Countering WMD Journal

FOCUS ON: TRANSFORMATION

IN THIS ISSUE:

TRANSFORMING ARMY CWMD EDUCATION: FILLING THE "OPERATIONAL VOID"

EDUCATING FUTURE LEADERS FOR DETERRENCE

AND MUCH MORE...

Issue 31: Spring/Summer 2026

U.S. Army Nuclear and Countering WMD Agency

Countering WMD JOURNAL

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Mission Statement

Countering WMD Journal is published semi-annually by the U.S. Army Nuclear and Countering Weapons of Mass Destruction Agency (USANCA). It furthers the education and professional development of military and civilian leaders and members of government and academia concerned with the nuclear and countering WMD matters.

Article Submission

We welcome articles from all U.S. Government agencies and academia involved with Countering WMD matters. Articles are reviewed and must be approved by the *Countering WMD Journal* Editorial Board prior to publication. For more information, email us at cwmdjournal@army.mil or visit our website at www.usanca.army.mil/.

How to submit your work to the

Countering WMD JOURNAL

The United States Army Nuclear and Countering WMD Agency welcomes articles from all U.S. Government agencies and academia involved with CWMD matters. Articles are reviewed and must be approved by the *Countering WMD Journal* Editorial Board prior to publication. The journal provides a forum for exchanging information and ideas within the CWMD community. Writers may discuss training, current operations and exercises, doctrine, equipment, history, personal viewpoints, or other areas of general interest to CWMD personnel. Articles may share good ideas and lessons learned or explore better ways of doing things.

In addition to the articles that the *Countering WMD Journal* is known for, the journal also welcomes after action type articles, reviews of books on CWMD topics, high-resolution photographs related to CWMD activities, and letters to the editor.

Articles submitted to *Countering WMD Journal* must be accompanied by a written release from the author's activity security manager before editing can begin. All information contained in an article must be unclassified, nonsensitive, and releasable to the public. It is the author's responsibility to ensure that security is not compromised; information appearing in open sources does not constitute declassification. *Countering WMD Journal* is published online and is distributed to military units and other agencies worldwide. As such, it is readily accessible to nongovernment or foreign individuals and organizations.

The Countering WMD Journal is published twice a year: Fall/Winter and Spring/Summer. For questions or submissions, please email cwmdjournal@army.mil.

Cover Images

FRONT COVER: SPC Kody Van Dorp, an unmanned aircraft system operator with the Multifunctional Strike Troop, 2nd Armored Brigade Combat Team, 1st Cavalry Division, prepares an Anduril Ghost X at NTC rotation 26-02, Nov. 1, 2025. The rotation marks the first armored Transforming in Contact (TiC) 2.0 combat training center rotation, where new concepts and emerging capabilities were tested in realistic, contested scenarios. (U.S. Army photo by 1LT Tyler Williams)

FRONT LEFT INSET: U.S. Army Soldiers assigned to Charlie Company, 4th Battalion, 70th Armor Regiment, 1st Armored Brigade Combat Team, 1st Armored Division, conduct a hasty brief before a tactical movement during a multinational force-on-force exercise for Saber Strike, May 18, 2026 in Finland demonstrating the ability, of nearly 15,000 warfighters from 11 nations, to fight and win on the modern battlefield.

Warfighters executed rapid maneuvers, air defense, counter-drone operations, and cyber defense to validate NATO's regional defense plans in real time during SWORD/Saber Strike 26. Together with our Allies, we are building a unified, lethal force ready to defend NATO territory and respond to any threat. (U.S. Army Reserve photo by SGT Caleb Watson) Journalist: Caleb Watson Unit: U.S. Army Europe and Africa Branch: Army Country: Finland.

RIGHT FRONT INSET: Officer Corps students participated in the multi-service partnership to leverage educational opportunities from the wargaming and nuclear integration fusion. With partnerships like this, students gain criticle knowledge and insight for understanding and applying conventional-nuclear integration and deterrence to ensure our warfighters' strategic and operational superiority.

BACK COVER: SSG Cole Robbins, a Soldier assigned to 4th Squadron, 10th Cavalry Regiment, 3rd Armored Brigade Combat Team, 4th Infantry Division, and 1LT Samuel Myers, a platoon leader assigned to Headquarters Support Company, 1st Battalion, 68th Armor Regiment, 3rd Armored Brigade Combat Team, 4th Infantry Division, review digital information on an Android Team Awareness Kit (ATAK) while positioned in concealment during Ivy Sting 4 at Fort Carson, Colorado, Jan. 27, 2026. The Soldiers synchronized security and reporting procedures to enable effective screening operations supported by Android Team Awareness Kits (ATAK) and GHOST X. (U.S. Army photo by SPC Samuel Brandon).

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By: COL Jarrod Gillam

Welcome to Issue 31, which explores the theme of Transformation. We distinguish transformation—designing forces for entirely new ways of warfighting—from the simple modernization of existing capabilities. This distinction is critical as the Joint Force undergoes its most significant strategic evolution in a generation.

Within the Army staff, we've been closely participating in Army modernization for nearly a decade. The 2018 National Defense Strategy announced the re-emergence of long-term, strategic competition, and created a requirement for a "lethal, resilient, and rapidly innovating Joint Force." The Army closely followed this by publishing a blueprint for a multi-domain force by 2028 within TRADOC Pamphlet 525-3-1, The U.S. Army in Multi-domain Operations in 2028. Both documents noted fundamental changes to the character of war due to advancements such as artificial intelligence (AI), hypersonic weapons, machine learning, nanotechnology, and robotics. Clearly the Army—and the Joint Force—needed to modernize to meet these future threats. The Army chose to field multi-domain-capable forces by 2028, with the goal of achieving a multi-domain Army by 2035.

It soon became apparent that incremental modernization was incapable of meeting the pace of a rapidly changing battlefield. The conflict in Ukraine became both an incubator and a crucible for layered use of autonomous systems within a contested electromagnetic environment and rapidly evolving battlefield tactics. Conflicts within the Middle East since October 7, 2023, pitted the power of AI-enabled multinational integrated air defenses against Iranian proxies employing a variety of long-range capabilities to hold civilian and commercial targets at risk. All of this takes place within a chaotic information environment where gaining and maintaining an information advantage is a daily struggle at every level from the tactical to the strategic.

