# Aviation DIGEST

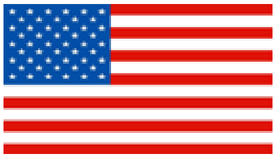
UNITED STATES ARMY

Fall 2025
Volume 13/Issue 3

THE PROFESSIONAL BULLETIN OF THE ARMY AVIATION BRANCH

UNITED STATES ARMY **Aviation** DIGEST

The Professional Bulletin of the Army Aviation Branch, Headquarters, Department of the Army, PB 1-25-3 Fall 2025
Volume 13/Issue 3



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The Doctrine and Tactics Division, Directorate of Training and Doctrine (DOTD), U.S. Army Aviation Center of Excellence, Fort Rucker, AL 36362 produces the *Aviation Digest* quarterly for the professional exchange of information related to all issues pertaining to Army Aviation. The articles presented here contain the opinion and experiences of the authors and should not be construed as approved Army policy or doctrine.

*Aviation Digest* is approved for public release. Distribution is unlimited. This publication is available through electronic media by accessing the DOTD SharePoint site or the *Aviation Digest* web page at https://home.army.mil/rucker/aviation-digest and is intended for the use of command levels C, D, and E for the Active Army, the Army National Guard, and the U.S. Army Reserve.

Archive issues of *Aviation Digest* (1955-2021) are available on the DOTD SharePoint site at https://armyeitaas.sharepoint-mil.us/sites/TR-ACOE-DOTD/Aviation%20Digest%20Documents/Forms/AllItems.aspx.

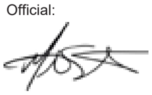
Issues from 2013-present may be found on the *Aviation Digest* web page.

Submit articles or direct comments pertaining to the *Aviation Digest* to: usarmy.novosel.avncoe.mbx.aviation-digest@army.mil

By Order of the Secretary of the Army:

**RANDY A. GEORGE**
*General, United States Army*
*Chief of Staff*

Official:



**MATTHEW L. SANNITO**
*Acting Administrative Assistant to the Secretary of the Army*
2521008

These Army Ranger Students are in the Mountain Phase of Ranger School at Camp Frank D. Merrill, Dahlonega, Georgia, and halfway through their journey of earning the right to wear the Ranger Tab. U.S. Army Reserve photo by SFC Austin Berner.

# The Command Corner

## Looking at a Convergence Window

As an Army (profession) that rightly learns from our own and other historical experiences, our attention has been keenly focused on the war in Ukraine…among other geopolitical challenges around the globe. These last few years of observation have yielded a bounty of information and lessons-learned, as Ukrainian forces have been pitted against heavy artillery, dense anti-access/area denial environments, and stunning developments in the employment of unmanned and robotic systems. The result has been a bloody grinding of traditional forces, akin to trench warfare experienced during World War I (except with lethal drones). Amid these lessons are questions regarding survivability in large-scale combat. Fair. However, Operation MIDNIGHT HAMMER, the recent precision attack on Iranian nuclear facilities, offers insight into multidomain operations (MDO) and an opportunity to deconstruct the discussion of survivability and convergence windows in the future fight.

On the early morning of 22 June, U.S. Joint Forces carried out an exceptionally bold mission on three of Iran's nuclear facilities. The very next day, the Secretary of Defense and Chairman of the Joint Chiefs of Staff provided a briefing on the historic mission from the Pentagon podium to share the incredible collaboration, planning, daring, and precision of the Central Command (CENTCOM) assigned/allocated forces. Let's review for our own understanding/development.

The mission emphasized tactical surprise, as it involved deception and exceptionally disciplined and limited communication within the "strike package." The visible portion of the mission included Continental U.S.-based B-2 bombers and 4th and 5th generation fighters. There were multiple aerial refueling iterations, as the strike package transited the entirety of the globe. Pentagon leadership also mentioned the tremendous synchronization required to open and maintain a slim corridor of opportunity. Most impressive is the fact that U.S. aircraft were undetected throughout the mission. It wasn't by happenstance.

So, what opens a corridor of opportunity, or doctrinally–a "convergence window," when approaching a contested environment protected by an integrated air defense system? As mentioned by the Chairman, this was a mission that relied upon precise coordination well beyond the U.S. Air Force strike package and U.S. Navy ship-based missile fires. The entire mission was dependent upon synchronization between nearly every Combatant Command, Military Service, Joint Staff, and various agencies. There were undoubtedly many all-nighters happening in various headquarters while Americans slept peaceably in their beds. Why revisit?

The purpose behind deconstructing this scenario is to analyze how success is achieved in a complex, joint operation occurring across multiple domains. This was a precision mission; however, the tyranny of distance and scale of the problem made the situation ideal to study aspects of large-scale combat. Some have questioned the survivability of Army Aviation in MDO and large-scale combat operations, but like Operation MIDNIGHT HAMMER, neither Army Aviation nor other services will fight as an independent force. We never have, and we never will. Learned in the same deserts of Iran in 1979, we now fight as joint and combined arms teams. Period.

A second point to consider is the role multinational partners, especially our Allies, play in our success during future warfare. Days before the eventual U.S. strike, Israeli fighters relentlessly attacked "missile infrastructure components" in Iran, reducing launcher capability by "more than 55 percent" (Frantzman, 2025). This preparatory work by Israel created a window of opportunity to be exploited by U.S. forces. Additionally, this effort shows the importance of strategic and tactical-level timing and the importance of preparatory work, either by traditional fires or via airborne assets (non-kinetic "fires"/effects) to reduce offensive and defensive capabilities of an enemy. No single formation can do this alone, and we are a joint force for a reason. This preparatory work opened a valuable window of opportunity that allowed the strike package of bombers and escort fighters to conduct their mission without detection or harm.

Doctrinally, the CENTCOM commander observed a prepared window of opportunity through the bombing campaign by Israel days prior to the strike. Relying upon joint partners and various commands, a convergence window across multiple domains was opened and maintained throughout the entirety of the mission. This convergence window was not created and maintained by chance, but through detailed planning and rigid adherence to standards and time-driven execution of supporting missions across all domains. Sound familiar to every aviation staff planner? Our doctrine, both as a joint force and Army, is clearly valid, functional, and successful. All can see too that our synchronized joint efforts are far more powerful compared to any individual effects.

While this operation didn't highlight the capabilities and effects of Army Aviation, it certainly reinforced the criticality of planning, convergence, opportunity, exploitation, and precise execution–something we all know and continue to reinforce. Study your doctrine and be confident in creating the opportunity for survivability, lethality, and DOMINANCE in MDO. I can't predict when Army Aviation will next be called, but, like our joint teammates, we WILL BE READY.

Above the Best!

Fly Army!

Clair A. Gill
Major General, USA
Commanding

Reference:
Frantzman, S.J. (2025, June 18). *Left of the boom: Israeli strikes concentrate on Iranian missile threat*. Breaking Defense. https://breakingdefense.com/2025/06/left-of-boom-israeli-strikes-concentrate-on-iranian-missile-threat/

Local leaders of Chamber West participate in a showcase of capabilities with the Utah Army National Guard (UTARNG) at the Army Aviation Services Facility in West Jordan, Utah. U.S. Army photo by Robert Harnden, UTARNG, Public Affairs.


# Aviation DIGEST

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### Author Guidelines

Articles prepared for *Aviation Digest* should relate directly to Army Aviation or reflect a subject that directly relates to the aviation professional. Submit the article to the *Aviation Digest* mailbox at usarmy.novosel.avncoe.mbx.aviation-digest@army.mil.

Please note that *Aviation Digest* does not accept previously published work or simultaneous submissions. This prevents an overlap of material in like publications with a similar or same audience.

*Aviation Digest* is an open-source publication. As such, we do not accept articles containing For Official Use Only or Classified materials. Please do not submit articles containing Operations Security (OPSEC) violations. If possible, have articles reviewed by an OPSEC officer prior to submission.

Please submit articles via MS Word document format. Articles should not exceed 1,500 words. Include a brief biography (50 word maximum) with your article. We invite military authors to include years of military service, significant previous assignments, and aircraft qualifications in their biographies.

*Aviation Digest* editorial style guidelines follow the American Psychological Association Publication Manual, 7th edition; however, *Digest* staff will incorporate all necessary grammar, syntax, and style corrections to the text to meet publication standards and redesign visual materials for clarity, as necessary. Please limit references to a maximum of 10 per article. These changes may be coordinated with the authors to ensure the content remains accurate and reflects the author's original thoughts and intent.

Visual materials such as photographs, drawings, charts, or graphs supporting the article should be included as separate enclosures. Please include credits with all photographs. All visual materials should be high-resolution images (preferably set at a resolution of 300 ppi) saved in TIFF or JPEG format. For Official Use Only or Classified images will be rejected.

Non-military authors should submit authorization for *Aviation Digest* to print their material. This can be an email stating that *Aviation Digest* has permission to print the submitted article. Additionally, the author should provide a separate comment indicating that there is no copyright restriction on the use of the submitted material.

The *Aviation Digest* upcoming article deadline and publication schedule is as follows:

Winter 2026 (published on or around 15 February 2026). Accepting articles now through 15 December 2025.

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

# Notices to Air Missions (NOTAMs)

**Director, Aviation Transformation Integration Directorate (COL Sean C. Keefe):**

The Directorate of Training and Doctrine (DOTD) is actively working to enhance the readiness and modernization of U.S. Army Aviation. Several key initiatives are underway to ensure our Soldiers are equipped with the training and doctrine necessary to evolve with the threat landscape

In collaboration with the Maneuver and Fires Center of Excellence, the pilot Unmanned Advanced Lethality Course launched at Fort Rucker, Alabama, in August to address a critical need for increased unmanned aerial system (UAS) proficiency across the force. The initial iteration focused on first-person view style drones and static dropped munitions from stabilized platforms. Lessons learned from this first course have been directly applied to improve the course for the successive iterations, and we anticipate continued evolution as more systems become available.

Maintaining current and relevant doctrine is paramount. The DOTD Doctrine Branch is accelerating the revision process and increasing force participation in shaping our foundational publications. Starting in Quarter 1, Fiscal Year (FY) 2026, DOTD will initiate a quarterly staffing process, soliciting preliminary feedback from all combat aviation brigades and aviation stakeholders on two–four publications currently published on APD. A 60-day feedback period will be followed by a virtual feedback session on Microsoft Teams to discuss proposed changes. Based on this input, publications will be either fully revised, urgently revised, or revalidated as current.

Furthermore, we are undertaking a major renumbering of doctrinal publications to create a more logical and intuitive framework for future development. This effort will prioritize smaller, targeted publications, allowing for quicker updates as technology and tactics evolve. The new structure will consist of seven aviation tactics, techniques, and procedures (ATP) publications covering: Aviation Tactical Operations, Aviation Lift/Cargo Operations, Aviation Attack/Reconnaissance Operations, Fixed-Wing Operations, Air Traffic Services and Airfield Operations, Fundamentals of Aviation Combat Survivability, and Aviation Maintenance and Support Operations. Each ATP will be supported by corresponding training circulars.

To streamline training and enhance operational effectiveness, the Army is transforming the 15W (UAS Operator) and 15E (UAS Repairer) military occupational specialties (MOS) into the modernized 15X MOS. This consolidation will cultivate subject matter experts across UAS Groups 1–3.

The Mobile Advanced Readiness Training (MART) pilot program, conducted in FY 2025 with the 25th Infantry Division, validated and refined the new 15X curriculum. Insights from MART are directly informing the development of 15X professional military education (PME), Train-the-Trainer courses, and the Transition Training Support Package. The phased transformation will proceed as follows:

- **Phase I**: Conversion of current 15W/E Advanced Individual Training (AIT) to a 15-week 15X AIT in FY 2026.
- **Phase II**: Expansion of 15X AIT to 22 weeks in FY 2027.
- Transitioning 15W/E PME to 15X PME beginning in FY 2026.
- Realigning operational units to reflect the new 15X structure and capabilities.

The 15X initiative represents a significant step forward in aligning UAS capabilities with the demands of modern warfare.

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**Gunnery Branch (Branch Chief: CW4 Joshua Diel):**

Gunnery Branch would like to congratulate the following Aircrews on achieving "Top Gun":

SPC Carter from Co. A., 5-101st AV, TF Cardinal, 101st CAB, Fort Campbell, Kentucky

CW2 Jarvis and CW2 Hughes from Troop B, 1-6th ACS, 1st ID, Fort Riley, Kansas

CPT Belden and CW3 Guymon from 1-211st AB, Utah Army National Guard

### *Aviation Digest* Editor-in-Chief (CPT Phillip Fluke):

Greetings and thanks to all our contributors and readers. Your continued participation in professional discourse through the *U.S. Army Aviation Digest* is the foundation of our publication and of our branch's intellectual growth.

Professional discourse is especially critical as we navigate this era of Army Transformation. Massive changes are occurring with unprecedented speed across the force. The feedback, ideas, analysis, and commentary from our warfighters and professionals are more important now than ever before, as they directly inform major decisions across Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities, and Policy. Please continue to submit your articles relating to these transformation initiatives. Your analysis is a vital element in shaping the future of Army Aviation.

**New Guidance: Clarity, Conciseness, and Impact**

I am pleased to announce that the *Aviation Digest* staff is finalizing their updated Submission Guidelines, which we will release in the Winter 2026 issue and post on the *Aviation Digest* website.

These updated guidelines will include more comprehensive guidance designed to support authors and contributors throughout the writing and editing process—from brainstorming through final revisions. Our goal is to enhance your writing skills, improve your final product, and ultimately increase your chances of submitting an article that the editors can accept, select for publication, feature in the *Digest*, and publish online at the Line of Departure website.

However, one piece of guidance is too important to wait. We are seeing a far too great a quantity of incoherent and unfocused draft submissions. To address this, let me be clear about a crucial responsibility for all prospective authors: You must do your due diligence to ensure your writing is clear and concise when you submit.

Our editorial staff does not have the time to completely overhaul full articles. More writing does not equal better writing or better ideas. Professional writing is clear, concise, and to the point. It communicates your ideas using as few words as possible. Therefore, I ask that you:

- Focus your core message.
- Simplify your paragraphs, sentences, and words.
- Simplify, simplify, simplify.

Remember that you are competing for the reader's time and attention. Your submission's aim is to contribute to, educate, inform, and better the Aviation Community. Only clear, concise, and impactful writing will achieve that goal.

We look forward to reviewing your future submissions, and thank you again for your commitment to professional excellence.

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### Enlisted Training Branch
### (Section Chief: Ms. Jaime Jack):

The 15Q Air Traffic Control Operator Career Management Field will be conducting its Critical Task(s) Site Selection Board from February 2nd to 6th, 2026. Input from both the operational and institutional communities is vital to ensure the success of this process and its impact on the Aviation Warfighter mission.

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### Training Division (Training Division Chief: Mr. Bo Thurman):

The Directorate's Training Division remains focused on management and development of the highest quality training products for Army Aviation. The team is actively engaged in several key initiatives to support Army Aviation modernization:

- Military Occupational Specialty (MOS) Convergence: We are analyzing the potential convergence of the 15W and 15E MOSs into a single unmanned aircraft system (UAS) MOS, focused on producing multi-capable operators who integrate, operate, modify, and maintain UAS group 1-3 platforms.
- Training Based on Mobile Advance Readiness Training (MART): We are assisting in the development of training materials to support delivery of UAS MOS training in the operational force through the use of a MART platform.
- 150U Training Strategy Review: We are reassessing the 150U training strategy to enhance focus on spectrum management, contested airspace management, robotics, and multidomain integration, ensuring our warrant officers are equipped for the evolving battlefield.
- MV-75 Future Long-Range Assault Aircraft Training: We continue to collaborate with the PM and Bell Textron, Inc., on total task list development and Training Aid, Device, Simulator, and Simulation, or TADSS, requirements, as well as the overall training strategy for the MV-75. Fort Rucker received the MV-75 Virtual Prototype in July 2025, and primary utilization focus is a developmental trainer to inform tactics, techniques, and procedures and MV-75A aircraft development.

Also, I ask that you please review the information on Fiscal Year 2026-29 Critical Task Site Selection Boards (CTSSBs). Feedback from subject matter experts during CTSSBs help us ensure we provide the most current and relevant training to our Aviation Soldiers.

# CTSSB

*Critical Task Site Selection Board*

| Name | Abr. | Last Board | Next Board | Location |
|---|---|---|---|---|
| Avionics Mechanic | 15N | Jun 2025 | 29-23 FEB 2029 | Ft. Eustis |
| Apache Pilot | AH-64 | Jan 2025 | 9-11 Mar 2027 | Ft. Rucker/MS Teams |
| MQ1 UAS Operator | 15C | Jun 2021 | 7-11 Feb 2028 | Ft. Rucker/MS Teams |
| Aviation Maintenance Tech WOBC | 151A WOBC | May 2021 | 3-7 Aug 2027 | Ft. Eustis |
| Blackhawk Pilot/NRCM | UH-60 | Mar 2025 | 13-15 Apr 2027 | Ft. Rucker/MS Teams |
| Aircraft Structural Repairer | 15G | May 2025 | 20-24 Mar 2028 | Ft. Eustis |
| UH-60 Helicopter Repairer | 15T | Jul 2025 | 15-19 May 2028 | Ft. Eustis |
| 15 Series Common Aviation Maintenance | 15 CAM | Jul 2022 | 16-18 Mar 2027 | Ft. Rucker/MS Teams |
| ALSE Technician | ALSE | Oct 2022 | 22-26 Jun 2026 | Ft. Rucker/MS Teams |
| AH-64 Arm/Electrical/Avionic Sys Rep | 15Y | Feb 2023 | 2-6 Feb 2026 | Ft. Eustis |
| ATC Operator | 15Q | Sep 2022 | 2-6 Feb 2026 | Ft. Rucker/MS Teams |
| Fixed Wing Pilot | FW Pilot | Jul 2020 | 3-5 Feb 2026/1-3 Feb 28 | Ft. Rucker/MS Teams |
| Maintenance Test Pilot *(all airframes)* | MTP/FCP | Sep 2021 | 10-12 Mar 2026/14-16 Mar 28 | Ft. Rucker/MS Teams |
| RQ7 UAS Operator | 15W | Jun 2021 | 16-20 Mar 2026 | Ft. Rucker/MS Teams |
| Lakota Pilot/NRCM | UH72 | Oct 2021 | 14-16 Apr 2026/17-19 Apr 29 | Ft. Rucker/MS Teams |
| MQ1 UAS Repairer | 15M | May 2023 | 13-17 Apr 2026 | Ft. Rucker/MS Teams |
| AH-64 Attack Helicopter Repairer | 15R | Mar 2023 | 4-8 May 2026 | Ft. Eustis |
| Aviation Operations Specialist | AOS | Jul 2022 | 8-12 Jun 2026 | Ft. Rucker/MS Teams |
| Aviation Maintenance Tech WOAC | 151A WOAC | May 2023 | 2-5 Nov 2027 | Ft. Eustis |
| RQ7 UAS Repairer | 15E | Aug 2022 | 17-21 Aug 2026 | Ft. Rucker/MS Teams |
| CH-47 Helicopter Repairer | 15U | Jun 2022 | 14-18 Sep 2026 | Ft. Eustis |
| Aircraft Powertrain Repairer | 15D | Feb 2024 | 8-12 Feb 2027 | Ft. Eustis |
| Warrant Officer Intermed Course WOIC | 151A | Mar 2022 | 15-19 Mar 2027 | Ft. Eustis |
| Aircraft Pneudraulics Repairer | 15H | May 2024 | 3-7 May 2027 | Ft. Eustis |
| Air Traffic and Airspace Mngement Tech | 150A | May 2024 | 10-14 May 2027 | Ft. Rucker/MS Teams |
| Warrant Officer Senior Course WOSC | 151A | Jun 2022 | 19-23 Jul 2027 | Ft. Eustis |
| Aircraft Powerplant Repairer | 15B | Jul 2024 | 20-24 Sep 2027 | Ft. Eustis |
| Aviation Maintenance Officer | AMOC | Nov 2023 | 15-19 Nov 2027 | Ft. Rucker/MS Teams |

## Look for upcoming surveys in our next issue!

*FY26– FY29*

To realize MOS training modernization goals, we need our Aviation Soldiers, Senior Enlisted Advisors, and Leaders in the Field to respond to Aviation Critical Task Site Selection Board (CTSSB) Surveys distributed by DOTD, to help determine what Soldier MOS tasks should stay in training and what should go. Our leaders must also enable the CTSSB process by ensuring that their most talented and proficient Soldiers will participate in these boards when called, this is your opportunity to affect change in Army Aviation.

**To contact and for more information, email: usarmy.novosel.avncoe.mbx.dotd-training-division@army.mil**

## Address Book:

**Fort Rucker has gone through several SharePoint migrations in the past year.**

As of 4 March 2024, the active DOTD public-facing SharePoint is: https://armyeitaas.sharepoint-mil.us/sites/TR-ACOE-DOTD

Training: https://armyeitaas.sharepoint-mil.us/sites/TR-ACoE-DOTD/SitePages/Training-Division.aspx

DTAC: https://armyeitaas.sharepoint-mil.us/sites/TR-ACoE-DOTD/SitePages/DTAC.aspx

**Aviation Leader Kit Bag: new address!** https://armyeitaas.sharepoint-mil.us/sites/TR-ACoE-ALKB

**Aviation Training Strategy:** https://armyeitaas.sharepoint-mil.us/sites/TR-ACOE-DOTD/DOTD%20Documents/Forms/AllItems.aspx?id=%2Fsites%2FTR%2DACOE%2DDOTD%2FDOTD%20Documents%2FArmy%20Aviation%20Training%20Strategy%2Epdf&parent=%2Fsites%2FTR%2DACOE%2DDOTD%2FDOTD%20Documents

**Aviation Branch Operations SOP, Annex A (Aviation Handbook), Annex B (Aviation Liaison Officer/Brigade Aviation Element Handbook), Annex C (Risk Common Operating Procedure), and Branch Maintenance SOP:** https://armyeitaas.sharepoint-mil.us/:f:/r/sites/TR-ACOE-DOTD/Aviation%20Branch%20SOPs/Aviation%20Branch%20Operations%20SOP?csf=1&web=1&e=M3gYgb

**DOTD Educational Technologies Branch** *(questions regarding the design, development, implementation, and administration of Interactive Multimedia Instruction and other design & development products)*.

