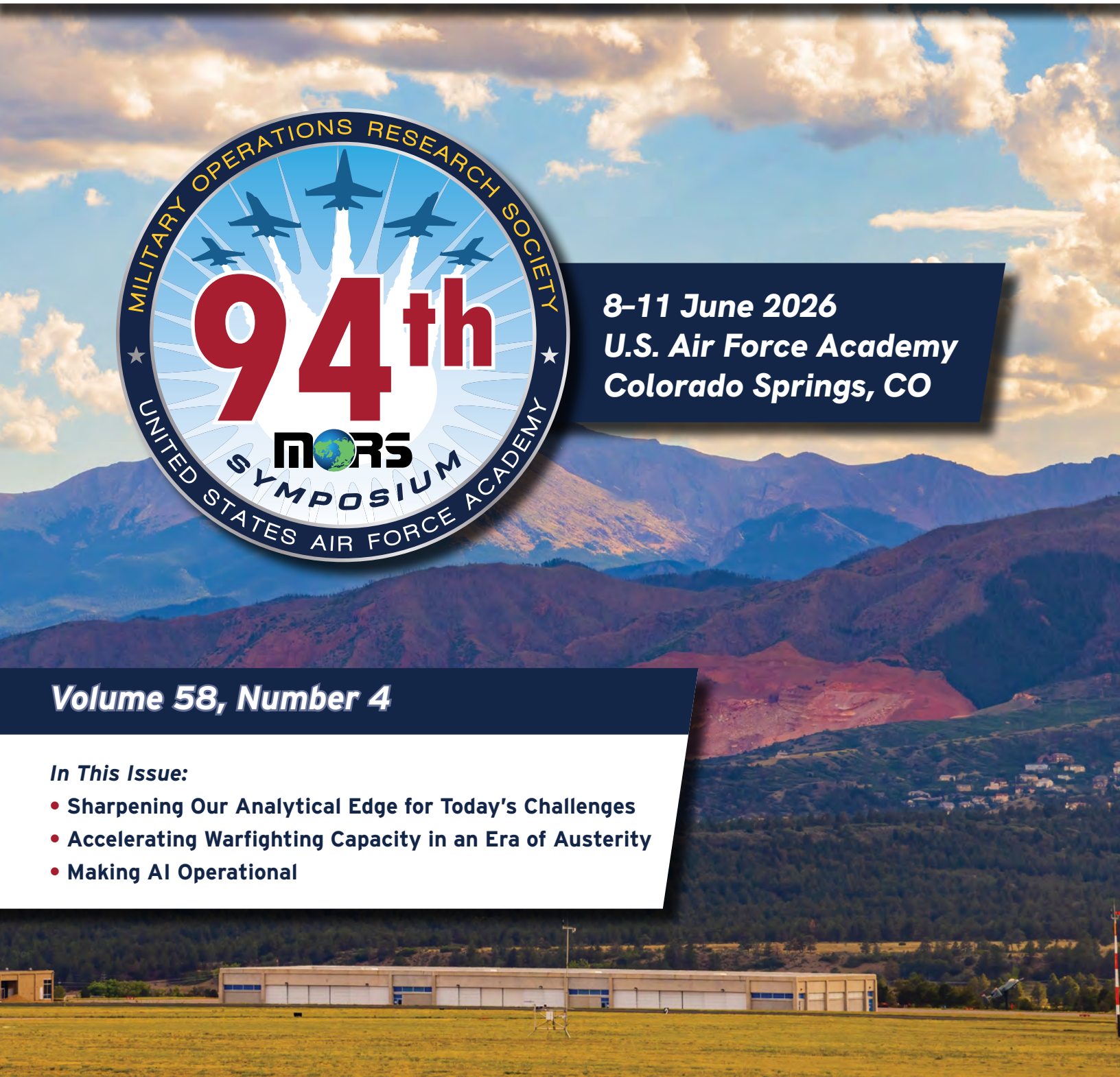
# PHALANX

The Magazine of National Security Analysis | Winter 2025




Volume 58, Number 4

*In This Issue:*

# In This Issue

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# [ The First Word ]

Mr. Harrison Schramm, *Phalanx* Editor

I'm writing this as the 2026 war in Iran is unfolding. This scenario—although perhaps not this exact iteration of it—is one that many readers of the *Phalanx* have studied and thought about for years. It is a difficult balance to strike when writing about current events/operations. One must be sufficiently specific to be of interest, but also with a broad enough eye to stand the test of future readings.

Military operations researchers are unique among scientists: physicists and engineers build experiments in order to test the quality of their theories; MOR practitioners develop their theories with an eye towards making them so good that they are never in fact tested. It is ironic, in a sense, to think that the goal is to build an aircraft so sleek, a submarine so stealthy, an infantry company so lethal, with mathematics and simulations so credible, that they are never tested in the real world. In that sense, fighting a war you have long studied represents a very subtle form of failure.

**When there is a war, study the war.** This was the maxim of my professor, friend and later fellow art critic Wayne Hughes. Failing to have prevented the war, the best thing that we can do is to study it. I have pretty much dropped whatever I was teaching my students to focus on OR applications to current events. If you had me in class you know I was never that big a fan of the syllabus anyway.

Studying the war means recounting not only the events, but the actions that led to them. Here we are straying from our technical roots and venturing into the world of Clausewitz, who proposed the 'trinity' as the mainspring of war: Passions of the people, Chance for the Military, and Reason for the Government. Future historians (likely, some of you!) will consider if this needs restating. To this end, I have challenged my students—and myself—to make a note today of how they think this conflict will end. Put it in an envelope, and keep it until it does. We very rarely do this type of 'backwards looking' analysis—but we should.

**Reason can be helped along by us.** It is our remit to quietly accept blame while not seeking credit, and apply the tools of our art to the conflict. Peace is the best thing. Paradoxically perhaps, a speedy conflict is the second-best thing. Those of us who have been around the block a time or two have experienced the heady days of early gains partnered with the grind of reality. Military power is like—to paraphrase William S. Burroughs—"The more you have, the more you use; the more you use, the less you have."

Harrison

PS: Your article is late!

# MORS PRESIDENT

# People. Partners. Profession. Sharpening Our Analytical Edge in Today's Challenges.

Mr. Nick Ulmer, President, Military Operations Research Society

In my first quarterly article, the focus was on honoring the past and celebrating 60 years of achievement. This quarter is firmly about the present, the work we are doing together, to meet today's national security challenges. The pace is fast, the problems are complex, and the demand for rigorous, relevant analysis has never been higher. Fortunately, this is exactly where MORS excels.

Across the Society, I see a community that continues to sharpen its analytical edge by investing in people, strengthening partnerships, and advancing the profession. Nowhere has that been more evident than in the extraordinary efforts of our volunteers and staff over the past several months.

In December, MORS successfully executed the Emerging Techniques Forum (ETF) under conditions that were anything but routine. Coming on the heels of the largest government shutdown in history, the ETF required flexibility, persistence, and no small amount of creativity. Special thanks go to Scott Cohick, who served as ETF chair and provided outstanding leadership, and to Systems Planning & Analysis (SPA) for generously hosting the event. Thanks to the dedication of our volunteers, committee members, speakers, and staff, the event delivered exactly what it promised: timely insight into emerging technologies and their application to real-world national security problems. That success is a testament to what this community can accomplish when it pulls together.

That same momentum continues as we look ahead. The 94th MORS Symposium at the United States Air Force Academy reflects the connection between analytical rigor, leadership, and service. The Academy setting reinforces our commitment to developing the next generation of analysts. The dedication and leadership of key volunteers, Kindra Bane (Chair), Trey Smith (Deputy Chair), Kathy Flynn (WG Chair), and Iain Cruickshank (Deputy WG Chair), make the symposium magic happen and drive our mission forward. They are exploring the addition of some new and invigorating options, sure to make the event even better.

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Continued from page 2

We're also expanding how we think about our community of analysts and decision makers with the launch of the Professional Gaming Society (PGS), a division of MORS. Professional gaming, including wargaming and analytical gaming, has long been part of the operations research toolkit. By growing and formalizing this community under MORS branding, we're creating an improved space for practitioners to share best practices, innovate, and integrate gaming more effectively into decision support. This is a clear example of sharpening our analytical edge by extending our reach and honing these methods to explore complex problems.


### *The 94th Symposium theme: "Sharpening Our Analytical Edge"*

Sharpening our analytical edge means continuously enhancing our ability to deliver precise and impactful analysis, which is crucial in adapting to evolving threats and leveraging new technologies. By fostering a culture of innovation and collaboration, we ensure that our insights remain at the forefront of operations research, driving success in both current and future endeavors.

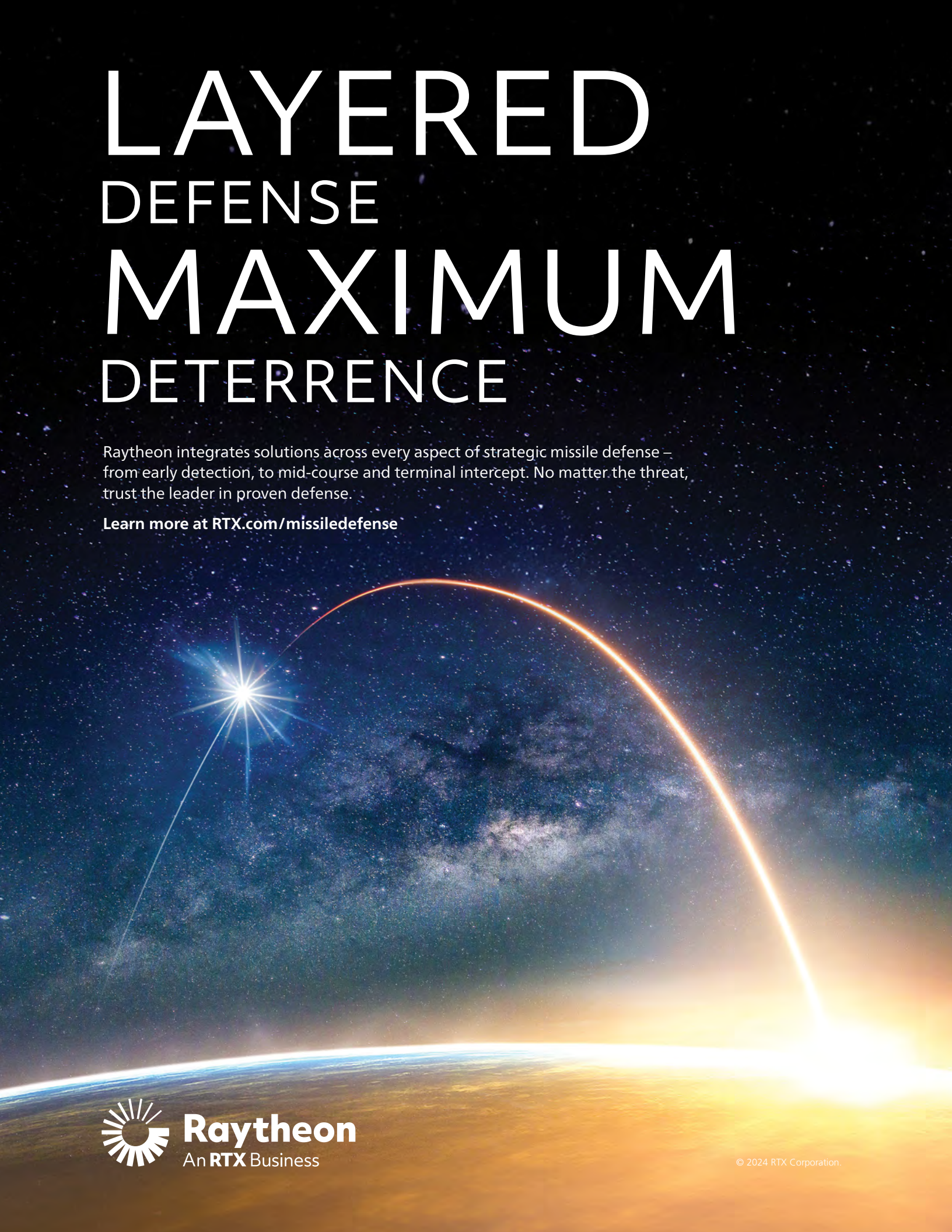
Another important near-term event is our upcoming Special Meeting on Artificial Intelligence, co-hosted by Carnegie Mellon University (CMU) and the RAND Corporation from April 20–23, 2026. This four-day event will feature two days at each site, bringing together leading experts and practitioners to explore how AI continues to reshape analysis, inform decisions, and manage uncertainty. The event offers a blend of hands-on tutorials, technology demonstrations, keynotes, and in-depth discussions designed to accelerate the integration of AI into operational practice for national security. Tracks will cover topics such as command and control, sustainment and logistics, warfighting and planning, critical infrastructure, kinetic and non-kinetic effects, intelligence and special operations, counter-AI, and business operations. The workshop is open to professionals from government, industry, academia, and international partners, and will include both unclassified and classified sessions. Participants will gain practical knowledge, exposure to real-world lessons learned, and opportunities for cross-sector collaboration, all aimed at advancing the use of AI-enabled capabilities for decision advantage in defense and national security. It also reflects MORS' commitment to engaging AI thoughtfully, rigorously, and responsibly.

This bias to action within MORS extends behind the scenes as well. With a surge of effort and enthusiasm, the MORS staff launched our new and improved website. Besides the visual improvements and ease of navigation, you will also find that it is more compatible with mobile devices. Community engagement and dialogue is now present on the page vice feeling separate and detached. All of this is also underpinned by a simplified backend where staff will be able to implement and make updates quickly and easily.

What ties all this together is a shared focus on the present moment. We are operating in an environment defined by uncertainty, rapid technological change, and evolving security challenges. Operations research analysts do not shy away from these conditions. We look for them. By being present in the moment and meeting today's challenges, we ensure that our work remains relevant, credible, and impactful.