Accordingly, in April 2025 Secretary Hegseth directed the Army to accelerate the pace of change. Soon afterward, Secretary Driscoll announced that the Army would be implementing a comprehensive transformation strategy designed to deliver critical warfighting capabilities, optimize force structure, and eliminate waste and obsolete programs. In this way, the deliberate modernization effort outlined in CSA Paper #1 (i.e., the 2028 Waypoint Force) gave way to Transformation in Contact as a means of implementing Multi-Domain Operations within Army formations.

The Services are undergoing similar transformation to meet the urgent requirements of a global, transparent, and multi-domain battlefield. The Air Force has transformed its posture, capabilities, and force generation models to realize the Agile Combat Employment, commonly referred to as ACE, concept. The Navy is employing resilient communications architectures and unmanned systems to disperse its posture while concentrating effects to achieve Distributed Maritime Operations. The United States Marine Corps is fielding Marine Littoral Regiments as "stand-in forces" to create asymmetric dilemmas for adversaries within critical sea lanes.

Concurrently, combatant commanders are developing planning constructs like United States Indo-Pacific Command's Hellscape and United States European Command's Eastern Flank Deterrence Line which create even greater demand for resilient networks and linked, autonomous sensors and effectors.

These changes are being implemented within a defense acquisition enterprise which is being almost literally rebuilt in-flight.

This rapid conventional transformation creates a dilemma for the CWMD community. While our warfighting concepts evolve at an accelerating rate, the physics of nuclear weapons, the core nature of chemical agents, and the fundamental biology of pathogens remain largely static. This raises the central question for our field: What is the role of CWMD within this transformed Joint Force? Or is the task at hand to simply rediscover skills that previous generations have neglected?

Of course, the threat is not truly static. The proliferation of advanced delivery systems, AI-enabled targeting, and the weaponization of the information environment allow adversaries to generate novel strategic effects from seemingly antiquated weapons. Answering this challenge requires a fresh perspective.

To that end, we tasked students of the 2025 FA52 Qualification Course to tackle these questions. This journal presents their findings. These emerging leaders offer innovative perspectives on nuclear posturing, joint nuclear operations, managing CBRN effects, and leveraging the information function to reduce biological vulnerabilities. Along the way, you'll also learn about transformation in CWMD professional education, how generative AI tools can be used to create plausible near-future scenarios for analysis, and you'll get an overview of a wargaming internship program intended to build familiarity with integration of nuclear effects into joint wargame design and execution.

None of these ideas are transformative by themselves. Yet each plays a small part in helping to define the role of WMD within an operational environment rife with accelerating, unpredictable change. Some future adaptations—properly applied—will help the joint force commander to degrade, defeat, or mitigate emerging WMD threats. Conversely, some of them will introduce new vulnerabilities and the potential for operational or strategic surprises.

On a separate and personal note, this will be my final issue as the USANCA Director. It has been a privilege to guide this publication, and I am pleased to announce that COL Troy Uhlman will soon join the team directly from his current assignment at US Forces Korea. It will fall to Troy to introduce our next edition of this Journal, Issue 32, which will be focused on Survivability and Resilience. I encourage all of you who have a part in building the resilience of the joint force and the Department to contribute your thoughts and keep this conversation going. As always, you can find instructions on how to submit your work on the inside of the back cover.

Thank you for the incredible work you do across the Joint Force every day, and I look forward to reading future contributions as a member of this community. We hope you find the following articles both informative and thought-provoking. ■

Transforming Army Countering Weapons of Mass Destruction (CWMD) Education:

Filling the "Operational Void"

By: Paul Sigler, LTC James Bowen, MAJ Mithun Sheth,
Kelvin Mills, and Dr. Kim 'KP' Pogoda

Modernizing CWMD education for leaders across the Joint Force has never been more urgent. Multi-polar, great power competition has highlighted the role of weapons of mass destruction (WMD) in the global operating environment. Since the full-scale invasion of Ukraine, Russia has frequently employed nuclear rhetoric as part of its strategic messaging.Lasting reverberations of the Coronavirus Disease 2019 pandemic, commonly referred to as COVID-19, spawned a Department of War (DOW) effort to strengthen its biological deterrence capabilities. The increasing number of operational nuclear threats from North Korea's Democratic People's Republic of Korea (DPRK) spurred and contributed to the United States (US)-South Korea (Republic of Korea (ROK)) effort to revitalize extended deterrence in the region. Like the DPRK's nuclear threat, Iran's pursuit of nuclear capabilities remains a continual source of conflict in the Middle East impacting regional and global areas alike and may also spur efforts like the US-ROK nuclear deterrence effort. WMD capabilities and programs that support nuclear deterrence and post-nuclear detonation and operational superiority are essential elements of the joint operational environment and will remain so well into the future.

Strategic guidance, joint doctrine, and even joint educational guidance now fully reflect the emergence of biological threats and hazards, the resurgence of nuclear capabilities, and the criticality of strategic deterrence.[1] Specifically, Joint Staff guidance on outcomes-based officer military education has now established an enduring Special Area of Emphasis for Strategic Deterrence and Countering Weapons of Mass Destruction within joint officer professional military education.[2]

The Problem Statement

Today's Joint Force Commanders (JFC) and their staffs are required to simultaneously balance effort across multiple CWMD activities within a global strategic messaging campaign. They must align and synchronize strategic capabilities to enforce arms control treaties and export controls, employ operational capabilities to track and degrade WMD capabilities, and posture tactical capabilities to prevail in spite of WMD employment on the battlefield.[3]

Joint Force activities to deter, degrade, counter, and respond to emerging WMD threats will employ a range of joint capabilities and require a whole-of-staff effort to plan, prepare, and execute. CWMD professionals, sourced from the Services, will lead or enable much of this planning. Each Service defines these specialties in accordance with their own tactical needs, rather than with a view toward providing leaders capable of accomplishing joint CWMD tasks.