- Branch Chief: Mr. Chuck Sampson at 334-255-0198 or charles.l.sampson10.civ@army.mil
- TRADOC SharePoint: https://armyeitaas.sharepoint-mil.us/sites/TR-ACOE-DOTD/SitePages/Educational-Technologies.aspx

**DOTD Enlisted Training Branch** *(questions regarding NCO professional military education [PME] and AVN Operations/Unmanned Aircraft Systems initial military training [IMT], ATC/UAS Warrant Officer Basic Course, and Aviation Life Support Equipment)*

- Branch Chief: Mr. Morris Anderson at 334-255-1909 or morris.anderson2.civ@army.mil
- TRADOC SharePoint: https://armyeitaas.sharepoint-mil.us/sites/TR-ACOE-DOTD/SitePages/Enlisted-Training-Branch.aspx

**DOTD Flight Training Branch** *(questions regarding ATMs, Training Support Packages, SOPs)*

- Branch Chief: CW5 Lucas Abeln at (334) 255-0363 or lucas.k.abeln.mil@army.mil
- TRADOC SharePoint: https://armyeitaas.sharepoint-mil.us/sites/TR-ACOE-DOTD/SitePages/Flight-Training-Branch.aspx

**DOTD Flight Training Integration Branch** *(questions regarding aviation flight programs of instruction [POIs])*

- Branch Chief: Mr. Brian Stewmon at 334-255-3119 or william.b.stewmon.civ@army.mil
- TRADOC SharePoint: https://armyeitaas.sharepoint-mil.us/sites/TR-ACOE-DOTD/SitePages/Flight-Training-Integration-Branch.aspx

**DOTD New Systems Integration Branch** *(questions regarding new system training deliverables, e.g., system training plans)*

- Branch Chief: Ms. Kelly Raftery at 334-255-9668 or kelly.a.raftery.civ@army.mil
- TRADOC SharePoint: https://armyeitaas.sharepoint-mil.us/sites/TR-ACOE-DOTD/SitePages/New-Systems-Integration-Branch.aspx

**DOTD Officer Training Branch** *(Questions about officer and WO IMT, PME, and non-flight functional courses)*

- Branch Chief: CPT Tyler Straits, (334) 255-1402, tyler.r.straits.army.mil
- TRADOC SharePoint: https://armyeitaas.sharepoint-mil.us/sites/TR-ACoE-DOTD/SitePages/Officer-Training-Branch.aspx

**DOTD Maintenance Training Branch** *(questions about Joint Base Langley-Eustis/128th Aviation Brigade IMT, PME, and functional courses)*

- Branch Chief: Mr. Philip Bryson at 757-878-6176 or philip.e.bryson.civ@army.mil
- TRADOC SharePoint: https://armyeitaas.sharepoint-mil.us/sites/TR-ACoE-DOTD/SitePages/Maintenance-Training-Branch.aspx

**DOTD Faculty & Staff Development Branch** *(questions regarding AVCOE faculty and staff courses and/or questions about Instructor and Developer training and certification)*

- Branch Chief: Mr. Chuck Sampson at 334-255-0198 or charles.l.sampson10.civ@army.mil

**DOTD Doctrine & Sustainment Branch** *(questions regarding Field Manual [FM], ATPs, TCs)*

- Branch Chief: MAJ Ross Skilling at 334-255-1796 or ross.m.skilling.mil@army.mil
- Group Mailbox: usarmy.novosel.avncoe.mbx.doctrine-branch@army.mil
- SharePoint: https://armyeitaas.sharepoint-mil.us/sites/TR-ACoE-DOTD/SitePages/Doctrine-Branch.aspx?csf=1&web=1&e=fFpkxS
- FMs, ATPs, and TCs are published by APD at https://armypubs.army.mil/
- Living Doctrine FM 3-04 (2015) Archive: https://armyeitaas.sharepoint-mil.us/:f:/r/sites/TR-ACOE-DOTD/Doctrine%20Branch%20Documents/ARCHIVE/Living%20Doctrine?csf=1&web=1&e=SYzlcG

**DOTD Tactics and Collective Training Branch** *(questions regarding Lessons Learned, Unit Mission-Essential Task Lists/Mission-essential tasks/Training & Evaluation Outlines/Task Lists/CATS, or Aviation Digest)*

- Branch Chief: A. Wolf Amaker at 334-255-1252 or aaron.w.amacker.mil@army.mil
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- Aviation Digest public site: https://home.army.mil/rucker/aviationdigest

**DOTD Survivability Branch** *(questions about all things AMS, Quick Reaction Tests, Computer-Based ASE Training, 2800/2900 Training Support-Packages, Aircraft Survivability Equipment home-station training)*

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- Intelinks NIPR/SIPR: https://intelshare.intelink.gov/sites/army-ams/ and https://intelshare.intelink.sgov.gov/sites/army-ams/

**DOTD Gunnery Branch** *(questions about all things gunnery, Master Gunner Course, Ranges, Standards in Training Commission)*

- Branch Chief: CW4 Justin W. Porter at 334-255-1897 or justin.w.porter.mil@army.mil
- Group Mailbox: usarmy.novosel.avncoe.mbx.atzq-tdd-g@army.mil
- Intelinks: NIPR/SIPR: https://intelshare.intelink.gov/sites/usaace/gb and https://intelshare.intelink.sgov.gov/sites/GunneryBranch

# Mind Over Machine: Electroencephalogram Brain-Computer Interfaces and the Transformation of Army Aviation

Photo courtesy of Pexels.com

By MAJ Nickolas D. Lupo and LTC Kent B. Monas

For decades, the United States has preserved its position as the world's leading military power through technological superiority. Two realities challenge our technology advantage: a persistent and growing manpower deficit and our enduring moral imperative to protect human life. The Department of War is now posturing for large-scale combat operations (LSCO), which will demand increased manpower through rapid mobilization with the anticipation of higher casualty rates. Large-scale combat operations present two major challenges. **First**, is a manpower deficit due to a shrinking pool of eligible, willing recruits who require extensive training on complex systems. **Second**, is a moral imperative to minimize battlefield losses and collateral damage. In an age where images are instantly transmitted to the global public, these challenges are amplified by strategic social media implications. Together, they underscore an urgent need for a new approach to modernization.

Electroencephalogram Brain-Computer Interfaces (EEG-BCIs) represent one of the most promising answers. By converting neural signals directly into machine commands, EEG-BCIs offer a way to expand combat power without expanding manpower, reduce risk to Soldiers while increasing lethality, and maintain American dominance in multidomain conflicts.

## The Promise of EEG-BCIs

At their core, EEG-BCIs function by capturing and interpreting the brain's electrical signals and translating them into commands that machines can execute. Electroencephalography records brain activity using noninvasive electrodes. Brain mapping then interprets unique neural patterns associated with intent, and machine learning algorithms train the system to recognize those signals with increasing accuracy. The result is a noninvasive interface that allows the human mind to control machines directly.

This is no longer theoretical. For example, Dr. Bin He, currently a Trustee Professor in the Biomedical Engineering, Electrical & Computer Engineering, Neuroscience Institute at Carnegie Mellon University, was the first to use EEG-BCI technology to fly a drone with thought alone (Chengyu & Weijie, 2019, para. 2). His lab's work demonstrates how EEG-BCIs enable control without traditional physical or sensory-based interfaces. This contrasts sharply with older methods, which required intensive visual and auditory training to execute even basic commands. The operator accomplished drone control from a chair without moving their arms or legs, showcasing how EEG-BCIs can expand participation beyond traditional definitions of physical ability.

Electroencephalogram-BCIs show strong potential to surpass traditional controls for drone operations by enabling faster reaction times, parallel multi-drone command, and adaptive cognitive load management. Current studies demonstrate real-time EEG control within 300–500 milliseconds (ms) (Xinbiin et al., 2023, p. 15), comparable to manual inputs, with emerging artificial intelligence (AI)-assisted systems and memory resistor, or memristor, hardware projected to cut this to 200 ms or less (p. 6). Early prototypes have already directed multiple drones using mental commands, while integrated cognitive-state monitoring can detect fatigue and dynamically adjust control levels for safety and efficiency. Combining this kind of technological innovation with lessons observed in modern conflict shows clear pathways for lethal integration and widespread adoption, all without placing Soldiers directly in harm's way.

## Addressing the Army's Core Challenges

Electroencephalogram-BCIs directly confront the most pressing manpower and moral issues facing the Army:

**Manpower and Retention:** The U.S. Army has struggled to meet recruitment goals, even as adversaries such as China maintain forces nearly twice as large. Traditional solutions, such as larger bonuses or expanded marketing, are insufficient. By enabling one operator to command multiple systems simultaneously, EEG-BCIs break the one-to-one ratio between Soldier and platform. This allows the Army to deliver greater combat power with fewer personnel.

**Casualty Sensitivity:** Modern conflict is scrutinized in real time by a public with

2D Cavalry Regiment reconnaissance drone operations at Saber Junction 25. U.S. Army photo by MAJ Brian Sutherland.

low tolerance for losses. Electroencephalogram-BCIs enable operators to remain far from the fight while exercising control over lethal systems in-theatre. This reduces exposure, mitigates political risk, and sustains combat endurance without incurring the societal costs of high casualties.

**Expanding the Talent Pool:** As former Secretary of the Army Mark Esper (2022) noted, 87% of Americans ages 17–24 are ineligible for service due to physical, academic, or legal barriers. Electroencephalogram-BCIs reframe service around cognitive skills, rather than physical ones. Individuals with disabilities or those previously excluded from combat roles could serve as operators, greatly expanding the Army's available pool of warfighters.

**Ethical use of AI Systems in National Defense:** Electroencephalogram-BCI has the potential to allow faster human involvement *on-the-loop* or *in the loop* for the use of lethal force in armed conflict. Electroencephalogram-BCI would enable additional ethical safeguards as outlined in the United States-endorsed *Political Declaration on Responsible Military Use of Artificial Intelligence and Autonomy* (Bureau of Arms Control and Nonproliferation, 2023).

## Transforming Aviation With EEG-BCIs

The most profound impact of EEG-BCIs will likely be felt in Army Aviation, a domain where cost, complexity, and risk converge. Pilots require years of physical training to master coordination, reflex, and technical skills. Once trained, they must be continually sustained through flight hours and costly simulations. Electroencephalogram-BCIs alter this equation by shifting the burden from physical skill acquisition to cognitive mapping. A new operator can achieve proficiency in high-level control within months, directing autonomous aircraft from a secure location. This reduces costs and accelerates readiness.

The precedent already exists. Lockheed Martin (2022) demonstrated an autonomous Black Hawk capable of flying itself under human supervision. With EEG-BCIs, the pilot of the future could remain thousands of miles from the battlefield, issuing high-level cognitive commands while the aircraft executes autonomously. This transition eliminates the risk of losing aircrews in hostile airspace.

Moreover, EEG-BCIs allow a single operator to simultaneously control multiple aircraft. An aviator could direct one rotorcraft to conduct reconnaissance, another to deliver supplies, and a third to prosecute a target, all from a single control station. Electroencephalogram-BCIs make this feasible by removing physical interface bottlenecks. The operator's intent directs each aircraft simultaneously, multiplying combat power without multiplying crews.

For the aviation community, this is not merely modernization, it is survival in an operational environment where adversaries field advanced anti-access and area denial (A2/AD) systems. Electroencephalogram-BCIs enable Army Aviation to decouple pilots from cockpits and project aviation power into denied areas without exposing aircrews to extreme danger.

## Multidomain Operations and Future Force Design

Electroencephalogram-BCIs are not limited to aviation. Their scalability makes them an enabler for multidomain LSCO. Unlike conventional control systems, which tether one operator to one platform, EEG-BCIs allow warfighters augmented with AI to orchestrate formations of unmanned systems across land, air, sea, and cyber. A single operator could command a squadron of drones, a platoon of robotic vehicles, or mixed-domain task forces, all synchronized through *intent* rather than physical control inputs.

This scalability calls for rethinking organizational design. The brigade combat team (BCT) of today may evolve into the "Cognitive BCT" of tomorrow; smaller, more efficient formations centered on EEG-BCI operators. Instead of battalions of Infantry, Armor, or Aviation, future brigades may deploy autonomous platforms directed by warrant officers trained in neural interface operations supported by specialized maintenance teams. The result would be leaner formations that increase lethality.

## Training, Implementation, and Humans in Autonomous Drones

The success of EEG-BCIs will not hinge solely on their technical performance but on the Army's ability to train operators quickly, implement the systems efficiently, and maintain trust through human-in-the-loop or on-the-loop engagement. Together, these three elements form the foundation of successful integration.

Traditional training pipelines, especially in aviation, require years of preparation. Producing a rated, fully mission-qualified Army Aviator can take 18–24 months or more, not including years of sustainment training. Electroencephalogram-BCIs collapse that timeline. Because the system interprets intent rather than demanding physical mastery, operators can achieve basic proficiency in weeks, expanding to multi-platform coordination within months. Machine learning accelerates this process by adapting in parallel with the operator's neural patterns, turning training into a recursive loop of human and system improvement. This scale of repetition, thousands of iterations in simulation vs. a handful of live flight hours, fundamentally transforms readiness.

Implementation is not a wholesale replacement of platforms, but an upgrade of interfaces. Most Army systems already operate through electrical and fly-by-wire controls. Electroencephalogram-BCIs insert at this junction, requiring new software and integration frameworks rather than costly hardware replacement. This makes modernization more efficient and affordable, allowing rapid scaling across formations once the baseline software is validated.

Electroencephalogram-BCIs must not be mistaken for a step toward autonomous war without oversight. Instead, they strengthen the principle of human-in-the-loop and on-the-loop warfare. Operators remain the source of tactical intent, direction, and lethal authorization, while machines execute those instructions with speed and precision. This ensures accountability, maintains trust, and aligns with the Army's doctrine that humans, not algorithms, decide when to apply force. The result is a system that combines machine efficiency with human judgment, preserving trust while enabling unprecedented lethality.

Together, training speed, software-driven implementation, and human oversight form the backbone of EEG-BCI integration. They shorten timelines, conserve resources, and safeguard legitimacy, ensuring that this technology can transition from laboratory to battlefield at the scale required for LSCO.

## Thinking Our Way Into the Future

Electroencephalogram-BCIs offer the Army a paradigm shift. They address the twin challenges of manpower deficits and upholding our moral imperatives, while expanding the talent pool of those able to serve. Most importantly, they allow the Army to sustain aviation dominance, where training costs are the highest and the risks most severe.

In multidomain LSCO operations, EEG-BCIs provide scalable combat power by enabling small teams of operators to command large formations of autonomous systems. With proper investment in training, acquisition, and organizational adaptation, the Army can harness this technology to preserve its technological superiority and reimagine the battlefield for the wars of tomorrow.

Warfare has always favored those who adapt first. By embracing EEG-BCIs, the Army ensures that its future warfighters will not just fly, march, or maneuver—they will think their way to victory.

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MAJ Nickolas Lupo serves as the Executive Officer for the 2-13th Aviation Regiment, overseeing the development and implementation of UAS Programs of Instruction, including the 15X (Tactical UAS Specialist) course. A dual-qualified fixed- and rotary-wing aviator, his experience spans intelligence, surveillance, reconnaissance, and armed aerial scout operations. He has led UAS acquisition and innovation initiatives across the Army and represented the Aviation Branch at national UAS and defense technology summits. His independent research focuses on integrating human-machine interfaces to enable unified combined arms operations from a single point of mission command.

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# Army Aviation and the Space Domain

Photo courtesy of Pexels.com

By CPT Jesslyn F. Clark and MAJ Heidi M. Beemer

## Impact of the Space Domain on Aviation

Multidomain operations (MDO) inspire visions of asymmetric warfare across a massive operational environment (OE), and conflict encompassing all elements of air, land, maritime, cyber, and space. Large-scale combat operations (LSCO, a fight against a near-peer adversary, a scenario the U.S. has not seen since World War II, is clearly outlined in the recently published Field Manual (FM) 3-0, Operations (Department of the Army [DA], 2025b, p. 3). Operating and sustaining a conflict of this size will be challenging, and planning and preparing for all domain facets will be crucial. Ironically, the domain farthest from our Soldiers on the battlefield—space—could be the most impactful to our daily operations.

Early in my career, I participated in a training exercise hosted by the U.S. Army Space and Missile Defense Command's Army Space Training Division (ASTD). This office facilitates space training for U.S. Army Forces Command units in support of the Army Space Training Strategy (ASTS). This training consisted of academic instruction on the effects of a denied, degraded, and disrupted space operational environment (D3SOE) and a practical portion of flying through a degraded environment. This experience was beneficial for a young aviator. The real-time correlation of changes with the helicopter instrumentation, a chance to troubleshoot the issues, and ultimately diagnose affected systems proved to be a foundational experience for all crew members. Observing the disrupted properties of our global positioning system (GPS) waypoint and degradation of our personal electronic devices (PEDs) and embedded global positioning/inertial navigation systems prompted multiple changes to our tactics, techniques, and procedures (TTPs); unit tactical standard operating procedures (SOPs); and crew briefs. As a direct result, the chain of command addressed the possibility of experiencing a D3SOE while flying and prioritized training and education to prepare the unit. The ASTD continues to collaborate with the U.S. Army Training and Doctrine Command to integrate space education, enhance contested OE training realism at combat training centers (CTCs), and conduct home station training for brigades and warfighters (U.S. Army Space and Missile Defense School, 2024).

> **"Space operations are those operations impacting or directly utilizing space-based assets to enhance the potential of the U.S. and unified action partners"**
> (DA, 2019, p. 1-1)

"The Army Space Training Strategy (ASTS) provides a framework to educate and train Soldiers at all levels across the total Army on current space capabilities and mitigation procedures for contested environments" (U.S. Army Space and Missile Defense School, 2024, p. 1). Annex N provides fundamental considerations, detailed information, and instructions on friendly and enemy space capabilities to aid commanders' operational decision-making (DA, 2019,

p. A-1; DA, 2022, p. 2-27). A clear understanding of our formation's reliance on space capabilities, and the tactical space capabilities available, can ensure we are planning key mission events during times of decreased adversary visibility and synchronize joint force capabilities in time and space (Figure).

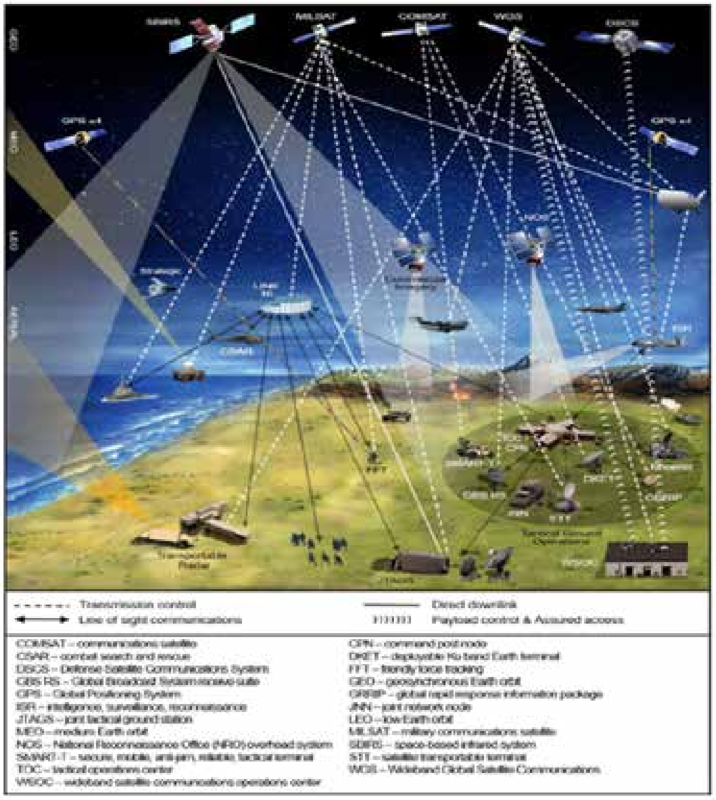


*Figure.* Army space operations concept overview (DA, 2019, p. 1-3).

## Utilization of Space-Based Capabilities

Today, all Army Soldiers, regardless of their military occupational specialty, rely on space-enabled devices, including PEDs, aircraft, weapons systems, communications equipment, command posts (CPs), and tactical operations centers (TOC). "A combat aviation brigade (CAB) has more than 2,500 positioning, navigation, and timing (PNT) enabled devices and more than 250 satellite communications (SATCOM)-enabled devices used to support all warfighting functions (WfFs)" (DA, 2019, p. 1-1). Brigades must incorporate advanced systems and technologies education and training into their unit training plan, while simultaneously ensuring Soldiers can complete the same tasks without the use of these devices. This training deepens Soldiers' understanding of the system, prepares them for reacting to a D3SOE, and increases the unit's chances of mission success. This equipment enhances efficiency, agility, and extends operational reach. All commanders must understand space capabilities and operations, recognize their advantages in understanding those capabilities, and the impact to missions when friendly/enemy forces are denied their use (DA, 2019, p. 1-2).

