THE TACTICAL INNOVATION SYMPOSIUM

TECHNICAL AND PROCEDURAL ABSTRACTS

VOLUME 2, 10-12 DECEMBER 2025, WEST POINT, NY

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Edited by:

Chris Aliperti
Department of Mechanical and Aerospace Engineering, West Point, NY

Chris Flournoy
Fort Benning, GA

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Letter from the Editors

We are proud to present the latest proceedings from the Tactical Innovation Symposium. What began as a small gathering of practitioners has grown into a community of leaders committed to solving Soldier problems at the tactical edge. Each iteration of the Symposium reinforces a central truth: the individuals closest to the fight often possess the clearest understanding of the problems that must be solved to win the next war.

This year's Symposium continued our effort to create a forum where innovation officers, operational leaders, researchers, and industry partners can share both technical solutions and the processes used to deliver them to warfighters. Rather than focusing solely on finished products, contributors were encouraged to highlight the experimentation, iteration, and organizational approaches that enable effective problem-solving within operational units.

The Tactical Innovation movement remains grounded in several enduring observations. Soldiers on the front lines encounter problems first and understand them most intimately. They also often remain the furthest removed from the resources needed to build and scale solutions to those problems. Meanwhile, those tasked with designing and delivering new capabilities frequently lack sustained interaction with the end users they aim to support. Bridging this gap remains one of the most important challenges facing modern defense innovation. Tactical innovation programs, and the Soldiers who run them, are that bridge.

The projects and insights contained in these proceedings demonstrate that meaningful progress occurs when operational units are empowered to experiment, when innovation programs provide the structure and resources necessary for rapid prototyping, and when partners from across government, academia, and industry collaborate directly with those closest to the problem.

The purpose of this publication is not to prescribe a single model for Tactical Innovation. Each unit faces unique operational constraints, leadership priorities, and resource environments. Instead, these proceedings aim to document the diverse approaches being developed across the joint force and to provide practitioners with practical examples they can adapt to their own organizations.

The work captured in these proceedings reflects several years of experimentation and collaboration across the force. It will continue to inform future efforts to strengthen tactical innovation programs across the Department of War. We hope the ideas shared here expand collaboration across the Tactical Innovation community and contribute to building programs that are durable, effective, and focused on delivering meaningful capability to the Soldiers who need it most.

Chris Aliperti

Chris Aliperti
Department of Mechanical and
Aerospace Engineering
West Point, NY

Chris Flournoy

Chris Flournoy
Fort Benning, GA

Shrike – Crowstorm -- Peregrine: Custom Uas Targeting Solutions

Timothy Naudet

Artificial Intelligence Integration Center (AI2C), 17A
Email: timothy.j.naudet.mil@army.mil

Avery Austin

Artificial Intelligence Integration Center (AI2C), 12A

INTRODUCTION:

Shrike [1] [2] is a software package co-developed at the US Army Artificial Intelligence Integration Center (AI2C) and Carnegie Mellon University's Software Engineering Institute (SEI). Shrike enables any service member to leverage commercial the-shelf (COTS) and program-of-record small unmanned aerial systems (sUAS) to instantly produce data required for call for fire (CFF) missions. With human-in-the-loop approval, the software employs ray projection, photogrammetry, and AI algorithms to exploit electro-optical (EO) and infrared (IR) imagery fused to UAS meta-data to produce accurate Military Grid Reference System (MGRS) coordinates of an observed target. Shrike uses computer vision to detect both potential military targets and kinetic impacts, algorithms to estimate the real-world MGRS coordinate from the [u, v] pixel space, and algorithms to correct indirect fire (IDF) trajectories. Shrike curates a machine speed kill chain for any service member through a simple, single-click user-friendly interface.

Peregrine is a software to perform terminal guidance. Peregrine is designed to perform its autonomous behaviors in GPS-denied, electronic warfare (EW) congested environments and as well as with inexpensive, attritable components. Peregrine employs computationally light, computer vision techniques to extract meaningful features from the [u, v] sensor feed and generate robotic controls to intercept the pixel. A large component of Peregrine, external to the autonomous software, is the hardware integration. Peregrine is dependent on soldering together a flight controller and computer, like a Raspberry Pi. The duality of software and hardware in Peregrine enabled any Soldier to employ a custom UAS to terminally engage a target.

Crowstorm is software that performs offensive computer vision targeting in the Hunter-Killer paradigm by employing Peregrine. Crowstorm facilitates end-to-end targeting, from packet reception to kinetic effect. Crowstorm enables offensive operations by facilitating communications between targeting software and un-launched UASs over a local area network. More specifically, Crowstorm ingests targeting packets from an ISR UAS using Shrike and launches separate kinetic FPV UASs equipped with a Raspberry Pi computer and the Peregrine software to engage the target. For each launched asset, Crowstorm computes an airborne objective rally point (ORP), maneuvers the UAS to the airborne ORP, employs an image matching algorithm for target acquisition, and culminates with a pre-defined UAS tactical behavior. The image-matching facilitates discrimination. Crowstorm achieves the "Hunter-Killer" UAS concept with autonomous decision-making.

Our contributions:
- Completely passive photogrammetric geolocation estimations
- Computer vision models for splash detection
- Integration into the tactical digital fires ecosystem
- Novel Hunter-Killer, One-to-Many human-to-UAS control
- Novel integration of SOTA target acquisition technique

DESIGN SPECIFICATIONS:

All Shrike software is ground-borne and is accessed as an application on the end-user-device (EUD), whether a computer, tablet, or Android device. All Peregrine software is airborne. Crowstorm's server is ground-borne and the Crowstorm client is airborne.
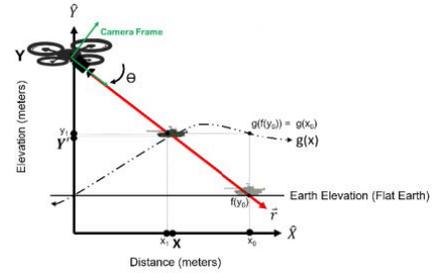
Fig 1. *Shrike photogrammetric MGRS estimation example. Accurate estimates require a digital terrain and elevation dataset and some iterative algorithm.*

EXPERIMENTS AND RESULTS:

Tested around the world. Shrike Core is currently operating in no less than 2 continents and in contested areas.
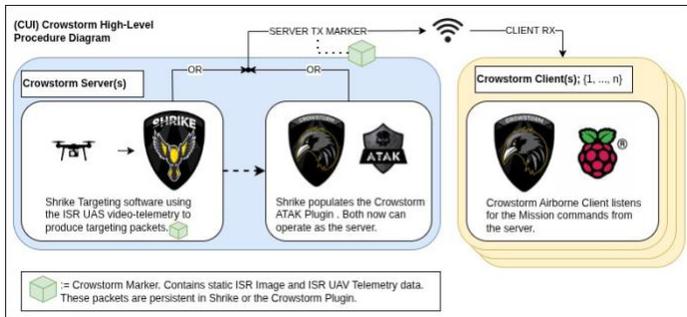
Fig 2. *Crowstorm High-Level Diagram. The flow is UAS-Shrike-Crowstorm-engagement*

ACKNOWLEDGEMENTS:

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CAPYBARA - Common Attritable Parts You Build and Assemble – Rover for All

Capt Preston "OBOGS" Spaulding & MSgt Matthew Sabo

Elevate Innovation Laboratory, 375 Air Mobility Wing, Scott AFB, Illinois
Email: Preston.spaulding.2@us.af.mil

INTRODUCTION:

The threat of low-cost technology solutions is already here. On the battlefield, we see the deployment of uncrewed aerial systems (UAS) and uncrewed ground vehicles (UGVs). Future conflicts will be determined by the side that can innovate and iterate faster. Unfortunately, these "low-cost" solutions often come at a price in money and technical know-how. Operators with even a basic understanding of how to build, repair, and modify UAS/UGVs will prove invaluable at the edges of conflict.

CAPYBARA enables in-house UGV fabrication and empowers unskilled operators to rapidly build and modify a basic UGV by following clear-cut instructions and using preprogrammed files. CAPYBARA's flexibility comes from its modularity. Operators pick the type of CAPYBARA they want to build, ranging from ISR to EOD, download the files, purchase parts, and get to building. This bypasses fundamentals training and lets anyone with a printer be a maker.

