an organization.

Other keys to success that have already been discussed used words like professionalism, shared vision, and culture, but none have the ability to contribute to the aviation enterprise and cause a positive cultural shift like this one. This is possible because this belief, when put into practice, will see aviators embracing the true nature of being a professional and challenge others to be self-aware enough to identify their own shortcomings and fix them, which will transcend traditional training efforts.

CW3 Nicholas A. Koeppen is currently serving as Standardization Officer for Task Force Fighting Eagles (2-1 General Support Aviation Battalion) forward deployed. CW3 Koeppen previously served as CH-47 pilot, instructor pilot, instrument examiner, and company standardization pilot in the 25th and 1st Combat Aviation Brigades. He has deployed multiple times to Afghanistan and Iraq. He has served in the military for 13 years, including time in both the Navy and Army. He is qualified on the CH-47D and CH-47F.

TURNING PAGES

~ book reviews of interest to the aviation professional

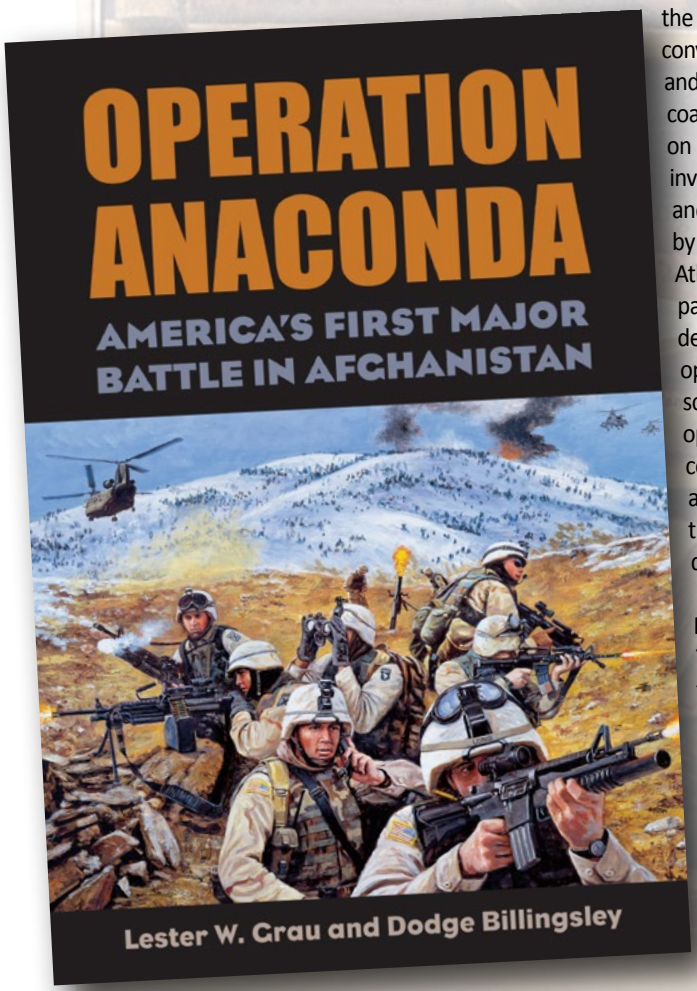
Operation Anaconda:

America's First Major Battle in Afghanistan.

By Lester W. Grau and Dodge Billingsley, Published by The University Press of Kansas, 2011.
464 pages, 32 photographs, 47 maps, 6 x 9. Available in hardcover.

A book review by Scott L. Gainey

Although there have been many books and articles on the crucial first test of conventional forces in Afghanistan, few take the comprehensive and sequential approach of these two authors. Lester W. Grau, a Vietnam veteran, Retired Army LTC, and research director for the Foreign Military Studies Office at the U.S. Army's Combined and General Staff College and Dodge Billingsley, a documentary filmmaker who was actually embedded with U.S. Infantry units during Operation Anaconda, give the reader an unparalleled view into the background and circumstances leading up to the battle. Using their extensive knowledge of the area and tactics of military forces, they provide a brief history of the years leading to this event, and compare the tactics that Soviet forces and Mujahedeen used in similar situations during the Russian involvement in Afghanistan. Their approach to the events and circumstances leading to Operation Anaconda, from both a political and a military viewpoint, enables a deeper understanding of all the factors influencing the battle and the decisions of the leaders involved.



After reviewing the background of the Soviet era, the authors describe the actions that precipitated the eventual fall of the Taliban and Al Qaeda forces. They discuss the United States' initial reliance on Special Operations Forces and the follow-on piecemeal deployment of conventional forces (the 10th Mountain and 101st Airborne Divisions) and coalition partners. The authors go on to describe the detailed planning involved with Operation Anaconda and the many obstacles encountered by the planners. American and North Atlantic Treaty Organization coalition partners had spent the previous decade executing peacekeeping operations or planning for large scale conflict against a conventional opponent. The early experiences conducting initial operations against an unconventional force echoed the mistakes made by the Russians during the Soviet-Afghan War.

In earlier engagements, such as Tora Bora, the Northern Alliance fighters under guidance of Special Forces with overwhelming fire support would force the Taliban and Al-Qaida to withdraw to the mountains leaving small detachments of rearguard forces to fight a delaying action until the main force could retreat safely over the mountainous border to strongholds in Pakistan. This precedent set the tone for planning Operation Anaconda, in which two task forces were envisioned to trap the enemy in a classic 'hammer and anvil' operation. Task Force Hammer, composed of Afghan militia forces guided by Special Forces, were to drive the enemy up the Shahi-Kot Valley into Task Force Anvil, composed of the American infantry units established in blocking positions at likely exit routes. The Afghan forces would convoy into the valley, while the 1-87th and 1-187th Infantry Regiments would air assault using into the mountain landing zones. Several Special Operations Forces units, to include U.S. Navy Seal Teams, established observation posts at key positions in order to report the movement of enemy forces and provide reconnaissance of the landing zones. Despite intelligence reports, Task Force Anvil ended up facing a set-piece battle with a large, well-entrenched, and experienced enemy. The operation illustrated many of the problems encountered during joint operations early in Operation Enduring Freedom.

The authors were careful to construct their approach and provide enough background information of Operation Anaconda so that even a novice student of military history could understand and relate to the decisions and processes affecting the battle. The book pieces together various parts of the planning process and recounts numerous shortfalls that include inaccurate intelligence estimates and lack of lift and attack aviation assets. The book includes a DVD that features maps, interviews with actual participants, footage from the battle, and author commentary. *Operation Anaconda: America's First Major Battle in Afghanistan* is recommended reading for anyone interested in reading of the early operations in Afghanistan, especially air assault and operations in mountainous terrain.

Respond to Content in the *Aviation Digest* with Your

Letters To The Editor

While information is available on the ***Letters to the Editor*** feature of the *Aviation Digest*, (on page 3 of each issue), it may not have garnered everyone's attention. For that, we apologize. It was not our intention to hide this feature.

If you have something to say about any of the articles published in the *Aviation Digest*, send your ***Letters to the Editor*** in an email or Microsoft Word document to the *Aviation Digest's* mailbox at: usarmy.rucker.avncoe.mbx.aviation-digest@mail.mil.

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PB 1-17-2
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