Space capabilities enable the Army to operate, communicate, converge, and protect units at echelon across large areas, synchronizing division efforts and supporting all WfFs (Table 1). Space mission areas include PNT, space situational awareness, space control, SATCOM, satellite operations, missile warning, environmental monitoring, and space-based surveillance and reconnaissance. All WfFs depend on space capabilities. Their various effects are interwoven throughout all six functions[1] to facilitate decision-making at the corps level and below. As technology advances, so will our use of space-based capabilities, but we are not the only ones. Our adversaries have watched our reliance on these systems grow and have actively built a robust architecture capable of denying our use of space. An enemy who can contest the space domain and force a D3SOE can significantly disrupt all missions.

Space Officers at the division echelon and above are responsible for planning, integrating, and coordinating space capabilities for their subordinate units. While our ability to counter adversary space effects is limited, space support elements (SSEs) can provide products that mitigate the impact of a D3SOE and integrate into targeting by providing non-lethal effects in coordination with

| WfF | The Army's use of Space-based capabilities in LSCO | Advantages to utilization of Aviation |
|---|---|---|
| Command and Control (C2) | Friendly Forces Tracking (FFT) feeds the COP with the most updated unit position data, helping to prevent fratricide. SATCOM assists with communication and dissemination of intent. Space-based surveillance provides satellite collections of enemy forces throughout the depth of the battlespace. | ***Enabling command and control*** Transporting key leaders between positions during critical decision points of the ground scheme of maneuver will increase overall C2. |
| Movement and Maneuver (M2) | PNT helps set accurate air corridors. SATCOM aids commanders with information collection on unit status' and dispositions. It also supports systems such as the Soldier Network Extension and Point of Presence. | ***Provide early warning, reaction time, and maneuver space*** Properly task-organized, Attack aviation, may conduct cover or guard tasks as a separate maneuver force in an assigned AO. |
| Intelligence | Space-based sensors collect information for the OE, provide positional relationships of threat forces during operations, and detailed knowledge of battle damage assessment. Geospatial intelligence assists with imagery that supports planning, combat assessment, and cartography. | ***Providing accurate and timely information collection*** Reconnaissance or movement to contact missions, provide the commander with accurate and timely information on enemy force disposition, composition, strengths, and weaknesses. |
| Fires | Space assets can confirm and geolocate targets in denied areas within the deep attack via GPS-aided systems such as the Army Tactical Missile System. Space-based surveillance can further develop the deep picture of enemy unit locations and disposition, aiding in targeting efforts. | ***Destroy, dislocate, disintegrate, or isolate enemy forces*** Ability to engage targets within the Close and Deep areas from manned and unmanned platforms will increase maneuver space for the ground force. |
| Sustainment | PNT precisely locates in-transit parts and equipment, enabling more accurate delivery forecasts of resupply efforts. SATCOM provides beyond-the-line-of-sight communications for COP updates across large geographic areas. It also provides further reach back for condition-based maintenance, minimizing downtime. | ***Air Assault and Air movement*** Aviation's agile nature can sustain the ground forces main effort and supporting efforts simultaneously, amassing endurance and decision space for Soldiers on the ground. |
| Protection | Space-based surveillance assists force protection measures via reconnaissance to denied areas by providing known launch locations and likely launch platforms with their associated kinematic ranges. | ***Aerial Evacuation*** Our robust MEDEVAC and CASEVAC platforms, dispersion methods, and doctrine will continue to sustain life throughout the OE. |

*Table 1.* Use of space capabilities by WfF contrasted by aviation core competencies LSCO (DA, 2019, pp. 4-10 to 4-14; DA, 2025a, p. 3-8).

[1] As taken from Table 1, the six WfFs are: command and control (C2), movement and maneuver (M2), intelligence, fires, sustainment, and protection (DA, 2019, pp. 4-10 to 4-14; DA, 2025, p. 3-8).

higher headquarters. These subject matter experts also support tactical formations through education, specifically the use of navigation and communication encryption. This is the single best—yet often overlooked—way to combat the effects of electromagnetic interference.

## Aviation's Role in D3SOE

When presented with a degraded space OE, Army Aviation may provide limited capabilities typically associated with space-based systems such as communications, navigation, or reconnaissance to the ground force commander. Aviation's internal capabilities may vary throughout missions (Table 2). Aircraft and systems can augment retransmission sites and aid with information collection, including Synthetic Aperture Radar,[2] enhancing precision fires and providing reliable targeting for non-GPS-reliant precision munitions. Army Aviation's ability to enhance C2 with maneuver forces can strengthen long-range communications, extend situational awareness, and ensure key leaders are embedded in real time at crucial decision points. Understanding division assets and coordinating with SSE planners for space operations integration, collection of space running estimates, incorporating space factors during intelligence preparation of the OE, and the publication of Annex N will be vital for mission success. Planning and preparing to incorporate space capabilities into base aviation tasks, small unmanned aircraft systems (UAS), tactical UAS, and future long-range assault aircraft platforms into medical evacuation (MEDEVAC), air movement, air resupply, reconnaissance, and attack missions will ensure our formations maintain lethality, speed, and decisiveness in combat. However, can we do more? As technology evolves, so do the list of contingencies. This will require a corresponding evolution of our planning factors to ensure success and superiority in LSC.

## Training for a D3SOE Fight

Training and educating Soldiers to understand and fight through a D3SOE is the best way to prepare our formations for this reality. The ASTS establishes a framework to improve space education and training across the force. It highlights the importance of incorporating space education into all professional military education, home station training, and culminating training events like CTCs. For Army Aviation, amending tasks to require repetitions be conducted in a D3SOE and updating TTPs in Aircrew Training Manuals (ATM)[3] could increase awareness of this threat. Creating or updating Aviation Branch SOP[4] contingencies, addressing flight in a degraded environment, and emphasizing the importance of training base tasks and tactical tasks will aid situational awareness. Introducing junior aviators to a virtual D3SOE in the Aviation Combined Arms Tactical Trainer, synthetic training environment, or including more in-depth academics during institutional training would establish primacy of the subject and allow the aviators to begin incorporating space into their planning and preparation. During individual and collective training, aircrew members can rehearse the Primary, Alternate, Contingency, and Emergency (PACE) plan, incorporate D3SOE into the aircrew brief, and practice their mission-essential and ATM tasks via analog products. Unit trainers and instructor pilots should integrate training aids, devices, simulators, and simulations into the unit training plan to enhance training and aviator proficiency. The staff can provide aviation-specific tools like GPS degradation plots at altitude so pilots can plan flight paths that exploit gaps in jammer coverage. Division SSEs can provide education and support realistic training scenarios, like providing jamming effects and coaching, as well as support in training tasks like encryption and protection measures.

> **"Even a simple training flight leverages space-based capabilities."**
> (U.S. Army Aviation Center of Excellence, 2025, p. 1)

Training in realistic, live jamming environments clarifies why supervisors and noncommissioned officers must incorporate D3SOE contingencies into precombat checks and precombat inspections during CP operations. Deploying antennas far from the TOC, ensuring navigation equipment is encrypted prior to use, disseminating analog maps, properly employing camo netting, training and submitting SPOT reports,[5] and understanding the PACE plan should all be reinforced. Training Soldiers how to identify, mitigate, locate, and report a D3SOE threat will increase confidence and situational awareness across the CP.

After completing home station training, units can train against live D3SOE effects at the National Training Center (NTC) within the training scenario. Ghost Team observes, coaches, and

| D3SOE is a factor of the Operational Environment and will present new challenges for Army Aviation | | | | | |
|---|---|---|---|---|---|
| Increase | Collateral Damage (Fires) | Contingencies, RXLs, and Training Requirements (Protection) | LOGPAC Resupply Requests (Sustainment) | Paper Map Requests and AMRs (Sustainment) | Analog OPS, Battle Tracking, LOS Comms, Manual Navigation Requirements (C2) |
| Decrease | OPTEMPO (C2, MM) | Situational Awareness (C2, MM, Intel Protection) | Asset Viability – Air and Ground Platforms, AGSE, Special Tools (Sust) | Lethality (Fires) | Intelligence Collection (ISR) |

*Table 2.* Consideration factors for Army Aviation in D3SOE (DA, 2025a, p. 4-13).

[2] "Synthetic aperture radar (SAR) is a type of active data collection where an instrument sends out a pulse of energy and then records the amount of that energy reflected back after it interacts with Earth" (National Aeronautics and Space Administration, 2025).

[3] If you need access to the Aircrew Training Manuals (ATMs), they are located at the following common access card-enabled link: https://armyeitaas.sharepoint-mil.us/:f:/r/sites/TR-ACOE-DOTD/Flight%20Training%20Branch%20Documents/ATMs?csf=1&web=1&e=OoMPRY

[4] The standard operating procedure is available at the following common access card-enabled link: https://armyeitaas.sharepoint-mil.us/sites/TR-ACoE-DOTD/SitePages/Doctrine-Branch.aspx?csf=1&web=1&e=fFpkxS

[5] A SPOT report is "used to report timely intelligence or status regarding events that could have an immediate and significant effect on current and future operations" (Training and Doctrine Command G2, 2025).

trains all activities within the information and human domains, controls the electromagnetic environment within the training area, and trains units to plan and react to a D3SOE. Each rotation typically experiences upward of 100 hours of interference across frequency modulation; the networked battle command information system, Joint Battle Command-Platform; and GPS to create a realistic OE. These effects are executed by a free-thinking adversary, and all effects are approved by the Commander of Operations Group to ensure overall training objectives are met. Additionally, Eagle Team utilizes the Training Aircraft Survivability Equipment Simulation Suite, or TASS,[6] at the NTC to provide aircrews with feedback and experience operating in a threat-based degraded environment.

## Nine Forms of Contact:

- Direct.
- Indirect.
- Non-hostile CIV contact.
- Obstacles.
- CBRN or CBRNE.
- Aerial.
- Visual.
- Electronic warfare.
- Influence.

(DA, 2023, p. 1-12)

During large-scale training events at the NTC, aviation units and staffs must focus on the imperatives of MDO, specifically assuming they are under constant observation and emitting across the electromagnetic spectrum. Noise and light discipline remain important aspects of area security, but many more emissions can negatively affect operations. Leaders should continuously rehearse and emphasize the importance of full-spectrum emissions control. Formations will be under constant observation across all nine forms of contact; a Soldier's understanding of their digital footprint and how it is seen from space will increase their survivability (DA, 2025b, pp. 58-59).

Army Aviation's ability to plan, communicate, maneuver, protect, and sustain the ground force is inextricably linked to space. The Army Leader Development Strategy states, "Leader development is achieved through the life-long synthesis of the knowledge, skills, and experiences gained through the training and education opportunities in the institutional, operational, and self-development domains" (DA, 2017, p. 3). Commanders at echelon must understand their subordinate unit's equipment and capabilities, train Soldiers, develop contingencies plans, conduct rehearsals, and incorporate space planning factors into the military decision-making process. Education and training may be

A Skydio UAS flies across a field during Combined Resolve 25-02 at the Hohenfels Training Center in Germany. U.S. Army photo by SPC Hunter Carpenter.

[6] "TASS provides stimulation of the ASE suite creating realistic cockpit warnings and indicators requiring pilots to take appropriate action to avoid being engaged by a peer or near peer IADS [Integrated Air Defense System] opponent" (Program Executive Office, Simulation, Training, and Instrumentation, n.d.).

The 1st Brigade Combat Team of the 101st Airborne Division at Fort Campbell, Kentucky, deploys a small uncrewed aircraft system at the Joint Readiness Training Center at Fort Johnson, Louisiana. U.S. Army photo by Michelle Miller (PEO, Aviation).

the deciding factors in aviation's ability to see/sense, move, strike, extend, and generate combat power for the ground force commander—and ultimately—our chances of success in LSCO.

Biographies:

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MAJ Heidi Beemer is the Senior Space Operations Officer at the NTC, Fort Irwin, California, callsign Space Ghost. She was commissioned through the Virginia Military Institute Reserve Officers' Training Course program as a Chemical Defense Officer. MAJ Beemer deployed with the 1st Calvary Division's Sustainment Brigade to Bagram Airfield in support of Operation Resolute Support. She commanded the 181st Hazard Response Company of the 48th Chemical Brigade at Fort Hood, Texas, from 2017-2019. She has two master's degrees—the first from Embry Riddle Aeronautical University Worldwide in Aeronautics, concentration in Space Studies, and the second from the Naval Postgraduate School in Space Systems Operations. She served as an assistant Professor of Physics at the United States Military Academy from 2021-2023. MAJ Beemer accepted a functional area transfer to Space Operations in 2023. She is enthusiastic about promoting tactical space and helping brigade combat teams prepare to fight in a space-degraded environment in future conflict.

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# Incentivizing Crew Chief and Flight Engineer Development and Retention

A CH-47 Helicopter Repairer (15U) works to replace a combining transmission (C-box) on a Chinook at a Fort Hood Airfield. U.S. Army photo by SGT Sydney Mariette.

By LTC Robert H. Wells

## Introduction

Across Army Aviation military occupational specialty (MOS), 15U helicopter repairer special qualification identifiers (SQI) F-coded (flying status) positions (CH-47F non-rated crew member [NRCMs]) are undermanned. While the aggregate number of 15U basic MOS-qualified personnel are understrength across the Army, the ability of the division to project combat power is most felt by shortages in the 15U SQI-F positions. Undermanning of 15UF positions is due to a lack of external incentives for Soldiers to develop the necessary skills and experience for career progression as a 15UF and achieve designation as flight engineers (FEs). Current inability to fill requisite 15UF positions directly results in a 45 percent loss in CH-47 combat power within the division. To re-incentivize progression as a 15UF, modifications to enlisted promotion processes and incentive pay programs are recommended.

## Background

Current CH-47 Company modified tables of organization and equipment (MTOEs) authorize 20x 15UF E5s (SGT) and 6x 15UF E6s (SSG) to serve in crew chief (CE) and FE positions, with 3x 15UF E7s (SFC) assigned as platoon sergeants. These 29 positions are filled from the same MOS pipeline as the 15U CH-47 repairers assigned to aviation maintenance and aviation support companies. Historically, experience gained in maintenance companies by junior enlisted 15Us sets conditions for rapid progression as CEs and FEs upon assignment to flight companies. Understanding aircraft systems and attainment of maintenance level (ML) 2 (sustainment) proficiency enables CEs to focus on flight-related requirements with a solid foundation in maintenance and rapidly progress to FEs. While initial assignment to maintenance companies builds foundational proficiency, the assignment creates a culture that disincentivizes follow-on assignment to flight companies. Additional duties and requirements associated with CE/FEs create external stressors not readily experienced outside of flying positions observation.

From my personal observation and sensing session feedback, it's clear that the additional requirements of 15Us assigned to flight companies increase personal, family, and career stressors compared to those assigned to the maintenance companies. In addition to proficiency in maintenance tasks, CE/FEs are required to conduct off-duty self-study to understand and perform aircraft flight-related tasks. Crew chiefs and FEs have both day and night tasks. As a result, they do not work an 8am to 5pm schedule in garrison, compared to most peers. Schedules vary week to week at the individual level, rather than based on the overall training schedule. Weekly variations in the duty day, to facilitate supported mission requirements, creates disruptions in family routines and scheduling.

Serving in low-density CE/FE positions, coupled with requirements to support higher headquarters-directed training events, limits opportunities in which Soldiers can attend professional military education, participate in self-development opportunities, and use authorized leave. Currently, insufficient external incentives exist to motivate 15Us to look past these external stressors and volunteer for assignment in a flight company, taking on duties and requirements above and beyond their peers.

The Army should incentivize 15U to 15UF career progression by developing policies focused on streamlining career advancement opportunities and incentive pay for 15Us volunteering for flying duty. Department of the Army policy change is necessary to apply these incentives across the force, creating a culture in which competing for flying positions within the 15U population is the norm.

## Proposal

I propose that the Army utilize a two-prong process—focused on streamlining career advancement opportunities and incentive pay—to reward 15Us for attaining the designation of Readiness Level 1 CEs and further progression as FEs and flight instructors (FIs).

Career Advancement: The Army should adjust skill identifiers and promotion points based on additional Soldier qualifications as seen in the following bullet points:

- Retain the A1A (enlisted flight crewmember and non-crewmember) and E1A (highly trained/qualified FEs) personnel development skill identifier (PDSI) for CEs and FEs, but remove current E5 and above grade restriction on the E1A PDSI. While an FE additional skill identifier (ASI) is being proposed for Headquarters, Department of the Army consideration, if approved, it should allow awarding of the ASI, regardless of grade or skill level.

- Create an *aviation advantage and airborne advantage* (Department of the Army, 2024, para. 3-16e), in which Soldiers assigned to authorized 15UF positions receive an additional number of promotion points without regard to the maximum point rules (Table).

| Scenario | Additional Points |
|---|---|
| CE (15U/T) serving in position authorized Hazardous Duty Incentive Pay (HDIP) for flying duty | 20 |
| FE (Soldiers awarded PDSI of E1A [certified CH/MH 47 FE]) serving in position authorized HDIP for flying duty | 40 |
| FI/Non-rated standardization instructor (SI) (Soldiers awarded ASI of N1) serving in position authorized HDIP for flying duty | 60 |

*Table*. Proposed *aviation advantage* example (Wells, 2025).

Incentive Pay: Enlisted flight personnel receive special duty assignment pay (SDAP) in addition to current HDIP, which is tiered to the level of increased responsibility associated with their operational position. Recent U.S. Army Aviation Center of Excellence proposals for similar pay have been submitted for Army decision. The following list represents an example of a potential tiered SDAP program:

- Retain current HDIP for flying duty crewmembers of $250 per month

- Create additional NRCM SDAP, scaled against flying duty position and corresponding level of responsibility

o CE: No change to HDIP ($250/month)

o FE: $250/month in addition to HDIP ($500/month total)

o FI/SI: $400/month in addition to HDIP ($650/month total)

U.S. Army Soldiers installing torque tube bolts on a CH-47 training aid. After the 17-week Advanced Individual Training, they will become qualified MOS skill 15U, CH-47 Chinook helicopter repairers. U.S. Army photo by SSG George Prince.

## Conclusion

Incentivizing 15U personnel to attain 15UF designation is critical to readiness. Unit culture and locally developed policies can contribute to increased 15UF manning within flight companies, but they are insufficient to meet required readiness levels. Development of career advancement and incentive pay schedules will incentivize 15U personnel to pursue the attainment of 15UF designation and significantly increase the ability of divisions to project combat power.

Biography:

LTC Robert Wells was commissioned in Army Aviation from the University of North Dakota in 2006. Assigned and deployed in both ground and aviation units, LTC Wells has served in staff and leadership positions from the platoon to division level. In 2023 he returned to Fort Campbell, Kentucky, as the G5 for the 101st Airborne Division (Air Assault). LTC Wells is currently the commander of 6-101st Aviation Regiment.

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The Eagle Eye

National Training Center Warrior Chronicles-Aviation Newsletter

# Survivability by Design: Aviation Protection in the Large-Scale Combat Operations Fight

Compiled and edited by CW3 Joseph M. Schwermer

In the evolving battlefield of large-scale combat operations (LSCO), the protection warfighting function is more paramount than ever for Army Aviation units. The threats are more lethal, precise, and ubiquitous than ever before. The proliferation of unmanned aircraft systems (UAS), long-range fires, cyber intrusions, and persistent surveillance capabilities presents a multidomain challenge, especially for aviation task forces, whose mobility, range, and striking power make them high-value targets

Survivability isn't luck, it's engineered. That means building agility, deception, dispersion, and doctrinal discipline into every phase of the operation. Recent conflicts show why protection is crucial; Russian command post losses in Ukraine, UAS attacks on U.S. forces in the Middle East, and long-range fires targeting sustainment nodes all underscore the cost of failing to adapt (Horton, 2025; Liebermann, 2021; Nieberg, 2024; Schinella & Welch, 2024). Aviation task forces can survive initial strikes and maintain tempo through deliberate planning, distributed command, use of terrain, and Counter UAS (C-UAS) training across all mission phases.

## Integrating Protection Into Planning and Operations

Protection isn't just about defense—it's about freedom of action. It enables aviation task forces to continue the mission, even in contested environments. Commanders must weigh survivability against operational effectiveness, shaping plans that account for both.

During the military decision-making process (MDMP), the staff identifies vulnerable phases such as transitions, forward arming and refueling point (FARP) establishment, or aircraft staging, and matches them to threats like long-range fires, persistent observation, and electronic warfare. A layered protection strategy includes camouflage, concealment, deception, dispersion, terrain use or engineered hardening, early warning systems, and doctrinal rehearsals.

Protection begins with the commander. Assigning responsibilities, prioritizing resources, and empowering subordinates to act on intent—all of this drives a proactive protection culture. Leaders must regularly review protection priorities, whether defending a tactical assembly area (TAA), securing a FARP, or hardening digital infrastructure, and adjust based on evolving threats.

A practical example came from a recent National Training Center (NTC) rotation: A UH-60 company's command post was hit during a simulated long-range UAS strike. The unit's failure to rehearse battle drills led to prolonged ex-

Airborne task force (ABTF) using existing infrastructure to mask operations and prevent identification. Photo provided by the authors.

posure, and operation ceased for over 2 hours. In contrast, their FARP operating forward rehearsed weekly react-to-contact and C-UAS drills, allowing immediate displacement and reestablishment at their alternate location with no impact to operations.