CAPYBARA utilizes CubePilot for UGV control via Android Team Awareness Kit (ATAK) for easy integration into existing tactical networks. ATAK's existing UGV plug permits either direct control by operator or the option for UGVs to follow pre-planned routes while streaming video telemetry. Additionally, the CubePilot system uses the same software and ground control programs utilized by UAS systems. This means that a CAPYBARA operator gains experience with interfaces and protocols that directly transfer to using UAS without the need for certifications or specialized designated ranges.

DESIGN SPECIFICATIONS:

A basic CAPYBARA is a 2ft X 3ft tracked rover consisting of a PLA 3D printed chassis, 2 x 12.8V batteries, 2 x 550W DC motors, a Cytron 2x30 speed controller, and assorted hardware available at a local hardware store. Digital control is provided by using the NDAA-compliant/Blue UAS Framework Listed CubePilot Blue Series, including the Cube Blue H7 autopilot, Here4 Blue Multiband GNSS GPS, Herelink Blue v1.1 Air Unit telemetry system, and the Herelink Blue v1.1 Controller. Our

Fig 1. *A CAPYBARA prototype ascends stairs*

current prototype of CAPYBARA has a recommended top speed of 5 mph and a range of about 3 miles. All 3D-printed parts were produced on a Creality K2 350 mm printer. The current cost of our prototype is $5,500.

Modularity for mission application is a core aspect of CAPYBARA's design. The chassis is made of interlocking parts that can be added or removed to change the overall length of the rover. The top portion, or lid, is interchangeable with modules for mission payloads. Our lab has successfully designed and built two lids. The first is the RAVEN module, designed for carrying an S618 mesh wireless router, providing a rapidly deployable mesh network compatible with any internet service provider. The second module incorporates a 5 ft telescoping manipulator arm with various cameras as a possible CBRN robot.

EXPERIMENTS AND RESULTS:

CAPYBARA participated in a USAF exercise in October 2025 as a RAVEN mesh node extender. This prototype operated via direct RC control rather than ATAK during our iterative process. Air National Guardsmen were given a two-hour overview of how to operate the rover and then granted full autonomy to use the system as they saw fit. Results were encouraging, with Airmen noting the ease of use and the chassis' robustness. One motor failed after users repeatedly exceeded the recommended top speed.

FUTURE WORK:

While we have a working CAPYBARA rover at our innovation cell here at Scott, the design is not yet ready for prime time. We have been unable to devote the time and resources needed to simplify the design and codify instructions so that any operator with a 3D printer and a parts list can make a CAPYBARA. Our vision is to share the CAPYBARA design files with undergraduates at West Point who could then iterate and simplify the design as part of an independent study or other academic experience

FOAM COOLER: Forward Operating Additive Manufacturing Connexes On Local Economy Resupply

CPT Brandon Cea

1st Special Forces Group, Joint Base Lewis-McChord, WA

1LT Stonewall Sisk

21st Multidomain Task Force, Joint Base Lewis-McChord, WA
Email: stonewall.t.sisk.mil@army.mil

SSG Jordan Westdy

32nd Multidomain Task Force, Mainz-Kastel, DEU
Email: jordan.a.westdyk.mil@army.mil

INTRODUCTION:

FOAM COOLER is a forward-deployable, distributed manufacturing capability designed to address the Joint Force's need to achieve massed autonomous effects by the 2027 threat window. Current force design lacks the throughput and adaptability required to sustain large-scale, attrition-tolerant unmanned systems across contested Indo-Pacific logistics chains. This capability would emplace assets capable of being employed in an INDOPACOM C-JILC scenario and or as part of the EUCOM EFDRL.

DESIGN SPECIFICATIONS:

FOAM COOLER embeds modular additive-manufacturing nodes inside standard CONEX containers positioned at EDCA sites and throughout the first and second island chains. By leveraging validated tooling through FFRDC partnerships, local materials, and commercial supply chains, the system enables on-demand production of attritable UAS and components at the tactical edge, reducing reliance on vulnerable strategic logistics and mitigating adversary A2/AD pressures.

The concept integrates MDTFs and ARSOF through a triad framework of home-station development, training-proxy validation, and forward effects employment. This framework functions as a fires multiplier, feeding distributed strike and sensing architectures with rapid-turn hardware manufactured near the point of employment. "Green" systems developed via FOAM COOLER increase the probability of kill for exquisite "Blue" effects while enabling FMS and DSC pathways for partner force integration.

A FOAM COOLER costs an estimated $150k for a setup, with the bulk of the costs being the dozen printers and the CONEX. The cost can be reduced to an estimated $30k if a different printer is selected and a CONEX unit is already on hand. The CAD files and BoM are available to interested parties. This would be capable of producing an estimated one airframe a day.

IMPLEMENTATION AND RESULTS:

The employment model positions Points of Manufacturing (POM) at Points of Need (PON) through SOF emplacement and access. This operationalizes a proven GPS-independent strike architecture already validated in field testing and constitutes the "C" (Contingency) in the Fires PACE plan.

The cost savings of capability would be in the millions per unit if compared to future fielded units of selected platforms. Allied trades personnel can manufacture the FOAM COOLER once the material is provided. A prototype unit was deployed forward with seven printers, enabling the production of multiple frames per week through discontinuous printing. Two service members conducted maintenance on the systems and were able to print airframes, payloads, and repair parts for payloads. While the printers were configured to maximize print speed, this demonstrated that the capability was feasible and could be easily taught from an FSR. Two service members with no prior additive manufacturing experience were brought up to speed quickly and were able to produce parts at the facility.

DISCUSSION, FUTURE WORK, & SIGNIFICANCE:

Resource initial nodes in FY26–27. Codify MDTF–SOF integration via MOUs and command relationships. Develop theater-agnostic playbooks. Align rapid, iteration-based acquisition with DCS and FMS pathways. Pairing these facilities with mobile hydrogen generators would enable off-grid manufacturing.

ACKNOWLEDGEMENTS:

INDOPACOM Units of Action for providing support.

REFERENCES:

Available upon request.

LoRa Mesh Tactical Network (LMTN)

SGT Ray L. Needham

5-7 Cavalry Squadron, 1st Armored Brigade Combat Team, 3rd Infantry Division
Email: r.lee.needham@gmail.com

INTRODUCTION:

U.S. Army dismount units operate in environments where communication infrastructure is fragile, contested, and targeted. Tactical formations depend heavily on the Android Tactical Awareness Kit (ATAK) for shared understanding, but the communication transports that support it are often degraded in an austere, contested environment. As units disperse over greater distances and endure operational constraints, the need for reliable, low-signature digital connectivity becomes essential. The problem is not solved by existing communication architectures, which often carry serious limitations and vulnerabilities: high-power radios elevate a unit's radio frequency (RF) signature, traditional Army network topologies suffer from single points-of-failure and bottlenecks, and many tactical radio solutions offer limited reliability for small, mobile elements operating beyond line-of-sight. The Army requires a communication solution that meets its mission requirements: reliable, low-signature, and resilient.

PROBLEM:

Dismount and, especially reconnaissance formations in Armored Brigade Combat Teams (ABCTs) rely on voice-based radio reporting to inform leaders of dismount locations; a process plagued by delays, inaccuracies, and a high RF signature.

DESIGN SPECIFICATIONS:

The LMTN provides commanders with immediate, continuous awareness of Soldier positions without requiring scouts to transmit or break concealment. Each node passes position location information (PLI), and ATAK message flows through an encrypted, low-signature, infrastructure-independent mesh network, ensuring persistent tactical awareness for command teams while minimizing the detection risk. The LMTN consists of field-configured LoRa (long-range) mesh radios built with RAK Wireless chipsets and dual-18650 batteries. The radios connect to end-user devices (EUDs) via Bluetooth Low Energy (BLE). Two radio variants are employed: dismount and mounted. Figure 1 illustrates the intended employment and mesh topology.

DISMOUNT VARIANT:

A small form-factor, lightweight, and ruggedized 3D-printed enclosure protects the radio and exposes SMA connectors for external antennas. The device integrates a Global Navigation Satellite

System (GNSS) module for positioning services and can fall back to the GNSS module in the EUD as needed. A commercial off-the-shelf (COTS) antenna kit increases radio range and prevents connector damage. LMTN is field-programmable and able to adjust/change power, cryptographic keys, spreading factor, bandwidth, and coding rate for different terrain and mission profiles.