This is where our core themes matter most. People are the source of our expertise and creativity. Partners across government, industry, academia, and international communities expand our perspective and reach. And our Profession provides the standards, ethics, and discipline that give our analysis meaning and trust. As you engage with MORS this quarter through events, courses, working groups, or informal connections, I encourage you to think about how your own work fits into this broader effort. Every model refined, every assumption challenged, every insight shared helps sharpen our collective edge.

This quarter is about action. It's about applying what we know, learning what we don't, and continuing to deliver analysis that matters when it matters most. And it's about doing that work together, as a community that understands both the responsibility and the privilege of supporting national security decision-making. People. Partners. Profession. Sharpening Our Analytical Edge in Today's Challenges.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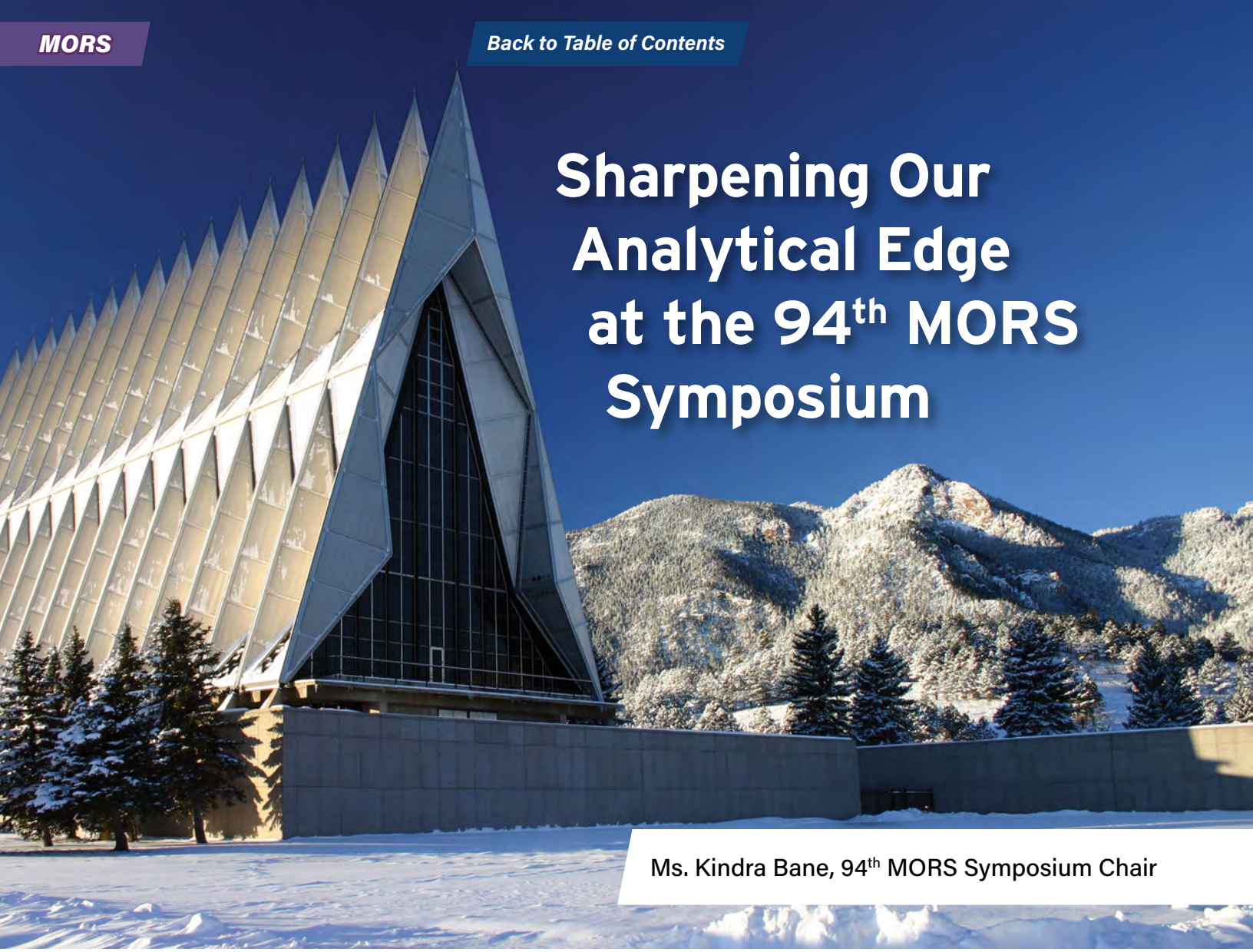
# Sharpening Our Analytical Edge at the 94th MORS Symposium



Ms. Kindra Bane, 94th MORS Symposium Chair

As the Program Chair for the 94th Military Operations Research Society (MORS) Symposium, I'm thrilled to share a preview of what promises to be one of the most content-rich, dynamic, and community-building Symposia in recent memory. Under the theme of "Sharpening Our Analytical Edge," this year's Symposium returns to the U.S. Air Force Academy in Colorado Springs, Colorado, June 8–11, 2026, bringing together roughly 1,000 national security analytics professionals from military, government, industry, and academia.

For six decades, the annual MORS Symposium has stood as the premier forum for exchanging insights, showcasing cutting-edge research, and addressing complex analytic challenges that shape national security decision making. From introducing emerging methodologies to strengthening professional networks, the Symposium continues to evolve and elevate the profession.

One of the defining features of the 94th Symposium is the sheer breadth and depth of its programming. We've purposefully designed a schedule full of learning and community celebration, ensuring every attendee finds opportunities to grow, connect, and contribute.

We're kicking things off with a full schedule of tutorials, hands-on demonstrations, and a Continuing Education Unit (CEU) course. These sessions are tailored to equip attendees with fresh tools and perspectives, whether you're exploring foundational subjects or diving into emerging analytic methods. As always, all Monday sessions are crafted to be interactive and applicable to your analytic work.

Tuesday's Plenary Session will set the tone for the week with a compelling keynote address from a distinguished

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leader in the national security analytics community, offering perspective on the challenges and opportunities shaping our profession. Immediately following the keynote, attendees will hear directly from several of our Symposium sponsors during a live panel Q&A. This session provides a unique opportunity to engage with organizations at the forefront of analytic tools, technologies, and support to the MORS community, fostering dialogue that connects strategic vision with practical capability.

This year's Symposium for the first time pairs the Wargaming Expo with the Tuesday afternoon networking social. Whether you're a seasoned gamer, an analyst curious about wargaming, or simply looking to connect in an informal atmosphere, this event will be the place to be. We highly encourage attendees to join the social, explore the expo, and engage with demonstrations that highlight creative analysis in action.

Across the heart of the week, our working groups will convene. With 35 distinct working groups on the agenda, covering topics from homeland security analysis to AI and autonomous systems, the Symposium offers unparalleled opportunities to share work in progress, explore new problem areas, and shape future research directions. These sessions, both unclassified and classified, are the engines of community insight and collaboration.

In addition to the core working groups, there are many special sessions that occur throughout the week on a variety of topics, and this year we are introducing several new topics and experiences designed to engage broader interests and spark interdisciplinary dialogue.

AI is rapidly pushing the boundaries of what's possible in operations research. Join us for a dynamic debate on *The Intersection of AI and Operations Research*, emceed by Lt Col Amanda Gustave. Our panelists will dive into the role of AI in national security, highlighting the biggest challenges and opportunities in a session designed to spark serious conversation.

Understanding complex systems lies at the heart of effective operations research (OR). To deepen this expertise, we have introduced this year a systems thinking series, led by C.J. Unis. This discipline cuts across traditional OR boundaries and highlights how integrated,

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(signed) Tina Yan, Director, Professional Development & Publications, MORS

holistic approaches can uncover insights that linear approaches may miss.

The Symposium also provides opportunities to honor excellence and foster community spirit. Wednesday evening's Recognition Dinner is one of the highlights of the week. Beyond celebrating this year's award and prize winners, we'll also recognize the installation of new MORS Fellows and commemorate MORS' 60th anniversary, a milestone that underscores six decades of analytic excellence and partnership. It's always a fun and memorable evening, fostering fellowship and appreciation across ranks and disciplines. Awards to be recognized include, but are not limited to, the Vance R. Wanner Award, Wayne P. Hughes Award, *MOR Journal* and *Phalanx* Editor's Awards, and Richard H. Barchi Prize, among others.

Wellbeing and camaraderie come together on Thursday morning with the Symposium 5K run/walk. Whether you're a competitive runner or simply enjoy a brisk morning activity, this event is a great way to kickstart the final day while connecting with fellow attendees outside the meeting rooms.

In an era where analytics increasingly underpins strategic decision making, there's no better place to stay current, expand your network, and contribute to your profession than the MORS Symposium. Whether you're presenting work, learning from peers, or participating in deep discussions on the future of operations research, this year's program is built to enable impact.

Attendees will find value in:

- Robust knowledge sharing across foundational and emerging topics.
- Practical training and upskilling through demonstrations, tutorials, and CEU courses.
- Dynamic dialogue and networking at social events and special sessions.
- Recognition of achievement and service within our community.

As we look forward to June 2026, I invite the entire community, seasoned practitioners and new analysts alike, to join us in Colorado Springs. The 94th Symposium is more than a conference; it's a chance to connect analysis with action, to learn from each other, and to sharpen our collective edge as analytic professionals advancing national security. For registration details, agenda updates, and more, visit the official Symposium page on the MORS website.

# Highlighting Women in OR and Their Achievements

***The Women in MORS Community of Practice is highlighting groundbreaking women in operations research (OR) past and present.***

## Ms. Carolyn Beatrice Parker

Ms. Carolyn Beatrice Parker was born November 18, 1917, in Gainesville, Florida. She was the eldest among her six sisters and a brother. Her father was a second-generation physician and pharmacist, and her mother was an educator. In 1938, Ms. Parker graduated from Fisk University, Magna Cum Laude, with a Bachelor of Arts in physics. She earned a Master of Science in mathematics from the University of Michigan in 1941.

At the height of the war effort in 1943, she left her work as an educator and became a research physicist in the Aircraft Radio Laboratory at Wright Field (later known as Wright-Patterson Air Force Base) in Dayton, Ohio. In her role, she tested the impedance, or resistance to alternating current, of radio antennae at different frequencies to efficiently match them to radio sets for aircraft. In a now-declassified report from February 1944, Parker and an engineering colleague detailed a new method for measuring the attenuation, or gradual signal loss, of short lengths of coaxial cable, used to carry radio frequencies between aircraft radio components. Since Carolyn had skills in the use of electronic testing equipment, infrared spectroscopy, and advanced applied mathematical techniques, she was soon recruited to begin work as a scientific employee with the Dayton project (part of the overall and much larger Manhattan Project) to produce the element polonium, Po-210, a radioactive material that would help to trigger the atomic bomb. In 1952, she worked as a research physicist at the Air Force Cambridge Research Center in Cambridge, Massachusetts. In 1951, Ms. Parker entered the physics graduate program at M.I.T., where she earned a second master's degree in physics in 1953 and completed coursework for a PhD. She was the first African American woman known to receive a graduate degree in physics. Ms. Parker was elected to the Sigma Xi Scientific Research Honor Society at M.I.T. However, she was unable to complete the process of defending her doctoral dissertation and graduating because she contracted leukemia, largely thought to be a result of her exposure to radiation during the Dayton project. A true "hidden figure," Carolyn Parker died in 1966 at age 48, and is buried at Mount Pleasant Cemetery in Gainesville.

## Ms. Nnenna L.I. Johnson, PMP

Ms. Nnenna L.I. Johnson is an operations research analyst employed by Headquarters Department of the Army (HQDA) Office of the Deputy Chief of Staff, G-4. She has exceptional problem-solving skills and greatly enjoys utilizing network and decision analysis to evaluate military studies at large. Ms. Johnson is an expert in providing insightful solutions to challenging obstacles by effectively communicating results within technical and non-technical

environments throughout the federal government. Ms. Johnson is currently leading the development of the Structured Visual Plan of Action and Milestones (POAM) system, a transformative framework that streamlines G-48 operations by standardizing effort categories, fostering transparency, enabling real-time status updates, empowering senior leaders to make data-driven decisions, and optimizing resource allocation to ensure alignment with strategic objectives. Ms. Johnson has a diverse technical and engineering background spanning over a 17-year career. Ms. Johnson obtained a Bachelor of Science in engineering physics in 2008 and a Master of Engineering in electrical engineering in 2010, both from Morgan State University (MSU). Ms. Johnson earned her Project Management Professional (PMP) certification in July 2024.

Ms. Johnson is a passionate advocate for women in national security, serving as one of the Community of Practice Committee Leads for Women in MORS and former Chair of the Team APG Federal Women's Program. She is dedicated to creating pathways for women in technical fields.

Ms. Johnson resides in Temple Hills, Maryland, with her husband, Michael, and daughter, Naimah Simone. Together, they enjoy traveling internationally and visiting historic landmarks.

**What is an aspect of your career that you are most proud of?**

One of the proudest aspects of my career has been leading several Resiliency Studies for the Department of the Air Force (DAF). Among them, the Maternal Health & Wellness Initiative (MHWI) holds a special place in my heart. I led efforts to investigate existing resources for pregnant and postpartum Airmen and Guardians, uncovering the absence of a comprehensive wellness program within the DAF. This study directly supported the CSAF and SecAF mission to modernize Air Force readiness and resiliency. I, with a close colleague, authored the first DAF-wide survey addressing barriers faced by over 16,000 members, helping give voice to women who too often felt unseen in policy. As the Co-Chair of the Women's Initiative Team (WIT) Third Line of Effort, I, alongside other teammates, helped drive change in female-specialized healthcare programs, policies, and entitlements—aimed squarely at removing barriers to equal opportunity within the Air Force healthcare system.

Another defining moment was being hand-selected to serve as a Strategic Partner with the Center for Army Analysis. While there, I was also chosen to deploy to Kabul, Afghanistan, alongside six other operations research analysts. We supported the Combined Security Transition Command and the Afghan National Defense Security Forces by conducting a table-top exercise to explore future force design concepts. It was my first deployment—and I will never forget the pride of standing beside other civilians and service members who shared my same passion, dedication, and unrelenting drive to meet the mission.