Sustainment and mission command systems require equal protection. Fuel and ammunition points must use terrain masking and counter-reconnaissance; convoys must be prepared for irregular threats, and TAAs must understand emission control to reduce detection. Protection working groups are critical for synchronizing these efforts. Effective working groups produce threat overlays, risk matrices, protection priorities, and identify vulnerabilities keeping protection integrated with operations.

## Survivability of Command and Control Nodes

Command and control (C2) nodes remain priority targets in LSCO. Aviation must decentralize. That means dispersing tactical command posts (TACs), logistics hubs, and mission command elements across the operational environment to complicate enemy targeting.

But dispersion alone doesn't cut it. Survivability demands masking, deception, and disruption. Use terrain like reverse slopes, forests, or even urban clutter. Employ standardized camouflage nets and tent profiles to limit thermal/visual detection. Incorporate decoys such as mock tactical operations centers (TOC) with idle generators, fake antennas, and remotely activated systems that draw intelligence, surveillance, and reconnaissance (ISR) attention away from real assets.

During a recent NTC rotation, an aviation battalion employed a distributed C2 architecture that proved decisive in maintaining mission command during enemy targeting. Instead of centralizing its main command post in one large tent, the unit dispersed its current operations, planning cells, and command elements into small, function-specific nodes across the entirety of its TAA. Each node operated independently with deliberate limited electronic signatures, separate power sources, and redundant communications. This dispersion complicated enemy targeting efforts and reduced the understanding of key C2 nodes within the TAA.

When enemy fires were committed to disrupt aviation operations, the result was minimal casualties and no disruption to mission command. The battalion maintained full operational tempo, with all core functions, airspace coordination, fires integration, and sustainment planning, continuing without interruption.

These techniques must be rehearsed and not improvised to be effective. Training must reflect that survivability is driven by function, not form. Dispersed C2 drills, camouflage discipline, and deception plan execution should be unit-level battle rhythms. Soldiers should understand that every stake they pound, antenna erected, and vehicle parked contribute to the fight for survivability.

## Leveraging Terrain for Protection

Consider the case of a Tactical UAS section conducting an aerial reconnaissance of its unit's TAA after occupation to assess its concealment and exposure. The live feed revealed gaps in camouflage coverage, exposed vehicle clusters near the main command post, and concentrated generator heat signatures visible from altitude. Using this real-time feedback, leaders directed immediate adjustments by dispersing vehicles and generators into defilade, improving netting placement, and repositioning equipment near rock outcrops. The UAS-enabled assessment allowed the unit to rapidly improve terrain utilization, enhancing survivability without delaying operations. In contrast, a nearby support unit that relied on open desert for speed was "destroyed" during a UAS-coordinated fire mission within 2 hours of setup.

Terrain is a free asset if used deliberately. Command posts, FARPs, and TAAs must capitalize on features like reverse slopes, forests, or abandoned structures to mask their presence from enemy ISR. Terrain analysis, aided by modeling tools and reconnaissance, can assess UAS line-of-sight, indirect fire threat arcs, and key mobility corridors. For aviation units, every ridgeline and tree line are potential shields against enemy observation and targeting.

Mobility remains a key tenet of survivability. Static positions, no matter how well camouflaged, grow more vulnerable over time as the enemy collects and

An ABTF employing a deception TOC at the NTC. Photo provided by the authors.

A TAA base defense battle drill. This is used to identify areas of vulnerability. Photo provided by the authors.

updates its targeting data. Frequent displacement, guided by METT-TC (mission, enemy, terrain, troops, time, and civil considerations), disrupts enemy collection cycles and reduces the likelihood of being targeted. Units that reposition regularly reset the enemy's intelligence picture and maintain the initiative.

However, when aviation units must operate from fixed locations such as airfields or long-duration TAAs, they must shift focus from mobility to reinforcement. Engineer support becomes critical in these scenarios. Engineers can improve survivability by constructing hardened pads, establishing bunkers, and reinforcing camouflage. Early integration of engineers allows aviation task forces to develop defensible layouts without sacrificing operational readiness or mobility.

Ultimately, terrain is a force multiplier when used creatively. Whether enabling movement or reinforcing static positions, deliberate terrain utilization degrades enemy targeting, preserves combat power, and extends operational reach in the LSCO environment.

## C-UAS Operations

The proliferation of UAS has transformed the battlefield. From tactical reconnaissance to precision strikes, UAS provides adversaries with a low-cost, high-payoff method to disrupt operations. The aviation task force, with its concentrations of high-value assets and personnel, presents a particularly lucrative target.

The Russo-Ukranian War demonstrates their impact. Small quadcopters deliver grenades with precision, while Group 3 UAS provide real-time targeting for long-range fires—or one-way attacks—as observed in the 2021 al-Tanf, Syria, attack and the 2024 Tower 22 (Jordan) strike (Horton, 2025; Liebermann, 2021).

In response, aviation units must train and posture themselves to counter this threat with a multilayered defense.

1. **Detection**: Equip airfields and command posts with early warning systems, including observation posts, radar, and acoustic sensors. Observation posts increase detection range, allowing critical reaction time to react to enemy UAS.

2. **Identification**: Train units to distinguish friendly from enemy UAS using visual markers, air corridors, and Blue Force Tracking, coordinating with airspace managers and air defense units. Common operating pictures and airspace control measures will reduce misidentification of UAS.

3. **Response**: Integrate kinetic (e.g., Fixed site-low, slow, small unmanned aircraft integrated defeat system; counter rockets, artillery, and mortar; and rifles); and non-kinetic (e.g., jammers, drone busters, electronic warfare systems) defeat mechanisms. Rapid-response quick reaction forces can target UAS launch sites, disrupting enemy operations. Counter-UAS battle drills must be rehearsed to ensure every Soldier takes the appropriate action.

Training must transform every Aviation Soldier into a sensor and a shooter. During a recent NTC iteration, a junior mechanic spotted and downed a simulated ISR drone with his M4—preventing a simulated FARP attack. Empowerment through training is how protection becomes culture.

## Recommendations

To enhance aviation survivability in LSCO, units must:


Middle East attack on U.S. Forces. Photo courtesy of ©2024 Microsoft Corporation.

Tactical command post breakdown. A high mobility multipurpose wheeled vehicle waits to jump. Photo provided by the authors.

1. **Institutionalize Protection in Training and Doctrine**: Incorporate LSCO-specific scenarios such as degraded communications, UAS, and contested logistics into all training.

2. **Prioritize Protection as a Command Imperative**: Embed protection into unit culture by assigning dedicated protection officers, establishing protection working groups, and requiring leaders to routinely assess and mitigate operational risks. Protection must be viewed not as a supporting effort, but as a critical enabler of combat power.

3. **Enhance Multidomain Awareness**: Integrate intelligence from cyber, space, and information domains, coordinating with adjacent units and higher headquarters to counter hybrid threats that extend beyond traditional ground-based attacks.

4. **Adopt Technological Innovations**: Field and employ low-signature equipment, mobile C-UAS systems, advanced camouflage materials, and resilient digital infrastructure. These tools should be accompanied by doctrinal adjustments, including dispersed C2 structures and digital emission control measures.

5. **Drive Continuous Adaptation**: Use after-action reviews, real-time intelligence, and battlefield observations to refine protection strategies. Incidents like the al-Tanf and Tower 22 attacks must inform tactical adjustments, training priorities, and individual accountability to avoid repeat vulnerabilities.

## Conclusion

Survivability is not a checkbox; it's a mindset. By prioritizing distributed C2, countering UAS threats, leveraging terrain, and embedding protection in planning and training, aviation task forces can survive initial strikes and sustain combat power. Survivability is a design principle—deliberately planned, rigorously trained, and adaptively executed. In LSCO's high-intensity environment, aviation units that protect themselves effectively will remain agile, resilient, and lethal, preserving combat power when it matters most.

Editor's Note:
This article is a consolidated and revision of four previously published articles from the *Eagle Eye Newsletter (NTC Warrior Chronicles)*, edited by CW3 Joseph Schwermer, former Eagle 3A–Assistant Operations Trainer and *Eagle Eye* Editor. CW3 Schwermer has served 18 years in the United States Army, including 13 years in Army Aviation. His experience spans Gray Eagle, Shadow, and small UAS platforms. Previous assignments include the 224th Military Intelligence Battalion, 4-6 Air Cavalry Squadron, and 2D Brigade, 101st Airborne Division. He served on the Eagle Team for 27 months and observed 16 NTC rotations. CW3 Schwermer is currently serving in the 25th Infantry Division, CAB, as an unmanned aerial vehicle operator at Wheeler Army Airfield in Hawaii.

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# Maximizing Effectiveness:

## Parts Prioritizing During Crisis

By CW3 Jacob N. Moore and MAJ Garrett C. Chandler

On August 1, 2024, a microburst struck Fort Carson, Colorado, damaging more than a battalion's worth of the 4th Combat Aviation Brigade's (4 CAB) aircraft across three Mission Design Series (MDS). This included a few with extensive damage and impacted aircraft from every flight battalion. The initial weeks were dedicated to meticulous inspections and repair part identification. The subsequent task of ordering and fulfilling replacement parts to repair the fleet fell to the Support Operations Officer-Air (SPO-Air) Section. To address this challenge, the SPO-Air team needed to understand the parts requirement, operate with and communicate priorities, and track components for the dozens of damaged aircraft simultaneously. This seemed a daunting task, as no historical precedent existed for fulfilling such a large-scale requirement.

### Identifying the Requirement and Prioritizing Orders

To fully understand the parts requirement, SPO-Air established explicit guidance to unit technical supplies on ordering procedures. Units created a single work order in the Global Combat Support System–Army (GCSS-A)[1] titled "Weather Event Damage" to function as a quick reference for weather-related work orders. All parts required to repair a weather-damaged aircraft were then loaded under this order using a customer fund code (CFC) generated by the brigade S8 (budget officer) and implemented by the division G8 (budget team). Utilizing the CFC allowed the S8 and G8 to isolate the weather-related parts costs from normal maintenance costs. Additionally, by creating one order for each aircraft by tail number, every echelon's budget office could see the total cost per aircraft. This provided leadership with valuable insight by aircraft type and tail number.

Once each technical supply officer loaded the parts into GCSS-A and the associated costs were calculated, the brigade commander could prioritize the entire list by specific aircraft. Additionally, the brigade executive officer (XO) could articulate how many aircraft by type could be repaired for a specific dollar amount. The commander and XO then used the information to communicate funding requirements across the Enterprise in daily updates and weekly operational planning teams with the Forces Command (FORSCOM) G3/5/7 team. As funding became available, the XO, SPO-Air, and S8 could quickly work down the parts list based off the commander's priority. This process averaged only 15–30 minutes to complete, regardless of the funding amount made available to the brigade.

To maximize the available budget, the team balanced several approaches. Once full aircraft orders exceeded the available budget, the team began ordering low-cost hardware for all aircraft to set conditions for when major components arrived. This prevented work stoppage due to missing small parts and hardware when major components arrived. Lastly, the scarce and expensive items such as blades, transmissions, and engines had to be communicated in detail for funding to be allocated by higher echelons. By first prioritizing via the commander's critical aircraft list, maximizing the budget with smaller components, and then balancing low-quantity, high-cost items, the 4 CAB team effectively expressed the parts demand to higher headquarters. As a result, all parts to conduct weather-related repairs were ordered and available in the national inventory within 2 months of the incident. The next challenge was tracking the nearly 2,000 separate lines of parts, ranging from washers and bolts to engines and transmissions.

### Communicating and Prioritizing

At the time, 4 CAB primarily ordered parts through GCSS-A. However, other echelons involved used alternative systems that connected with GCSS-A but showed different data. Issues and information gaps became apparent quickly and led to conflicting reports among the different levels of leadership. Higher level organizations utilized other

[1]GCSS-A website available at: https://gcss.army.mil/Default

programs such as the consolidated hub of Enterprise data–Army Enterprise System Integration Program, the Army budget system–General Fund Enterprise Business System, or the Sustainment Enterprise resource planning system–Logistics Modernization Program. This made initial coordination difficult due to differing data based on information system and echelon until materiel managers began to understand each system's limitations.

While GCSS-A provides an easy way to consolidate, order, and track parts, it requires a tedious multi-step process. For example, when using GCSS-A, no single transaction code (T code) exists to display all tracking data on one screen at one time. To obtain the reservation number for each aircraft order, materiel managers needed to obtain the order number for each aircraft using T code IW32. This reservation number was then entered in bulk using T code ZRRR to obtain the supply support activity (SSA) purchase order number. After obtaining the purchase order number, it was entered in bulk using T code ZPROSTAT to obtain the SSA rollover number. The rollover number is how the order is tracked at a national level and associates the order with the unit. Ultimately, the rollover number would be loaded into the Integrated Data Environment/Global Transportation Network Convergence system, producing the estimated ship date, as well as the source of supply. The SPO-Air team combined all these data into one single spreadsheet.

This spreadsheet could be filtered and sorted as necessary by the user, allowing for only pertinent data to be displayed. By combining all data, filtering by tail number, MDS, source of supply, and estimated ship date was simple. This "Master List" was updated daily by SPO-Air, and it was so effective that the XO eventually included the document in the routine report sent to FORSCOM, the Defense Logistics Agency (DLA), Army Materiel Command (AMC), Headquarters, Department of the Army G4, and U.S. Aviation and Missile Command. It enabled the 4 CAB commander to share precise details across the Enterprise and communicate where and when they needed prioritization and/or support. This allowed various commanders to prioritize parts acquisition and shipment rapidly. Critically, the 4th Infantry Division's DLA Customer Support Representative (CSR) and the AMC Installation Support Representative (ISR) used this spreadsheet to identify and describe issues not previously apparent in the traditional, disjointed patchwork of parts ordering and tracking systems. These individuals proved vital in the parts allocation process.

## Tracking En Masse

Traditionally, maintenance managers at a battalion or brigade also query the Enterprise when parts are ordered through GCSS-A. If a part is not locally available, the maintenance manager can check inventories across the Army and contact other units directly. Due to the sheer volume of orders, totaling nearly 2,000 separate line items, 4 CAB was quickly overwhelmed, and support from the Enterprise was imperative to mission success. Communication between Enterprise item managers and SPO-Air became a daily battle rhythm event. Items with long lead times, or with distant estimated ship dates, were prioritized first. Some items had estimated ship dates **years** out due to acquisition or production timelines. Many parts were simply flagged in the system due to the sheer quantity of orders placed all at once. Working with order fulfillment specialists, CSRs, and ISRs, SPO-Air was able to expedite these shipments. By clearly communicating the requirements across the Enterprise and working collectively to validate available inventory, the team reduced shipping dates from **months** and **years** to **days** and **weeks**. Furthermore, many parts were unavailable at the Enterprise level, necessitating communication of exact data in bulk. This facilitated the movement of items from across the globe, all thanks to an innovative, consolidated report, built and managed by a three-person team. Ultimately, all items were ordered, coordinated, shipped, and arrived at Fort Carson within 3 months of the weather incident.

## Conclusion

The challenge seemed insurmountable. The 4 CAB faced obstacles in funding, gaps in Enterprise system communication, and parts inventory limitations. Consolidating parts requirements enabled rapid funding and ordering, while aligning funding to specific aircraft via a CFC allowed FORSCOM to calculate the exact cost of repairs and prioritize parts redistribution. Establishing a combined parts and estimated shipping date spreadsheet, and the emphasis on total system repair proved vital for communicating and prioritizing the repair process. Overcoming system shortfalls through consistent communication across the Enterprise enabled leadership to prioritize and redistribute inventory to accelerate shipping times, which accelerated repairs and allowed the CAB to return the vast majority of aircraft to training and operations with a few months of the weather incident.

Photo courtesy of Pexels.com

Biographies:

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MAJ Garrett Chandler was the previous XO of the 4 CAB at Fort Carson, Colorado. Additionally, he served as the course director for the Army Supply Chain Management course from 2018–2020.

# Operationalizing a Budget

By CPT Patrick M. Dickman and MAJ Garrett C. Chandler

Rapid, accurate, and reportable data are essential for successful organizations. In the Army, there is a high demand for data designed to inform senior leader decision-making. However, overlapping systems of record and translating data between military occupational specialties can disrupt efficiency. While accounting might be the "language of business," (Stanford Business, 2024), operations are the Army's language. The use of customer fund codes (CFC) establishes a common language, enabling formations to operationalize financial planning. This improves cost tracking for emergencies and contingencies, enables cost sharing during equipment transfers, and allows units to capture costs for training and operations, supporting future forecasting and auditing.

Customer fund codes are two-digit, alphanumeric tags aligned to unit Department of Defense Activity Address Codes and storage locations. When classes of supply are ordered in the Global Combat Support System–Army (GCSS-A),[1] these CFCs associate orders to funded programs in the General Fund Enterprise Business System (GFEBS), obligating the dollars against those requirements. Generally, users in either GFEBS or GCSS-A solicit the systems they primarily use for data with specific variants. This causes errors, diminishes tracking accuracy, and impedes effective data analytics, because these data do not incorporate all the variables in both systems unless deliberately built to do so.

Soldiers assigned to the supply support activity team of the 404th Aviation Support Battalion, 4 CAB, 4th Infantry Division, assists a customer with an order. U.S. Army photo by SPC Brenda Salgado.

## Cost Tracking

Unexpected contingencies disrupt data collection and complicate reporting. Disruptions cause challenges in tracking outbound expenses, complicating routine procurement and accounting. On August 1, 2024, the 4th Combat Aviation Brigade (4 CAB) experienced a weather microburst that damaged two battalions' worth of aircraft. Within 24 hours, a small team consisting of brigade leadership, the budget team, and the aviation materiel officer created a CFC-based concept to link Class IX repair parts[2] orders to specific aircraft associated with the weather event. While maintainers focused on completing inspections of the damage, maintenance managers placed orders in GCSS-A the same way they ordered all other parts; however, they used the custom CFC to separate weather damage-related expenses from routine expenses. This enabled the brigade to seamlessly manage contingency repairs separate from the routine ordering and echelons above brigade to track progress using the CFC as a common variable within the systems of record. Most importantly, it allowed us to calculate the exact cost of repairs using GCSS-A order pricing and enabled rapid prioritized purchase of repair parts as funding became available over time. During weekly operational planning team meetings, leadership at brigade, division, corps, and above could discuss data-driven solutions to logistical problems. This rapid sharing of information allowed the unit to regenerate combat power more than three times faster than projected. All echelons could examine the specific parts and cost required to restore each aircraft throughout the entire process.

## Cost Sharing

A constantly changing Army presents unique challenges in accounting, prioritization, and maintenance management. In Fiscal Year (FY) 24 into FY25, 4 CAB received AH-64D Apaches from the 25th CAB. The 25th CAB (Hawaii) experiences challenges with corrosion not found in the dry mountains of Colorado. During the aircraft transfer, 4 CAB utilized another unique CFC to isolate the cost of corrosion-related maintenance from routine maintenance. These data allowed leaders to request additional funding to recoup the corrosion-related maintenance costs. Critically, this allows a commander to proceed with transfers,

[1] "GCSS-Army is the automated web-based information and logistics system of record for Army materiel management" (Department of the Army, 2024, p. 6).

[2] "Class IX consists of any repair part, subassembly, assembly, or component required in the maintenance or repair of an end item, subassembly, or component. These support the maintenance and repair functions performed throughout the theater on all materiel except medical. Large batteries for vehicles, to include hybridization and charging stations for energy sources, are also included" (Department of the Army, 2024, pp. 4-5).

| *Class and Symbol* | *Description and Subclasses* |
|---|---|
| **Class I** | **Subsistence:** Food.<br>**A** – Nonperishable dehydrated subsistence that requires organized dining facilities.<br>**C** – Combat rations include meals, ready to eat that require no organized dining facility; used in combat and in-flight environments. Includes gratuitous health and welfare items.<br>**R** – Refrigerated subsistence.<br>**S** – Non-refrigerated subsistence (less other subclasses).<br>**W** – Water. |
| **Class II** | **General Support Items:** Clothing, individual equipment, tentage, organizational tool sets and tool kits, hand tools, maps, administrative and housekeeping supplies.<br>**A** – Air.<br>**B** – Ground support material.<br>**E** – General supplies.<br>**F** – Clothing and textiles.<br>**G** – Electronics.<br>**M** – Weapons.<br>**T** – Industrial supplies (for example, bearings, block and tackle, cable, chain, wire, rope, screws, bolts, studs, steel rods, plates, and bars). |
| **Class III** | **Petroleum, Oils, Lubricants:** Petroleum (including packaged items), fuels, lubricants, hydraulic and insulating oils, preservatives, liquids and compressed gasses, coolants, deicing and antifreeze compounds, plus components and additives of such products, including coal.<br>**A** – Air.<br>**W** – Ground (surface).<br>**P** – Packaged products. |
| **Class IV** | **Construction/Barrier:** Materials that support fortification, obstacle and barrier construction, and construction material for base development and general engineering.<br>**A** – Construction.<br>**B** – Barrier materials. |
| **Class V** | **Ammunition:** Ammunition of all types (including chemical, radiological, and special weapons), bombs, explosives, mines, fuses, detonators, pyrotechnics, missiles, rockets, propellants, and other associated items.<br>**A** – Air.<br>**W** – Ground. |
| **Class VI** | **Personal Demand Items:** Nonmilitary sales items.<br>**A** – Personal demand items not packaged as ration supplement sundry packs.<br>**M** – Personal and official letter and packaged mail. Does not include items in other classes such as spare parts.<br>**P** – Ration supplement sundry packs. |
| **Class VII** | **Major End-Items:** A final combination of end- products ready for intended use (for example, launchers, tanks, racks, adapters, pylons, mobile machine shops, and administrative and tracked vehicles).<br>**A** – Air.<br>**B** – Ground support material (includes power generators, firefighting, and mapping equipment).<br>**D** – Administrative and general-purpose vehicles (commercial vehicles used in administrative motor pools).<br>**G** – Electronics.<br>**J** – Tanks, racks, adapters, and pylons (United States Air Force only).<br>**K** – Tactical and special purpose vehicles (includes trucks, truck-tractors, trailers, semi-trailers).<br>**L** – Missiles.<br>**M** – Weapons.<br>**N** – Special weapons.<br>**X** – Aircraft engines. |
| **Class VIII** | **Medical Materiel/ Medical Repair**<br>**A** – Medical materiel (including repair parts special to medical items).<br>**B** – Blood and fluids. |
| **Class IX** | **Repair Parts (less medical special repair parts):** All repair parts and components, including kits, assemblies, material power generators sub-assemblies (repairable and nonrepairable) required for all equipment; dry batteries.<br>**A** – Air.<br>**B** – Ground support material, power generators, and bridging, firefighting, and mapping equipment.<br>**D** – Administrative vehicles (vehicles used in radio administrative motor pools).<br>**G** – Electronics.<br>**K** – Tactical vehicles (including trucks, truck-tractors, trailers, semi-trailers).<br>**L** – Missiles.<br>**M** – Weapons.<br>**N** – Special weapons.<br>**T** – Industrial supplies (for example, bearings, block and tackle, cable, chain, wire, rope, screws, bolts, studs, steel rods, plates, and bars).<br>**X** – Aircraft engines. |
| **Class X** CA | Materiel to support nonmilitary programs, such as agriculture and economic development, not included in classes I through IX. |

Classes of supply. Table taken from Army Techniques Publication 4-42.2 (2024).

even if the equipment does not initially meet transfer criteria during joint inspections. These cost sharing arrangements reduce friction between units during equipment transfers, support budget stability, and allow the losing unit to fund repairs without having to perform the maintenance.