MOUNTED VARIANT:

A COTS or 3D-printed enclosure provides durability for vehicle integration. Due to low power-draw, mounted variants leverage solar charging to ensure availability and reduce their logistical burden. The mounted architecture mirrors the dismounted design and allows secure hard-mounting or magnetic attachment to vehicles, allowing the track commander to connect directly to the radio for continuous ATAK-based position and messaging features within the network. In this variant, external antennas can be optimally employed on top of armored platforms to maximize radio performance.

EXPERIMENTS AND RESULTS:

The LMTN performed exceptionally well during field tests conducted at National Training Center (NTC) Rotation 24-09, Exercise Hedgehog 2025, and Combined Resolve (CbR) 25-02, where it was employed at the Troop-level. Across all field tests, dual-18650 RAK-based dismount nodes operated for 18–24 hours, with full recharge achievable in four hours via

Fig 1. *Troop-Level Mesh Network*

USB-C. Improved antenna kits provided a reliable total network range of 5km and a maximum range of 19km. The LMTN succeeded where traditional systems degraded, often outperforming organic radio equipment across all relevant performance metrics. Additionally, during a United States European Command (EUCOM) rotation in FY25, partner nations were trained by 5-7 CAV in producing and employing the LMTN in support of their military operations, demonstrating both the broad applicability and trainability of the LMTN within multinational operating environments.

DISCUSSION, FUTURE WORK, & SIGNIFICANCE:

The current design supports modular, mission-specific employment, and there is potential in developing a UAS-mounted variant to extend network coverage. Future work includes pairing a short-range 2.4 GHz link with the existing 915 MHz LoRa mesh for higher-bandwidth, proximity-based team chat, exploring directional and elevated relay nodes, and evaluating RFD900-class links for long-haul data transport. Collectively, these efforts emphasize the operational need for a cost-effective, low-burden, and reliable communication solution that delivers low-signature, resilient communications down to the Team level. In its current state, the LMTN provides leaders with persistent, real-time visibility across a diverse formation at a fraction of the cost (~3%) of currently fielded military radios, such as the radios incumbent to the Integrated Tactical Network (ITN).

Increasing Survivability of Forward Medical Elements in LSCO

Payton T. Mogford

67th Forward Resuscitative & Surgical Detachment,
30th Medical Brigade, Germany, U.S. Army
Email: payton.t.mogford.mil@army.mil

INTRODUCTION:

Given lessons learned from the Russo-Ukraine conflict, the preferred method of Protection for far-forward medical elements is the utilization of pre-existing bunkers or reliance on the engineer corps to build them. When this is not feasible, units must be mobile. U.S. medical units are not currently equipped to achieve initial operating capability (IOC) or hasty exfil within a timeframe that is both reasonable and survivable. The next peer conflict will demand that forward medical assets be equipped with mobile operating centers that are as versatile as they are specialized, easy to maneuver, easy to replace, and highly scalable. This paper will focus on elements providing damage control resuscitation (DCR) and damage control surgery (DCS) capabilities.

DESIGN SPECIFICATIONS:

The Forward Resuscitative and Surgical Detachment (FRSD) is a 20-personnel modular unit capable of executing 10-personnel split operations or breaking down further into Advanced Trauma Life Support (ATLS), operating room (OR), and post-operative care. Each 10-person slice must mirror the others, be capable of organic personnel transport, and be able to evacuate under duress with casualties under operation. En route patient care is not a reasonable expectation. There are three possible solutions with their own merits: 1) affixing a container to a load-handling system (LHS) equipped prime mover, 2) using a vehicle with a rear suite, like a box truck or expandable van, or 3) using a civilian van. Each option yields a spectrum of opportunities for medical specialization. Under no circumstances should a medical unit forward of the division support area consider downloading the container; operations must always take place from the vehicle.

Combat-ready considerations include ballistic protection, electromagnetic pulse shielding, anti-UAS protection, cover/concealment, and platforms capable of enduring both field and urban environments while maintaining pace with augmented units. Sustainment considerations include cost, maximal ability to service using Army (non-contracted) personnel, and ease of both scalability and replaceability. Medical specializations include temperature control (HVAC) to mitigate hypo/hyperthermia, surgical lighting, patient ingress/egress solution, 360-degree patient access, anesthesia outlet, space claim for sterilization and sterile fields, L-tracks/railing, ceiling-mounted IV pole mounts, cold chain storage, positive-pressure feature to aid in maintaining sterile operating room, fluid drainage ports, surgical sink, and storage solutions to carry adequate medical supplies anticipating delays in resupply.

EXPERIMENTS AND RESULTS:

The 67th FRSD assessed multiple platforms that currently exist within the Army's inventory, including a container affixed to a prime mover (HEMTT, PLS, or M1148A2), M1087 "Expando" van, non-tactical vehicle, the Chemical Biological Protective Shelter (CBPS), and the Field Litter Ambulance (FLA). Of these, only the container and M1087 met the base tactical and clinical capabilities for units operating in the Role 2 space. From 67th FRSD's own experiences, reliance on tents or buildings of opportunity yields IOC of 60 minutes by day and up to 210 minutes at night. EXFIL could take 60 minutes. In October 2025, 67 FRSD exercised an unmodified M1087 "Expando" Van at the Joint Multinational Training Center and reduced IOC to 20 minutes and EXFIL to 10 minutes. If on uneven terrain and requiring stabilizing beams, add an additional 10-20 minutes. The Medical Future Capabilities Directorate (MFCD) found similar times using a container on an M1148A2, though experienced issues with patient upload/download due to the limitations of a 15 ft. ramp and ultimately resorted to grounded operations.
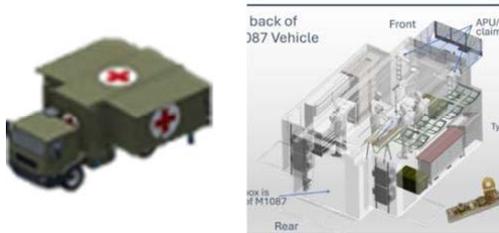
Fig 1. *M1087 Customized Operating Room (DES)*

Fig 2. *MFCD Multimodal Medical Container (M3C Concept)*

DISCUSSION, FUTURE WORK, & SIGNIFICANCE:

As an interim solution, 67th FRSD partnered with Defense Engineering Services (DES) to custom fabricate an OR into an M1087 Expando van, which we sourced from a unit that deemed it surplus equipment. Fabrications are expected to be completed by spring 2026. This pilot will provide a stopgap solution, but the M1087 is limited by its inability to scale and its reliance on surplus equipment if a fleet is desired. This pilot will demonstrate the ability to achieve rapid change far in advance of the usual acquisition pipeline at reasonable cost and to generate a feedback loop to the enterprise on what went well (or did not). Included in this assessment is a critical point at which MFCD and I diverge: reliance on cabinetry rather than classic medical chests. Cabinetry will reduce setup times and improve equipment organization. MFCD and I both agree on the M3C as the future, but I seek to highlight options like Valinor Harbor, which have achieved every feature I have sought (and then some) at reasonable prices and lightning-fast production timelines. Further, each container comes standard with software that enables C2, communications, and sustainment features, which are a massive value-add in degraded environments. The ability to reduce risk to force and mission, and increase operational effectiveness for 49 specialized units comprised of professionals, the physicians of whom take up to 14 years and millions of dollars to train, should not be forwent to save a few hundred thousand dollars per detachment in favor of a universal fix.

Preventive Readiness Information & Signal Module (PRISM): Sick Call–Driven Command Intelligence for Readiness Degraders

SPC Santiago Arminana-Quintana

2ABCT, 3ID, Fort Stewart
Email: santiago.arminanaquintana.mil@army.mil

INTRODUCTION:

In 2018, Army injuries drove an estimated $4.7B in total direct medical and indirect readiness costs, largely from lost duty time [1]—yet musculoskeletal injuries (MSKIs) and other duty-limiting conditions are still largely captured on paper DD-689 Sick Call slips at presentation and routed by hand from units to clinics. This reduces commander visibility, separates accountability, and obscures links between Sick Call signals, training exposure, and readiness trends. Units need a streamlined, secure electronic DD-689 workflow that provides Soldiers with faster treatment and enables early intervention before acute issues become chronic readiness losses.

Brigade, division, and higher headquarters also need real-time, de-identified trend visualization to baseline Sick Call rates across formations, identify units sustaining lower injury burden and higher deployability, and replicate what works—because without comparable data, readiness degradation goes undetected.