Beyond these professional milestones, I am deeply humbled to have been recognized as a three-time Civilian Service Medal award recipient over the course of nearly 16 years. Each medal represents not only my professional achievements but also my steadfast commitment to service, excellence, and community impact. Recognition in this manner is both an honor and a reminder of the importance of humility, teamwork, and purpose in everything I do.

**What are the key events that got you where you are now in your career?**

In 2016, I became the youngest elected Chair for the Team APG Federal Women's Program (FWP)—a defining milestone in my professional journey. Reporting directly to the Garrison Commander, I was entrusted to lead and advocate for the advancement of women across the federal workforce. Over my two-year term, I organized professional development events and training opportunities for more than 1,000 members, all free of charge.

That experience cemented my passion for empowering women and reinforced my belief that leadership begins with service. I made it my mission to inspire women to lead, to take up space confidently and unapologetically. I realized how vital it is to encourage women to shatter glass ceilings, to walk boldly down roads less traveled, and to never let society determine their value. Even today, in rooms where women are still underestimated, I stand as a reminder that we belong, we are capable, and we are more than enough.

Professional development and mentorship have remained at the heart of my purpose. Most recently, I have continued this work as a Committee Lead for the Women in MORS Community of Practice (CoP), where I emphasize the importance of women leading within the national security and operations research communities. Our CoP was established to recognize women's contributions and challenges, while also providing spaces for professional development, mentorship, and networking.

This work is deeply meaningful to me because it uplifts women analysts and ensures our voices are heard in conversations that shape our nation's future. These experiences collectively shaped the leader I am today—one who is passionate about creating pathways for others, breaking barriers, and ensuring that women are seen, valued, and celebrated at every level of leadership.

**What advice would you offer to young analysts?**

It all starts with you. You must first believe in your own power—believe that you can achieve anything you set your mind and heart to. Once that belief takes root inside you, speak it out loud. There is power in your words—the power of life and death lies in the tongue—so use them wisely.

Surround yourself with positivity and people who see your light, even when you forget it's there. Get involved. Join organizations that stretch your thinking and broaden your perspective. Seek opportunities to give back, because service doesn't just uplift your community—it refines you.

Most importantly, find your purpose. Once you understand why you do what you do, every challenge becomes a lesson, and every success becomes fuel for your next victory.

**Who are your role models?**

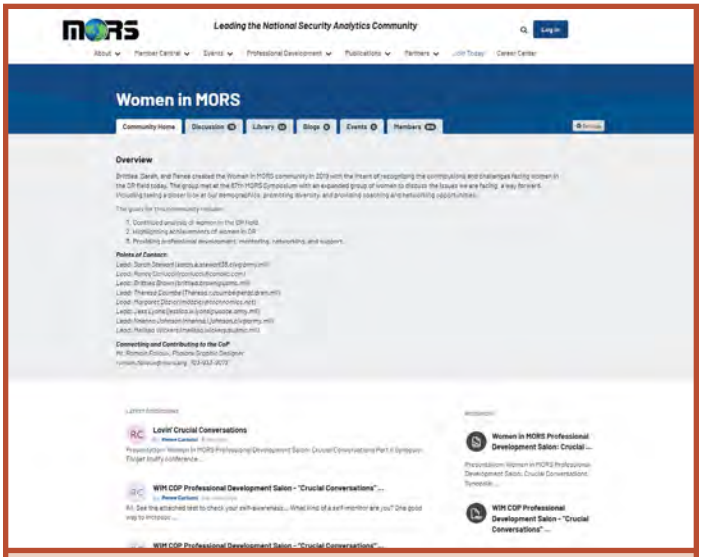
My greatest role models are the women in my family—strong, educated, faith-filled women who built their lives on perseverance and purpose.

Foremost is my mother. I was raised in a single-parent household by a woman who embodied grace and strength in equal measure. A highly educated woman with two degrees and years of service as an elementary school principal, my mom ran her school with elegance, compassion, and unshakable authority. She taught me that leadership is not about power—it's about service, integrity, and love.

When I was 17, she selflessly allowed me to attend Morgan State University, more than 400 miles from our home in Buffalo, NY. She never missed a milestone—every important moment, she was there. She has been my biggest supporter, my cheerleader, and my best friend. She introduced me to the love of God and taught me that with faith, all things are possible.

My grandmother and great-grandmother, both educators and college graduates, paved the way long before it was common for Black women to do so in the early 1900s. Their courage and intellect laid the foundation for the woman I've become.

I am, without question, the product of their strength—a legacy of women who refused to be defined by circumstance, and who continue to inspire me every day to lead with heart and purpose.




## *WIM Community of Practice Website*

A compilation of female MORS oral histories, past articles on historical and contemporary female OR trailblazers, as well as links to some of their work can be found on our WIM CoP website. We will be continuing to add to these, so please let us know if there is an analyst you'd like to see interviewed or someone from the history books you'd like to learn more about or whom we should include.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# ETF 2025 Marks a Decade of Innovation at MORS' Premier Forum

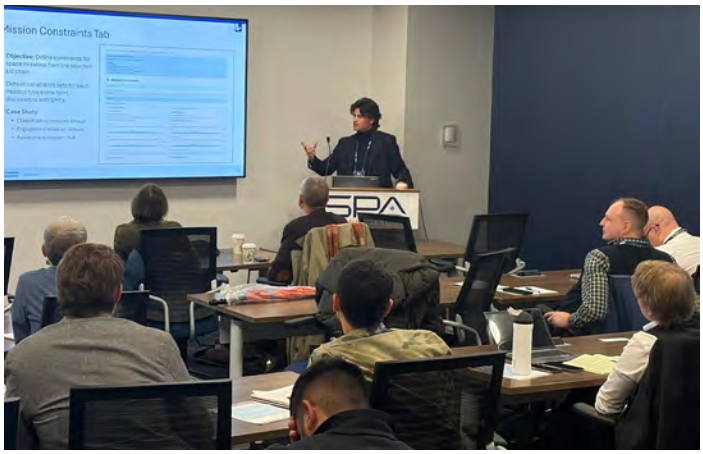
Mr. Scott Cohick, CANA, LLC

The Military Operations Research Society's 2025 Emerging Techniques Forum (ETF), held December 2–5 at Systems Planning & Analysis (SPA) in Alexandria, Virginia, celebrated its tenth anniversary. Despite a lengthy government shutdown that complicated planning, delayed speaker confirmations, and constrained travel for many government analysts, the forum achieved strong attendance with 96 registrants and 33 presenters. Their fortitude and unwavering support underscored the strength of the MORS community and ensured ETF's continued momentum into 2026.

The 2025 theme, "Models to Mission: Analytics for Complex Challenges," set the tone for a program that blended rigorous analytics with real-world relevance. Four engaging keynote speakers anchored the agenda and were complemented by two well-attended panels that drew strong participation from government, industry, and academia. On day two, the Senior Leader Panel attracted more than 50 attendees and sparked candid discussion about accelerating analytic tool development, integrating logistics and protraction-of-war considerations into campaign models, and strengthening analytic governance.

The Capstone Panel on day three provided a fitting close to the event, underscoring ETF's role as a venue where practitioners can explore emerging techniques in greater detail through extended 45-minute sessions.

Artificial intelligence emerged as a defining theme across the week, reflecting its expanding influence on national security analysis. Presenters emphasized the need for




*Mr. Guillermo Castro Martinez of Lawrence Livermore National Laboratory, during his presentation on Kill Chain Modeling of Planetary Defense Campaigns.*

transparency, verification, and responsible governance in AI-enabled systems, while several sessions highlighted the renewed relevance of Bayesian networks as interpretable alternatives to black-box models. Others showcased practical workflows for integrating AI tools into analysis, underscoring both the promise of these capabilities and the challenges analysts face in adopting them. The day-three tutorial, "Observability and Evaluation in LLMs and Agentic AI Systems," drew strong interest and reinforced attendee enthusiasm for more immersive, hands-on learning opportunities. Its focus on evaluating model behavior and improving system observability resonated with participants seeking to build confidence in AI-driven methods and pointed to a growing demand for expanded tutorial offerings in future ETFs.


*2025 Visco Prize winner Mr. Ioannis Nikas (center) poses with former Visco winners LTC Jaison D. Desai, Ph.D. (left, 2020) and Dr. Iain Cruickshank (right, 2021).*

The Visco Prize competition, established in 2019 to recognize early-career analysts for excellence in research quality, contributions, and presentation, continued its tradition of spotlighting emerging talent. Named for Mr. Eugene P. Visco, the prize honors junior analysts conducting impactful, technically rigorous, and original research that advances national security operations research. This year's Visco Prize winner, Mr. Ioannis Nikas of Group W (an SPA company), was recognized for his outstanding analysis and presentation, "Modeling Orbital Debris Effects on Satellite Operations Using Survival Curves for Campaign Analysis in STORM." His work exemplified the spirit of ETF and highlighted the growing importance of space-related analytics in modern campaign modeling.

ETF 2025's success was made possible through the hard work and dedication of the planning committee, volunteers, presenters, and the SPA team. Reflecting on the milestone year, ETF Planning Committee Chair Scott Cohick expressed deep appreciation for the community's commitment: "ETF 2025 succeeded because of the dedication and professionalism of this community. I'm sincerely grateful to our attendees, presenters, volunteers, and the MORS staff whose commitment and expertise made this year's forum both engaging and impactful."

MORS President Nick Ulmer added his perspective on the significance of the anniversary: "ETF in its 10th year continued to demonstrate benefits to national security and defense analysis, innovation, and collaboration. ETF serves an important role in MORS professional offerings each year and has become a favorite event."

As the MORS community turns its attention to June's symposium and ETF 2026, the success of this year's forum makes one thing clear: the need for rigorous, forward-leaning analytic engagement has never been greater. ETF's tenth anniversary underscored its essential role in shaping the tools, techniques, and conversations that will define the next decade of operations research.

# A Three-Pronged Approach to Accelerating Warfighting Capacity in an Era of Austerity

Robert "Chan" Swallow, Director, Program Assessment & Evaluation Office, SAF/SAE, Secretariat of the Air Force (SAF/SA), robert.swallow@us.af.mil

***"In the past, we often waited until a new capability was nearly perfect, rigorously tested to exacting standards prior to [operational] acceptance but today's contested environment requires a different risk model, because we don't have time as a luxury anymore."***

—Chief of Space Operations Gen Chance Saltzman at Air, Space and Cyber Conference, September 23, 2025

***"We must guarantee that tomorrow's Airmen inherit an Air Force that can win. . . . Just as important, we must shorten the time it takes to move from concept to combat power while empowering our innovators to move faster."***

—Chief of Staff of the Air Force Gen Kenneth Wilsbach, First Letter to The Force, December 10, 2025

***"Innovate faster than our adversaries, it's a rate of change thing. . . . Execute, execute, execute cost, schedule and performance."***

—SecAF Troy Meink at Air, Space and Cyber Conference, September 22, 2025

## Introduction

From the quotes above, clearly the pace of winning needs acceleration, yet annual interest payments on the U.S. National Debt exceed the Department of Defense's annual budget. U.S. government spending nearly always exceeds U.S. government revenues, steadily increasing the size of the U.S. debt. These two facts force the U.S. Armed Services to conduct their missions in austerity, which results in hard decisions of accepted risk. Simultaneously, the Armed Services must rapidly field warfighting capacity that addresses modern threats such that U.S. adversaries are deterred or defeated. How can the Armed Services accelerate in austerity?

Executing this mission requires a three-pronged approach consisting of operational risk management (ORM) across research, concept, acquisition, development, test and evaluation (RDT&E) to improve the pace of fielding warfighting capacity; enterprise risk management return on investment (ERM ROI) to assess tradeoffs in risk reduction options; and the assessment of the ability to achieve operational momentum (OM) as measured in large-scale exercises. OM is maintaining the initiative to lead vice react in the midst of Blue versus Red competition. This combined RDT&E ORM, ERM ROI, and OM approach must be rigorous, sustained, and contain an empowered feedback loop to force the adversary to react to being placed on the horns of multiple dilemmas. Simultaneously, Blue must

become proficient at reacting to the speed of change in warfare during austere defense funding epochs as seen and projected today.

Given this austerity, assessing risk in terms of RDT&E ORM, ERM ROI, and OM requires measuring production against the pace of the adversary both in time (faster), capacity (more), and funding selection (high reduction in Blue risk or significantly higher Red risk). Stating that you need to be funded to your strategy indicates a lack of understanding of the two fiscal facts presented at the start. The amount of funding will be fixed and insufficient, hence the need to optimize risk reduction and implement and exercise the highest valued solutions that accelerate OM, and then repeat and improve that process based on exercise or wartime results.

This combined RDT&E ORM, ERM ROI, and OM approach seeks to address several concerns noted in the U.S. military's actual production of warfighting capacity, especially across the emerging warfighting domains of space, cyber, and the electromagnetic spectrum. That said, nascent developments in autonomy and artificial intelligence have already changed the impacts of drones in the air, land, and sea warfighting domains. These concerns include fielding well after need; failure to field at all; ineffective partnering with industry; poor partnering with allies; difficult integration of bespoke capabilities; excessive classification burdens; slow testing, evaluation, adaptation, and fielding cycles; inability to scale solutions; and lack of effective integrated systems of systems digital engineering.

This article seeks to address the above concerns by describing the RDT&E ORM, ERM ROI, and OM approach; detailing areas of difficulty in the three-pronged approach, including the difficulty in differentiating ROI between risk mitigation options; and describing the value of achieving economies of scale by design. It concludes with how best to align this three-pronged approach with often changing strategies. If implemented, this three-pronged approach will enable the Joint Force to manage risk, including affordability, such that the services deliver the capabilities our warfighters need, in the quantities needed, when they are needed, to deter, defend, and win.