## Cost Capture

This same concept applies to other significant costs, including combat training center rotations, pre-deployment activities, cyclical gunnery, or range activities. When units task organize for various missions, they align equipment to different supply support activities. When a smaller portion of their unit supports another mission (e.g., an aviation or artillery task force assigned to a ground maneuver brigade), it can be difficult to align funding appropriately from the higher headquarters. Assigning a CFC leaves no doubt as to which mission the requirement supports and achieves data by mission as opposed to unit or equipment type. This enables accurate accounting for missions and training, which improves budgeting and auditing.

## Conclusion

Establishing a unique CFC improves cost tracking for specific emergencies or contingencies, enables cost sharing during equipment transfers, and allows units to account for training and operations. This supports rapid data collection that is reportable and auditable, which can enable leaders to make better decisions faster. The ability to analyze historical CFCs will improve financial planning throughout the brigade. Ultimately, something so minor as generating unique CFCs can exponentially improve the quality of decision-making for an organization in a fiscally constrained environment.

Biographies:

CPT Patrick Dickman is currently the Finance Officer (S8) of 4 CAB at Fort Carson, Colorado. He previously served as a Program Budget Officer for the Army Budget Office from 2020–2022.

MAJ Garrett Chandler was the previous executive officer of 4 CAB at Fort Carson, Colorado. He served as the course director for the Army Supply Chain Management course from 2018–2020.

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# AH-64E Transformation:

## Rim of the Pacific, Munitions, and Tactics

By CPT Taylor D. Krug

The 25th CAB proves invaluable in RIMPAC 2024 maritime operations. U.S. Army photo by SGT Richard Mohr.

In 2024, the 2-6 Air Cavalry Squadron (ACS) was the latest U.S. Army Aviation unit to field the AH-64E Version 6 (AH-64Ev6) and divest the AH-64D. During this modernization process, the ACS participated in the biennial Rim of the Pacific 2024 (RIMPAC). Rim of the Pacific is the largest international maritime exercise in the world, consisting of 29 nations, 40 surface ships, four submarines, more than 171 aircraft, and over 25,000 personnel (U.S. 3D Fleet Public Affairs, 2024a). The purpose of the exercise is to foster relationships and enhance interoperability with other nations in the strategically important Indo-Pacific Theater.

During RIMPAC, the 25th Combat Aviation Brigade (CAB) trained logistical shaping operations, while 2-6 ACS participated in a live-fire sinking exercise (SINKEX) under the command and control of the 3D Multidomain Task Force (MDTF). The SINKEX involved U.S., allied, and partner nation army, air force, and navy elements that provided a multitude of effects to sink a hulk more than 50 nautical miles off the northern coast of Kauai (U.S. 3D Fleet, 2024b).

The ACS was tasked to provide 30 minutes of effects against the *USS Dubuque*, one of two hulks targeted during the SINKEX. The squadron fielded a team flight, employing the new AH-64Ev6 in concert with a multitude of assets firing from the air, surface, and shore. The team successfully engaged the *USS Dubuque* with autonomous AGM-114R *Hellfire* missiles, aerial rockets, and the 30-mm area weapon system. While the engagements caused significant damage, sinking the outsized *USS Dubuque* required a joint effort. The team mission did, however, serve as a valuable proxy for engaging more relevant targets and motivated thoughts about AH-64 tactics in the littoral during large-scale combat operations (LSCO).

### Tactically Applicable Training Benefits

Future rotary-wing maritime operations will be impacted significantly by contested airspace, extensive target ranges, and logistical challenges. This makes participating in large-scale maritime exercises prized training opportunities for Army Aviation. During the SINKEX, 2-6 ACS gained experience in congested airspace under joint live-fire conditions. The aircrews demonstrated their tactical and technical proficiency, successfully executing fundamental engagements and integrating with joint and multinational partners in a high-intensity environment. Additionally, the 25th CAB exercised sustainment operations, using only organic resources that will be essential to success in an island chain fight.

The SINKEX airspace was congested and tightly controlled, characteristic of the conditions that aviators expect in a LSCO fight in the Pacific or elsewhere.

An AH-64 Apache helicopter shoots an AGM-114 *Hellfire* missile during a live-fire sinking exercise at RIMPAC 2024. U.S. Army photo by SGT Perla Alfaro.

The stack during the exercise included more than 10 air assets deconflicted by altitude, position, and time. Additionally, the aircrews had to contend with gun-target lines for surface vessels and elements on shore. Replicating this environment in routine training is challenging due to the extensive resources required and the level of difficulty associated with synchronizing each asset. The seamless integration of the Apache aircrews into this complex operation underscores their ability to thrive in a highly contested and coordinated operational environment, a critical capability for future conflicts.

Sustaining the U.S. Army's enduring rotary-wing fleet in a future island chain fight presents unique challenges. Excluding Army special operations aviation units, no rotary-wing platform in the U.S. Army is equipped for aerial refueling. Ground forward arming and refueling points (FARPs) are impractical because they require a distant expanse of roads, bridges, or trafficable terrain for ground vehicles to transport fuel. Refueling aboard a naval vessel is a logical solution but presents practical difficulties. Generally, there is roughly a platoon's worth of AH-64 pilots in the 25th CAB fully qualified to perform deck landings. This is due to an insufficient number of training opportunities with naval assets and the combined effect of sea state, AH-64 landing limitations, and vessel landing limits. This makes jump FARPs, specifically the "Fat Cow" concept, as the most pragmatic rearming and refueling solution for Army rotary-wing assets in an archipelago.

The RIMPAC exercise provided an opportunity for the 25th CAB to train and employ CH-47 Fat Cow operations. "Fat Cow is a field-expedited refueling process during which a CH-47 Chinook, the largest helicopter in the Army, provides fuel for other helicopters while operating behind enemy lines" (Lewis, 2022). Company B, 3-25 General Support Battalion, executed the Fat Cow operation using two CH-47s to transport fuel, ammunition, and armament personnel to the designated FARP location on Kauai. This shaping operation was designed to mimic aerial jump FARPs essential to supporting forward troops. By leveraging its organic assets to establish forward refueling points, the 25th CAB demonstrated a crucial ability to operate with increased independence and resilience in a contested maritime environment, minimizing reliance on potentially vulnerable external support.

## AH-64s in the Littoral

The ACS's participation in the SINKEX exercise demonstrates its ability to integrate into joint maritime operations. However, it also raises critical questions regarding the optimal role and capabilities of the AH-64 in the challenging littoral environment. While training during the RIMPAC was valuable, significant considerations remain before employing AH-64s in large-scale maritime combat operations, particularly against increasingly sophisticated adversaries. A careful assessment of target selection, weapon suitability, and survivability enhancements is paramount.

The SINKEX targeted the *USS Dubuque*, an Austin-class amphibious transport dock. A contemporary equivalent fielded by a potential peer adversary is China's Type 071 (Yuzhao) Amphibious Transport Dock. These vessels represent a formidable threat, possessing substantial armament and robust defenses. The Type 071 is equipped with a 76.2-mm naval gun, capable of a high rate of fire, and four 30-mm rotary cannons providing close-in defense (Wertheim, 2020). Recent imagery also suggests the potential integration of a laser-based direct energy weapon, mirroring systems being developed by the U.S. Navy (Luck, 2024). Furthermore, the Type 071 incorporates advanced radar systems and chaff countermeasures, characteristics common to modern warships, making them hazardous targets for AH-64s operating without substantial supporting assets.

The decommissioned Austin-class amphibious transport dock, *USS Dubuque*, smokes after taking a direct hit with a missile during long-planned, live-fire SINKEX during Exercise RIMPAC 2024. U.S. Army photo by SGT Perla Alfaro.


Countries of RIMPAC 2024. Photo by U.S. Navy MC2, Alexis Perez.

Given these challenges, focusing the AH-64's capabilities on smaller, more vulnerable targets may be a more effective approach. Chinese autonomous surface vehicles (ASVs) and landing craft, such as the Z170 ASV and Type 067 (Yunnan Class) Landing Craft, present more appropriate targets. The Z170 ASV, primarily used for electronic warfare, is lightly armed, while the Type 067 Landing Craft, designed for ship-to-shore transport, carries limited defensive weaponry.[1] Engaging these targets aligns better with the Apache's existing munitions and tactical engagement techniques.

The rapidly evolving nature of warfare, particularly the proliferation of drone technology and artificial intelligence, necessitates a parallel transformation in how we employ our forces. As 2-6 ACS transitions to the AH-64Ev6, we must also adapt our tactics. The recent RIMPAC exercise highlighted limitations in available munitions—AGM-114R, unguided rockets, and 30-mm cannon—restricting the full demonstration of the Apache's capabilities to within 8 km. Future large-scale exercises should prioritize the integration of advanced missiles like the Joint Air-to-Ground Missile (JAGM) and Spike® NLOS (Non-Line-of-Sight) and leverage the AH-64Ev6's underutilized maritime targeting mode (MTM). The JAGM-Medium Range, with its 16+- km range and fire-and-forget capability, and the Spike NLOS, offering a 32-km range and "man-in-the-loop" guidance (Lockheed Martin, 2022; Rafael, 2025), would significantly enhance survivability and standoff distance. Maritime targeting mode, optimized for overwater targeting, can effectively identify moving targets beyond the shoreline, further extending the Apache's operational reach. Investing in the utilization of these capabilities during the 2026 RIMPAC would provide valuable proof of concept for the AH-64Ev6's relevance in the maritime fight, improving crew proficiency, planning processes, and exercise realism.

Finally, in scenarios where laser-guided munitions are the only option, maintaining standoff distance is crucial. The RIMPAC exercise revealed inefficiencies in target designation, with the Gray Eagle unmanned aircraft system (UAS) used for surveillance rather than providing remote laser designation, resulting in delays through the 3D MDTF tactical operations center. Directly employing UAS assets for remote designation would be a critical force multiplier, potentially making the difference in mission success and crew survivability.

## Conclusion

The 2-6 ACS's participation in the 2024 RIMPAC provided valuable experience for the squadron as the unit integrates the AH-64Ev6 and adapts to operating in the Indo-Pacific theater. The successful fielding of the AH-64Ev6, alongside the employment of organic sustainment capabilities like the Fat Cow operation, demonstrated the 25th CAB's ability to project power and maintain operational independence in a complex maritime environment. However, the exercise also underscored the need for continued tactical evolution, particularly regarding target selection and weapons integration, as the Army prepares to face increasingly sophisticated adversaries. Prioritizing the incorporation of advanced munitions, the AH-64Ev6's MTM, and streamlining target designation processes will be critical to ensuring the Apache remains a relevant and effective asset in future LSCO, ultimately bolstering the Army's contribution to joint force lethality in the littoral.

Biography:

CPT Taylor Krug began her Army career after graduating from the United States Military Academy in 2020 and commissioning as an aviation officer. Following flight school, CPT Krug served as an AH-64 D/E pilot, aviation platoon leader, and assistant operations officer in the 2-6 ACS at Wheeler Army Airfield. She recently completed the Aviation Captain's Career Course and looks forward to her next assignment back in the 25th Combat Aviation Brigade.

[1] Use the search feature at https://odin.tradoc.army.mil to find more information about this ASV and landing craft.

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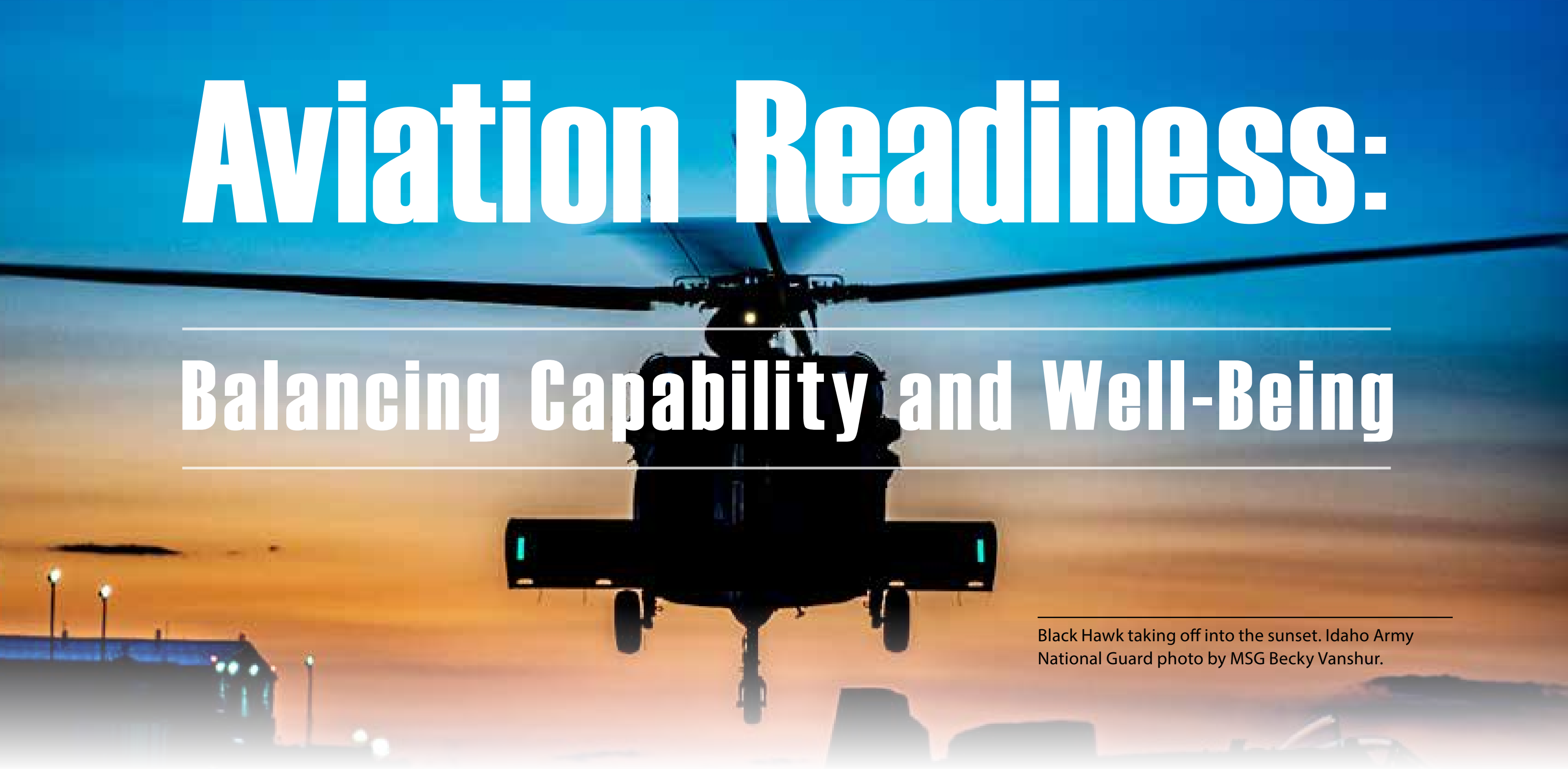
# Aviation Readiness:

## Balancing Capability and Well-Being



Black Hawk taking off into the sunset. Idaho Army National Guard photo by MSG Becky Vanshur.

**By CPT Larry K. (Trey) Glover, III**

### Introduction

Army Aviation remains a critical component of tactical and strategic relevance. However, sustaining combat readiness places significant pressure on Soldiers and leaders. While contingency operations in the Middle East have largely diminished, the intensity and frequency of training required to prepare for large-scale combat operations (LSCO) have increased correspondingly. Commanders must balance these readiness demands with the imperative to safeguard Soldiers' time, motivation, and holistic well-being. This article explores how emerging technologies and optimized training design can enable Army Aviation units to achieve both enhanced operational capability and improved quality of life for Soldiers.

### Training Culture

As Billie Jean King stated, "pressure is a privilege." Soldiers join to do their job—not be sidelined. A strong training culture nurtures this mindset, encouraging Soldiers to view challenges as opportunities for growth. For Army Aviation, that culture is historically rooted in pride, tradition, and esprit de corps. Unit symbols—proudly displayed on aircraft—represent more than aesthetics; they represent identity and legacy. Reintroducing these symbols, along with heritage rooms and displays that connect current Soldiers with the experiences of past generations, deepens the cultural investment and sense of purpose.

Company-level leaders have an outsized impact in shaping culture. A unit often takes on the personality of its commander, making visible and engaged leadership essential. Gaining buy-in is the antidote to resistance and complacency. When Soldiers understand the *why* behind their training and understand their contributions to the mission, trust and commitment are strengthened.

The 3-17 Air Cavalry Squadron participates in a summer 2025 field training exercise. U.S. Army photo by CW3 Aaron Sargent.

Creating ownership is equally powerful. As a young crew chief, the simple act of having my name stenciled on an aircraft instilled pride and accountability. I wanted my aircraft to be the best—mission-ready and visually pristine. That pride drove me to build stronger relationships in the maintenance shops and cut down time. This sense of ownership drives engagement and high performance. Recognizing excellence through programs like 'Maintainer of the Month' or incentive flights are low-cost, high-impact positive reinforcement.

### Leveraging Data and Technology

Innovation in Army Aviation isn't just about new airframes or munitions; it's about transforming how we train. Tools like Microsoft Power Business Intelligence (BI)[1] offer the capability to visualize and analyze readiness in real time. By integrating live data from systems like the Digital Training Management System, Centralized Aviation Flight Records System (CAFRS), and Aviation Maintainer Analytics Platform, leaders can automate training dashboards that replace time-consuming manual updates.

[1] Power BI's "ability to ingest data from a variety of sources and easily create and present visualizations has made it a preferred tool throughout the Army. Included in the Microsoft A365 software package, Power BI is available to all Army users with an A365 license" (Donahue et al., 2025).

Seize the Marne! Tug of war: 3D Combat Aviation Brigade (CAB) vs. the 2D Armored Brigade Combat Team. U.S. Army photo taken by the 3D Infantry Division Public Affairs Officer.

No more tedious Excel files or slides—just a single operational picture that informs data-driven decision-making.

Leveraging data analytics for improved readiness-level progression tracking is another opportunity for innovation. Aviation Maintainer Analytics Platform has already improved visibility over maintenance training but integrating it with CAFRS could bring similar gains to pilot development. Commanders would be able to see who is nearing pilot-in-command status, identify remaining requirements, and optimize flight hour allocation.

Additionally, emerging tools like augmented reality are promising for tasks such as tactical rehearsals. Programs like ForeFlight's Voyager, currently used in civilian aviation, show the potential to simulate routes and scenarios on demand. Incorporating similar tools into field operations would allow Army Aviation crews to conduct route previews and mission planning, even in austere environments.

## Smarter Training Design

A key opportunity lies in consolidating training requirements to make the most of every field exercise. The 2-3 General Support Aviation Battalion demonstrated this approach in the summer of 2024 by integrating driver training; M4 carbine qualification; nuclear, biological, and chemical weapons drills; downed aircraft recovery team (DART) operations; air assault tasks; and mission command into one cohesive event. This model mirrors combat training center complexity while providing Soldiers valuable repetitions prior to high-stakes evaluations.

Applying a "crawl-walk-run" methodology to mission tasks is equally critical. Soldiers should first master tasks in isolation, like using the unit maintenance aerial recovery kit in a DART mission, before layering in convoy operations and combat injects. This progressive approach builds expertise—not just exposure.