PRISM digitally converts the DD-689 Sick Call process by capturing unit-level injury and illness data (which is not recorded in the Electronic Health Record) and automatically routing it through the chain of command. This generates de-identified readiness analytics that enable division and corps commanders to establish baseline injury rates, compare health trends across formations, and replicate practices that enhance deployability. The system is designed as a lightweight, unit-focused tool rather than an enterprise medical record: it captures only the minimum, de-identified fields recorded by the Soldier at presentation—specifically, injury vs. illness selection, body region/MSK specifics, and mechanism of injury. This data enables commanders to rapidly identify at-risk units, high-injury training events, and emerging injury trends linked to training calendars.

DESIGN SPECIFICATIONS:

PRISM is a lightweight, web-based electronic DD-689 portal built on a Django/PostgreSQL backend, currently deployed on Heroku for rapid prototyping and engineered for IL4/5 migration to AWS GovCloud (US). Soldiers present a QR-coded Sick Call card that opens a structured intake form; medics/clinic staff complete only the DD-689 accountability fields (unit, profile category, duty limitations, follow-up date, return-to-duty status) and submit to PRISM. Role-based access control enforces echeloned visibility: company leadership sees only their company's slips, battalion leadership sees subordinate companies, and brigade leadership views aggregated trends. PRISM

intentionally excludes narrative clinical notes and diagnosis codes to avoid creating a parallel EHR and to stay readiness-focused. Commanders upload the unit training calendar (Excel) through the dashboard; the file is stored in AWS S3, parsed with openpyxl into JSON, and automatically aligned with Sick Call time series. Injury clusters and training-linked patterns are visualized in a Highcharts readiness dashboard, and commanders can generate COA narratives by selecting one of five standardized templates from a drop-down, which triggers gpt-4o-nano to produce concise, commander-focused recommendations. All actions are time-stamped and logged for auditability and command inspection.
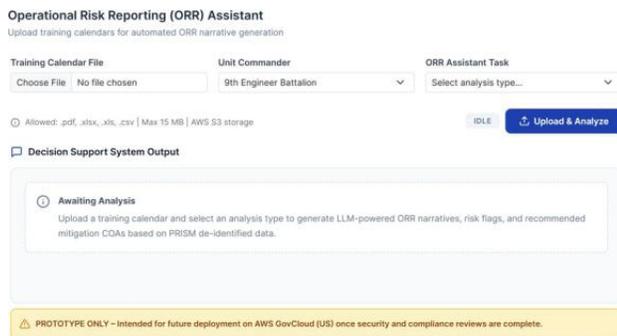

Fig 1. *Operational Risk Reporting (ORR) Assistant*

Fig 2. *Sick Call Forecasting Module (forecast injuries).*

EXPERIMENTS AND RESULTS:

To validate the proof of concept without using real Soldier data, an automated script generated a daily stream of realistic, randomized Sick Call submissions through PRISM, thereby creating a continuous company-level time series. From the commander dashboard, a sample training calendar was uploaded (Figure 1); the system stored it in AWS S3, parsed it to JSON, and overlaid training events on the Sick Call timeline for context and visualization. Meta's Prophet model (Figure 2) was then applied to the Sick Call time series alone (with weekend and holiday effects) to produce short-horizon forecasts of expected encounter volume. At the same time, gpt-4o-nano used the aligned calendar context to draft concise COA narratives (e.g., adjust ruck load, insert recovery days, target H2F support) when observed encounters exceeded the forecast baseline. These simulations show that PRISM can ingest continuous Sick Call data, accept a commander-uploaded training calendar for operational context, generate interpretable forecasts, and automatically surface commander-ready recommendations when risk appears elevated—validating the end-to-end workflow for a future live-unit pilot.

DISCUSSION, FUTURE WORK, AND SIGNIFICANCE:

PRISM shows that a lightweight, non-EHR electronic DD-689 portal can improve readiness visibility and commander decision-making without replacing, duplicating, or modifying enterprise medical systems. Near-term work will: (1) deepen training-calendar linkage to automate risk flags when recurring event–injury combinations emerge, highlighting readiness loss at the point of injury; (2) migrate the prototype from Heroku to IL4/5-compliant AWS GovCloud (US) an integrate secure identity providers—with CAC-enabled authentication if approved—to harden access control for operational use; and (3) validate scalability across multi-battalion deployments while preserving strict data minimization and privacy safeguards. A further extension is an AI-supported H2F module that uses unit-level injury patterns to recommend targeted training adjustments and recovery-focused H2F workouts, helping higher-burden units converge toward the deployability baselines established by lower-injury formations. If transitioned at scale, PRISM would compress the gap between Sick Call presentation and commander awareness from days to minutes, interrupt the

acute-to-chronic injury pipeline that drives non-deployability, and provide commanders and H2F teams with a repeatable readiness-intelligence system to sustain combat power across the force.

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Aviation Tools Fabrication and Prototyping

Matthew Y. Kim, Michael A. Wenzel, & Zaw M. Aung

Aviation Maintenance Company 2-3 GSAB, 3CAB
Emails: matthew.y.kim7.mil@army.mil, michael.a.wenzel13.mil@army.mil,
& zaw.m.aung.mil@army.mil

INTRODUCTION:

As the Army shifts toward unmanned aerial systems, Aviation is at a critical inflection point. We must sustain readiness with fewer resources. At the AUSA 2025 Conference, Secretary Driscoll called for embracing additive manufacturing (3D printing) and other emerging technologies to reduce costs and speed up the replacement of parts. While he did not mention tools, the same methodology should be applied to how we approach maintenance [1]. Too often, maintenance relies on a brute-force approach, ordering parts and tools rather than leveraging ingenuity. To meet mission demands, Aviation maintenance must bypass bureaucratic limitations and seek real efficiencies so our soldiers can train and support the ground force. During the Southern Border Mission, our unit faced this challenge head-on. For two months, maintenance funding came solely from turn-in credits.

Every part had to be justified by the question: would it move an aircraft from non-mission capable to fully mission capable? We lacked funding to replace basic consumable tools and had to go through a slow, procedural approval process to justify funding. The problem persisted as we prepared for a deployment to Europe. Our company was directed to operate across five locations, including one in the United States. The MTOE does not account for such a dispersed setup, yet mission requirements demanded it. Our experience shows maintenance units will need to operate in widely split configurations, regardless of ARSTRUC. The real problem is how to do so with limited resources.

PROCEDURE SPECIFICATIONS:

We have developed a decision tree that outlines the steps a soldier should take in product development (See Figure 1). The process is first simplified by identifying the problem and determining whether the regulation allows us to produce the item. With a basic understanding of "if else statements," this process allows a soldier to determine the process from Identification, Development, Prototyping, Implementation, and Deployment across the Army. While we cannot develop all tools due to calibration constraints and
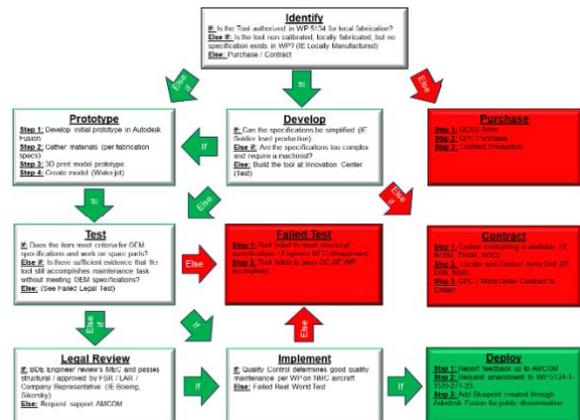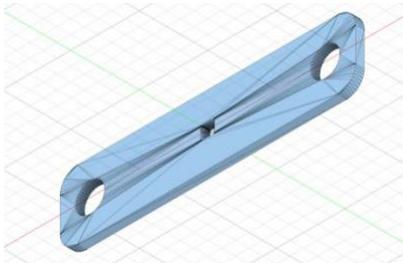

Fig 1. *Fabrication Process*

product limitations, user feedback on simplifying fragile, expensive tools is essential. Such feedback can significantly reduce costs, replace traditional brute-force approaches, and inspire soldier ingenuity.