More specifically, each Service develops tactical specialists in chemical, biological, radiological, and nuclear (CBRN) protection, force health protection, and explosive ordnance disposal. The Services organize these leaders into force elements and advisory capabilities to mitigate CBRN threats for tactical commanders. Services also develop specialized technical capabilities which can be employed by the JFC for operational CWMD effects.

The challenge within any Service is to identify and develop leaders who will serve as CWMD professionals within a joint headquarters or a Service component command. Services have few resources to devote to providing joint CWMD education to their mid-grade leaders. For those individuals who seek professional development or continuing education on their own, the available course offerings for CWMD topics are difficult to decipher, and even harder to align with CWMD tasks performed at the operational level.

In 2015, in the aftermath of the publication of the 2014 "Department of Defense Strategy for Countering Weapons of Mass Destruction," the Joint Staff led a similar effort to develop non-materiel approaches to CWMD education.[6] The Joint Department of Defense Change Request (JDCR) directed the development of a joint CWMD educational consortium, tasked the Army to develop a joint CWMD staff planners education program, and tasked the CWMD Coordinating Authority (then the US Strategic Command) to establish a joint additional skill identifier for officers who had completed Level 1 and Level 2 CWMD education. While the joint skill identifier never came into being, the US Army CBRN School did establish a staff planners education program. USANCA later adapted this curriculum into the CWMD Advisor's Course which confers the "D1" skill identifier to Army leaders who complete it. By the end of fiscal year (FY) 26, over 700 leaders (military and civilian) from across the Joint Force will have completed this course.

The following section summarizes the CWMD competencies developed by the joint CWMD community to standardize the lexicon in use amongst CWMD educators. The CWMD competencies identify "CWMD professionals" within the Army by virtue of their branch, specialty, and career path. The final section will demonstrate how USANCA is applying the CWMD competency framework to its educational programs to better prepare these key Army populations to participate in development of joint WMD deterrence and response options while also building resilience to WMD effects on behalf of the JFC.

In 2025, the Joint Staff published a CWMD Decision Support (CDS) JDCR for Doctrine, Organization, Training, Material, Leadership, and Education, Personnel, Facilities, and Policy, commonly referred to as DOTMLPF-P, which challenged the joint community to come together to accomplish several specific reforms to increase the quality and consistency of Service-led CWMD education. This article focuses on two tasks which the U.S. Army Nuclear and CWMD Agency (USANCA) either facilitated or led. In the process of describing the approach to these two tasks, the article will further explore which aspects of CWMD education are critical for preparing future leaders to assess, contextualize, and exploit WMD challenges within a dynamic joint operational environment.

CWMD Competencies: Defining the Core Skills of a CWMD Professional

The CWMD educational consortium founded, by the 2015 JDCR, led to the development of a comprehensive catalogue of CWMD-related offerings including advanced degree programs, fellowships, certificate programs, professional development programs, continuing education programs, and foreign education opportunities.[7] A brief glance at this catalogue made clear that while CWMD educational opportunities were widely available and extremely diverse, they were also extremely difficult for a prospective student to navigate. Without any means of standardization, prospective students often selected training via a search of key terms for available course descriptions without any assurance that the instruction would deliver the skills required for their current or future position.

Given this background, with the publishing of the 2023 CWMD Strategy, the joint CWMD community recognized that a key requirement for reforming CWMD education would be to establish a common understanding of CWMD competencies. Reformation required educators apply this rubric across a range of CWMD educational offerings to permit informed choices by students and their commands.

Concurrently, the writers of the CDS JDCR recognized that Service-driven educational pathways for CWMD professionals were insufficient to prepare these leaders to engage in joint options development against near-peer adversaries with a range of WMD capabilities. The Army—with the list of CWMD competencies in hand—received tasking to develop a template for the development of these leaders.

A working group representing primary joint CWMD education providers met to scope the current landscape and establish standardized CWMD Competencies.[8] An initial survey of learning outcomes from 440 different course offerings with "CWMD" in the title or syllabus revealed hundreds of uncoordinated objectives which were neither job aligned, nor task driven. These scattershot learning outcomes served as the point of departure.

The working group next worked to compile and compare learning outcomes currently taught (i.e., schoolhouse learning outcomes) against what students likely need to know (i.e., established knowledge gaps). Working group members aligned current schoolhouse learning outcomes and established knowledge gaps against joint CWMD tasks.

To ensure coverage against all knowledge gaps, the team first compared, analyzed, and added knowledge-based identified and validated requirements gaps across nine related Joint Capabilities-Based Assessments. The working group evaluated the comprehensive list of gaps against CWMD tasks from the Universal Joint Task List (UJTL). The UJTL represented CWMD tasks at the strategic and operational level.[9]

After six months of the working group's internal meetings, the working group presented an initial list to the US Special Operations Command (USSOCOM) Leader Development Training and Education Working Group for initial feedback. The working group incorporated the feedback into a refined list and presented the information to the USSOCOM CWMD Coordination Conference in September 2024 resulting in hundreds of comments from across the community. As of this writing, the Joint CWMD Working Group's approval of the refined list, validating the satisfaction of the task within the CDS JDCR, is pending approval.

The overall CWMD Competency Framework, as shown in Figure 1, has five categories which represent 114 specific competencies. The top "baseline" category includes functional and knowledge-based competencies that civilian or military leaders in a CWMD role needs to navigate and operate within the CWMD community. It includes competencies related to WMD characteristics, Joint and Service doctrine and capabilities, a general overview of counter and nonproliferation, and responsibilities of the DOW through strategic guidance. These competencies are general in nature and do not require expertise in any specific field.