## RDT&E ORM Description

The U.S. military implemented ORM techniques to better achieve operational tasks with reduced risk to personnel and equipment. Units with an effective ORM culture build the process into daily practice. The key is knowing and communicating risk effectively in a systematic broadly accepted and used process. An air flight operational example is provided to illuminate how RDT&E ORM can succeed.

In "Service Acquisition Leaders: Why This Time Will Be Different for Defense Acquisition," published by *Breaking Defense* on January 5, 2026, senior defense acquisition leaders Gen. Dale White USAF, Lt. Gen. Robert Collins USA, Vice Adm. Seiko Okano USN, and Maj. Gen. Stephen Purdy USSF, underscore a fundamental shift in how modernization decisions must be made. The authors argue that acquisition reform hinges on a three-pronged approach:

- Modernization decisions must be treated as operational choices, not bureaucratic exercises. Acquisition success should be measured by operational outcomes, rather than compliance with legacy processes.
- Accountability must be paired with authority, recognizing that "true accountability requires that decision rights align with responsibility—you can't hold someone accountable for a race they're not allowed to run."

The article further emphasizes a deliberate rebalancing of risk, asserting that the Department must "accept acquisition risk to reduce operational risk," favoring 80% solutions delivered in two years over 100% solutions delivered in 10. In this construct, speed and adaptability become critical force multipliers, reflecting a conscious choice to manage and not avoid risk to deliver capability at the pace of modern conflict.

Air flight operational ORM example using a 100-point scale:

- Scoring rubric: Safe/routine is a score above 75, risky is 50 to 75, below 50 is high risk and abort or cancellation should be recommended and acknowledged up the chain of command. Flight Operations are scheduled for tomorrow.
- Weather: Conditions are bad with both low visibility, ice and high winds (–20).
- Human factors: The scheduled flight ops team is tired, newly assembled, and lacks proficiency (–20).
- Adversary interaction: Not anticipated (0).

- Equipment: The aircraft have all just come out of significant maintenance and require check flights (–20).
- Miscellaneous (includes communications): Ops are planned to include allies and partners (–5), comms have neither been established or practiced (–5).

The commander receiving a high-risk ORM score would then ask how to mitigate the risk. By delaying a day, weather will clear, comms can be rehearsed on the ground, the team can both rest and be plussed up with more experienced members, and the additional time can be used to get the aircraft cleared of their required post maintenance flight checks.

## Application of ORM to RDT&E

The following RDT&E ORM example highlights issues often seen while seeking to improve fielding of warfighting capacity:

- Delivery deadline: Routine (0); process small change same timeline (–5); process large change shorter timeline (–15); new process (–20).
- Human factors: Experienced team (0); blended team with significant experience (–5); inexperienced team of rivals (–20).
- Tech maturity: 1 miracle required (–5), 2 miracles (–15), >2 miracles (jump to high risk).
- Adversary interaction: Making rapid gains in achieving OM here (–10), dominating with OM here (–20). (For example, the British shipbuilding industry was a major concern for the Germans prior to and during WWI & II as the British typically built and fielded a counter to what the Germans were building to attempt to gain an edge in the same time periods.)[1]
- Miscellaneous (includes supply chain assessment, fragility, expense, and scalability assessment): Part availability poor (–5); very large cyber attack surface (–5); produces few expensive units slowly (–10); easily shared with allies and partners (+10).

In this RDT&E ORM, keep the following phrase in mind from Air Force Rapid Capability Office Director, SES William "Elvis" Bailey, "Don't build 9/10's of a bridge." Too often in systems of systems warfare, we effectively only complete 9/10's of a bridge.

A break Red's signals cryptology ORM example:

- Delivery deadline: Takes a year for Blue to develop and field (some track record (–5)).
- Human factors: Team turnover high (–10).
- Tech maturity: No miracles required (0).
- Adversary interaction: Expected new Red crypto will be in place in 18 months that will not be addressed by solution proposed thus short window of operational effectiveness (–10).
- Miscellaneous: Cost is high, other methods of signals intelligence available through human intelligence (–5).
- Total score: 70. Risky. If production slips, not worth it. Next would come the mitigation proposals and discussion.

If well implemented, leveraging the currently in place ORM culture, RDT&E ORM would drive earlier and higher accountability, enabling carried risk to be well understood and act as a forcing function across stove pipes to resolve challenges earlier. Examples resolved (or earlier well assessed cancellation of a program) might include unplanned requirements creep, software authorization (authority to operate) delays, supply chain delays, unforeseen cost growth, failure to achieve technical miracles on schedule, and unanticipated adversary interaction (say development of a countermeasure to what you were planning to field for example).

Value of the RDT&E ORM methodology: RDT&E ORM is easy for warfighters, acquirers, test and evaluators, assessors, and Congress to grasp, debate, and communicate. Importantly, it penalizes slippage that would come with new late requirement adds. The adversary interaction and emphasis on OM are too often overlooked in Blue fielding decisions, but RDT&E ORM will force and elevate those conversations. Additionally, RDT&E ORM provides credibility in ERM ROI calculations.

## ERM ROI Description

ERM ROI helps assess options to better explore opportunity costs. Many will recognize the risk assessment matrix in Figure 1 as a key step in grasping how Blue and Red strategies intersect. Not shown in Figure 1, but the reader should imagine where certain Red actions would

1. Krepinevich Jr., A. F. 2023. *The Origins of Victory: How Disruptive Military Innovation Determines the Fates of Great Powers.*

*Continued on page 20*

SEA LAND AIR SPACE CYBER

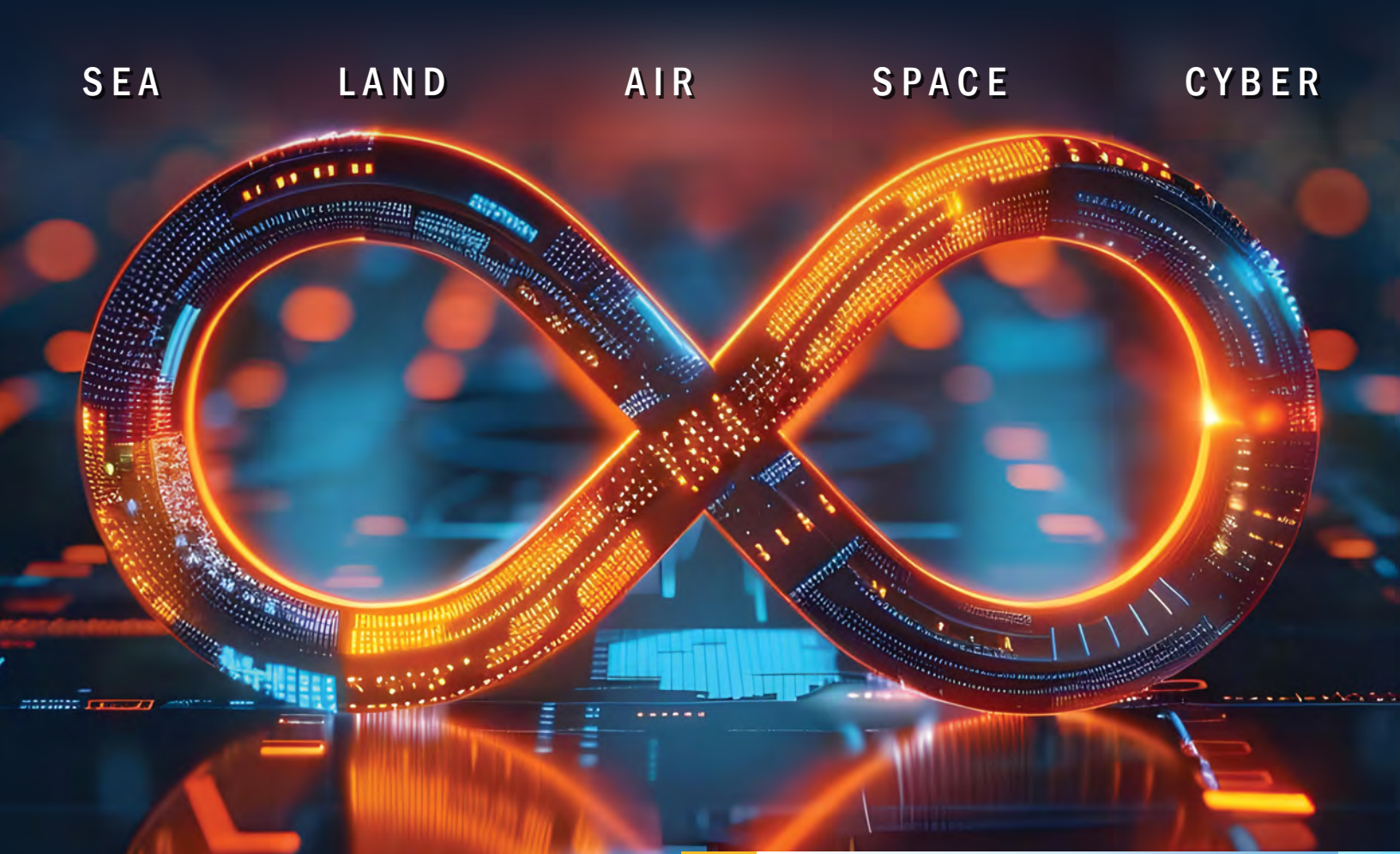


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**Figure 1. Risk assessment matrix**

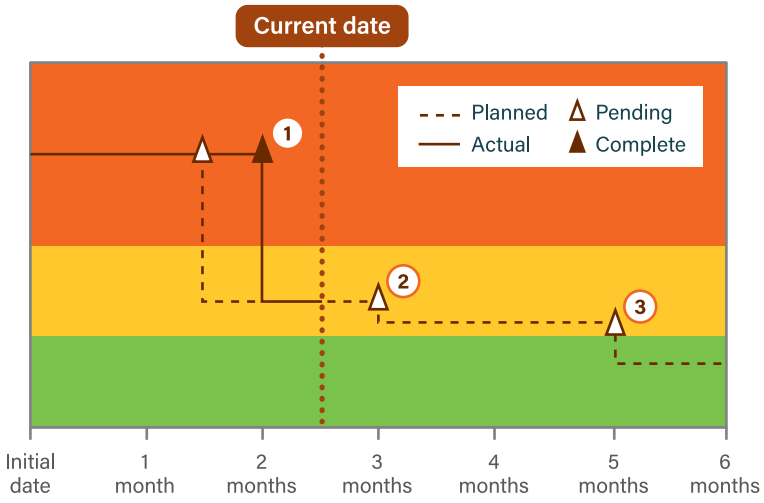
| Severity (Effect of hazard) | | Probability (Frequency of occurrence over time) A \| Frequent (Continuously experienced) | B \| Likely (Will occur frequently) | C \| Occasional (Will occur several times) | D \| Seldom (Unlikely; can be expected to occur) | E \| Rarely (Improbable; but possible to occur) |
|---|---|---|---|---|---|---|
| **Catastrophic** (Death, loss of asset, mission capability, or unit readiness) | I | | | | | |
| **Critical** (Severe injury or damage, significantly degraded mission capability or unit readiness) | II | | | | | |
| **Moderate** (Minor injury or damage, degraded mission capability or unit readiness) | III | | | | | |
| **Negligible** (Minimal injury or damage, little or no loss of mission capability or unit readiness) | IV | | | | | |

Risk assessment levels: Extremely high; High; Medium; Low

*Continued from page 18*

land on the matrix. Three examples: 1) use of nuclear weapons would be in block I, E; 2) while use of reversible nonkinetic cyber activities in space would land in block IV, B; and 3) operations like Ukraine's surprise deceptive drone attacks on Russian bombers launched from within wooden modular cabins trucked by commercial shipping to strategic locations would land in block II, C.

**Figure 2. Assessing risk management mitigation specifics**




(1) = Install higher efficiency magnets (static test results)
(2) = Improve generator power output (bench test)
(3) = Flight test of UAV

Taking the last example for illustration, the decision is made to mitigate the risk of drone attacks moved via commercial shipping. A team proposes multiple options to consider. Figure 2 provides a clear way to visualize that in order to reduce risk from red to green, it will take a total of five months to 1) install higher efficiency magnets, improve generator power output, and flight test the unmanned aerial vehicle (UAV). Multiple Figure 2 type possible mitigation proposals would need to be compared to grasp the RDT&E ORM risk including cost.

With the steps required leveraging Figures 1 and 2, the next step requires similar attention to detail. Consider Table 1's ORM ROI matrix.

Note, the data within Table 1 are made up, and provided purely to help convey the ERM ROI methodology. Sticking with the examples from Figure 1, consider Risk 1, 2, and 3 from the left-hand column of Table 1 to be the risks in block I, E (nuclear attack), block IV, B (reversible nonkinetic cyber attack), and block II, C (deceptive drone attack), respectively. The Likelihood column numbers would be refined, starting with Figure 1 block assessments. After doing the analytics required to defend three separate Figure 2 diagrams, the Consequence Cost column and Cost to Mitigate column data could be updated. The Risk Weighted Consequence column is just the product of Likelihood times Consequence Cost. In the Expected Return on Investment column, the left-hand term is the difference in Risk Weighted Consequence and Cost to

**Table 1. ERM ROI matrix**

| Risk | Likelihood | Consequence cost | Risk weighted consequence | Cost to mitigate | Expected return on investment |
|---|---|---|---|---|---|
| Risk 1 | 20% | $10M | $2M | $1M | $1M (1:1) |
| Risk 2 | 70% | $10M | $7M | $1M | $6M (6:1) |
| Risk 3 | 40% | $36M | $14.4M | $2M | $12.4M (6:1) |
| Risk 4 | 60% | $5M | $3M | $0.5M | $2.5M (5:1) |
| Total | | $61M | $21M | $4.5M | |

Mitigate. The right-hand term is the ratio of Expected Return on Investment to Cost to Mitigate. While the numbers are inherently uncertain and the services all employ cost estimators to reduce that uncertainty, the use of comparison to help drive the clarity of decisions is the real benefit of using the ERM ROI methodology as visualized in Figures 1–2 and Table 1. The RDT&E ORM methodology will keep the focus on elevating required decisions that come up in the ERM ROI process for quick resolution.