Fig 2. Torque Adapter Vertical Hinge Pin

IMPLEMENTATION AND RESULTS:

We tested our procedure on Torque Adapter Vertical Hinge Pin Seals, which often leak due to environmental factors and installation issues. WP 2770 requires special tools, including the Torque Adapter, for replacing oil tanks on our fleet of twelve CH-47 Chinooks, which often need replacement weekly [2]. The task is tedious and time-intensive, often taking multiple days due to limited resources and only one functioning Torque Adapter. SGT Thomas Wilhelms, Powertrain NCO, in reference to the IETM specifications WP 5509 and WP 5134, had an idea for a simple fix [3, 4]. In under four hours, he prototyped a new torque adapter using steel flat stock, a wrench adapter, a drill press and a welder (See Figure 3). The design was refined at the Marne Innovation Center. Using Autodesk Fusion 360, we developed a blueprint and manufactured a tool that meets design specifications for the task (See Figure 2). The prototype allows us to take a tool that costs $1661.33 and brings Army costs to ~$11, a decrease of 99.37%. We were able to produce a tool and a concept that could be built in less than two hours, which would allow us to operate in multiple austere locations.

DISCUSSION, FUTURE WORK & SIGNIFICANCE:

The torque adapter is just one of hundreds of tools to which we can apply this same procedural approach. Our next step is to raise awareness across the Aviation enterprise and create a shared system that allows all Combat Aviation Brigades to readily access and develop tools at the soldier level. Our short-term solution is to use Microsoft Teams to display our projects locally. Our long-term solution is to incorporate these soldiers' developed ideas into the Interactive Authoring and Display Software, so soldiers can access these blueprints through Aviation maintenance work packages. Soldiers can modernize Aviation tools through their own Division-level innovation centers.

Fig 3. Torque Adapter Prototype

ACKNOWLEDGEMENTS:

CPT Matthew Kim, 1LT Michael Wenzel, SFC Zaw Aung, SGT Thomas Wilhelms [Tool Procurement NCO], Marne Innovation Center

REFERENCES:

[1] Secretary of the Army AUSA Opening Remarks 36:00-39:00; [2] WP 2270 Install Vertical Hinge Pin Oil Tank; [3] WP 5509 FMI-380 Torque Adapter Vertical Hinge Pin Blueprint [4] Soldier Created Fusion Blueprint Prototype [5] WP 5134 Illustrated List of Manufactured Items

ExPaTSI: Expanding Partnerships for Expedient Tactical Soldier Innovation

Shamaria Rivers, Lucas Rider, Eric Tang, & Yisroel Schatz

Georgia Tech Research Institute
Email: shamaria.rivers@gtri.gatech.edu

INTRODUCTION:

Army Tactical Innovation Centers (TICs) encourage a bottoms-up approach to rapidly address soldier-identified capability gaps. While this is an exciting opportunity for innovation, at some TICs, soldiers often have to receive permission to spend time away from their jobs to design and prototype their ideas. In cases where they cannot spend time away from their job, soldiers may be forced to spend some of their off-duty time developing their ideas or abandon the idea entirely. Additionally, soldiers may need to receive training to learn how to use the various software and hardware in the TICs before they are able to begin working on their idea, thereby lengthening the time it takes for the soldier to develop a useful prototype. One way to expedite innovation while minimizing the demand on soldiers' time is to work with external partners who have the relevant expertise to help soldiers bring their ideas to life. Such partnerships have proven fruitful in the past. For example, soldiers at Marne Innovation Center were able to successfully partner with students at the University of Florida to develop a vehicle camouflage deployment device [1]. As pointed out in [1], a professor from the University of Florida learned about the opportunity to collaborate with Marne Innovation Center through a colleague who worked at the TIC. While pre-existing relationships are a great baseline for connecting soldiers with additional expertise, these pre-existing relationships cannot scale. That is, TIC staff may not always have a pre-existing relationship with the necessary subject matter experts for every project, thereby requiring soldiers to spend additional time learning a particular subject matter or abandoning the idea entirely due to the lack of time—signaling a need to expand the expertise available to TICs to help soldiers fill their capability gaps. To overcome this challenge, GTRI is developing ExPaTSI, a platform designed to connect soldier innovators with academic labs and small businesses to help soldiers rapidly bring their ideas to life. ExPaTSI provides several unique features and research that directly address a critical need for TICs, it is designed to: 1) enable rapid prototyping to fill capability gaps identified by soldiers, 2) minimize demand on soldiers' time, and 3) minimize costs to TICs by exploring non-monetary incentives for external partners.

DESIGN SPECIFICATIONS:
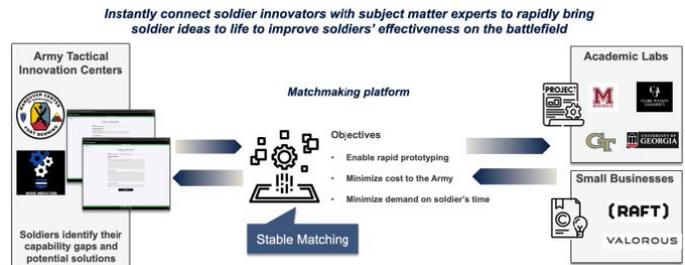
ExPaTSI leverages two key technologies: 1) a GTRI developed Large Language Model (LLM), and 2) a stable matching algorithm. As shown in Figure 1, ExPaTSI can input submissions from the soldier innovation platform (SIP) that describes the soldier identified problem and a set of academic labs and small business. Using in-context search, the LLM will find an initial set of potential matches

based on the SIP submission and the skills of relevant academic labs and small businesses. Once an initial set of relevant matches is identified, using a set of preference questions developed through stakeholder interviews, ExPaTSI will employ a stable matching algorithm, such as an adaptation of the Gale-Shapley algorithm [2], to find a ranking of the most stable matches. A match is deemed stable if for any two participants that are matched, no participant prefers to be matched with another participant that they are not currently matched with, which ensures the strongest possible match for optimal success.

EXPERIMENTS AND RESULTS:

While ExPaTSI is currently under development, our team has conducted a number of stakeholder interviews to ensure the platform is developed with our intended users' feedback in mind and to garner buy-in for our approach. On the TIC side, our interviews have revealed that soldiers do not like using new software and existing platforms that claim to match them with partners because they remove the human element of the interaction. For these reasons, we have

Fig 1. *ExPaTSI instantly connects soldier innovators with subject matter experts to enable rapid prototyping, while minimizing costs to the Army and demands on Soldiers' time*

designed ExPaTSI to take input from the SIP, as that is a software that TICs are already familiar with, and we have designed ExPaTSI similar to dating apps (e.g., Hinge [2]), where the stable matches (e.g., academic lab) are presented to the user and they can choose to message them directly on the platform or contact them outside of the platform if this permission is granted by the lab or business. On the academic lab side, our interviews have revealed that instructors of senior capstone courses are generally willing to work with TICs for free in exchange for the students gaining real-world experience, thereby minimizing costs to TICs.

DISCUSSION, FUTURE WORK & SIGNIFICANCE:

Upon completion of the ExPaTSI prototype, we plan to conduct usability tests with a group of stakeholders to validate and refine our approach. ExPaTSI has the potential to greatly expand the capability of TICs by connecting them with a national network of expertise, while adding little to no cost to their existing operations and fostering a better environment for innovation and collaboration between the DoW, academic institutions, and small businesses.

ACKNOWLEDGEMENTS:

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MASSACHUSETTS NATIONAL GUARD PROCESS FOR DEVELOPMENT OF AN INVENTORY MANAGEMENT TOOL

SGT Paul Martin

State Innovation Officer, Massachusetts National Guard Innovation Team (MANGIT)
387TH ORD co (EOD) MA Army National Guard
Email: Paul.D.Martin107.mil@army.mil

INTRODUCTION:

Members of the 387th EOD in the MA National Guard have a long and complex process to inventory all of the gear that is assigned to them. A team cage with 2-3 team members can take 8 hours to complete. A complete company level inventory commonly takes 3 full days to complete. It is not uncommon to have to do this 2-3 times per year. This means that of the 48 days available for training, 9 of them are spent accounting for equipment. This single task can take up approximately 19% of the available training time in a year. Time that could be better spent on mission critical tasks that improve survivability and mission success. Currently this process involves a Supply SGT pulling records from G-Army. They then create a physical binder with a working copy, final copy, and historical copies of the inventory. The equipment is a mix between Army, Navy, a commercial off the shelf items. Items are poorly named, usually missing pictures, and occasionally replaced with alternate items. This leads to a high dollar inventory that is chaotic, slow, and extremely prone to errors. A team will go though each case looking for individual parts, then mark them on a working copy. After this has been completed they will repeat the entire process onto a final copy. Then they will fill out DA-2404s for all equipment that was found deficient. We needed an application that would show an image of the item, tell us what it was, where it should be, and ask us if we had it. However, this was beyond our ability to create in-house.