The Department of Defense (DOD) Directive titled DOD Directive 2060.02, "DOD Countering Weapons of Mass Destruction Policy," establishes the DOW's, formerly the DOD, Countering WMD policy, assigns responsibilities, and formalizes relationships within the CWMD community. DOD Directive 2026.02 provides a text-based framework for equipping CWMD professionals within different staff roles to successfully attain knowledge required for obtaining operational superiority when facing nuclear capable

<table>
<tr><th colspan="4">CATEGORY: BASELINE</th></tr>
<tr><td colspan="4">Description: Fundamental knowledge required for CWMD professionals.</td></tr>
<tr><td></td><td>CATEGORY: WMD DISCIPLINES</td><td>CATEGORY: CWMD ACTIVITIES</td><td>CATEGORY: STAFF ROLES</td></tr>
<tr><td>Description</td><td>Competencies associated with specific technical roles associated with WMD disciplines. CWMD professionals should focus on the competencies specific to their role and type of WMD.</td><td>Competencies specific to CWMD activities and what professionals in each space should know. Unlike the baseline category, it is recommended for use with individuals with a specific role in that activity. In general, CWMD activities are operational in nature and impact the strategic level of war.</td><td>Competencies for staff members in roles to support CWMD tactical activities, support CWMD decision making at the operational level, and strategically communicate deterrence.</td></tr>
<tr><td>Sub-Categories</td><td>•Tactical Impacts
•Operational Impacts
•Strategic Impacts</td><td>•Strategy, Policy, Doctrine
•Whole of gov. roles, responsibilities, relationships
•Innovation, Research, Capability Development, and Acquisitions
•Means of National Power (For each DIMEFIL)
•Counterproliferation
•Deterrence
•CBRN Defense
•CBRN Response</td><td>•JIPOE
•Effects Preparation and Mitigation
•Planning
•Integration
•Decision Support</td></tr>
<tr><th colspan="4">CATEGORY: LEADERSHIP</th></tr>
<tr><td colspan="4">Description: Recommendations for CWMD professionals to inform decision makers regarding CWMD activities and implications for adjacent activities.</td></tr>
</table>

FIGURE 1: CWMD Competency Framework overview and categories

adversaries.[10] Based on DOD Directive 2060.02, Figure 1 provides a graphical depiction of how educators can use the information to develop and implement actionable and measurable learning outcomes that effectively prepare warfighters.

The bottom "leadership" category includes the knowledge and skills required by CWMD professionals to effectively inform decision makers about CWMD activities and implications. The knowledge and skills include competencies like strategic communications, operational activities, information operations, and legal constraints. Competencies from these two categories are foundational for any CWMD professional working at the operational level or higher. Generalists serving in a command with CWMD tasks and requirements also benefit from the competencies.

The middle portion of the framework lists competency categories and sub-categories. Users can select and align this information against specific duty positions within the overall CWMD community to identify and mitigate gaps in education for CWMD professionals.

The WMD Discipline Category. This category contains requirements for professionals who require expertise in a specific weapon of mass destruction modality (i.e., chemical, biological, radiological, or nuclear). These personnel could be medical professionals, nuclear scientists, biochemists, or others with advanced education and training in their field. This category breaks down competencies by level of war at which it will be employed. For instance, a tactical competency may include language such as "detection methods, capabilities, and shortfalls" while operational competency language might focus on "adversary use-case scenarios based on theories of victory and warfare."

The CWMD Activities Category. This competency targets individuals who may not be experts in a specific WMD modality but will conduct CWMD missions. These could be technical interdiction teams, service members on Interagency CWMD task forces, CBRN Defense and Response professionals, or capability coordinators/integrators. These competencies are sub-categorized by specific types of activity.

The Staff Roles Category. This grouping directly relates to professionals in a staff that supports CMWD activities. The subcategorization illustrates the type of staff activity.

Direct input from hundreds of practitioners with educational, operational, and technical CWMD experience produced a framework with broad applicability. USANCA expects changes to the current framework. However, the framework already serves as a starting point for organizations to determine training paths for CWMD professionals. The full framework is expected to be presented to the Joint CWMD community by the Joint Staff J-8 for final modifications and approval during the summer of 2026. In the meantime, the USANCA Director approved the use of the draft CWMD Competency Framework in the development of course objectives for USANCA-managed training and education programs. The following sections outline the Army populations that perform as "CWMD Professionals" and the initial approach to developing a competency-based educational pathway for these individuals.

CWMD Professionals: Leading Cross-Functional Teams to Develop Option for the JFC

The CWMD "Operational Void," article published in the CWMD Journal in 2023, discussed the generic attributes of CWMD professionals and the functions they perform for the JFC without specifically defining them. Arriving at specific recommendations for CWMD educational transformation requires definition of the target population.

Within the Army, two officer cohorts serve as the primary source of this expertise at the operational level: 74A CBRN Officers, and Functional Area (FA) 52 Nuclear and CWMD Officers. Several other specialties such as 89E Explosive Ordnance Disposal Officers, 72A Nuclear Medical Science

Officers, and 71B Microbiologists are also key and essential to mitigating WMD effects on land formations, while FA59 Army Strategists and 131A Field Artillery Targeting Technicians play a key role in developing joint options that deter WMD attack.

This list is neither exhaustive nor prescriptive. It is meant to demonstrate that defining CWMD professionals is difficult, and that any educational approach needs to balance the needs of multiple populations, each of whom will play a role at the operational level.

The tactical CBRN defense education of each cohort is already sufficient for their roles within Army units of action, normally the Division level and below. The challenge for Army CWMD education is to bridge the gap between tactical and operational. Done correctly, the Army will deliver CWMD professionals to the JFC with impeccable tactical credentials who can integrate joint multi-domain capabilities into viable deterrence and response options as part of a joint planning team.

The Army assigns only FA52 field grade officers primarily to joint commands and combat support agencies where operational CWMD activities occur. Field grade officers from other Army branches and specialties with CWMD equities follow career trajectories which oscillate between joint positions and Army tactical command and institutional support roles. On the other hand, an Army FA52 might easily spend their entire career in joint or interagency positions. For this reason, the FA52 population is the most lucrative target amongst the cohorts of Army CWMD professionals.

Concurrently, the USANCA Director has authority over FA52 qualification standards and is the certifying authority for the annual FA52 Qualification Course. For these reasons, the FY26 Army FA52 Qualification Course serves as the means to implement and beta-test the draft CWMD competency framework within Military Education Level 4, referred to as MEL4, education for newly selected FA52s. The lesson plans and courseware developed for the FA52 Qualification Course provide a menu of options for other Army branch proponents as they seek to update CWMD content within their own programs of instruction.