## Minimizing Impact on Soldiers' Lives

Efficient training isn't just better for readiness, it directly improves Soldiers' quality of life. Consolidating multiple tasks into a single exercise reduces the number of required training days. This gives Soldiers more predictable schedules, more family time, and enhances focus during training events.

Instead of spreading training over the entire year, leaders can concentrate yearly or semi-annual events that fulfill 90 percent of annual requirements. The remaining requirements can be addressed during weekly or biweekly leader training time sessions that blend seamlessly with the unit's battle rhythm. This approach supports both continuity and resilience, while still achieving the Army's standards for readiness.

## Conclusion

Innovation in Army Aviation training must serve two ends: operational effectiveness and Soldier well-being. By leveraging emerging technologies, designing smarter training, and cultivating a culture of ownership and excellence, leaders can achieve both. The path forward isn't about doing more with less—it's about doing better with what we have. In doing so, we prepare our units not only to meet today's challenges, but to dominate tomorrow's battlefield.

Biography:

CPT Trey Glover has served 11 years in Army Aviation in various roles from crew chief to company commander. He recently served as the 3D CAB Battle Captain/ Training Officer and currently as the Headquarter and Headquarters Troop, 3-17 Air Cavalry Squadron Troop Commander.

Field training exercise post-convoy preventive maintenance checks and services. U.S. Army photo by CPT Trey Glover.

Reference:

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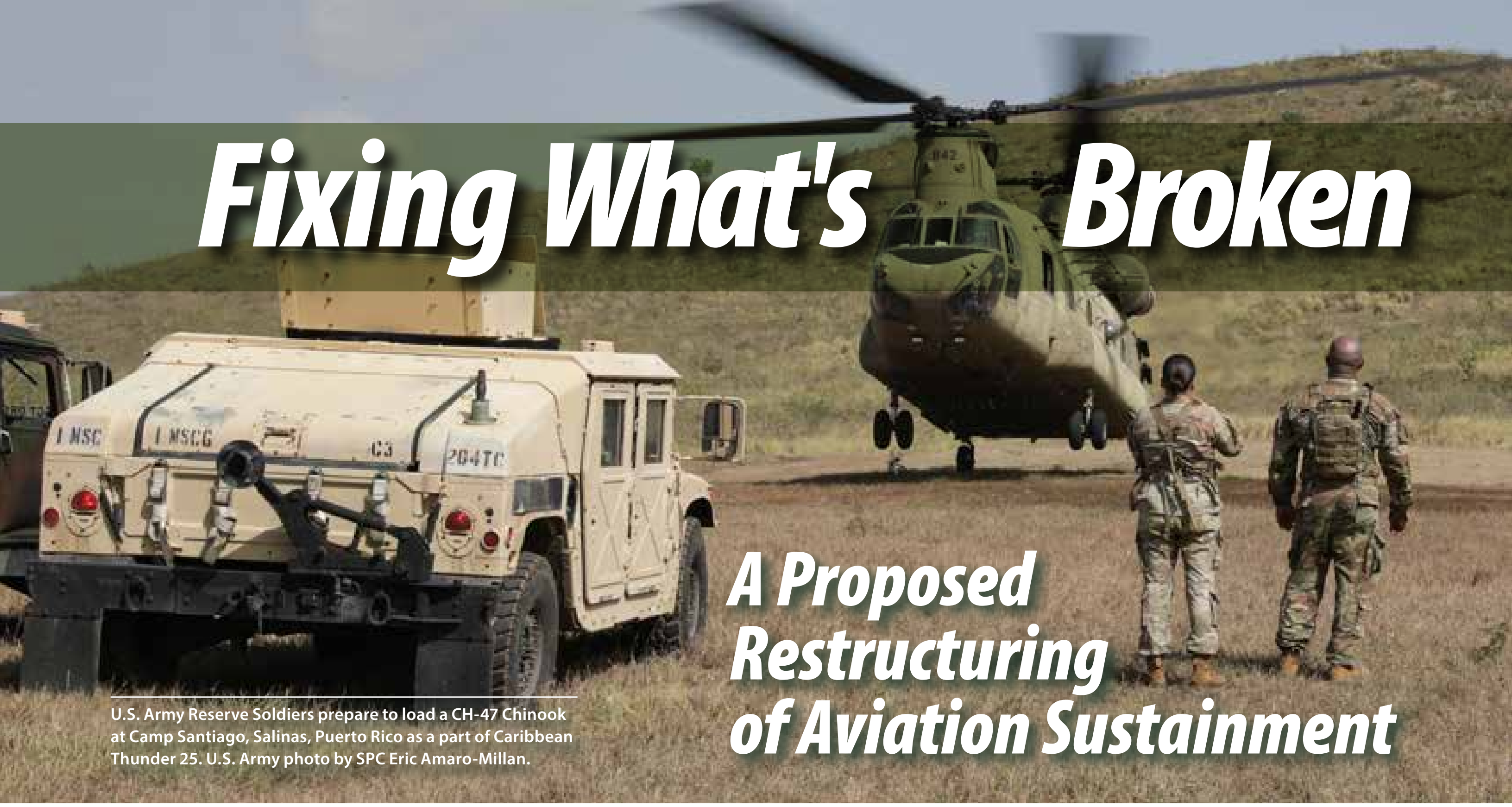


# Fixing What's Broken

## A Proposed Restructuring of Aviation Sustainment

U.S. Army Reserve Soldiers prepare to load a CH-47 Chinook at Camp Santiago, Salinas, Puerto Rico as a part of Caribbean Thunder 25. U.S. Army photo by SPC Eric Amaro-Millan.

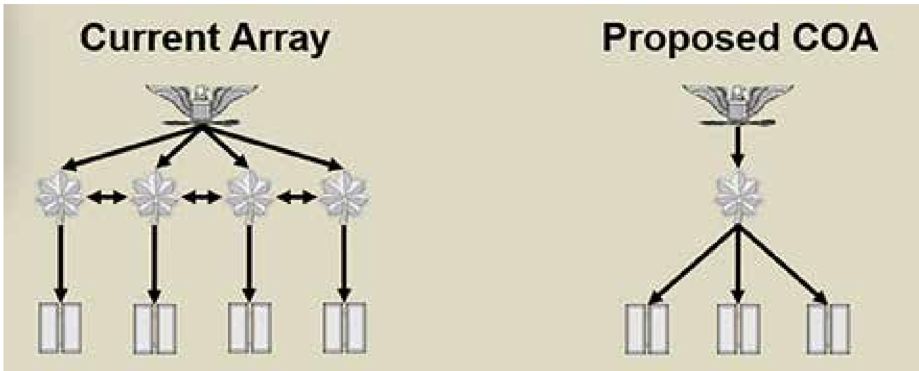
By CPT Gene S. Thagard, LTC Billy D. Blue, MAJ Oziel Rodriguezgamez, and CPT Coty M. Ruether

Imagine a modern battlefield with intense combat spanning the entire close area. The combat aviation brigade (CAB) is employed throughout the division's area of operations. The attack battalion disrupts an enemy advance in the east, while lift assets are preparing for a large-scale air assault, enabling the division to regain the initiative. Each battalion distributes its forward support company's (FSC) fuel assets to support its assigned mission. As operations begin, senior leaders are puzzled. Despite the brigade commander prioritizing the lift mission, the battalions deployed their forward arming and refueling points inefficiently and in close proximity, creating a potential hazard and hindering fuel availability as the air assault progresses. Sixteen AH-64Es, 15 UH-60Ms, and six CH-47Gs are airborne and now must adjust on the fly. Risk to force and mission dramatically increase due to preventable sustainment shortfalls.

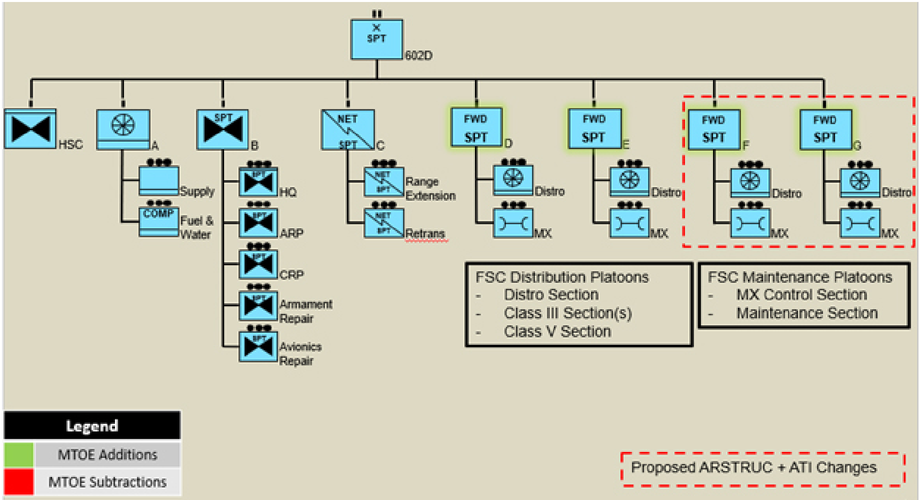
These risks mirror observations from a recent Warfighter Exercise conducted by the 8th Army, 2D Infantry Division (2 ID), and the 2D CAB (2 CAB). These sustainment hurdles consistently threaten operational success. In the 602D Aviation Support Battalion (ASB), we believe the greatest risk in large-scale combat operations (LSCO) is the requirement for simultaneous, complex operations without centralized sustainment command and control. This results in inefficient and ineffective resource allocation that is misaligned with the CAB commander's priorities. At its core, this is an organizational issue depicted in Graphic 1.

In the CAB's current construct, bureaucratic friction arises when a CAB commander expresses sustainment priorities requiring collaboration across FSCs. Battalion commanders must figure out how to meet the intent while accomplishing their own vital mission. A collective action problem is at play: Who will relinquish sustainment capabilities to support a separate mission and potentially jeopardize their own? How will this be coordinated across the dispersed battalion tactical assembly areas required in LSCO? Collective sustainment in LSCO is a public good, and mismanagement carries significant consequences.

Recent articles in *The Aviation Digest* support this assessment. The October–December 2024 issue highlighted the need for rapid sustainment task organization and contended "the current MTOE [modified table of organization and equipment] for the sustainment units within the CAB is clearly designed to support battalion-level operations,




*Graphic 1.* Current vs. proposed array (Thagard et al., 2025a).




*Graphic 2.* Phase I example (Thagard et al., 2025b).

not CAB-level efforts" (Sevigny & Chandler, 2024, p. 32). Another article in the same issue detailed sustainment shortcomings during National Training Center Rotation 24-03, highlighting consistent issues with command and control of logistical distribution, as well as commenting on the complications of redirecting assets for independently planned missions (Westrick et al., 2024). An author in the January-March 2025 issue criticized the convoluted organization of sustainment assets in the CAB and the resultant challenges to manning and training (Turner, 2025).

The common thread is a call to consolidate sustainment assets under the ASB, often in the likeness of a brigade support battalion (BSB). These calls for change demand action.

In this article, we offer a two-phase solution to address aviation's sustainment shortcomings and maximize effectiveness through reorganization. Phase I consolidates the FSCs into the ASB under the BSB model. This step solves many of the CAB's LSCO sustainment problems. Yet, this step alone is insufficient and necessitates a Phase II, in which assets are redistributed within the ASB by sustainment function. This consolidation of specialties will enhance training and command and control.

## Phase I

Phase I is a widely accepted solution. It offers benefits in task organization, training, and resource management. By simply consolidating all sustainment assets under the ASB, the brigade commander can now prioritize missions and entrust sustainment assets will be allocated accordingly via the ASB commander. Most importantly, this phase can be executed rapidly (Graphic 2).

Phase I provides a valuable adaptation period as the FSCs integrate into the ASB, allowing for refinement of relationships, systems, and processes. This transition enables experimentation with new methods while leveraging the proven structure of the BSB. The BSB model, which has been effective in the Army for more than 20 years, minimizes risk and maximizes the potential for improved sustainment capabilities in the CAB during this period of change.

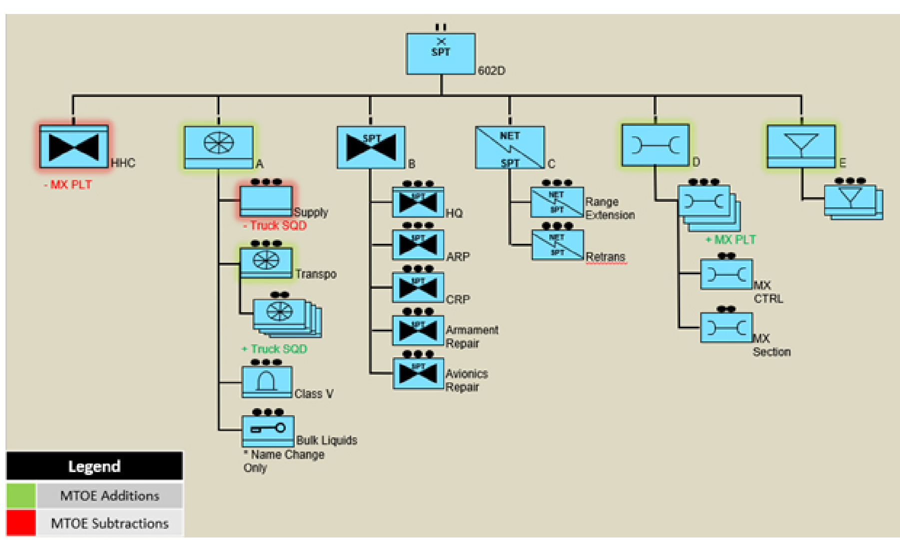
However, simply folding the FSCs under the ASB does not solve some of the underlying issues. A support company—a jumble of fueling, maintenance, and distribution capabilities—is Frankenstein's monster. It is complex, inefficient, and built for battalion-level operations. If the ASB is to truly own the CAB's sustainment mission, can we afford to maintain a fragmented structure with fueling, maintenance, and distribution capabilities dispersed across five different companies? Is there a better way?

## Phase II

We argue a more effective approach is reorganizing sustainment personnel and equipment by function and specialty, thus creating a cleaner and more efficient ASB command structure. Our proposal is outlined in Graphic 3.

By realigning personnel and equipment, we trade breadth for depth and create companies with a narrow sustainment focus. Company Alpha owns the CAB's distribution practice, Company Delta owns ground maintenance, and Company Echo owns refueling. Phase II significantly enhances collective training, flexibility, and modularity within the CAB.

Company Alpha becomes the CAB's distribution workhorse. It manages distribution across all classes of supply (sans Class III [petroleum, oils, and lubricants]). The supply platoon maintains supply support activity operations (i.e., receiving, managing, storing, and issuing all classes of supply (sans Class I (W) [water]), II [general support items], V




*Graphic 3.* Phase II example (Thagard et al., 2025c).

[ammunition], and VIII [medical materiel/medical repair]). The transportation platoon combines distribution platoons from each FSC and the truck squad originally found in the supply platoon. The Class V platoon owns the reception, management, storage, and issue of the CAB's ammunition. Finally, the bulk liquids platoon retains both its structure and mission.

Companies Bravo and Charlie both maintain their current mission, composition, and structure.

The new Company Delta consolidates ground maintenance by combining the ground maintenance platoons from each FSC and the ASB's headquarters support company. The current platoon format is maintained to enable direct support to battalions and facilitate preventative, scheduled, and unscheduled maintenance. However, each battalion will still own its own rolling stock fleet.

Finally, Company Echo becomes a fueling powerhouse, with two platoons of 92F petroleum supply specialists. This consolidation enables a comprehensive and focused training plan that develops mastery at refueling any aircraft by any method. Tasking a single commander with preparing the CAB's 92Fs for LSCO ensures our refuelers are adaptable experts in, perhaps, LSCO's most important sustainment function.

This new structure offers a streamlined command, increased focus and proficiency, and the modular capability to match sustainment assets to specific requirements. This restructuring creates a vertically integrated ASB, fully prepared to meet the CAB's sustainment demands in LSCO.

## Risks to Mission

While the benefits of reorganization outweigh the risks, several areas will require special attention.

First is the need for new garrison systems and processes. Structural changes may require relationship changes. Do direct support relationships continue in garrison, or do battalions submit requests through the support operations (SPO) section? Do refueling platoons rotate between a "on-off" cycle of garrison fueling support and training exercise support? How do we implement changes without threatening readiness? Experimentation and a phased approach will be crucial.

The second risk is battlefield geometry. How will the ASB and CAB organize in its area of responsibility and distribute its sustainment assets within that space? What risk does consolidation pose to mobility and survivability? While these questions remain, we should not let uncertainty prevent innovation. We cannot retreat to the comfortable sanctuary of a known, yet deficient, solution. We must experiment and iterate because while different CABs and installations *may* require different solutions, different theaters will *certainly* require different solutions. Accordingly, our two-phase solution offers an advantage: heightened focus. Consolidation by sustainment function allows commanders to focus on solving one sustainment problem at a time.

## Looking Ahead

As outlined in the *Army Transformation Initiative*, GEN Randy George and Secretary Daniel Driscoll challenge us "to maintain our edge on the battlefield" by leaning into changes that "transform [us] to a leaner, more lethal force by adapting how we fight, train, organize, and buy equipment" (Driscoll & George, 2025). We strongly believe this organizational change definitively improves our ability to train sustainment, creates a more coherent sustainment command structure, and finally, postures aviation sustainment to meet the speed and scale of LSCO. There may be uncertainties; however, these pale in comparison to the risks posed by remaining aligned with a structure we are confident no longer serves its mission. As GEN George and Secretary Driscoll preach, "adaptation is no longer an advantage—it's a requirement for survival" (Driscoll & George, 2025). Aviation sustainment must adapt, for the risk is too great to fail.

Biographies:

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# From Hours to Minutes: Transforming Air Movement Planning in Army Aviation

By LTC Russ J. Nelson, Mr. Jake Stanfield, LTC Tyler J. Espinoza, Dr. Russell E. King, and Dr. Brandon M. McConnell

**Background**: Army utility and cargo helicopters are crucial, yet limited, assets in the execution of air assault and air movement missions. With effective and timely planning of such missions, Army Aviation creates a significant tactical advantage over the enemy.

Air assault missions are characterized by their complexity and coordination; these maneuvers require a massive collaborative effort involving various personnel, each providing a specific contribution toward the mission's success. Air movement operations represent the majority of combat aviation activities, driven by the high demand from troops needing rapid movement across the battlefield. Furthermore, air movement operations require agile planning that prevents the "all hands-on deck" mentality of air assault missions. A proficient helicopter crew can arrive just hours before takeoff, receive their air mission requests (AMRs) and routing from the aviation mission planners, complete the necessary preparations, and execute the mission. Aviation mission planners work behind the scenes where the air crew is usually unaware of the effort required.

**Problem**: Aviation mission planners' objectives are to rapidly develop effective assignments of AMRs to helicopter teams and generate the best route for each aircraft. Air mission request planning is a complex task that requires tracking each crew member's flight time by hour and mission type. Additionally, the planners must weigh mission priorities, allocate required activities to available resources, verify available routes, and conduct feasibility checks on potential execution schedules. The current process for aviation mission planners takes several hours to complete. This process considers priority levels, locations, number of personnel, and pickup/drop-off time windows. Time is a high priority, with rapid production of good plans yielding an operational advantage. Any resource that could shift planner effort from plan construction to

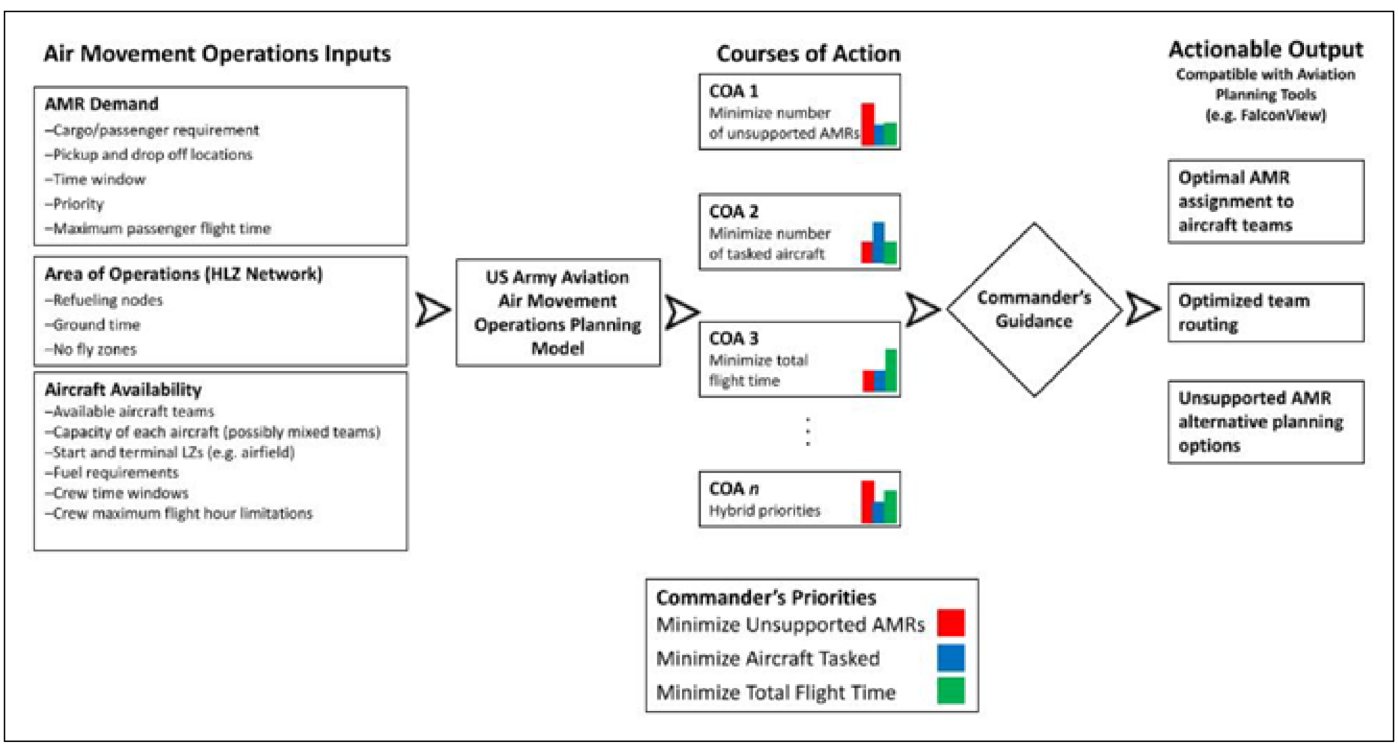


*Figure.* Model's inputs and outputs (Nelson et al., 2022).