PROCEDURE SPECIFICATIONS:

At first, we reached out to DIUs Hacking for Defence program looking for a computer science program with coding expertise. We were partnered with a class from Tufts University that we later learned was an engineering psychology program, that had limited expertise in coding. We chose to pivot to their specialty which was researching human centred design. The Tufts students travelled to the unit multiple times to evaluate how the process was done currently. They then developed an intuitive workflow for how an application should function. At the end of the semester, we took the work that was developed with Tufts and brought it to the computer science program at Northeastern University. We worked with the professors on the pilot launch of the Introduction to Consulting course. We managed to arrange that the software would be developed in a series of sprints in conjunction with the class. The students took some of the human workflow approach from Tufts, then coded a fully functioning backend. The next semester will take this fully functioning alpha and further refine it. The code will be jointly owned between the MA National Guard and Northeastern University. We have worked with the Air National Guard's ARCWERX who provided subject matter

experts to guide the students on all relevant coding and security standards early on. ARCWERX has also agreed to host the application on their servers and help grow to scale.

IMPLEMENTATION AND RESULTS:

Initial trials showed that a new individual who was both unfamiliar with the application and the military equipment was able to inventory the box of test equipment with perfect accuracy in 90 seconds. Compared to an experienced soldier inventorying the same equipment using the legacy method taking about 5 minutes and occasionally making errors. Overall user testing showed that the new application took about 25% of the time to conduct an inventory as the traditional method. A function was also built to generate a DA 2404 for any item that was discovered damaged during the inventory. When the service member has completed the inventory, it generates a spread sheet that can be directly sent to the supply NCO to be entered into G-Army. It will also provide all applicable 2404s that have been prefilled out. This application is designed to be a stand-alone tool in isolation from any military systems and is designed solely to assist the service member conducting the inventory. We cannot fix the entire system; however, we found a small part of it that we could make a meaningful impact.

DISCUSSION, FUTURE WORK & SIGNIFICANCE:

The lessons learned for the MA National Guard Innovation Team are that making direct relations with the universities that you wish to work with is superior to having them assigned by a 3rd party. Using multiple capstone projects in a series of sprints is highly effective at developing a quality product. This can include using multiple types of university programs. We also found that giving general parameters, being available for quality support, and then providing access to end users is far superior to generating an overly prescriptive requirements document and expecting developers to work in a vacuum. This project will continue to develop with the goal of being able to implement it at scale to any unit that would like it in the DOD. This is only one of the tools we have developed using this methodology. The next sprint at Northeastern is already lining up to make improvements, look for bugs, conduct penetration testing, and prepare to scale.

ACKNOWLEDGEMENTS:

Enabling Units with Operational Data Science Teams

Gage Callahan & Thomas Canchola

Army Artificial Intelligence Integration Center, Research and Engagements
Email: gage.d.callahan.mil@army.mil

INTRODUCTION:

To enable data-driven decision-making and transformation in contact (TiC) while delivering artificial intelligence (AI) and machine learning (ML) capabilities at echelon, the AI Integration Center (AI2C) supports operational units through Operational Data Science Teams (ODSTs). ODSTs (a) Discover capability gaps directly through unit engagements; (b) collect and access relevant data streams from the source; and (c) test initial solutions with users to rapidly refine prototype data products and AI tools. By linking ODSTs directly to operational units, AI2C strengthens the technical skillset of its personnel and meets real operational decision-support, data science, and AI/ML needs. While AI2C continues to refine and utilize variations of the ODST concept, its primary procedural data comes from the VALEX conducted from 20 July to 22 August 2025.

PROCEDURE SPECIFICATIONS:

The ODST consists of three to five AI2C personnel, trained through its AI Scholar and AI Technician programs. From these programs, the team has a foundation of skills in machine learning, software development, data engineering, data science, and cloud architecture. Additionally, team members have experience developing experimental products for Army users through one of AI2C's four incubator portfolios.

Project	Project Key Deliverables
TACML	Develop Map Overlay Product
Crowstorm Peregrine	Drone-based computer vision model development
TACML	Computer Vision Image Labeling
PMx	Long-lead time parts tracking
Shrike	Drone-based hardware integration
Pangea / Loadout	Ingest disparate systems of Logistics, Medical and Infrastructure Data
GenAI	Build, improve, and Deploy LLM Tool
GMAP	Create user-friendly application for maintainer data

Fig 1. *ODST projects in support of operational units during Summer 2025 VALEX*

To best support operational teams, AI2C considers its personnel's skills and matches them to the operational needs identified by units. Some units seek specific AI2C capabilities while others have more general requirements. Ultimately, AI2C defines the initial project timeline and goals, completes administrative planning, assigns appropriate personnel, and addresses any gaps in the team's knowledge or experience. This can involve executing user-engagement exercises, refreshing analytical skills, and cross-training on other portfolio projects. While AI2C's VALEX rotations lasted between one and three weeks each, future AI2C ODSTs are prepared to support missions lasting several months, potentially.

IMPLEMENTATION AND RESULTS:

During validation of this procedure, AI2C sent 9 teams to 6 locations. This mission primarily supported USAREUR-AF units, although the teams also supported 1st AD and 25th ID. A summary of AI2C projects and the corresponding deliverables is shown in Figure 1. To maximize the value of the supported unit while achieving our internal assessment goals, an additional Soldier was assigned to each team as an assessor. This allowed the team leader to focus on coordinating with the unit, managing the project, and mentoring newer team members.

Each team successfully integrated with their unit and met preestablished project milestones, though UAS teams were hindered by poor weather and hardware compatibility issues. ODSTs delivered value by integrating existing AI2C products and developing minimum viable products (MVPs) to meet emergent demands. The teams' software skills were especially helpful for flexible integration with the varied hardware and software employed by each unit. Additionally, this exercise highlighted some gaps in training, deployment capability, and long-term product maintenance that AI2C is working towards addressing for future support missions.

DISCUSSION, FUTURE WORK & SIGNIFICANCE:

The ODST VALEX was nested under the ongoing Mission Command Center of Excellence's Operational Data Team (ODT) concept assessment (Figure 2). The ODT concept functions similarly to the ODST, with additional personnel focused on software development, product management, and knowledge management. As this concept continues to develop, lessons learned from the ODST implementation will help shape the data support construct of the future Army.

Fig 2. *ODST concept nested into Mission Command Center of Excellence (MCCoE) Operational ODT concept [1]*

Results from the ODST VALEX and other ongoing related support exercises showcase the potential for teams of technically skilled Soldiers to support the creation of data products for operational units. Based on the success of this exercise and expanding operational requirements, the demand signal for ODST support continues to grow. This type of support should continue until a long-term, stable construct is in place to embed data analytics capabilities within formations. AI2C currently plans to support future events, such as the C2/Counter-C2 CFWE, and expand its role in supporting the needs of operational units.

REFERENCES:

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Sowing Research Gains From Academic Seeds: AI2C's Collaborative Research Strategy

William Cocke & Gage Callahan

Army Artificial Intelligence Integration Center, Research and Engagements
Email: william.l.cocke2.mil@army.mil

INTRODUCTION:

The Army Artificial Intelligence Integration Center (AI2C) manages the AI Scholar and AI Technician programs, in which students earn a master's degree or certificate from Carnegie Mellon University (CMU) and then complete utilization assignments to improve their AI expertise through product development. Part of AI2C's mission is to manage collaborative basic research projects with CMU. These projects can cover work on large language model design, agentic systems, autonomous vehicles, and more. Academic projects often are overly esoteric and result in research that is difficult to apply to Army problems. Additionally, the expertise and knowledge developed through projects quickly fade upon project completion. To better retain and propagate generated knowledge, we have designed a new project management system that helps develop Soldier AI expertise and align projects with relevant goals. Through a deliberate collaboration strategy, AI2C engages academic partners on basic research to leverage institutional academic knowledge and experience while developing AI expertise among Army personnel.