## OM Description

In competition, whether it's boxing, venture capital, chess, air combat, or spy craft, just to name a few of myriad examples, the ability to lead vice react is crucial. Only by leading can you keep your adversary on the horns of dilemmas. U.S. Air Force strategist John Boyd captures the concept of OM in the observe, orient, decide, act (OODA) loop.[2] He emphasized the need to accelerate the OODA loop at the strategic level. He stressed purposefully inserting confusion and disorder to slow the adversary's ability to think and grab OM back. Achieving both a faster OODA than your adversary and the ability to maintain that advantage, a faster OODA loop acceleration rate, remains a major driver in achieving victory. The value of the RDT&E community working in parallel with the operations (A3, G3, J3, N3, S3, etc.), Intelligence (A2, etc.), Logistics (A4, etc.), Command, Control, and Communications (A6, etc.), and training (A7 etc.) to test the speed of the OODA loop and the ability to gain and sustain OM in large-scale exercises cannot be overstated. History is replete with examples of strong forces training and testing new concepts and equipment against a worthy aggressor force prior to actual war as fundamental to fielding effective warfighting capacity. Only in large-scale exercises with robust empowered Red forces can the ability to achieve and sustain OM be appropriately assessed.

2. https://oodaloop.com/the-ooda-loop-explained-the-real-story-about-the-ultimate-model-for-decision-making-in-competitive-environments/

Some may wonder about the difference between the proposed three-pronged approach and DARPA's Heilmeier Catechism. The Heilmeier Catechism is similar in overall thinking, but does not have the structure, rigor, and repeatability of the RDT&E ORM, ERM ROI, and OM three-pronged approach.[3]

The Heilmeier Catechism consists of eight simple questions:

1. What are you trying to do? Articulate your objectives using absolutely no jargon.
2. How is it done today, and what are the limits of current practice?
3. What is new in your approach and why do you think it will be successful?
4. Who cares? If you are successful, what difference will it make?
5. What are the risks?
6. How much will it cost?
7. How long will it take?
8. What are the midterm and final "exams" to check for success?

3. https://the-learning-agency.com/insights/does-the-heilmeier-catechism-need-a-2-0-reflections-from-arpa-experts/

## Challenges in Using the Three-Pronged Approach to Highlight High ROI Mitigations

In assessing ORM, ERM ROI, and OM, one area to look at suspiciously is complexity.

"Complexity was often considered more reliable, but that, as Kiko Dontchev, SpaceX's vice president of launch, declared during a conference, was 'false. Oftentimes, the most simple thing is the best design, and the most reliable.

*U.S. Air Force crew chiefs perform post flight maintenance on the first F-35A Lightning II aircraft to arrive in Ceiba, Puerto Rico, Dec. 20, 2025. U.S. military forces are deployed to the Caribbean in support of the U.S. Southern Command mission, Department of War-directed operations, and the president's priorities to disrupt illicit drug trafficking and protect the homeland. (U.S. Air Force photo by Senior Airman Gabriel Jones)*

Complexity, we like to say, is the devil. Spending a lot of time optimizing, simplifying, and deleting parts from your product is critical.'"[4]

You might argue the SpaceX experience is too small of a sample size to apply in risk reduction. My experience in 40 years of military service, especially with tired young people working under exceptional stress, aligns with the Prussian military theorist Carl von Clausewitz, in *On War*, published in 1832: "Everything in war is very simple, but the simplest thing is difficult."

When the entire team thinks with an RDT&E ORM, ERM ROI, and OM mindset, risk is properly assessed, understood, communicated, mitigated, or accepted.

Another area of difficulty is how to fill out the data for the ERM ROI tables. Using the drone example, do you include in the costs the damage caused by the drones to the civilian infrastructure as well as the military infrastructure? Do you have costs of surrender near infinity? Do you measure the costs of the weapons, plus the costs of the delivery platforms, logistics costs, logistics vulnerability, plus the training and acquisition costs? Some could convincingly argue that by choosing how you bound the problem set you control the answer. The most effective way ahead, typical for effective operations analysis, is that you must bound the problem in a defendable and repeatable manner that helps drive decisions, then iterate to a better answer with exercises and real-world examples including historical data from both U.S. and other nations' wars. Consistency of approach helps in ERM ROI, just as the advantages of a recognizable and repeatable ORM process is understood and has become part of the Armed Services culture. In ORM, the warfighters do not quibble over exact numbers but instead focus on safety with the goal being how to mitigate risk when required. Just executing ORM reduces risk because the very effort of assessing risk highlights risk, making it less likely, like steel sharpening steel.

4. Davenport, C. 2025. Why SpaceX and Elon Musk Keep Winning in Space and with NASA, *Washington Post*, September 21, p. B12.

*Continued on page 24*

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Similarly, how much value should OM be given in the final decisions regarding tradeoffs? As noted above, part of this tradeoff evaluation can be sensed in large-scale exercises and actual war results. For example, going back to the United States versus England in the Revolutionary War, the British attempted to control the initiative, but General Washington chose to retreat into the countryside picking when and where to expose his forces. Guerilla warfare, by design, provides OM to the weaker side when conducted effectively. Conversely, achieving OM against an indigenous force over an extended period requires significant logistics, equipment, and personnel costs, which must be included in the assessment of ROI for that operational approach. Vietnam (French and U.S.), Iraq, and Afghanistan (British, Soviet Union, and U.S.) are six examples of this dynamic. Admiral Nimitz's use of two staffs working in parallel, one planning while the other executed, with just one fighting force, exemplifies how the United States kept Japan from regaining OM after losing the momentum in the Battle of Midway.

*U.S. Air Force Staff Sgt. Matthew McKoin, 332nd Expeditionary Maintenance Squadron aircraft structural maintenance technician, holds a hydraulic line for the main landing gear selector valve of an F-15E Strike Eagle aircraft in the U.S. Central Command area of responsibility, Jan. 28, 2026. The automated system streamlines tube fabrication for aircraft maintenance operations. (U.S. Air Force photo by Senior Airman Kari Degraffenreed)*

Another difficulty is fully funding a strategy. Funding deception without funding intelligence gathering of adversary reactions to deception ahead of time would be a poor use of funds. Funding offensive cyber without funding cyber intelligence gathering prior to need would be a similar blunder. If the Space domain is your path to victory, funding terrestrial and on orbit space defense is required. One of the purposes of the three-pronged strategy's focus on OM is to highlight the value when the funding stays in place long enough to get the desired OM acceleration. Pulling the funding early will have the opposite effect. The three-pronged approach should help determine where the "knee in the curve" exists, allowing the service to deliver meaningful incremental capabilities that may not fully address formal requirements but rapidly offers interim solutions that significantly and affordably close risk gaps.

A final difficulty in the three-pronged approach is selecting which strategies to pursue and blunt in austerity. This difficulty is addressed in the conclusion.

## Conclusion

> ***"Victory smiles on those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur."***
>
> —Italian General Giulio Douhet, circa 1921

In a Government Accountability Office (GAO) report, issued in December 2025, directed to all services, the GAO prescribes solutions that align with the three-pronged approach: "GAO's analysis of DOD-wide test and evaluation policies found they [the Services] were not fully consistent with selected leading practices for product development as applied to test and evaluation: Involve testers early, conduct iterative testing, use digital twins and threads, and obtain user feedback iteratively," "Revisions should require involvement of testers in acquisition strategies."[5]

To optimize risk reduction in austerity, a thorough assessment of both U.S. (Blue) and adversary (Red) strategies of victory and blunting must be conducted. As then Chief of Staff of the Air Force General David Allvin directed, our challenge is to "learn, iterate, execute, make

5. To field weapons quicker, Pentagon should improve testing and evaluation processes: GAO
*Breaking Defense, 11 Dec 25* by Ashley Roque
https://breakingdefense.com/2025/12/to-field-weapons-quicker-pentagon-should-improve-testing-and-evaluation-process-gao/

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# INTEGRATED DETERRENCE BEGINS IN SPACE

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*A U.S. Air Force F-15E Strike Eagle F100-PW-229 engine undergoes diagnostic testing at Mountain Home Air Force Base, Idaho, Feb. 5, 2026. Engine tests are vital to verifying that the F-15E Strike Eagle performs at peak efficiency, which is integral to the 366th Fighter Wing's mission readiness. (U.S. Air Force photo by Senior Airman Grace Turpin.)*

*Continued from page 24*

mistakes, move those lessons forward . . . follow through and fix those failures."[6] This is particularly difficult as each Service will seek to elevate its strategy to fund the sustainment and growth of its Service. OSD CAPE and the Joint Staff can help narrow to a focus by emphasizing taking away the cheapest and easiest paths of victory for the adversary, while funding the cheapest and easiest paths to victory for Blue. Here the operations analyst would examine Red and Blue assets in multiple strategies to discover which combinations are most desirable for Red and Blue and in what strategies. The use of sensitivity analysis to grasp the proper takeaways will require adept modeling and simulation. Important in this kind of analysis is the assessment of the value and likelihood of support from allies and partners. With the United States comprising only 4% of the global population, getting into a protracted conflict without partners could rapidly bankrupt the war effort and nation. Importantly, the operations analysts must ensure all phases of war are assessed, not just "seize the initiative." Otherwise, the tradeoffs and opportunity costs or ERM ROI will be misleading, and the importance of maintaining OM will be incomplete because the Blue forces being assessed will be overfitted to that one part of the warfighters task.

Further, the United States must train to rapidly adjust risk tolerance like a rheostat to accelerate innovation and deliver warfighting capabilities ahead of need. The United States is testing and fielding capabilities for Ukraine with much greater risk to the operator because those operators are already in harm's way. The United States must have the ability to turn the risk rheostat quickly. Consider rapidly entering a war with Russia or China, which have a higher

6. Air, Space, and Cyber Conference, September 22, 2025

*Continued on page 28*

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tolerance for heavy losses than the United States or its allies. For example, since invading Ukraine four years ago, Russia has shown a high tolerance for casualties with approximately 1 million wounded and killed. For comparison, from October 7, 2001, through January 30, 2025, the United States has suffered fewer than 61,000 casualties in Middle East operations. In about seven times less time, the Russians have accepted more than 16 times the casualties.[7] The United States must practice turning the risk rheostat in RDT&E, and production, to a commensurate level as the risk to be faced by the U.S. warfighters engaging the enemy. Failure to practice this commensurate risk balancing will result in too much risk being accepted by our operators forward. Often this appropriate risk balancing costs nothing, requiring changes in policy and regulations, protocols, and procedures.

If implemented and executed across the Joint Force, and with allies and partners, the three-pronged ORM, ERM ROI, and OM approach will systematically enable the Blue coalition to maximize austere budgets to reduce risk, maintain momentum, and win. First steps should include properly funding cyber, electronic warfare, space, and drone Red teams. These Red teams will help the Joint Force quickly grasp vulnerabilities in these domains, acknowledging and elevating problems, following the successful U.S. Navy campaign methodology to correct aircraft availability, with "Get Real, Get Better" initiated by Chief of Naval Operations Adm. Mike Gilday in 2022.

In execution, "Get Real/Get Better" drove transparency, trust, and alignment, winnowing out the "talking heads" by forcing everyone to come to the table with predictions on how many fully mission capable (FMC) aircraft they would have in the next period and why. Those who missed their predictions and could explain why kept leading. Those who missed and had no idea why they missed . . . moved on. Brutally honest—brutally transparent—true team learning—and rapid adjustments to the environment resulted in rapid improvement of FMC rates.

The time for complacency ended when the People's Republic of China accelerated past the United States in their modernization of anti-access capabilities, placing the Joint Force on the horns of dilemmas. As an example, U.S. Space Command Commander Stephen Whiting stated that cyber is the soft underbelly of the U.S. Space enterprise.[8] Only by changing our trajectory in the rapid fielding of warfighting capacity and then accelerating past the PRC with high ROI execution can those horns be reversed. Forceful execution of the three-pronged RDT&E ORM, ERM ROI, and OM approach in today's fiscally constrained environment offers a defendable, repeatable process to regain strategic operational momentum. Normal bureaucratic processes will fight conversion to the three-pronged approach. Decisive sustained senior leadership is required that emphasizes the ORM culture, quantitatively balances risk and reward at pace, and achieves OM across strategic priorities.

7. U.S. Department of Defense Casualty Status as of 10 a.m. EST Jan. 30, 2025. https://www.war.gov/casualty.pdf accessed 29 Sept., 2025.

8. Air, Space, and Cyber Conference, September 24.

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# Making AI Operational: The Army's New Technical Career Path

Major Iain Cruickshank, Colonel Nicole Curtis, Colonel Chris Eastburg, Major Bethany Dumas, and CW4 James Yantis, United States Army

Leaders across academia, industry, and the military consistently recognize artificial intelligence (AI) as critical to deterring and winning future conflicts.[1] Military experts broadly agree that the nations that best leverage AI will dominate future battlefields, whether through faster decision cycles, more efficient logistics, or enhanced surveillance.[2] As such, contemporary militaries are racing to develop new AI capabilities to gain a technical and operational edge over their competitors.

Yet, AI does not deliver capability to commanders by itself. Instead, it often involves intense collaboration between academia, commercial, and defense sectors. To translate innovation into operational advantage, the U.S. Army requires a dedicated cadre of AI professionals capable of building and maintaining AI-enabled systems and their constituent machine learning (ML) models to deliver innovative and tailored capabilities.

In this article, we detail the forthcoming creation of the AI/ML officer career path for the U.S. Army. We begin by exploring why a dedicated career path for AI/ML professionals is necessary. We then outline the composition of such a career path and its contributions to military commands to inform commanders. Next, we examine how AI/ML officers operate and their relationship to other Army career fields in delivering AI solutions. Finally, we conclude with considerations for the future direction of AI/ML professionals in the U.S. Army.