U.S. Army Soldiers conduct air assault operations in South Korea. U.S. Army photo by SGT Alexander Knight.

schedule evaluation and optimization could yield better overall efficiency and quality of air movement operations.

**Process**: The *Aviation Digest* article by Nelson et al. (2022), "Army Aviation Air Movement Automation for the Mission Planner," proposed developing a user-friendly planning model (Figure) to empower AMR planners to function more efficiently. U.S. Army researchers, in coordination with academia, have completed a recent proof of concept that fulfills this initial vision. In collaboration with military aviators, these researchers developed an algorithm designed to efficiently assign AMRs to aviation teams and optimize their routing.

This system is built to empower human planners by enhancing their decision-making through interaction, rather than replacing them. In its final form, the researchers envision planners uploading AMRs—in Excel or other format—for preprocessing. The planning model will then output several courses of action (COAs) that consist of AMRs' assignment to helicopter teams, as well as helicopter team routing, ensuring fuel, capacity, and time window limitations are not exceeded. Planners can then accept or augment COAs for further improvement. The final assignment and routings will then output in a user-friendly format compatible with aviation mission planning tools.

In the model's current form, the following simplifying assumptions are made:

1. Helicopter capacity is limited by passenger seats. Cargo weight and volume must be converted to passenger equivalency.

2. Each AMR has a single time window in which it is to be picked up from its pickup location and delivered to its destination.

3. An AMR is defined as a set of passengers with a shared pickup and drop off helicopter landing zone (HLZ), time window constraint, and priority level.

4. Service time (ground delay) is a function of the HLZ and includes time to refuel at HLZs with fuel services.

The model has the capability to shorten plan construction from many hours to just a few minutes. This capability provides many benefits, enabling the planners to take system output and blend it into the desired execution schedule. Users provide mission specifications, enabling the system to use established assignment and routing methods to produce an initial solution. The air movement-specific techniques are then applied to search for improved plans.

| Number of AMRs | Number of Helicopter (UH-60) Teams | Number of HLZs (total) | Number of HLZs with fuel | Average Solution Time |
|---|---|---|---|---|
| 100 | 10 teams | 10 | 5 of 10 | 22 minutes |

*Table.* Model performance summary (Nelson et al., 2025b).

*Table*. Model performance summary (Nelson et al., 2025b).

Real-world considerations include multiple refuel nodes, minimization of unsupported demand by priority level, AMR time windows, aircraft team time windows/maximum duration, and passenger ride time limits. The inputs can be grouped into AMR Demand, Area of Operations (HLZ Network), and Aircraft Availability. The system balances three commander priorities: maximizing supported AMRs, minimizing aircraft utilization, and minimizing total flight time. These priorities can be tuned up or down as needed. The model can generate multiple viable options, allowing AMR planners to use

The 2-82 Assault Helicopter Battalion participates in a mission brief ahead of an air assault mission. U.S. Army photo by CPT Shervon Pope.

this output to plan better air movement missions more rapidly.

**Performance**: This system has been tested and improved to reduce computation time and provide multiple COAs based on adjustable parameters. A developed experimental design process can optimize these parameters for a given environment.

The system was tested in high-density (urban) and low-density (rural) environments. In HLZ-dense environments, it provided superior AMR support. In areas with fewer HLZs, the utilization of high-cost helicopter teams (e.g., standby or reserve helicopter teams) was reduced. These improvements help preserve scarce Army Aviation maintenance personnel and resources while enhancing the support provided to the units involved. As shown in the Table, the system processed scenarios with 100 AMR requests and gave feasible AMR assignment and team routing solutions in an average of 22 minutes. The system is flexible and can be adjusted to accommodate bulk assignments for an aircraft fleet, helping to minimize the helicopter teams needed. Overall, the versatility and efficiency of this system enable both resource allocation optimization and support effectiveness assistance for military operations across diverse environments.

**Future Steps**: The methodology and proof of concept algorithm is now available for Army Aviation to consider and pursue for future development, including potential integration with aviation planning tools (e.g., FalconView).[1] Having funded this research, the U.S. Army already owns the intellectual property for this model. For more information regarding the model, reference Nelson et al. (2023; 2025a).

The planning model can have an immediate impact by reducing time planning, providing route generation, and maximizing resources. Ultimately, the successful integration of these systems can revolutionize air movement operations, ensuring that Army Aviation can deliver timely and practical support to troops when needed.


Biographies:

LTC Russ Nelson, PhD, is an Army Operations Research/Systems Analyst with Army Aviation experience. He is an Assistant Professor in the Department of Mathematical Sciences at the United States Military Academy at West Point in New York.

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[1] "FalconView is a Windows mapping system that displays various types of maps and geographically referenced overlays" (National Geospatial-Intelligence Agency, n.d.).

# Modernizing Maintenance in Army ★ Aviation:

## A Call for Predictive Solutions

By CPT Brittany M. Haggett

Army Aviation has long prided itself on maintaining the highest standards of aircraft readiness and safety. However, even in such a highly structured environment, inefficiencies still exist, particularly around maintenance, especially since the rate of personnel turnover has increased, reflected in aviation retention decreasing. While the North Carolina Army National Guard Army Aviation Support Facility #2 Flight Facility Logistics Management Officer, I observed that even the most elite and disciplined teams struggle under the current reactive model. To support our personnel, reduce aircraft downtime, and strengthen mission readiness, Army Aviation must implement modern tools, specifically artificial intelligence (AI) and predictive maintenance scheduling systems.

As a technician at a demanding rotary-wing facility supporting state medical rescue operations, I managed maintenance and logistics alongside a team of highly trained Soldiers and General Schedule technicians. Despite their unwavering dedication, strict adherence to Army regulations, and technical expertise they consistently faced fatigue, long hours, and heightened stress levels. Through networking with other facilities, I noticed that all military maintenance programs have a common vulnerability: having one or two extremely experienced supervisors whose absence can significantly reduce program effectiveness. The root of the problem isn't incompetence or underperformance but the reactive nature of our current maintenance scheduling model.

Currently, Army Aviation maintenance relies heavily on fixed schedules, routine inspections, and time-based component changes with some reactive interventions. While partially effective, this method often results in unnecessary part replacements or missed early indications of failure, resulting in aircraft being grounded for extended periods. Transitioning to predictive maintenance scheduling, powered by AI and machine learning (ML), offers a viable solution to mitigate some risk and improve operational readiness.

Production control meetings, designed to balance airframe and flight hour usage with scheduled maintenance


A UH-60 MEDEVAC being loaded onto a C-17 at the Charlotte National Guard AF ramp, North Carolina. Photo provided by the author.

A UH-60 flies over North Carolina. Photo provided by the author.

requirements, typically involve senior maintainers, commanders, and operations personnel. However, these plans are frequently disrupted by unforeseen mission demands or last-minute training changes—Annual Proficiency and Readiness Tests, Readiness Level progression, Helo-Aquatic Rescue Team taskings, VIP movements, company commander requests, and Medic progression flights, to name a few. Each deviation triggers a cascade of adjustments and reactive maintenance needs, placing significant strain on an already stretched workforce, resulting in heightened urgency and fatigue. By integrating AI and predictive maintenance scheduling, the Army would be investing not only in technological superiority but in its most valuable asset, its people.

These scheduling systems would help streamline the unpredictability, reduce manual planning burdens, and enhance the responsiveness of the entire aviation maintenance structure. The civilian aviation sector has already embraced predictive analytics with remarkable success. According to Boeing, the commercial airline industry has seen a significant reduction in delays and maintenance-related costs since introducing predictive maintenance technologies (Boeing, 2025). If the Army adopts similar tools tailored to our mission needs, it can yield comparable gains across aviation units.

Furthermore, predictive systems can ease the burden on personnel. In my previous role, the maintenance team frequently worked long shifts, scrambling to recover aircraft experiencing grounding faults related to components that often fail without clear warning or that are difficult for technicians to anticipate. This cycle of urgency eroded morale and increased the risk of human error, a dangerous combination in aviation. Predictive insights enable proactive inspection and maintenance planning, reducing the reliance on last-minute troubleshooting and ensuring a more sustainable work environment. Predictive maintenance also enhances decision-making, providing commanders and maintenance leaders with actionable data for more confident mission planning.

Fortunately, the conversation surrounding the integration of AI-driven predictive maintenance is already gaining strong momentum within the Army Aviation community. Major General Lori L. Robinson reports that Army Aviation and Missile Command has "developed a data-analytics-based Enduring Fleet Management Tool (EFMT) that scores every aircraft in the Army's inventory" to determine higher-level maintenance priorities (Robinson, 2024, p.16). Additionally, Griffin, the Army's flagship AI/ML algorithm prototype, is being tested with notable success by XVIII Airborne Corps, Army Reserve Aviation Command, and Central Command to enhance rotary-wing asset tracking and management (Fairfield, 2024, pp. 82-87). However, despite the promise of innovative systems, full implementation across the Army Aviation fleet remains limited due to software complexity and program sensitivity. Civilian aviation has already demonstrated success in applying similar AI-based maintenance systems. Collaborating with established civilian AI predictive maintenance programs may offer a realistic and attainable solution for broader Army adoption.

Understandably, any shift toward AI and predictive maintenance requires careful consideration. Concerns about over-reliance on technology and cybersecurity vulnerabilities are valid. Yet, some Army units have already begun experimenting with AI-enabled diagnostics, yielding positive outcomes in logistics tracking and management. Extending these trials to aviation units is a logical next step toward realizing "The Army of 2030" and supporting large-scale combat and multidomain operations (U.S. Army, 2022). Institutional resistance to change is often a hurdle in military environments, but the risk of maintaining the status quo is far greater.

In closing, the Army Aviation Enterprise stands at a critical juncture. We have the tools and data to revolutionize how we maintain our aircraft. What we need now is the will to lead that change. From my personal experience managing a high-performing but overburdened maintenance team, I can confidently say that predictive scheduling isn't a luxury—it's a necessity. By modernizing maintenance scheduling with AI and predictive analytics, we can reduce aircraft downtime, improve readiness, and provide our aviation professionals with the support they deserve.

CPT Brittany Haggett pictured with a UH-60. Photo provided by the author.

Biography:

CPT Brittany Haggett began her aviation career in the National Guard, flying UH-60A/L Black Hawks before transitioning to the U.S. Army Reserve C-12 fixed-wing community. She holds a kinesiology degree with a pre-medical concentration from Louisiana State University and brings a strong foundation in health and performance to her role as an aviator. Most recently, she graduated as the Honor Graduate of Aviation Captains Career Course Class 25-004.

A UH-60 MEDEVAC and C-17 at the Charlotte, North Carolina, National Guard AF Ramp. Photo provided by the author.

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# Integrating Aviation Practices Into the Ground Maintenance Process

An Alaska Army National Guard Black Hawk helicopter mechanic conducts post-flight maintenance on the tail rotor in Yuma, Arizona. U.S. Army Alaska National Guard photo by CPT Balinda O'Neal.

By LTC Linus D. Wilson

Maintenance remains a cornerstone of all military operations, directly impacting conflict outcomes. Aviation and ground maintenance are disparate in their application but are similar in their shared purpose of building combat power and providing commanders with options. A recurring challenge across many motor pools is the absence of standard operating procedures and effective organization.

To enhance ground maintenance capabilities and increase operational readiness (OR), maintenance leaders should implement daily production control (PC) meetings; adopt the Problem, Plan, People, Parts, Time, Tools, Training (P4T3) methodology; and integrate deliberate training gates—modeled after the Aviation Maintenance Training Program (AMTP)—into their daily maintenance practices. Additionally, maintainers should establish standardized maintenance timelines for predictable and routine tasks.

## Implement Daily PC Meetings

The first step is for commanders to host a PC meeting to set daily maintenance priorities based on pacing items, mission requirements, and available parts—not solely on non-mission capable (NMC) status equipment.

Mirroring an aviation PC meeting, ground maintenance control officers should review Department of the Army (DA) Form 5988s, *Equipment Maintenance and Inspection Worksheet* (DA, 1991); coordinate, schedule, and prioritize maintenance; monitor test, measurement, and diagnostic equipment status; maintain parts status; direct supply operations; and coordinate inspections and road tests to baseline the priority of work across battalions.

Daily PC meetings maximize efficiency across companies by focusing resources on tasks most essential to mission accomplishment. Daily briefings by company representatives on expected completion times, work stoppages, and parts shortages enforce accountability and provide supply sections critical updates and lead time for parts procurement. Additionally, PC meetings provide a forum for leaders to emphasize the importance of maintenance, reinforce priorities, and discuss upcoming training and mission requirements, ultimately driving maintenance efforts.

## Adopt the P4T3 Methodology

The P4T3 approach, proven effective in aviation maintenance, provides a holistic framework to plan maintenance tasks. More specifically, "P4T3 is a planning concept allowing commanders, leaders, and maintenance personnel to coordinate and plan the personnel and resources required to perform maintenance. Using the P4T3 concept streamlines maintenance operations and normally saves time and resources" (DA, 2020, p. 1-15). Adding P4T3 to ground maintenance may significantly increase OR.

## Problem

A key difference between aviation and ground maintenance is the identification of underlying problems. Ground maintenance often addresses faults reported on DA Form 5988 without a systematic process for identifying the underlying issue. Properly identifying the problem and not just addressing the symptoms is essential for efficient and effective maintenance.

## Plan and People

Develop a detailed plan using the appropriate technical manuals and team expertise. A common shortfall in motor pool maintenance is the misallocation of personnel, where leaders assign mechanics to tasks based on availability rather than expertise. Maintainers should be assigned based on experience level, pairing junior maintainers with senior mentors. Senior maintainers should focus on leadership and mentorship, not solely administrative tasks. Aligning experience levels with task difficulty will improve problem-solving and foster professional development.

## Parts, Time, and Tools

Parts ordering is inefficient and extends NMC time due to either poor problem diagnosis leading to unnecessary orders, or reactive ordering where parts are requested only as needed. Senior maintainers should confirm the accuracy of part numbers and quantity and the availability of required tools prior to tasks assignment. This ensures tasks are resourced and reduces overall maintenance time by minimizing tool-search delays. This efficiency allows leaders to rapidly redeploy maintainers and equipment.

## Training

The final and arguably most critical component of P4T3 is training. Adopting a ground maintenance training program mirroring the AMTP provides a structured approach to developing and evaluating maintainer proficiency. As highlighted by industry expert, Roy H. Williams, “Training is not an expense, but an investment in human capital.” The AMTP “standardizes aviation maintenance across the Army … to promote predictability and builds the knowledge base needed to provide maintenance excellence” (DA, 2020, p. 1-3). It creates a deliberate gated training method requiring maintainers to perform specified tasks in a crawl, walk, run approach. A ground maintenance training program will allow commanders to gain valuable insights into unit strengths, track individual proficiencies, optimize talent management, and proactively address training needs. Individual maintenance level designations can be linked with established industry standards and professional military education, allowing maintainers to transfer their skills to the private sector. This integration is not simply about adopting new programs, it’s about fostering a culture of continuous improvement and professional development within the ground maintenance force.

> **“Training is not an expense, but an investment in human capital”**
>
> **—Roy H. Williams**

U.S. Army Soldiers conduct maintenance on an AH-64D Apache helicopter at the Joint Multinational Readiness Center Hohenfels, Germany, September 10, 2025. U.S. Army photo by PFC Ariana Smith.

## The Cultural Impact

Unlike aviation maintenance, ground maintenance often exhibits shortfalls in accountability, emphasizing a hierarchy of responsibility rather than individual duty. Holding individuals accountable not only reinforces standards but instills a sense of ownership, which can result in a greater sense of pride and professionalism in their work. By institutionalizing standard practices (e.g., conducting daily PC meetings, P4T3, and adopting the AMTP), ground units across our formations can foster a climate of standardization, accountability, and professional growth.

## Conclusion

Adopting proven aviation practices like daily PC meetings, P4T3, and AMTP, creates a valuable opportunity to positively shift ground maintenance practices. By focusing on standardized procedures, proactive planning, and continuously developing training, ground units can boost readiness, support mission demands, and develop a more capable and flexible sustainment force. Moreover, this approach builds a strong maintenance culture rooted in organization, skills, and mission success.

Biography:
LTC Linus Wilson is currently a student at the Air War College on Maxwell Air Force Base, Montgomery, Alabama. He was commissioned and went on active duty as an Aviation Officer in October 2004 after graduating from Troy University, Troy, Alabama. His previous assignments include 127th Aviation Support Battalion Commander in the 1st Armored Division Combat Aviation Brigade at Fort Bliss, Texas; Deputy Commander Joint Special Task Force–Somalia; as well as assigned Organization Personnel & Force Development, Fort Rucker, Alabama; and Brigade Executive Officer, 1st Aviation Brigade, Fort Rucker.

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This reprinted article was originally published in the *Army Sustainment* Professional Bulletin's Fall 2024 issue and is used with permission.

# AVIATION REFU
# PLANNING CONSIDERAT

## Limiting Factors

▪ *By Lt. Col. Gregory Sterley, Maj. Andrew Keithley, Capt. Joseph Keegan, and Capt. Ian Greer*

# EL
# TIONS


According to Joint Publication 3-18, Joint Forcible Entry Operations, air assault operations are a "movement of friendly assault forces ... to engage and destroy enemy forces or to seize and hold key terrain." The maneuver allows ground commanders to mass combat power at critical points on the battlefield, creating multiple dilemmas for the enemy to slow their decision-making and their placement of ground units at a position of relative advantage. The air assault provides enormous amounts of combat power for the ground commander, but the precision that air assault operations require makes them inherently fragile. Any number of contingencies en route to the objective could jeopardize the operation. As a result, air assaults require thorough mission planning to ensure they achieve the effects that ground commanders desire.

With the Army's emphasis on counterinsurgency operations over the past 20 years, air assault operations have largely remained at the battalion level and below. However, recent modifications and changes in operational thinking, as captured in top-level doctrine such as Field Manual 3-0, Operations, necessitate the resurrection of the air assault as a joint forcible entry (JFE) capability for the Army.

The 101st Airborne Division drives the charge with newly approved force design updates that bring a heavy-lift battalion. This allows the division a brigade-level JFE capability, which it lost with the deactivation of the division's second combat aviation brigade (CAB), the 159th CAB. Recently the division conducted a series of long-range, large-scale air assaults (L2A2s) to overcome a two-decade gap in organizational knowledge about division-level rotary-wing JFE capabilities.

Refueling operations, too, have grown with the appetite for L2A2s and continuously prove a point of friction. Forward arming and refueling points (FARPs) require the same level of deliberate analysis and planning to prevent backlogs or stoppages to aviation operations. The most consequential factors limiting FARP operations during L2A2s are insufficient total capacity, insufficient unit capacity, the number of available refueling points, fuel flow, crew duty day, and FARP certification. While the 101st CAB continues to develop tactics, techniques, and procedures to overcome each limiting factor, commanders and planners must understand the risks of their implementation to identify appropriate situations for using them.

Total capacity is the simplest limiting factor to overcome. Adding more fuel-carrying vessels to a FARP site increases the amount of fuel on hand, and not all vessels need to be capable of refueling aircraft if fuel transfer is possible. Adding more M978 Heavy Expanded Mobility Tactical Truck (HEMTT) fuelers is the preferred method of increasing total capacity at a FARP location, due to their ability to transfer fuel to aircraft. However, the HEMMT has a relatively low capacity, and a fleet of them is not always sufficient for meeting total capacity needs.

Additionally, the lower capacity of the HEMTT and tank rack modules (TRMs) relative to the M969 fuel tanker or bulk-fuel carriers means that more of them are needed to meet the same total fuel capacity as that of M969 tankers and bulk-fuel tankers. This increases the total footprint of the FARP site and makes the sustainment node a larger, more obvious target for enemy forces. Adding bulk vessels, therefore, helps meet total capacity and aircraft requirements while largely reducing the FARP footprint. However, these bulk assets are limited in their operations on the fuel line if they lack an internal pump, and therefore are used to refill M978s with the associated HEMTT Tanker Aviation Refueling System (HTARS) attachment.

With the addition of HEMTTs or other bulk Class III-carrying vessels, planners must conduct more thorough analysis to determine a support package that facilitates the sequence and timing of aircraft serials (groupings) in the mission. To perform this calculus, logisticians must consider unit capacity, or the amount of fuel available to aircraft at a mainline. An implicit assumption in planning for total fuel requirements at a FARP site is that all fuel, regardless of the vessel that contains it, will become usable to an aircraft at some point in the mission. While obvious on the surface, battalion- and brigade-sized support elements must turn this assumption into a fact before mission execution to prevent serious backlogs or even mission stoppage en route to the objective.