PROCEDURE SPECIFICATIONS:

Our overall project selection, execution, and close-out process is shown in Figure 1. A panel of Soldiers evaluates each proposal, adopting a peer-review system that ranks each potential project across five categories: technical feasibility, alignment with Army priorities, clarity of deliverables, motivation, and technical justification. The top submissions may be optionally invited to present their work to the panel, including potential liaisons, such as third-party subject matter experts across the modernization enterprise. The panel then makes recommendations to AI2C leadership as to which projects are likely to provide the greatest value to the Army. AI2C conducts monthly informal touchpoints with the selected project PIs and more formal quarterly capability demonstrations.

Once selected, each project is assigned to a Soldier-liaison, who partially embeds with the team and meets with them weekly. These Soldiers work on projects

Fig 1. *Project Management Process*

for approximately 20% of their time, contributing to technical research and publication/dissemination pipelines. This training enables Soldiers to develop technical expertise beyond their academic coursework. While the Soldier does not have authority to direct research goals, they provide the team additional manpower and insight into operational requirements.

Prior to project conclusion, the embedded Soldier-liaison assists the academic partner with archiving project results and creating usable knowledge products that preserve technical procedures and innovations, ensuring the longevity and usability of any experimental hardware, software, AI models, and associated data developed or generated. The Soldier then leverages their experience and personal stake in the project to ensure applicable lessons learned are integrated into future work.

IMPLEMENTATION AND RESULTS:

We currently support four projects in which Soldiers contribute code and co-author publications. Academic partners are inclined to accept technical assistance and operational insights, while Soldiers exploit the additional opportunities to enhance their AI skills and expertise. In new projects on drone dogfighting and LLM edge inference, Soldiers have guided research directions toward solutions that optimally address Army-relevant problems. In more mature projects, embedded Soldiers have successfully gained a baseline understanding of the technical work and prepared plans to maintain knowledge products and codebases. Each of these projects is under analysis for maturation into an official AI2C product development effort.

DISCUSSION, FUTURE WORK, AND SIGNIFICANCE:

Training and maintaining a technical workforce are critical to future multi-domain operations and to the Army's ability to maintain decision dominance at echelon. AI, data science, and automation will dominate workforce development programs for the foreseeable future. When Soldiers acquire advanced skill sets that are underutilized in future assignments, the Army risks skill atrophy and attrition of its most talented personnel. Our integration strategy allows Soldiers to develop deeper AI expertise while ensuring the Army receives the maximum return on its investment in basic research.

While the goals of academic researchers are often not directly applicable to immediate operational needs, embedding Soldiers ensures that research aligns with current Army modernization priorities. Similar programs could be established with any organization across academic, industry, or other government partners. Our managed research program builds Soldiers' technical AI experience and guides basic research more explicitly toward the development of future Army capabilities.

The Value of Soldier Innovation Competitions

CPT Brenden M. Shutt & 1LT Robert L. Saldutti

3rd Infantry Division, Marne Innovation Center
Email: brenden.m.shutt.mil@army.mil

BACKGROUND:

The Marne Innovation Center (MIC) at the 3rd Infantry Division (3ID) is the center of gravity for innovation at Fort Stewart. Since its establishment in November 2021, the MIC has endorsed a Soldier-led innovation model that enables 3ID Soldiers to own the tactical innovation process: problem identification, solution development, and solution integration. The 3ID Soldiers receive support from a hybrid Soldier-civilian team assigned to the MIC, which facilitates the prototype development process by providing project-aligned training, funding, equipment, and advocacy. Along with Combat Training Center (CTC) rotations and semi-annual innovation symposia, a core event for the MIC and a genuine driver of innovation within 3ID is the annual Marne Innovation Challenge.

PROBLEM:

There is a lack of formal mechanisms for convergence and exposure for Soldier-led innovation, resulting in limited leadership visibility for high-potential, early-stage projects that receive less attention than more popular innovation trends. Furthermore, the garrison environment offers fewer intrinsic motivators than a deployed environment for Soldiers to lean forward and innovate. Tempo in a garrison environment is generally dictated by unit training, to include CTC rotations, with the rehearsed nature of these events failing to foster the ideal, persistent conditions for problem discovery and Soldier innovation.

VALUE PROPOSITION:

Innovation competitions provide a high-visibility forum to recognize innovation success, motivating Soldiers to seek out problems/solutions relevant to their specific mission by offering recognition, awards, and opportunities for career advancement through Army schools or coveted positions. Focusing on the Soldier stakeholders, the competition's value lies more in its externalities and less in the competition itself; the process of project development, producing an articulate project pitch, and the positive feedback loop associated with inspiring adjacent Soldiers/units to achieve success in the innovation domain all work to achieve the desired end-state: a culture of innovation. For the competition's judges and attendees, the communal event showcases innovations and Soldier talent that might otherwise go overlooked, underutilized, and unsupported.

Procedure Specifications: There is no universal model for Soldier innovation competitions, though

there are two main formats: Shark Tank and Science Fair style. The Shark Tank model focuses on Soldiers pitching projects to a dedicated panel of judges and best fits a tightly curated portfolio of mature innovation projects; in contrast, the Science Fair model offers less rigidity in the event's sequence and more attendee participation via its distributed judging model, best fitting a wider project portfolio and emphasizing a discussion-oriented presentation style. Both models can work well, and the decision between the two should reflect the event's overall intent.

A challenge in conducting an innovation competition is sourcing enough high-quality Soldier innovation projects. It's optimal for lower-echelon teams to facilitate their own competition and deliver the best projects to the next higher competition. If this is infeasible, sourcing projects must be a grassroots initiative. Flyers with registration QR codes distributed to company areas two months before the event, coinciding with a regular presence at motor pools, ranges, and in-briefs, are typically sufficient for identifying Soldier problem sets. The next step is encouraging Soldiers to participate in the competition; a task that is easier when the Soldier stakeholders and sponsoring units have a clear understanding of the innovation team's value, a product of relationship building and branding.

Success is not without failure, and the MIC is not immune. Over the years, the MIC has witnessed/made many procedural mistakes in its innovation competitions. The most common failure stems from a misunderstanding of the Soldier innovation process: the sourcing of high-impact projects. Many ambitious commanders at all echelons want to direct innovation toward an emerging capability (e.g., drones) but often encounter misaligned or apathetic attitudes from lower-echelon entities tasked with "doing innovation" for that capability. A bit counterintuitive, but the MIC finds that the optimal path toward a converged innovation effort at scale often begins by empowering the network of Soldiers/units to work on projects closest to them – tapping into intrinsic Soldier motivation and seeing what projects rise above the rest, void of an imposed top-down bias.

Continuing lessons learned, the value of innovation competitions seldom improves with added complexity. This advice is widely applicable, but two aspects where the MIC has over-valued complex methods are the project judging mechanism and event attendees. Judging should be swift and straightforward: the MIC recommends project ranking across four criteria in the Science Fair model and project scoring (10-point scale) over no more than five criteria in the Shark Tank model. Regarding attendees, the ideal competition attendee is someone who can enact immediate action in support of a Soldier project. Leave the schmoozing for cocktail hour and prioritize attendees who have an authentic vision for Soldier innovation, those with an incentive to support innovation at the lowest level. In the MIC's experience, the best attendees are just down the road: the Battalion and higher command teams who benefit most from Soldier projects and who can exercise their authority to prioritize meaningful innovation efforts within their formations.

IMPLEMENTATION AND RESULTS:

Innovation competitions offer a low-cost, high-reward opportunity to showcase, reward, and accelerate Soldiers' innovative efforts. The event aims to be a development milestone, not an endpoint: a progress check and a newfound source of motivation for meaningful work, ideally going beyond the original Soldier stakeholder. The output of a well-conducted Division innovation competition ought to be five (x5) Soldier innovation projects with the aptitude to generate a transformative impact on the underlying organization. For 3ID, that means increasing lethality, enhancing operability, and assuring survivability to enable 3ID to accomplish its mission in the era of Large-Scale

Combat Operations. As it stands, 21 Soldier innovation projects (19% of total projects sourced in 3ID) were sourced through the three Marne Innovation Challenges, making it the second most common project sourcing mechanism after walk-ins.