"The CWMD "Operational Void" article also notes that CWMD professionals require a great deal of assistance from other members of the operational staff. While tactical CBRN defense activities are specialized, CWMD activities are inherently cross-cutting. This is especially true when the JFC is seeking to deter WMD employment or to support an integrated, whole-of-government response to restore WMD deterrence. Achieving this level of integration requires recruitment of experts from a variety of disciplines, armed with enough nuclear or CWMD knowledge to participate in cross-functional planning and response.

To accomplish this across the Army, USANCA modified two existing courses to align with specific CWMD competencies—the Theater Nuclear Operations Course (TNOC) and the CWMD Advisor’s Course. Additionally, USANCA developed a third course, the Biodefense Executive Seminar (BDES), to build an understanding of how biological threats and hazards drive land-component commander decisions.

The next section will describe:

(1). How the Army has implemented the CWMD competencies within the FA52 Qualification Course, the CWMD Advisor Course, the TNOC, and the BDES.

(2). How USANCA will expand these educational offerings to professional military education, commonly referred to as PME, for CWMD professionals and to leaders from other branches and disciplines.

Applying CWMD Competencies to Army CWMD Professionals

With the draft CWMD competency framework in hand, USANCA sought to align those competencies against existing course outlines and to refine capstone exercises to evaluate how well students can integrate CWMD considerations into realistic joint/combined plans and operations.

As noted in the previous section, the Army FA52 cohort provides a valuable test bed for validation and implementation of the competency framework. Courses are small, planned, and executed by a single team, and most officers progress immediately to a joint position related to nuclear and CWMD planning, execution, and capability development.

Historically, the FA52 Qualification Course focused primarily on nuclear weapons design, effects, and joint nuclear operations. While senior FA52s were cognizant that this relatively narrow focus was not sufficient to fully prepare new FA52s for joint CWMD assignments, the knowledge gap had not been fully scoped or addressed.

The draft CWMD competency framework served as the cornerstone for the development of the FA52 Major Individual Critical Task List (ICTL) in early 2026. USANCA developed the FA52 ICTL for Army Soldiers at the Major rank to encompass the key tasks expected of an FA52 officer in their first assignment. The framework was essential in establishing the baseline knowledge requirements to support those specific tasks, to include inter-organizational roles, strategic guidance documents, operational/strategic effects associated with WMD threats and employment, deterrence theory, the competition continuum, and Service capabilities in CBRN defense and response. The competency framework facilitated the identification of requirements gaps

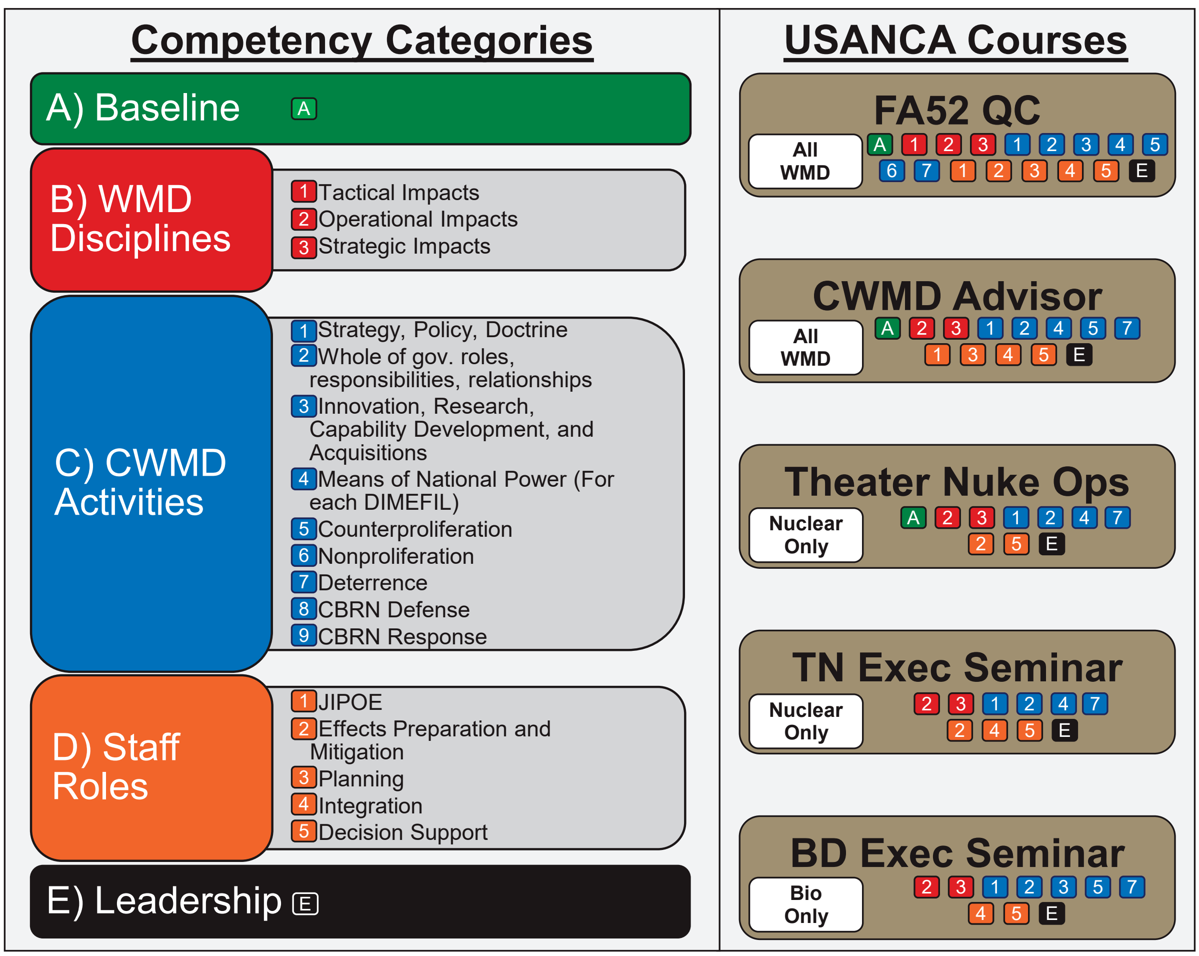

FIGURE 2: CWMD Competency Framework mapping to USANCA courses

and informed the refinement of learning objectives, scenario-based exercises, and case studies within the FA52 curriculum. The resulting course design prepares officers to integrate nuclear and CWMD considerations into planning, execution, and advisory roles across the Joint Force.