Currently, the M978, M969, and TRM stand as the most proliferated and commonly used fuel vessels in the logistics community. However, only the M978 is widely available and capable of transferring fuel into an aircraft with the HTARS. This equipment is commonly found on a distribution or forward support company's modified table of organization and equipment. The Forward Area Refueling Equipment and its variants continue to be an option as well, but its capacity (500-gallon collapsible drums) becomes a planning concern for L2A2 operations.

Support units have several options to overcome unit-capacity limitations, but the two most common techniques are (1) connecting multiple M978s to the same mainline and (2) increasing the number of mainlines above what the largest aircraft serial requires. Either technique, however, brings its own disadvantages. If support elements connect multiple M978s to the same mainline hose, fuelers gain the ability to transfer fuel from bulk vessels into one of the mainline vessels while the other mainline vessel distributes fuel to aircraft. This option, however, generally limits the number of aircraft in each serial because it also limits the number of mainlines available at a FARP. Additionally, support units risk more fuel becoming non-transferrable if anything damages or destroys the main fuel line or any of its valves.

Support units that increase the number of mainlines above what the largest aircraft serial requires gain the flexibility to move aircraft across different mainlines to effectively plan and schedule fuel transfer from bulk vessels to vessels connected to a mainline. This enables continuous fuel transfer to non-active mainlines. It also affords flexibility to the task force commander because it ensures the FARP can accommodate all aircraft in each serial, even if a dispensing vessel or main fuel line becomes inoperative. The support unit does assume risk, however, because as the FARP footprint grows with the addition of mainlines, this makes command and control over the total area more difficult and increases the logistical footprint.

The number of total points (fuel-distributing hoses) on a FARP is the most micro-level analysis planners must undertake to identify support requirements in aviation operations. To ensure all chalks in a serial (platoon-sized units) of aircraft receive fuel without spending time in holding, the number of points must, at a minimum, match the number of chalks in the largest serial. To meet this demand, support units again have two primary

*Sgt. Luiyi Genao, a petroleum supply specialist assigned to the 524th Division Support Battalion, 25th Division Support Brigade, 25th Infantry Division, pumps fuel from a fuel servicing truck into a U.S. Air Force F-22 Raptor assigned to the 27th Fighter Squadron, 1st Fighter Wing, during joint refueling operations in support of Valiant Shield 24 at the Tinian International Airport, Tinian, Northern Mariana Islands, June 12, 2024. (Photo by Staff Sgt. Tristan Moore)*

techniques: adding more hoses to the same mainline or adding more mainlines with the same number of fuel-distributing hoses. The technique the support unit uses to overcome unit capacity will drive which technique is more suitable to address the number of points.

For elements that increase unit capacity to a mainline by coupling vessels to a single line, adding more points to the mainline decreases fuel flow as the distance from the vessel increases. In cases of heavy-lift aircraft such as the CH-47 Chinook, fuel flow limits the number of feasible points to two per vessel.

In the case of the AH-64 Apache or the UH-60 Black Hawk, four points are generally the maximum. Units that face limitations with this technique should consider adding more vessels to their FARP configuration to maximize flow and throughput, matching the number of fuel-distributing hoses (points) to the largest serial.

For elements that add more mainlines with the same number of points, the greater quantity of mainlines enables throughput via an increased flow rate to a lower number of points from each vessel. Adding more mainlines is a technique that benefits elements who need to decrease aircraft time on the FARP due to mission requirements. Though this technique increases the dependence on logistical infrastructure due to an increased reliance on maintenance of ground equipment, it renders the failure of a single point less impactful to the overall refueling plan. Since both techniques pose risks, the planning process necessitates constant dialogue between platoon, company, battalion, and aviation/sustainment planners to address mitigation techniques.

An additional limitation when setting refuel requirements during aviation operations is total flight time for pilots. Army Regulation 95-1, Flight Regulations, requires units to maintain a crew endurance policy. While the policy is unit dependent, common practice is to limit aircrews to 14 hours per duty day while performing flight-related duties, and to 6 to 8 hours of flight time without an extension, which generally requires O-6 approval.

The precise nature of air assault operations implies inherent risk, and extensions to duty day or flight time introduce fatigue and further increase the risk to the mission and the force. To avoid this constraint, three iterations of L2A2s in the 101st Airborne Division used the cold fuel process, where aircraft stopped their main engines to receive fuel, and reduced their flight time. This afforded the crews an opportunity to rest mid-mission, and effectively increased their alertness during their infiltration into the final objective, the most critical and dangerous part of the air assault. Under these conditions, cold fuel requirements are still time sensitive, and throughput is still one of the largest planning considerations, with the composition of the serial spending the least time shut down and total capacity determining the number of trucks required to support the mission. Cold shutdowns also feed into operational planning because they allow multiple landing-zone landings nearly simultaneously.

The final limitation planners face in large-scale aviation operations is the FARP certifying official. Doctrinally, there is no regulatory requirement that outlines which individuals in an organization can certify a FARP. Army publications such as Army Techniques Publication 3-04.17, Techniques for Forward Arming and Refueling Points, recommend that the aviation safety officer (ASO) or a "commander's designated representative" be the lawful certifying official. However, they frequently use qualifiers such as "should" and "may," indicating the techniques are preferred and not mandatory. As a result, the 101st CAB petroleum standard operating procedure, which permits the battalion safety officer, the ASO, or any command pilot designated by the battalion commander to certify a FARP, stands as the only regulatory document that appoints certifying officials.

Issues arise when non-aviation units seek to certify a FARP. Even in the aviation support battalion, a battalion organic to the CAB with its own aviation maintenance company, pilots in command are hard to come by, and FARP certification can become a significant point of friction if the appropriate personnel are not present before operations. This issue only compounds for non-aviation units as they look to exercise aviation refueling operations, since the only pilots in command within a brigade combat team belong to the brigade aviation element (BAE), who throughout planning are more than likely involved in acting as the liaison for their respective elements. Within the division sustainment brigade, the level of difficulty to coordinate certification only grows because no BAE exists to help coordinate aviation support, let alone self-certify. Due to the lack of regulatory requirements, non-aviation units seeking to support aviation operations should, and legally can, develop their own procedures to train personnel organic to their organization to certify FARPs.

While total capacity is a non-negotiable factor for planners at the brigade level and above, support units and aviators have flexibility in determining what risk is acceptable during FARP operations. Increasing unit capacity and limiting the number of mainlines at a FARP site are best suited for operations that require continuous, manageable throughput, such as massing friendly forces and assets onto an objective following the initial air assault, during reconnaissance operations where maintaining enemy contact is critical, or during continuous attacks on the enemy. The somewhat smaller footprint increases survivability, which is a critical consideration since a FARP supporting each of these missions would be nearest the enemy.

Increasing the number of mainlines, on the other hand, allows for larger serials to sequence through the FARP without having to wait for fuel. Thus, this is more suitable for heavy-lift aircraft, where fuel flow becomes a limiting factor, or for initial assaults into an objective when the ground force must meet its minimum force to complete its initial actions on the objective.

Hybrid options exist for support commanders as well, such as adding mainlines with relatively low additional unit capacity to a FARP, with a separate high unit-capacity mainline to facilitate maximum destruction and phased attacks as they transition to continuous attacks. In general, however, adding more mainlines is preferable in permissive environments because it enables more flexibility to account for broken equipment. The large footprint of this configuration, though, makes it less ideal for non-permissive or forward activity.

As the Army transitions its focus from counterinsurgency back to large-scale combat operations, aviation operations will continue to grow to meet demands of the division as it becomes the new unit of action. Sustainment leaders must produce thorough, deliberate plans that minimize friction during refueling operations to synchronize sustainment and movement and maneuver warfighting functions. Sustainment planners in the CAB must be aware of refuel limitations, how they affect operations, solutions to these limitations, and the risks that leaders assume in implementing each one. Sustainment leaders at echelon must synchronize their efforts to understand and mitigate limitations of total capacity, unit capacity, the number of points, refueling fuel flow, pilot duty day, and FARP certification. Leaders in the CAB and ground force must acknowledge these limitations and be receptive to potential changes they could drive in the scheme of maneuver. Indeed, the transition to the division as the unit of action will entail a level of coordination not practiced for nearly two decades, but this level of coordination will become necessary as aviation operations continue to grow in scale.


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***Featured Photo***
***Staff Sgt. Buddy Loo, left, and Sgt. Kenley Patadlas, both petroleum supply specialists assigned to Detachment 1, Alpha Company, 3rd Battalion, 140th Aviation Regiment, 103D Troop Command, Hawaii Army National Guard, refuel a UH-72 Lakota helicopter at Schofield Barracks, Hawaii, June 4, 2024. (Photo by Sgt. Justin Nye)***

# Increasing Aviation Warfighter Lethality:

## Creating Effective Accountability Programs for Cartridge-Actuated Devices and Propellant-Actuated Devices

A U.S. Army Soldier loads 30mm auto cannon ammunition on an AH-64E helicopter during the Combined Joint Fires Coordination Exercise at Kunsan Air Base, South Korea. U.S. Army photo by CPT Frank Spatt.

**By CPT Sarah L. Lebold**

### Introduction

The accountability of cartridge-actuated devices (CADs) and propellant-actuated devices (PADs) presents a frustrating administrative challenge for Army Aviation units. The June 23, 2021, update to Department of the Army (DA) Pamphlet (PAM) 700-16, Ammunition Management, added section 12-2f, which formalized the requirement for property book accountability of CADs and PADs (DA PAM, 2021b, pp. 59-60). While intended to enhance accountability and control, this directive demands a highly manual and labor-intensive process. Adhering to this directive requires significant administrative effort and conflicts with aviation maintenance regulations.

U.S. Army Soldiers receive and process CLV materials at the In-transit Munitions Facility, Ali Al Salem Air Base, Kuwait. U.S. Army photo by SPC Elorina Charles.

### Background

Cartridge-actuated devices and PADs are functional aircraft components essential for activating mechanical releases, fire extinguishing systems, and jettisoning canopies. They are categorized as Class V (CLV) items (ammunition) and require formal accountability per DA PAM 700-16 (DA, 2021b, pp. 59-60). Army Regulation (AR) 710-4, *Property Accountability*, requires these devices be identified on company property books by Department of Defense Identification Code (DODIC) and lot number (DA, 2023c, p. 52).

Cartridge-actuated device and PAD management is a highly regulated maintenance function. Operational loads are dictated by the quantity of aircraft and ordered by tail number. Typically, there are no spare devices unless requested and approved at echelons above brigade. A common practice for maintenance managers is to generate weekly reports and forecast monthly and annual requirements to the aviation support battalion for approval. Aircraft may not be fully mission capable if a device is not installed; thus, installation, accounting, and storage are critical due to restrictions on excess and ordering. Upon installation, maintainers generate maintenance records in the aircraft logbook cataloging DODIC, lot number, shelf life, and installation date. In summary, CADs and PADs are subject to stringent maintenance regulations that satisfy the intent of the prevailing property accountability regulation.

### Problem-Set

The primary challenges to maintaining devices on the property book are the inability to visually identify devices once they are installed and record keeping. While maintenance personnel keep meticulous records of CADs and PADs during installation for technical and safety purposes, these records are distinct from the records required for property book transactions. Records mismanagement post-CADs/PADs installation (i.e., loss of a DA Form 581 [2021a], *Request for Issue and Turn in of Ammunition*) will result in the line company's inability to conduct timely property book transactions and trigger a division-level AR 15-6, *Procedures for Preliminary Inquiries, Administrative Investigations, and Boards of Officers*, (DA, 2025) due to the loss/gain/mismanagement of CLV items per AR 710-4 (DA, 2023c, p. 42).

Compounding these difficulties is the frequent personnel turnover among key players preventing the development of consistent expertise and fostering a cycle of relearning. As a result, commanders and property book officers tend to prioritize CAD/PAD accountability only to the extent required by the current incentive structure, lacking the sustained understanding and dedicated resources to address the underlying complexities.

A 1st Combat Aviation Brigade, 1st Infantry Division Soldier, prepares ammunition for an AH-64D attack helicopter prior to aerial gunnery training at the Grafenwoehr Training Area, Germany. U.S. Army photo by Markus Rauchenberger.

### Steady-State Property Management

Effective CADs and PADs accountability requires a coordinated effort between the forward support company, flight company, aviation maintenance company, battalion and brigade S4 sections, and the brigade property book officer. When these elements are synchronized, accurate accountability can be achieved; however, the process remains resource intensive. The process relies on found on installation (FOI) and administrative adjustment report procedures. In turn, these procedures rely on providing evidence including DA 581s, photos, and maintenance records to demonstrate the issuance and turn-in of CADs and PADs that are already being accounted for within aviation maintenance and logistics lanes. These processes, while functional, were designed for more permanent property adjustments, and are demonstrably tedious and ill-suited for the frequent transactions inherent in CADs and PADs management. The reliance on these processes highlights the need for a simplified accountability system or policy adjustment that recognizes the unique challenges of tracking such technical aircraft components.

Each unit accounts for CADs and PADs differently: no devices on the book, some on the book, or correct quantities with inaccurate lot numbers. The various versions of accountability, and the inability to verify DODIC and lot numbers on installed devices make the data on DA Form 3161 (2023b), *Request for Issue or Turn-In*, untrustworthy. Thus, comprehensive CADs and PADs records are required during aircraft lateral transfers. In the absence of comprehensive records, company commanders are still expected to sign for the devices. Even if the gaining commander refused to sign for the CADs and PADs, they would still have to insert FOI “placeholders” onto the property book to attempt to meet the standard.

LTC Stephen M. Neppl conducts a site visit at Pōhakuloa Training Area, Hawaii, to review ammunition accountability operations during Joint Pacific Multinational Readiness Center activities. U.S. Army photo by Aaron DeCapua.

A company commander’s motivation in CADs and PADs accountability is largely dictated by the perceived cost of noncompliance. Property book transactions for these items are exceptionally tedious and time-consuming, requiring significant data correlation between paper and digital records. The AR 15-6 investigations triggered by discrepancies in CADs/PADs accountability are even more burdensome; they are resource-intensive, demand attention at multiple echelons, and are understandably avoided by commanders when possible. Additionally, in practice, these investigations rarely result in findings of negligence or misconduct—instead, they function as an additional layer of administrative processing to enable routine property book transactions. Given the substantial man-hours required for these investigations, even in garrison, the situation raises a critical question: If no one is ever held liable for mismanagement, and if the AR 15-6 process is widely un-

Army AH-64E Apache Guardian helicopter pilots fire a 30mm M230 cannon during Exercise Super Garuda Shield 25 in Baturaja, Indonesia. U.S. Army photo by SPC John Farmer.

derstood as a procedural formality, then what is the purpose of conducting these investigations at all?

As an S4, I led an effort to improve CAD/PAD accountability within our battalion. Collecting and reconciling more than 200 DA Form 581s from our forward support company with maintenance and property book data consumed 3 months, followed by 2 months of coordination with the brigade staff. Despite this investment of more than 150 man-hours per company, the resulting property book adjustments were immediately inaccurate and required further paperwork. The investigations ultimately took almost a year to resolve, by which time, aircraft had been transferred and devices replaced. This experience underscored that without a simplified process, this cycle of effort and limited results is destined to repeat and is likely occurring in formations across the Army right now.

## Corrective Action

The purpose of CLV accountability, above all, is safety. However, CADs and PADs accountability verges on overkill, resulting in redundant data collection efforts and disproportionate administrative burden without enhancing safety or reducing risk. Army Aviation maintenance programs are not only bound by arms, ammunition, and explosives storage policy, but also by AR 750-1, *Army Materiel Maintenance Policy*, (DA, 2023a) to catalog the same administrative information that is required by DA PAM 700-16 (DA, 2021b).

Therefore, I propose an Army Aviation standard that CADs and PADs are accounted for on property books by DODIC quantities alone. This adjustment will maintain command accountability per AR 710-4 and would support continuing monthly sensitive item inventories but would eliminate the costly and often performative "paperwork race" and investigations triggered by discrepancies in lot number tracking (DA, 2023c).

The maintenance activity will continue to adhere to existing regulations, which inherently limit fraud, waste, and abuse, and requires tracking administrative data for all devices by tail number. By streamlining property book procedures and focusing on quantity accountability, we can drastically reduce wasted manpower at echelon, allowing tactical leaders to prioritize their core mission—preparing the next generation of Soldiers. Without a standardized approach, this cycle of inefficiency will persist, needlessly diverting resources from critical training and readiness activities.

Biography:

CPT Sarah Lebold is a graduate of Tulane University, holding a degree in Cell and Molecular Biology. She is an AH-64 pilot and previously served as an attack battalion S4 in garrison and combat operations.

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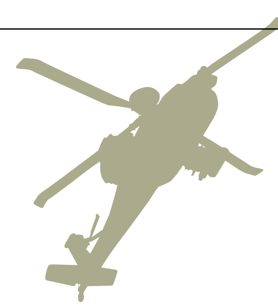


# *Rocket Men: The Epic Story of the First Men on the Moon*

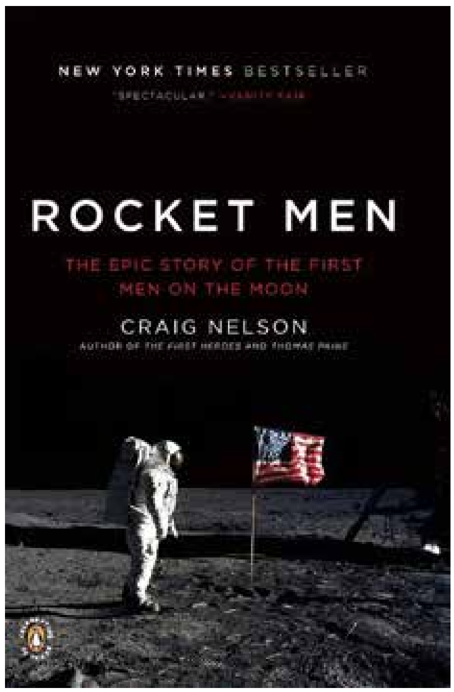
Author: Craig Nelson
Penguin Publishing Group; 2009; 432 pages

**A book review by Dr. Leonard S. Momeny**

Army Aviation recently celebrated the selection of one of its own to be a member of the National Aeronautics and Space Administration's (NASA) 2025 Astronaut Candidate Class, Chief Warrant Officer 3 (CW3), Joseph "Ben" Bailey. Mr. Bailey, an Army Warrant Officer, will no doubt contribute to NASA's bright future. There are many who would still be surprised to learn the U.S. Army had a significant role in contributing to the ultimate founding and creation of NASA. To learn more about the origins of NASA, there is no better book to explore than Craig Nelson's *Rocket Men*.

What makes this book so valuable to the modern aviator? Much of NASA's original work is focused on both aeronautical and astronautical pursuit, and this is always sure to capture an aviator's full attention. Also, there are few alive today who do not still marvel at the miracle of manned space flight and the work of NASA, whose origin can be traced to U.S. military test flight activities. After all, World War II is the moment in history when rockets really came into their own, and aircraft design was constantly turning over rapid advancements in performance and capability. Essentially, this was a remarkable period of defense capability development, and the world was shifting from tremendous conflict to global competition. That competition was really focused on command of the skies, and it played out throughout the Cold War.

The book opens with a discussion on the launch of *Apollo 11*, the mission that ultimately landed on the moon. However, by the middle of the book, the author explores the real origin of NASA and what many referred to as the Space Race. Nelson aptly notes that it would be more appropriate to call this period "the Space and Missile Race." This race primarily takes place between the United States and Russia, and while many were focused on the feats of astronauts, the worry




of leaders across the globe was on the capability rockets offered for bringing both satellite-based observation and weapons of mass destruction to nations across the world.

Nelson takes the time to cover Operation Paper Clip, a mission executed during the closing hours of World War II that would allow U.S. Army forces to secure a critical collection of then Nazi rocket scientists and bring them back to the United States. This mission would ultimately secure America's coming future in space-based capability. Their work, the V2 rocket, the world's first real ballistic missile, was brought back to Texas and eventually Huntsville, Alabama, integrating their science across multiple agencies.

While many have looked at man's journey to the moon through the lens of astronaut experiences, Nelson explores the topic from a position of peer nations jockeying for the new strategic high ground. The book really does explore the whole period through great power competition, demonstrating the unique relationship between government agencies, American engineering, and the boldness of all involved in aerospace pursuit. In fact, I am certain that many readers are sure to note similarities between the pursuit of legitimate rocket power and today's competition in areas like drones and artificial intelligence. Nelson paints a picture of interagency and government competition that eventually learns to focus their collective efforts with tremendous synergy.

Read *Rocket Men* to learn the history of NASA and also to better understand great power competition between peer nations. The lessons for the modern aviator and Soldier abound in this short work, as we are able to see the competition continuum (refer to Joint Doctrine) play out across the stage of modern history. *Rocket Men* will also bring any aviator a deeper appreciation for the process underlying technological growth in any aerospace endeavor. Finally, read *Rocket Men* to simply look upon the stars and consider just how far an aviator can go.

One of our own, CW3 Bailey, has shown us that all of Army Aviation is quite capable of contributing to the greatest pursuits possible. I invite you all to learn a bit more about his coming adventure through the exploration of NASA's history, and consider reaching for the stars yourself.

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Special Forces and Army Aviators conduct helocast training. U.S. Army photo by SGT Charlie Duke.

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*(Articles due 15 December 2025–Published on or about 15 February 2026)*

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