Enhancing Innovation Through Dedicated Training

Seth A. Addeo, Judah M. Koebel, Larry W. Dockins, Oleksander Kimbirskyi,

Airborne Innovation Lab, Gainey Company/82nd ABN DIV HHBn, US Army
Email: seth.a.addeo.mil@army.mil

Tim Ripley, & Brendan J. Webster

Airborne Innovation Lab/Civil-Military Innovation Institute (CMI2), DoD Contractors

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INTRODUCTION:

The U.S. Army is currently heavily saturated with innovation efforts. Army-wide, units are establishing innovation labs, designating innovation officers at the Corps, Division, Brigade, and even Battalion levels, and developing innovative solutions to the problems servicemembers face daily. Oftentimes, however, leaders will demand solutions that current technology cannot deliver or will require internal modifications to Program of Record (PoR) equipment that most—if not all—soldiers are not permitted to access (opening the case on a radio to repair or modify internal components, re-wiring faulty electrical sensors, or modifying vehicles), or require Battalion (or higher) Commanders' approval to fabricate and utilize [1]. While doctrinal and regulatory changes are far beyond the reach of unit-level innovation teams, educating personnel within their units about what is physically and technologically possible is not only plausible but necessary.

Educating Soldiers and leaders at all levels on additive manufacturing and electronics better prepares personnel for success both inside and outside the military, while also ensuring the complex problems Soldiers face daily can be effectively planned for and solved. Outside of 91Es (Allied Trades Specialist) and 914As (Allied Trades Warrant Officer), there is no dedicated Army training on additive manufacturing, and there is no current Army-run training on microcontroller electronics. The Airborne Innovation Lab (AIL) at Fort Bragg, NC, offers two courses: the Basic Additive Manufacturing Course (BAMC) and the Introduction to Microcontrollers Course (I2MC). Both are 5-day, 40-hour courses offered free of cost to all military personnel, regardless of duty position, rank, branch, or MOS. While these courses do not produce technical experts in 3D printing, microcontrollers, and coding, they do provide students with an understanding of how to apply these concepts as tools when they attempt to solve problems or explain the process to their leadership when asked for something impossible. While innovation is not reliant on the education of the force, introducing Soldiers and leaders to the process helps create specific, realistic projects to solve issues within the Army.

PROCEDURE SPECIFICATIONS:

Both BAMC and I2MC cover a range of topics, ensuring that students of all skill levels can take away valuable information from the course. Both courses rely on classroom instruction on days 1 and 2, while incorporating various practical exercises (and two graded events for BAMC) to ensure students' comprehension of the topics. BAMC first focuses on ensuring a baseline competency on

Autodesk Fusion's Computer Aided Design (CAD) software (used due to it being no-cost to personnel for personal use) to model in both 2D and 3D before teaching students how to slice CAD files for 3D printing, as well as 3D printer setup and maintenance, slicing tips and tricks, and designing models for 3D printing [2]. I2MC focuses on different inputs and outputs on an Arduino Uno microcontroller board, incorporating different sensors, motors, LEDs, and display boards utilizing the Arduino student kit [3]. Once students have grasped these concepts, both courses push students to complete a "capstone" event that involves solving a problem they face in their workplace or have seen within the Army. Students receive 1 to 2 days for a design sprint, during which they must plan an idea, iterate on it, and showcase it to their classmates using the proper terminology before graduating from the course.

IMPLEMENTATION AND RESULTS:

Currently, over 340 students within the 82nd ABN DIV and over 45 82nd-external units at the Brigade or higher level, including students from the Navy, Air Force, USASOC, and JSOC, have attended BAMC (287 students) and I2MC (55 students) since their inaugural classes at the AIL in late 2023. Service members from PV2 to COL and CSM attended, growing their understanding of manufacturing processes, coding, and electronics. For approximately $7 per student for BAMC and nearly no additional cost to the AIL for I2MC due to the reusability of the Arduino student kits, countless students now possess skills that assist AIL personnel in designing and fabricating innovative solutions to their problems. Recent revisions to course content emphasize reverse engineering in BAMC, better enabling graduates to design and fabricate non-load-bearing replacement parts for equipment, particularly fielded equipment whose manufacturers have gone out of business or no longer offer post-fielding maintenance.

DISCUSSION, FUTURE WORK & SIGNIFICANCE:

As these courses progress, their structure and topics will shift to better align with the 82nd ABN DIV's vision, while remaining relevant to the force at large. BAMC's recent revisions align with the Army-wide effort to field "right to repair" equipment, putting units in a better position to repair or replace broken items and ensure their equipment remains in the fight. I2MC is looking at a complete overhaul as the 82nd pushes towards Uncrewed Aerial Systems (UAS) and Raspberry Pi-based devices, switching from a microcontroller-centric course to a soldering, robotics, and Raspberry Pi baseline course. Both courses are implementing a more comprehensive entry survey for FY26 and beyond to determine the characteristics, factors, and MOS that indicate high potential for CAD and electronics skills, thereby enabling the best training of appropriate service members for jobs requiring those skills.

ACKNOWLEDGEMENTS:

The AIL team would like to thank the Gainey and CMI2 leadership for supporting the education of the force on innovation through additive manufacturing and electronics, and all students who have taken the AIL's courses and provided feedback.

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From Frustration in the Field to Fielded Solution: Uncovering Opportunities and Challenges of Soldier-Sourced Innovation at the 82nd Airborne Division Innovation Labs, 2021-2025

Thien Vo & Vivek Rao

Duke University, Pratt School of Engineering
Master of Engineering in Design & Technology Innovation Program
Emails: thien.vo@duke.edu & vivek.rao@duke.edu

INTRODUCTION:

Grassroots innovations, solutions, and initiatives driven by the acute needs of warfighters are widely recognized as playing a critical role in the military and national security. However, in the Army and in large organizations more broadly, supporting, scaling, and sustaining this kind of bottom-up innovation remains a significant challenge. Operating under the Corps' "America's Contingency Corps" mission, the 82nd Airborne Division's Airborne Innovation Lab (AIL) supports soldier-sourced innovation through structured experimentation, prototyping, and partnerships with organizations such as DEVCOM, DIU, and AFWERX. Five years after its inception, the AIL shows compelling signs of success: 450 ideas submitted through Soldier innovation efforts have produced 54 prototypes, 28 fielded solutions, 7 transition-ready capabilities, and the Dragon's Lair event, which highlights top innovations, has earned wide acclaim. Despite the Army's increasing investment in innovation infrastructure and these successes, grassroots innovation efforts and the structures created to promote them (such as the AIL) face challenges in scaling and sustaining outcomes. This creates opportunities to better support soldier-sourced ideas as they move beyond early concepts and prototypes to make a measurable impact on the Army's mission. Our team from Duke University's Pratt School of Engineering worked with the Airborne Innovation Lab to conduct a 9-week preliminary qualitative and quantitative assessment of its processes, impact, and outcomes.

PROCEDURE SPECIFICATIONS:

An analysis was conducted on quantitative problem-sourcing data from the Soldier Innovation Platform covering 2021 through 2025, examining yearly submission volume distribution across units, project status, and indicators of participation and throughput within the Army's innovation pipeline. Qualitative information about AIL and similar, adjacent programs in other service branches was referenced and compiled, and this was combined with quantitative results and synthesized into descriptions of project success and recommendations to address challenges in the status quo.

IMPLEMENTATION AND RESULTS:

Preliminary results highlight strong growth in idea sourcing and prototyping capabilities at AIL and at partner innovation labs (e.g. the 10th Mountain Division's Mountain Innovation and System Integration Lab), as well as the success of various programs in promoting idea submission and movement through the AIL process. Case studies of three projects are examined to inspire an emerging

framework for describing problem and idea classification and trajectory. Procedural and strategic recommendations are presented based on themes.

DISCUSSION, FUTURE WORK, AND SIGNIFICANCE:

This presentation captures preliminary results from our efforts. At scale, this framework can guide other division-level labs in streamlining their innovation-to-adoption pipelines, enhancing the Army's ability to respond rapidly to emerging battlefield challenges. However, as AIL moves toward institutionalizing these transition pathways, challenges remain. Addressing these gaps is central to AIL's ongoing efforts to formalize communication channels between innovators, leadership, and transition partners by reducing friction, clarifying accountability, and ensuring promising solutions move beyond the prototype stage toward full adoption across the force. Future work will focus on a deeper analysis of project characteristics and AIL interventions that lead to successful outcomes; quantifying and refining transition metrics; integrating digital tools for data tracking, and expanding AIL's model through the JIOP, and deeper follow-on studies engaging both AIL and partners across the XVIII Corps and Army are proposed.

ACKNOWLEDGEMENTS:

Special thanks to the 82nd Airborne Division's Airborne Innovation Lab team and participants in the Dragon's Lair for access and collaboration

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