## Why Do We Need an AI/ML Functional Area?

With the proliferation of AI capabilities, paired with more powerful computational resources from cloud providers and portable servers at forward headquarters, decision cycles are rapidly condensing. The potential implications include faster targeting cycles, reduced bias in intelligence analysis, and rapidly conducting course of action modeling based on new reporting. Such benefits are not created without a dedicated workforce, and the Army cannot afford to rely on ad hoc, redundant, or disjointed solutions.

Delivering these capabilities requires professionals who can not only build AI models but deploy and sustain them in austere, disconnected, and security-constrained environments. As such, creating ML models and maintaining AI-enabled systems requires a distinct set of technical skills spanning multiple traditional disciplines. The 2023 Data, Analytics, and AI Adoption Strategy specifically calls for the expansion of digital talent management with

1. Burdette, Z., et al. 2025. An AI Revolution in Military Affairs. Working paper, RAND. https://www.rand.org/content/dam/rand/pubs/working_papers/WRA4000/WRA4004-1/RAND_WRA4004-1.pdf
2. Department of Defense. 2023. *Data, Analytics, and Artificial Intelligence Adoption Strategy*. June 27. Washington, DC. https://media.defense.gov/2023/Nov/02/2003333300/-1/-1/1/DOD_DATA_ANALYTICS_AI_ADOPTION_STRATEGY.PDF

the Department of War, through hiring, training, or retaining trained personnel.[3] Furthermore, recent service-wide change initiatives, like the Army's Transformation Initiative, directly highlight the need for both uniformed and civilian AI professionals in the Army.[4] Having a dedicated cadre of AI/ML professionals, both uniformed and civilian, is a critical component of delivering AI solutions for a military.

Currently, no Army branch or career field is doctrinally tasked, trained, or structured to develop, field, and sustain AI-enabled capabilities. Some branches have modernized to use AI/ML tools (e.g., Military Intelligence, Signal) or provide limited software support (e.g., cyber capability developers), but these efforts address branch-specific needs rather than enterprise AI capability. Across the force, units are improvising their own solutions by forming ad hoc "data teams" or "innovation cells" staffed with personnel who happen to possess technical skills. The result is a patchwork of uneven capability, resourcing, and expertise.[5] Such a situation is hard to maintain and scale.

Consider a potential scenario: a division or corps G-2 requires AI-assisted fusion capability faster than the Army can adjust budgets, finalize a contract, and adjust a commercial solution, which can take multiple months or even years. To meet the immediate demand, the staff assembles a contractor, a Signal officer with Python skills, a warrant officer with domain expertise, and an operations research/systems analysis (ORSA) analyst—none trained to work together on AI systems, and all scheduled to rotate within two years. When replacements arrive, inconsistent skills and training lead to degraded performance or extended on-the-job learning. This approach cannot sustain the AI capabilities that future operations demand. While it remains important to upskill personnel across career fields to operate AI-enabled systems,[6] general training alone will not generate the specialized expertise required to build, adapt, and maintain them.

Currently, the requisite skills for delivering AI/ML solutions from concept to deployment most closely align with ORSA Functional Area 49 (FA49). ORSA officers possess deep quantitative and qualitative analytic skills, such as simulations, statistical modeling, optimization, and wargaming. While FA49 holds the preponderance of AI/ML talent within the Army, the generalist 49A designation does not require the technical competencies essential for operational AI capabilities: software development, ML engineering, DevSecOps practices, cloud architecture, and production system maintenance.


*U.S. Army Staff Sgt. Karen Najera, a current operations intelligence noncommissioned officer assigned to U.S. Army Southern European Task Force, Africa (SETAF-AF), conducted a wargaming event as part of an ongoing deployment readiness exercise at Caserma Del Din, Vicenza, Italy, Sep. 3, 2025. The wargaming phase, part of the joint planning process, utilized artificial intelligence tools to stress-test the command's response to real-world crises. It was a critical step toward innovating and validating SETAF-AF's joint task force capabilities. (U.S. Army photo by Brian Andries)*

Previous attempts to identify and manage AI/ML talent within ORSA proved insufficient. The R1J position description supplemental identifier (PDSI) suffered from misaligned skill definitions as it only identified officers with general data science skills and not ML engineering skills, and had inconsistent award standards for awarding the designation.[7] Without a dedicated career field, the Army cannot effectively identify, recruit, develop, and retain AI/ML professionals, leaving commanders dependent on ad

3. Ibid.
4. U.S. Department of the Army. 2025. *Army Transformation and Acquisition Reform*. May 1. Washington, DC. https://media.defense.gov/2025/May/01/2003702281/-1/-1/1/ARMY-TRANSFORMATION-AND-ACQUISITION-REFORM.PDF
5. Cruickshank, I. 2023. An AI-Ready Military Workforce, *Joint Force Quarterly*, Vol 110 (3rd quarter), 46–53. https://ndupress.ndu.edu/Media/News/News-Article-View/Article/3449468/an-ai-ready-military-workforce/
6. Ibid.
7. U.S. Department of the Army. 2018. Notification of Future Change to DA PAM 611-21, P-1810-05, Establishment of Personnel Development Skill Identifier (PDSI) R1J (Data Scientist). February 2. Department of Defense, Washington, DC.

hoc solutions that dissolve with every permanent change of station (PCS) cycle.[8]

Meanwhile, operational demand for AI/ML expertise continues to accelerate. Commands across all warfighting functions, from intelligence fusion to logistics optimization, increasingly rely on AI capabilities. Recent conflicts in Ukraine and Gaza have demonstrated how AI systems sort, link, and enrich battlefield data to deliver enhanced situational awareness. As LTG Anthony Hale, the Army G-2, noted in 2024, AI has significant potential to support intelligence analysts through improved data selection and fusion.[9]

*Maj. Matthew Martinez (right), Combined Arms Doctrine Directorate information management officer, explains how to find a historical vignette using a generative artificial intelligence tool to Lt. Col. Kellan Travis, CADD Tactics Division doctrine author, Feb. 17, 2026, at Fort Leavenworth, Kansas. CADD authors are incorporating the use of Gen AI and other digital tools to improve processes and speed delivery of doctrine products to the force. Photo by Randi Stenson.*

This convergence of insufficient talent management and growing operational demand creates an unsustainable gap. Assigning generalist ORSAs to temporary AI/ML roles cannot meet Joint Force requirements. The specialized education, hands-on experience, and continuous learning required to deliver AI/ML solutions, combined with the field's rapid evolution, make part-time proficiency impossible. The Army needs a dedicated cadre who focuses exclusively on AI/ML capability development and sustainment: the 49B AI/ML officer and 490B AI/ML operations warrant officer.

## What Will the AI/ML Functional Area Personnel Do?

Before describing the 49B AI/ML officer and 490B AI/ML operations warrant officer work roles, two foundational principles must be established.

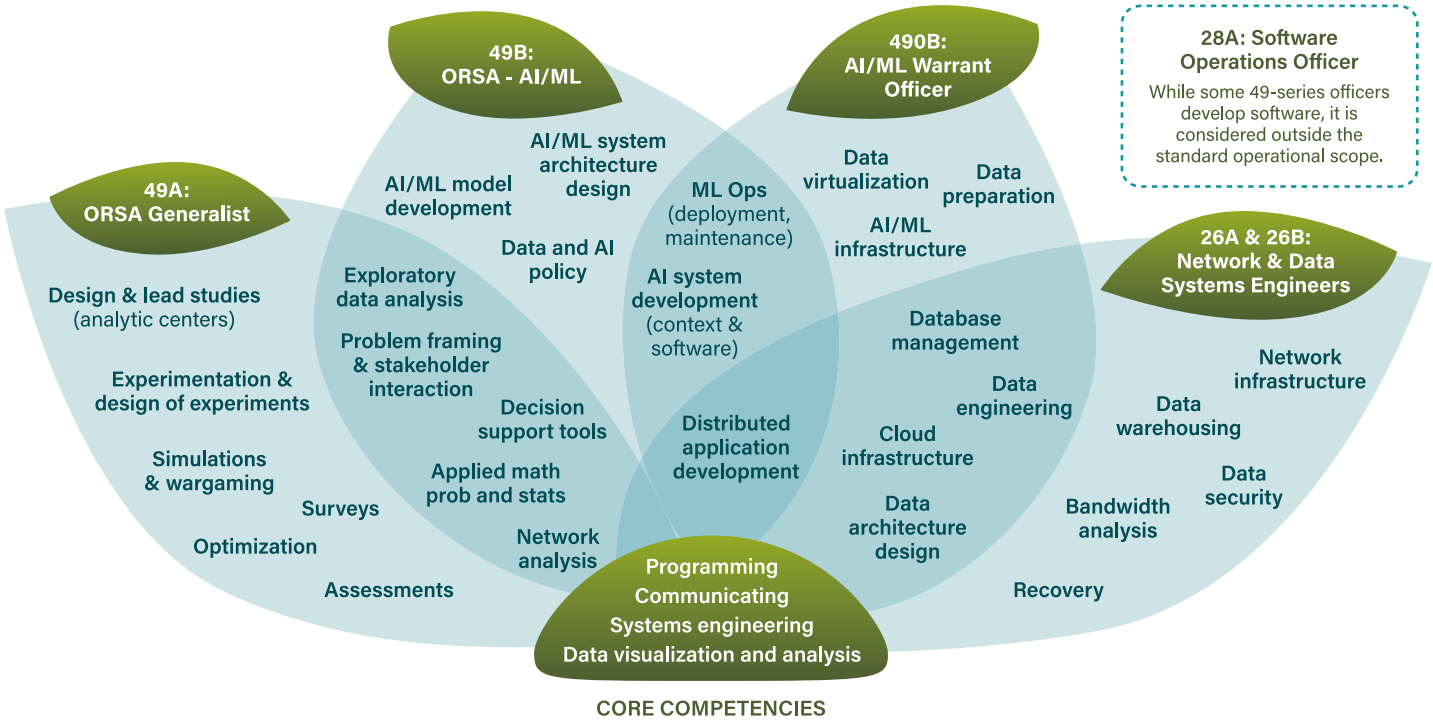
First, 49B/490B personnel must deliver operational capability. They are not executive officers, night battle captains, nor do they operate S6 help desks. They build and maintain AI systems that directly enhance unit lethality and effectiveness. To be effective, they must be positioned at echelons where they can implement solutions and integrated with staffs to address specific operational challenges.

Second, work roles in the AI/ML domain have overlapping boundaries. In both industry and military contexts, data scientists, data engineers, ML engineers, software developers, and infrastructure specialists perform distinct but complementary functions. While these roles are conceptually separate, their technical tasks often overlap.[10] For example, both data engineers and ML engineers build data pipelines, but data engineers focus on curation and storage, while ML engineers focus on preparing data for model ingestion. Figure 1 illustrates how Army work roles overlap in delivering AI/ML capabilities.

Understanding this overlap is critical for two reasons. First, commanders should not expect rigid role boundaries, since 49B/490B personnel will necessarily perform tasks that touch data engineering, software development, and infrastructure management. Second, individuals should not over-identify with a single role simply because they use some of its techniques. A 490B who builds data pipelines is not a data engineer; they are an AI/ML professional using data engineering skills to support model deployment.

8. Bastian, N. 2020. Building the Army's Artificial Intelligence Workforce, *The Cyber Defense Review*, Vol 5, No 2. 79–99. https://cyberdefensereview.army.mil/Portals/6/Documents/CDR%20Journal%20Articles/Bastian_CDR%20V5N2%20Summer%202020.pdf?ver=2020-07-27-053231-920
9. Boudreau, J. 2025. Putting the Intelligence in Artificial Intelligence: Fireside Chat with LTG Anthony Hale on Military Intelligence Today and Tomorrow, *Georgetown Security Studies Review*, January 16. https://georgetownsecuritystudiesreview.org/2025/01/16/putting-the-intelligence-in-artificial-intelligence-fireside-chat-with-ltg-anthony-hale-on-military-intelligence-today-and-tomorrow/
10. Cruickshank, I. J., Bastian, N. D., Blair, J. R. S., Chewar, C. M., and Sobiesk, E. 2024. Seeing the Whole Elephant: A Comprehensive Framework for Data Education. *Proceedings of the 55th ACM Technical Symposium on Computer Science Education* V. 1 (SIGCSE 2024). ACM, 248–254, https://doi.org/10.1145/3626252.3630922

**Figure 1. Overlap of competencies between military data-related work roles involved in delivering AI/ML capabilities**




*The core competencies of the 49-series are mathematics, programming, modeling, data analysis, data visualization, and systems engineering. AI/ML is a combination of data science, programming, and systems engineering (49-series AOC).*

With these principles established we can now describe the primary work roles within the 49B/490B career fields.

## 49B Artificial Intelligence / Machine Learning Officer

The 49B officer applies advanced data science and ML engineering methods to operational and strategic problem sets, building upon the foundation of the ORSA functional area. These officers possess the expertise to extract insights from structured and unstructured data through statistical modeling, data mining, and ML. They conduct exploratory data analysis, feature engineering, and predictive modeling for AI/ML model creation to support data-driven decision making across the force. They then design AI-enabled systems from these models, which deliver value for their organizations.

Their primary function is to transform data into actionable intelligence and develop algorithms that enhance decision superiority. 49B officers focus on experimentation, model and system design, and performance evaluation rather than large-scale deployment. They employ modern software development and cloud-based computing practices to process and analyze data efficiently and train effective ML models. By integrating with commanders and staff, 49B officers translate operational challenges into AI/ML problems and deliver prototype AI-enabled systems that inform tactical, operational, and strategic outcomes.

## 490B Artificial Intelligence / Machine Learning Operations Technician

The 490B warrant officer serves as the technical lead responsible for implementing, sustaining, and optimizing AI and ML capabilities in operational environments. Functionally similar to an MLOps engineer, the 490B bridges the gap between data science and production systems. These technicians design, build, and maintain data pipelines, integrate models with existing applications, and apply automation frameworks to ensure reliability, scalability, and resilience.