USANCA accomplished much of this broadening by importing terminal learning objectives from the existing CWMD Advisor Course, an 80-hour program which equips students with the knowledge and skills to synchronize and integrate CWMD operational activities, enabling informed decision-making at Combatant Command (CCMD) and Army Service Component Command levels. Integration of D1 introduced scenario-based exercises and case studies, requiring students to apply CWMD principles in realistic operational contexts. These scenarios confront staff groups with complex dilemmas—such as force projection and theater-setting activities-- into which WMD threats are woven. Students studied derived authorities and permissions to understand both opportunities and limitations in their operational environments. Figure 2 shows how CWMD competency sub-categories, in draft form, map to each of USANCA's course offerings.

USANCA intends to reflect the Army's transformation priorities through the other FA52 Qualification Course updates. The course now includes a more rigorous focus on strategy and planning, starting from the National Security Strategy, commonly referred to as NSS, and cascading down to CCMD-level planning. USANCA enhanced the technical depth with dedicated eight-hour blocks on chemical warfare and biowarfare, providing students with a robust understanding of these critical areas. USANCA redesigned the capstone exercise to challenge students with realistic scenarios, requiring them to develop staff vulnerability analyses and provide commanders with recommendations for Flexible Deterrent Options, commonly referred to as FDOs and Flexible Response Options, commonly referred to as FROs. This exercise integrates operational and strategic-level questions with technical expertise, ensuring graduates are prepared to address complex CWMD challenges in real-world environments.

FIGURE 3: Traditional classroom-based tactical education
(Grafenwoehr, Germany, photo by Visual Information Specialist Markus Rauchenberger)

FIGURE 4: Soldiers learning through experiencing at Saber Strike in 2026 (Finland, 17 May 2026, Photo by SGT Caleb Watson, U.S. Army Europe and Africa)

In alignment with Army Transformation Initiatives, USANCA also made significant changes to the content and delivery methods of the TNOC and CWMD Advisor Course to better prepare Army commands for joint and combined multidomain operations against WMD-capable adversaries.

The program with the greatest potential impact is TNOC and its associated Theater Nuclear Executive Seminar (TNOES). TNOC serves as a qualifying course for the Additional Skill Identifier (ASI) 5H (Nuclear Target Effects Analyst), an additional skill which harkens back to the Cold War era when Army artillery units had nuclear capabilities. Authorizations for this ASI were poorly aligned to the Total Army's emerging structure for multidomain operations, and the curriculum required revision to both integrate new nuclear effects analysis capabilities as well as to broaden the skills of the 5H population to enable them to support red teaming and nuclear vulnerability analysis in support of both planning and operations. USANCA led a revision of the TNOC curriculum and conducted an Army-wide review of 5H authorizations to identify the correct positions and specialties that are best positioned to employ these skills in support of the commander. The updated ASI, titled "Nuclear Effects Integrator," will no longer be restricted to officers; warrant officers and senior enlisted Soldiers will be offered this training under the new model. These reforms—combined with increased FA52 authorizations within Theater Army and Corps Headquarter staffs—will increase the ability of Army formations to integrate nuclear effects into their plans and operations, contributing to deterrence and assurance efforts by the JFC. Concurrently, USANCA offers the TNOES course as a tailorable training package for senior leaders and specific populations who require a better understanding of the land component role in nuclear operations. USANCA and its Basic Strategic Arts Program (BSAP) partner, fully integrated TNOES into BSAP.

Recent updates to the CWMD Advisor Course curriculum have also expanded its accessibility and relevance, including

FIGURE 5: USARPAC CWMD Advisor Course Graduates

the creation of an unclassified version of the course in collaboration with the Army Command and General Staff College at Fort Leavenworth. This unclassified version, taught as elective A525 "Countering Weapons of Mass Destruction," now offers the D1 ASI to all students who complete the four-week elective. This innovation allows multinational partners. interagency personnel, and government officials who lack Secret clearances but play vital roles in CWMD efforts to receive this valuable knowledge.

Both the 5H and D1 ASIs serve as key mechanisms for continuing education and professional development among potential CWMD integrators within the Army, which include planners, strategists, intelligence analysts, logisticians, and targeting officers; all of whom work together to bridge tactical and operational gaps in countering WMD threats. Both ASIs serve as formal recognition of specialised training and expertise. Their associated courses provide ongoing opportunities for pesonnel who support CWMD operations at the Corps and above levels.

Executive level courses such as the TNOES, and the BDES likewise increase familiarity of senior leaders with the operational issues presented by WMD threats, as well as with the types of decisions which they can make to balance these risks without creating new vulnerabilities. These courses pull elements from across the CWMD competency framework, with specific focus on contextualizing the senior-leader decisions related to each competency.

USANCA and partners from within CWMD community applied analytical rigor to Army nuclear and CWMD learning objectives while connecting them directly to joint CWMD tasks. Concurrently, USANCA has undertaken efforts to modularize these offerings as much as possible to facilitate adoption by other Army proponents and schoolhouses to modernize their own leader education programs. Finally, USANCA has worked diligently to retain the classification level of the courseware to offer these classes to the widest audience possible. CWMD professionals are and always will be in short supply—unclassified, modularized course offerings provide a means of recruiting leaders and experts of various stripes to participate in solving complex, cross-domain WMD-related problem sets.

Internally, USANCA led the development of critical tasks for newly trained Nuclear and CWMD officers. Through a Critical Task and Site Selection Board (CTSSB), senior members of the branch established an ICTL. The ICTL solidifies what is expected of an FA52 by supported organizations and drives training and education requirements for the USANCA proponent team. As the Army continues to transform, aligning FA52 training to command and organization requirements ensures the branch meets its purpose.USANCA continues to process the CTSSB's findings.