Working closely with IT, Signal, and cyber personnel, 490Bs implement secure, efficient architectures that enable the deployment of AI/ML solutions at scale. Their responsibilities extend beyond model deployment to include monitoring model performance, mitigating data drift, and managing lifecycle maintenance. 490Bs also develop AI-driven workflows and automation agents that integrate multiple models and data sources to achieve mission-specific effects. In this capacity, the 490B ensures

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that the analytical products and prototypes developed by 49Bs transition into sustained, operational capabilities within Army systems.

## How Will AI/ML Functional Area Personnel Deliver Capabilities?

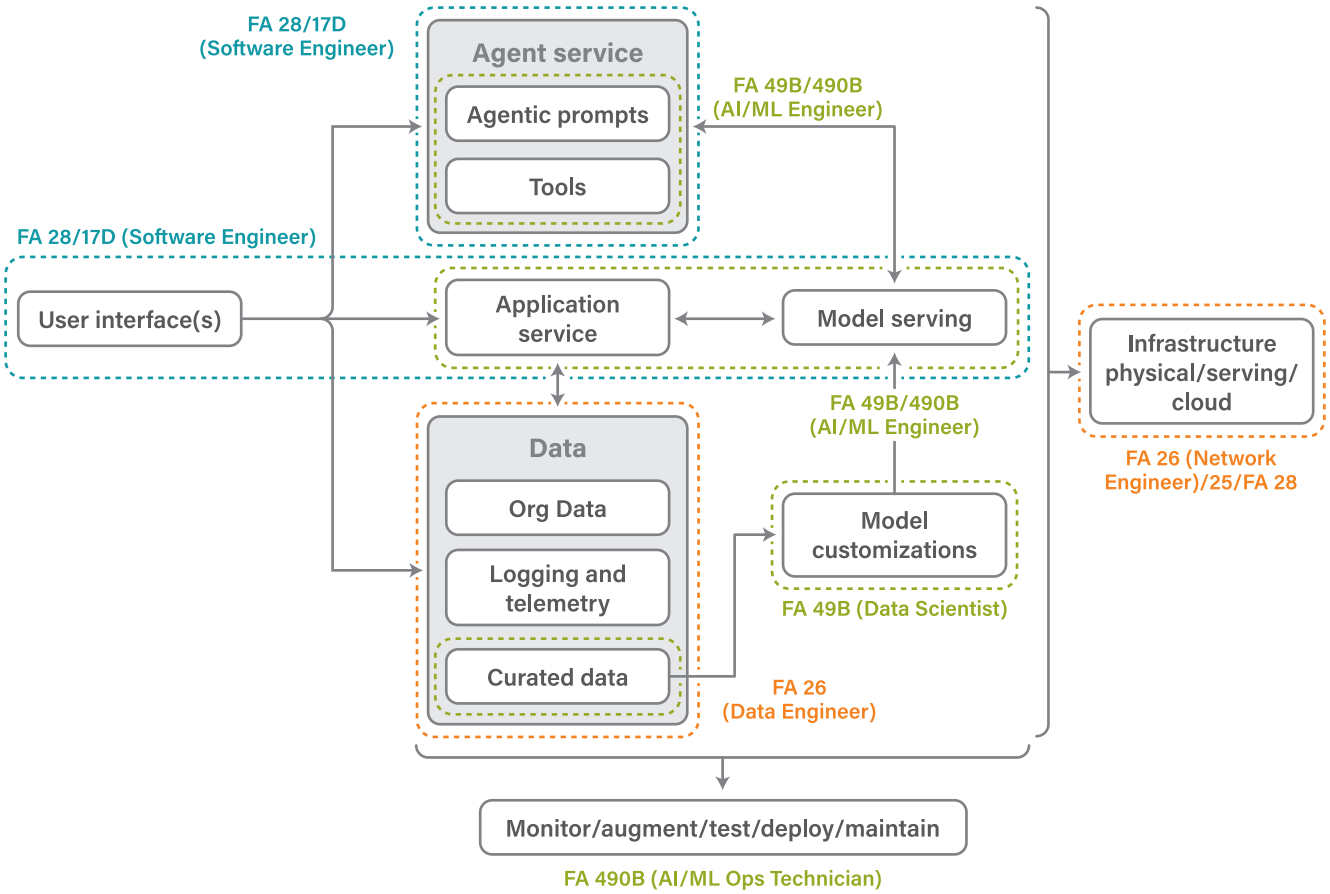
The core value proposition for AI comes from user-centric AI-enabled systems that frequently consist of ML models, data, and applications. As such, delivering operational AI and ML capabilities requires a multidisciplinary team of technical specialists with complementary skill sets. 49B and 490B personnel are central to these teams but must operate alongside data engineers, software developers, and network and cyber professionals to transform concepts into fielded solutions.

A common solution pattern employed across Army organizations integrates large foundation models, such as large language models (LLMs), with unit or enterprise data sources. This approach, often described as retrieval-augmented generation (RAG) or the more recent agentic RAG, enhances model performance and relevance by combining the power of generative AI with mission-specific data.

Figures 2 and 3 illustrate that creating an AI solution, such as RAG, typically requires a small team of highly skilled technical personnel. Developing and deploying such a system requires a tightly integrated team. The 49B officer designs and refines the model for the operational task, applying data science and analytical methods to align outputs with mission objectives. Data engineers (FA26) curate and manage datasets and develop robust data pipelines. Infrastructure and cloud engineers from the Signal and cyber branches provide and maintain the computer, network, and security environments required to host models and data services. Software engineers (CMFs 17 and 28) develop user interfaces and integrate AI tools into existing command-and-control or decision-support

Continued on page 36

**Figure 2.** Concept for a generative AI-driven capability

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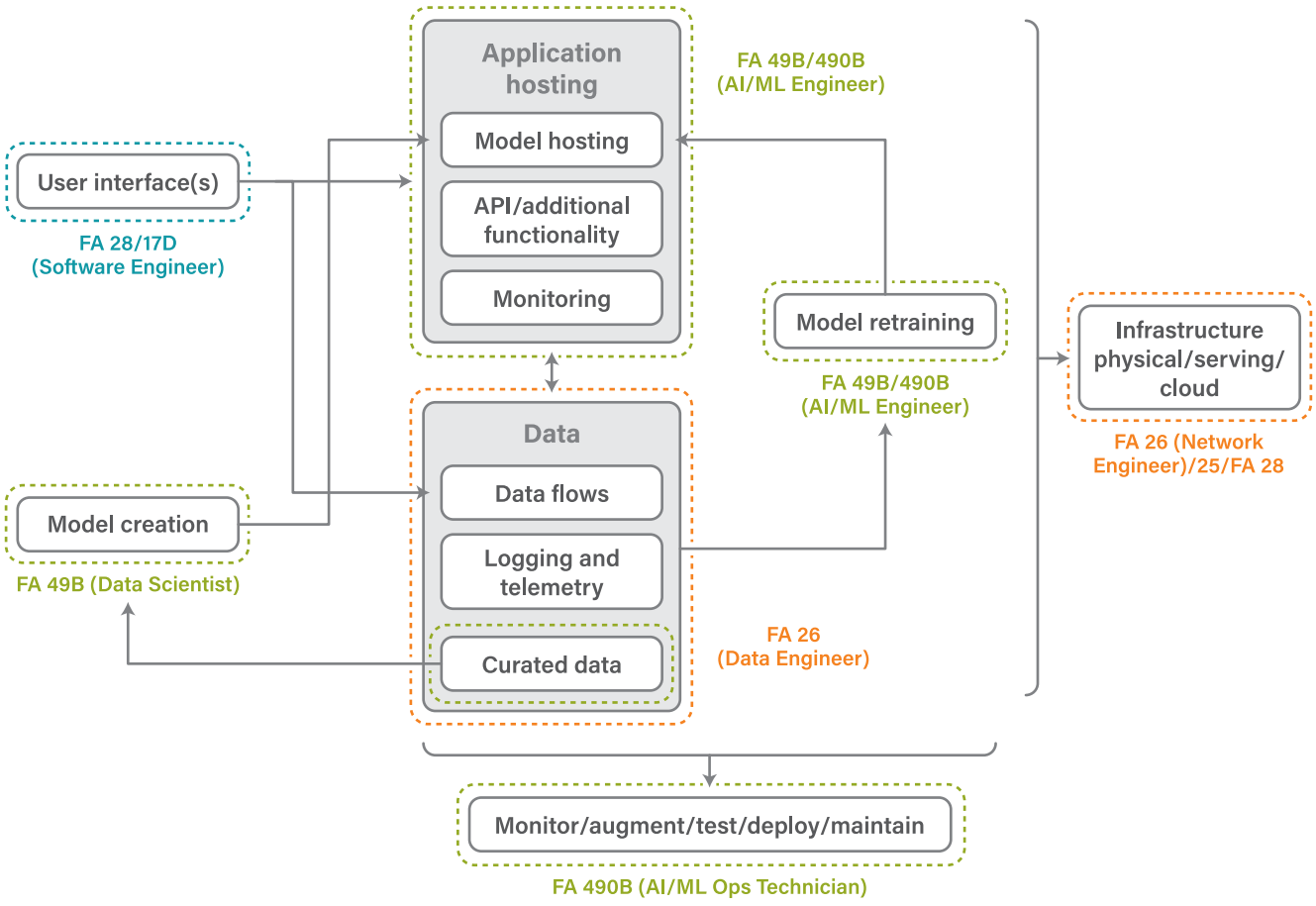
systems. Finally, the 490B AI/ML operations technician leads the deployment and sustainment process, integrating backend services, implementing security controls, automating workflows, and maintaining model performance in production environments.

Beyond foundation models, many operational applications employ specialist models, ML systems trained for narrow, mission-specific tasks often using supervised learning techniques. These models deliver high accuracy and fast inference, making them well-suited for tactical decision support. For example, a computer vision model trained to classify military equipment types can enable rapid target identification or automated battle damage assessment. Developing such models requires the same multidisciplinary approach: 49Bs prototype and evaluate models; data engineers curate datasets and manage pipelines; software engineers integrate models into operational systems; and 490Bs ensure that deployed models remain secure, optimized, and sustainable in the field.

This team-based approach is already being implemented across the force. Operational data teams (ODTs) within formations such as the 82nd Airborne Division employ technically skilled personnel to design machine learning–powered solutions tailored to unit needs. The Army Artificial Intelligence Integration Center (AI2C) fields operational data science teams (ODSTs), which are agile, cross-functional teams that rapidly prototype and deliver AI/ML capabilities across the Army enterprise. These ODSTs are supported by dedicated infrastructure and platform teams that ensure secure, scalable deployments. Similarly, elements of the Special Operations community, such as the Global Analytics Platform, assemble small, highly trained technical teams to deliver AI-enabled capabilities in support of mission objectives. Across all these efforts, 49B officers and 490B technicians serve as key members of cross-functional AI teams, embodying a *combined arms* approach to data and AI operations.

Continued on page 38

**Figure 3. Concept for a special-purpose AI-driven capability**



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Equally important as the operational AI/ML teams are those supporting enterprise-level functions and organizations, including the Army and Joint Staffs, contracting offices, and other institutional entities. In these organizations AI tools are already transforming administrative efficiency, logistics planning, and strategic analysis. While the operational tempo and focus differ from that of tactical units, the requirement for cohesive, technically proficient teams remains constant. Whether deployed at the tactical edge or supporting enterprise modernization, 49B and 490B personnel are instrumental in enabling the Army to operationalize data and AI at scale.


*Airmen from the Department of the Air Force Portfolio Acquisition Executive for Command, Control, Communications and Battle Management participate in its first iteration of a training pipeline meant to prepare them for the rigors of software development, here, Feb. 12, 2026. The Airmen are software developers C3BM's Kessel Run division, Operational Response Team division, and Airspace Mission Planning division's Conjure branch. The pipeline will provide them with technical knowledge in a range of subjects centered around software development mirroring industry standards and C3BM's culture. (Official U.S. Air Force photo by Richard Blumenstein)*

## Looking Forward

As the Army formalizes AI/ML work roles and establishes the 49B and 490B career fields, several structural and developmental challenges must be addressed to ensure long-term success.

A primary consideration is establishing clear career progression pathways that allow AI/ML officers and warrant officers to advance to senior ranks such as Colonel and Chief Warrant Officer Five. One approach could involve creating a "senior ORSA" concentration (e.g., 49Z) within the functional area, enabling officers at the Colonel level to transition into this concentration while retaining access to all Colonel-level positions, mirroring the structure used in other technical areas such as FA26. Additionally, the Army should deliberately advocate for the placement of uniformed technical officers, particularly FA49 personnel, in senior enterprise-level roles, including chief technology officer/advisor (CTO/CTA), chief data officer (CDO), or chief AI officer positions within major commands and joint organizations.

The 490B AI/ML operations technician introduces the first warrant officer pathway within FA49. This presents unique challenges in recruiting, developing, and retaining technical expertise. Initially, warrant officers currently serving with the 2V Additional Skill Identifier and appropriate backgrounds should be reassigned to build the foundational structure for the new specialty. Since FA49 lacks an enlisted counterpart to fuel the transitional accessions path, accessions will need to be Military Occupational Specialty (MOS) immaterial, based on clearly defined academic and experiential prerequisites. The functional area must also develop a dedicated warrant officer training program, or partner with an existing Center of Excellence, to cultivate both technical proficiency and leadership skills. Just as critically, FA49 must deliberately integrate warrant officers into its existing processes, leverage their applied expertise, and include them in ORSA-sponsored education to foster cohesive, cross-functional data teams.

Finally, unlike many other military domains, the data and AI domain is intrinsically linked to industry, academia, and contracting. In the world of software, which includes AI/ML, there is a blurring of lines between what is the traditional industry work of building something and what is war fighting. The boundary between software development and warfighting continues to blur; building and operating AI/ML systems are inherently operational activities. Consequently, each desired AI capability must be assessed to determine which components are best managed through industry partnerships and which should be developed internally.[11] Sustainable AI capabilities will almost always require both.

11. Cruickshank, I. J., and Kohtz, S. 2023. Acquiring Maintainable AI-Enabled Systems. *Proceedings of the Twentieth Annual Acquisition Research Symposium* (SYM-AM-23-084). Naval Postgraduate School, May 1. https://dair.nps.edu/handle/123456789/4852

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Continued from page 38

For example, contracting for large-scale foundation models, such as LLMs, may be necessary given their immense compute and data requirements. However, tasks like model fine-tuning, integration, and sustainment can often be executed more efficiently by uniformed personnel, enabling cost savings and faster operational adaptation.[12] Regardless of the balance between service and industry roles, 49B and 490B personnel will routinely collaborate with civilian partners. Accordingly, policies governing network access, contracting authorities, and data governance must evolve to enable these officers and warrant officers to fully operationalize AI within the Army enterprise.

12. Cruickshank, I., and Kohtz, S. 2024. Planning for AI Sustainment: A Methodology for Maintenance and Cost Management. *Proceedings of the Twenty-First Annual Acquisition Research Symposium* (SYM-AM-24-168). Naval Postgraduate School, August 28. https://dair.nps.edu/handle/123456789/5262

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**Colonel Chris Eastburg** is a Functional Area 49 (Operations Research/Systems Analysis) officer. His prior operations research assignments include Headquarters Department of the Army, US Southern Command, Office of the Secretary of War – Cost Assessment and Program Evaluation, Army Test and Evaluation Command, Combined Joint Task Force (CJTF) Paladin – Afghanistan, and West Point. Before crossing over to operations research, he had multiple deployments to Iraq and assignments as a Combat Engineer. Colonel Eastburg holds master's degrees in operations research, business administration, and engineering management.

**Major Bethany Dumas** is a Functional Area 49 (Operations Research/Systems Analysis) officer serving in the Research and Analysis Division at the Headquarters Department of the Army G-8. Previously, she was the FA49 Proponent Officer and a Combat Operations Analyst at The Research and Analysis Center (TRAC), following several assignments as an Adjutant General officer. She is slated to lead the newly established Operational Data Team at Multi-Domain Command Pacific. Major Dumas earned a Master of Science in operations research from Kansas State University and an MBA from the Wharton School of Business at The University of Pennsylvania.

**CW4 James Yantis** is a career Intelligence professional currently assigned to the Army's Artificial Intelligence (AI) Integration Center as a senior Warrant Officer and AI capability developer. His previous assignments include positions subordinate to U.S. Army Intelligence and Security Command, U.S. Army Special Operations Command, U.S. Army Europe and Africa, and Western Hemisphere Command. He is a graduate of the Army's AI Technician Program through Carnegie Mellon University and holds a Masters of Science in government analytics and Certificate in Intelligence from Johns Hopkins University.


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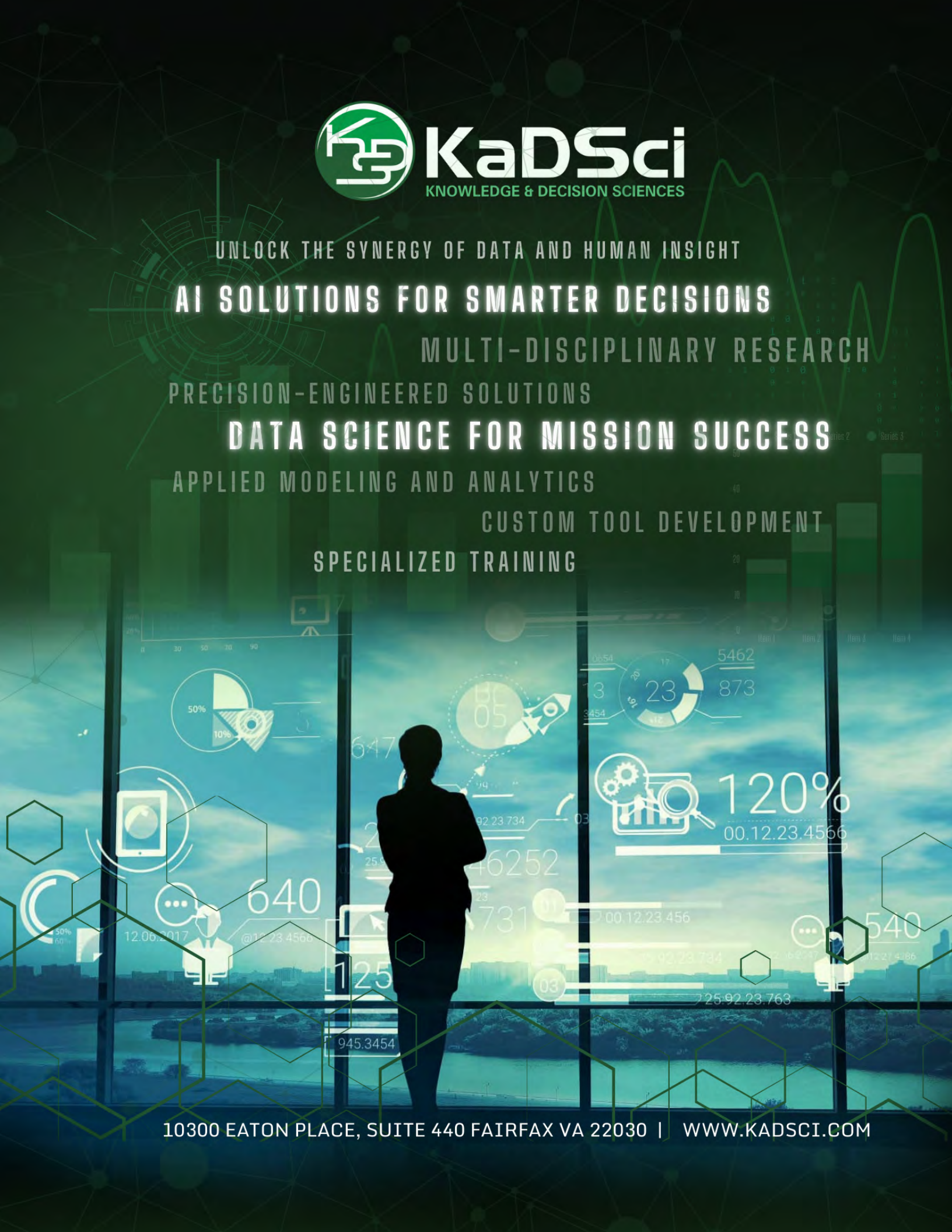
**Lee Maccarone**
Principal Cybersecurity R&D Engineer, Sandia National Laboratories

**When did you join MORS?**
I became a member of MORS in 2017. I was a graduate student in a course called "Hacking for Defense" that teaches interdisciplinary teams of students to apply lean start-up methods to solve defense and intelligence challenges. My project mentor from the U.S. Army Cyber Command encouraged my team to join MORS and present our work at the MORS Symposium.

**What was your childhood ambition?**
My first childhood ambition was to become a wilderness explorer, but I decided to pursue engineering in college because of my strengths in science and math. As a graduate student I conducted research in an instrumentation and controls lab focused on nuclear energy applications. I was fortunate to have the opportunity to intern at two Department of Energy national laboratories which led to my interest in cybersecurity for critical infrastructure. Today I keep my childhood ambitions alive through hiking and backpacking.

**Why did you become an operations analyst?**
I became an operations analyst because I wanted to solve complex and meaningful problems. This goal led me to Sandia National Laboratories, where I am able to contribute to teams solving a variety of national security problems. My research primarily focuses on cybersecurity-by-design for advanced nuclear power plants and other energy infrastructure.

**How has your MORS membership benefited you? What do you value most about your membership?**
My MORS membership has been highly valuable in my professional development as an analyst and I appreciate the mentorship I have received from the network of MORS analysts. I've attended the MORS Symposium, Emerging Techniques Forum, and meetings for several Communities of Practice, and the technical expertise showcased at MORS events has enhanced the quality of my research. As co-chair of the Cyber Community of Practice, I've met other analysts working on similar cybersecurity challenges and also had the opportunity to network with other CoPs such as the Data Science & AI and Critical Infrastructure CoPs.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# Upcoming Events

**The Military Operations Research Society (MORS) offers opportunities for professional development and training via courses, tutorials, workshops, and the annual Symposium. Payment can be made via credit card, check, or form SF182.**

## Gaming Weapons of Mass Destruction Course – *From Policy to Practice*

**Mar 31** to **Apr 2**

**Location:** Online

This three-day course focuses on the intersection of weapons of mass destruction (WMD) and gaming. Students will learn to develop and execute games related to WMD in all its forms (chemical, biological, and nuclear), including how to integrate technical data and build games on policy, deterrence, and as a tool for response preparedness.

## Certificate in National Security Risk Analysis

**Apr 13–17**

**Location:** Online

This five-day course is for analysts seeking to understand risk as it relates to national security. Students will explore common risk factors, survey quantitative risk methodologies, learn quantitative risk evaluation, build probability models, compute the value of information, and survey best practices for relaying risk.

**MORS has a lot of upcoming events and activities. Make sure to visit mors.org/events to stay updated.**

## Education and Professional Development Colloquium (EPD)

**Apr 15–16**

**Location:** Annapolis, MD

This annual event brings together students, junior analysts, and senior professionals for unique mentoring and professional development opportunities. The main event is the Richard E. Rosenthal Competition, which gives undergraduate students the chance to work on an operations research problem and drive towards a team solution.

## AI Workshop

**Apr 20–23**

**Location:** Pittsburgh, PA

This will be MORS' third AI Workshop, building on the successes of our 2019 and 2021 events. Across four days, we will capture and share concrete lessons learned while building a body of knowledge that enables analysts to research, develop, field, and apply AI-enabled capabilities for decision advantage.

## Campaign Analysis Methods Course

**Apr 24** and **May 1, 8, 15**

**Location:** Online

This four-day course (over four consecutive Fridays) focuses on the methods and techniques that underpin campaign analysis. Students will learn the basics of campaign analysis and how it's applied in the operations research community, common campaign tools, applicable MS&A techniques, and how to build elements of a campaign model.

## Certificate in Wargaming

**May 4–8**

**Location:** Online

This five-day course examines wargaming theory, research, design, development, execution, analysis, and reporting. Building on Peter Perla's theory of the "Architect, Artist, and Analyst" model for game designers, the course covers each style of wargame design. On the last day, students develop and execute their own games.

## 94th MORS Symposium

**Jun 8–11**

**Location:** Colorado Springs, CO

The premier opportunity for the national security community to exchange information, examine research, and discuss critical national security topics. Operations research professionals from military, government, industry, and academia gather to participate in tutorials, CEU courses, and various presentations across 30+ working group topics.

**If you have any questions, please don't hesitate to contact Ms. Sarah Madonia, Billing & Office Manager, at sarah.madonia@mors.org or 703.933.9074.**

# Appearing in *Military Operations Research*

### *The Military Bulk Fuel Distribution Problem*

**David L. Alderson and Robert F. Dell**

Maintaining U.S. military operations worldwide requires vast quantities of fuel to support aircraft, ships, and ground equipment. Military planners routinely evaluate the requirements for moving and storing fuel and the feasibility of satisfying these demands, particularly for illustrative scenarios or to prepare for potential conflicts. This article integrates several decades of applied research into a sequence of models representing best practices for assessing capability and planning investment in bulk fuel operations. This case study shows how such modeling can aid an analyst in understanding the capabilities of a supply chain and/or advise investment in relevant infrastructure to support such operations.

### *Using Prize-Collection Concepts to Solve Time-Limited Search Problems: A Military and Security Case Study*

**Nastaran Oladzad and Rajan Batta**

Time-limited search problems play a crucial role in military and homeland security operations, from search-and-rescue missions to identifying potential threats in critical areas. This article presents a novel framework that links such search problems to well-studied prize-collection problems, enabling more efficient solutions through established optimization techniques. The authors apply mathematical modeling, stochastic programming, and heuristic methods to address complex search scenarios. A real-world case study on monitoring Colorado's water reservoirs highlights the practical impact of this approach, improving security by detecting fluctuations in water levels and potential contamination risks.

### *Military Operations Research Society (MORS) Oral History Project Interview of Dr. Rafael E. Matos*

**Bob Sheldon, FS**

Dr. Rafael Matos was President of MORS from 2014 to 2015. In 2017, Dr. Matos was elected a Fellow of the Society (FS). Dr. Matos was the requirements generation analyst for the Office of the Chief of Naval Operations Assessments Division at the Pentagon. In that assignment, he became familiar with other people's studies and identified limitations in the analysis, as well as recognized terrific advances in analytical skills. His oral history appears in the online version of volume 30, number 4 of *Military Operations Research*.

### *Exact and Heuristic Approaches for Anti-aircraft Mission Planning for Defensive Missile Battalions*

**Bui Quoc Trung**

This research explores optimization strategies for anti-aircraft defense planning, addressing the anti-aircraft launching assignment and anti-aircraft mission planning problems, both of which are NP-hard. Using mixed integer linear programming and tabu search, the study develops exact and heuristic approaches, demonstrating that exact methods are ideal for offline planning while metaheuristic methods are more effective for real-time decision making. Experimental validation confirms the efficiency of these approaches, leading to the development of a decision-support tool now used for educational purposes at Vietnam's Air Defense-Air Force Academy. Future research aims to incorporate time constraints, weather conditions, and uncertainty modeling to further enhance practical applications in military defense.

### *Prioritizing Organizational and Human Aspects for Preventing Military Secret Leaks*

**Dojin Ryu**

Recent insider threat cases, including classified leaks within the Republic of Korea Armed Forces, highlight the increasing risk of information breaches. This study examines organizational and human factors contributing to these leaks. Using focus group interviews and analytic hierarchy process, it identifies rationalization as the most influential defense mechanism, with moral standards and organizational commitment playing key roles in deterrence. Findings from 62 military security personnel provide a basis for developing military security policies. The study's recommendations include awareness programs to counter self-rationalization, ethical reinforcement training, and strategies to enhance organizational loyalty. These insights offer globally applicable measures to reduce insider threats and strengthen military information security.


Military Operations Research Society

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