FIGURE 6: FA52 CTSSB Board Members
(Photo by Gerald Barrington, USANCA)

Conclusion

Although the joint CWMD competencies framework remain in draft form, USANCA has made good use of this tool to add structure better prepare one of the foundational populations of Army CWMD professionals. Concurrently, the framework has provided a useful rubric to guide modernization of qualification courses for Army ASIs 5H and D1. Finally, the framework has provided a useful handrail in the development of executive seminars intended to familiarize senior leaders with their role in nuclear, CWMD and biodefense risk management.

Future WMD threats will be complex, multidomain, and integrated with other elements of national power. For that reason, future CWMD professionals will need to be able to seamlessly integrate their deep knowledge of WMD effects and tactics with an understanding of how joint and combined forces converge effects to deter, degrade and defeat adversary WMD capabilities while assuring allies, partners, and the American public. CWMD professionals will be leading joint and component-level planning teams in development of options to counter these threats.

CWMD competencies provides the means for focusing effort and measuring progress; the educational pathway for CWMD professionals and their enablers serves as ways for achieving the end state: tactically proficient CWMD professionals who can integrate joint multi-domain capabilities into viable deterrence and response options. ■

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4. Sigler and Bowen, "The CWMD "Operational Void," Countering WMD Journal, Issue 27, 6-17.

5. James Bowen, "Integrating Risk from Weapons of Mass Destruction: Defining Strategic and Emerging Threats," Countering WMD Journal, Issue 30, 6-13.

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9. Chairman of the Joint Chiefs of Staff, CJCSI 3500.02C, Universal Joint Task List Program (Washington, DC: The Joint Staff, December 19, 2022); The team emphasized measures of performance for tasks SN 9, Coordinate Countering Weapons of Mass Destruction (CWMD), ST 9, Conduct Countering Weapons of Mass Destruction (CWMD), and OP 7, Execute Countering Weapons of Mass Destruction (CWMD). The full UJTL listing can be found at: https://www.jcs.mil/Portals/36/Documents/Doctrine/training/ujtl_tasks.pdf?ver=2SnRB6x21B9EX-uXTb7uhXg%3d%3d (Sheth's emphasis).

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Educating Future Leaders for Deterrence:
A Multi-Service Approach to Wargaming and Nuclear Integration

By: MAJ Tyler Halbert and LTC Steven O'Dell

In an era of renewed Great Power Competition and strategic uncertainty, the need for a nuclear-literate Officer Corps has never been greater. The complexities of deterrence, the nuances of conventional-nuclear integration (CNI), and the challenges of operations in a nuclear environment demand not only academic rigor but also immersive, experiential learning. Recognizing this need, the Defense Threat Reduction Agency (DTRA) Nuclear Science and Engineering Research Center (NSERC) partnered with the Air Force Wargaming Institute (AFWI) to deliver a pioneering Nuclear Wargaming Internship that bridges the gap between nuclear warfighting theory and application for pre-commissioned Department of Defense (DOD) students. In 2025, DTRA-NSERC and AFWI launched its inaugural partnership brought together 18 cadets and midshipmen from across the Service Academies and the United States' (US) Reserve Officers' Training Corps (ROTC) for a deep dive into strategic wargaming, deterrence operations, and nuclear decision-making.

The internship occurred over three weeks, with each week providing a specific educational focus. During the first week, students received academic instruction. Students received foundational education in nuclear weapons design and effects, the current US nuclear stockpile, and the strategic policies governing nuclear weapons employment. Experts introduced students to key concepts such as deterrence theory, including conditions such as strategic stability, assured second-strike capability, and escalation management.

Weeks two and three transitioned into applied learning through wargaming exercises. Students learned how wargames are designed, developed, and executed. They also explored the analytical value of games and game theory, the role of wargaming in scenario planning, and how wargames may contribute to both policy refinement and operational readiness.[1]

The students engaged in multiple wargames in week three, beginning with introductory level games utilizing the AFWI developed AFWI and Air Force Wargame European Expansion (AFWE) games focused on the Indo-Pacific and European theaters. These games allowed students to experience many decision-making processes at operational and tactical levels with strategic insights. The culminating experience was a capstone wargame that focused on conventional-nuclear integration and operations in a nuclear environment. This final game challenged students to navigate high-stakes scenarios involving nuclear thresholds, adversary signaling, and command and control dilemmas. These engagements provided the students with critical insight into how nuclear considerations permeate Joint Force operations and strategic planning.

Beyond the wargames themselves, students interacted with professionals from across the strategic deterrence community. Briefing experts included a variety of experts, including a missileer, a bomber pilot, a Ship, Submersible, Ballistic, and Nuclear officer, often referred to as a SSBN officer, and representatives from the US Army Nuclear and Countering Weapons of Mass Destruction Agency, DTRA, Sandia National Laboratory, United States Strategic Command, and Lawrence Livermore National Laboratory. These interactions enriched the students' understanding of how US nuclear deterrence is operationalized across the Joint Services and within various elements of the US nuclear enterprise.

The cohort visited the Montgomery, Alabama Air National Guard. While there, the cohort saw a fighter aircraft, model F-35, and discussed its role in modern deterrence missions. This experience highlighted the integration of cutting-edge platforms into modern warfighting.

The NSERC-AFWI Nuclear Wargaming Internship represents a vital investment in the professional development of future military leaders. By introducing cadets and midshipmen to the complexities of nuclear deterrence early and enabling them to engage with realistic scenarios, the internship helps cultivate officers' nuclear proficiency. The NSERC-AFWI Nuclear Wargaming Internship prepares officers to think critically about 21st-century strategic security challenges. Moving forward, expanding this program to include more participants, incorporating additional Joint-Service components, and developing an exportable curriculum could enhance its impact. Ensuring continued support and resources for such initiatives is also essential to sustaining and expanding this strategic competence across the DOD.

As the security environment continues to evolve, the need for innovative and immersive education in nuclear operations and deterrence strategy will only grow. The 2025 NSERC-AFWI Nuclear Internship exemplifies how interagency collaboration can deliver high-impact training and cultivate the nuclear proficiency required to maintain strategic stability. This internship opportunity helps educate the next generation of DOD leaders and empowers officers to confront the challenges of strategic deterrence with confidence and competence. ■

FIGURE 1. Cadets and midshipmen visiting the Montgomery, Alabama Air National Guard

FIGURE 2. Students at the Lemay Center

FIGURE 3. Students at the Lemay Center. with Air University Chief of Staff MG Parker H. Wright

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Creating Artificial Intelligence (AI)-Assisted Fictional Intelligence (FICINT) for Countering Weapons of Mass Destruction (CWMD) Scenarios

By: MAJ Kurt Hebert and LTC Mark Bailey

Abstract

FICINT, defined as narratives grounded in plausible, near-term scenarios, can immerse decision-makers in futures that traditional analytic formats struggle to convey. This article presents a structured method for analysts in the United States (US) Intelligence Community (IC) to employ large language models (LLM) as creative partners in generating weapons of mass destruction (WMD)-relevant FICINT while adhering to the "no vaporware" rule, i.e., that all technologies depicted must exist or be in development. Drawing from a threatcasting-informed approach, this article's researchers developed a rubric to assess narrative quality and fidelity, and a prompt-engineering guide to structure analyst–AI collaboration. The researchers tasked three AI platforms (including chat generative pre-trained transformer (ChatGPT) 4 free version, ChatGPT 4 Plus, and a novel-writing GPT) with generating FICINT based on prior analytic products. Comparative analysis assessed story depth, technical accuracy, and engagement. Findings indicate that combining a high-performance LLM with pre-existing analytic work yields the most operationally useful narratives. Integrated excerpts from four original works illustrate how AI-assisted FICINT can convey second- and third-order effects of WMD scenarios in a compelling manner, potentially improving comprehension, retention, and strategic foresight among policy and operational audiences.

Introduction

The US IC collects, analyzes, and delivers foreign intelligence and counterintelligence information to America's leaders enabling effective decision-making from a wide range of topics including WMD and their enabling conditions.[1] This mission spans nuclear, biological, chemical, and radiological threats, along with associated delivery systems, enabling technologies, and adversary intent. Historical programs such as the Soviet Union's covert biological weapons initiative described by Alibek and Handelman illustrate how advanced capabilities can remain hidden until geopolitical shifts reveal their scope.[2] More recent developments in biotechnology, genomic surveillance, and cyber operations underscore embedded threats within WMD within broader socio-technical systems.[3]

Traditional intelligence products, such as briefings, reports, and slide decks, often compress this complexity into discrete bullet points, limiting the ability to convey cascading effects, uncertainty, and human consequences.[4] In biological domains, for example, the transmission dynamics of the Ebola virus disease

(EVD) and other high-consequence pathogens involve intricate interactions among epidemiology, infrastructure, and human behavior.[5] Disinformation and social unrest, as seen in both public health emergencies and extremist exploitation of crisis events, compound the complexity.[6]

FICINT has emerged as one method to bridge this gap. Sometimes referred to as "useful fiction," FICINT blends grounded research with narrative storytelling to present plausible near-future scenarios that decision-makers can experience vicariously.[7] Futurists have explored this approach in contexts including cyber conflict, terrorist radicalization, and pandemic preparedness.[8] For WMD scenarios, FICINT can illuminate operational realities and make second- and third-order effects standout in technical analysis.[9]

One critical constraint for credible FICINT is adherence to the "no vaporware" principle: all technologies and tactics depicted must either exist, be in development, or be otherwise technically feasible given open-source knowledge.[10] This maintains plausibility, avoids speculative distraction, and helps align narrative outputs with real-world threat indicators and policy relevance.[11] It also mitigates operational security risks by ensuring that no classified or otherwise sensitive methods are disclosed.[12]

LLMs present new opportunities and challenges for generating FICINT. When guided by structured prompts and analyst oversight, LLMs can accelerate narrative production while preserving alignment with analytic baselines.[13] However, using unbounded models introduces risks such as factual errors, operational security violations, and bias.[14] Lessons from operational case studies in both AI-enabled research and disinformation campaigns reinforce the need for disciplined workflows that integrate human review at every stage.[15]

To illustrate the potential of this approach, the following excerpt from the AI-generated short story The Synthesis shows how extremist ideology, technical skill, and accessible commercial technology can converge to create a chemical attack scenario:[16]

"The attacker had used a drone to disperse the agent. Investigators initially assumed it was a terrorist cell or state actor. It wasn't. It was Ethan Voss—a 23-year-old chemistry master's student. No prior record. No history of violence. But his laptop told a different story: search histories, forum memberships, AI transcripts, and private lab notes."

Similarly, in "Genomic Shadows," the researcher directed the model to integrate open-source reporting on genomic data exploitation, producing a scenario that blended geopolitical tension, biotechnology risk, and targeted biological weapon development:[17]

"The mutation was unlike anything in the natural world; it had been designed. The larger nation had used commercial genetic databases to craft a biological weapon aimed with precision at the Naramese genome."

By embedding such narrative vignettes within an analytic framework, AI-assisted FICINT can make abstract threat concepts tangible, helping countering weapons of mass destruction (CWMD) professionals visualize operational dilemmas, anticipate cascading effects, and rehearse decision-making under conditions of uncertainty.[18]

Methodology

This project applied a structured, three-stage process to generate AI-assisted FICINT suitable for counter-WMD analysis: (1) scenario development via threatcasting, (2) structured AI prompting using the Concise, Logical, Explicit, Adaptive, Reflective (CLEAR) framework, and (3) quality assessment using a purpose-built rubric.

Threatcasting as a Scenario Founcation

Threatcasting is a foresight methodology that projects a range of plausible future states, identifying potential threats and reverse-engineering the steps that could lead there.[19] Its application to WMD scenarios has been demonstrated in areas ranging from cyber-enabled nuclear escalation to extremist use of biological threats.[20] For this project, existing analytic products, coursework, and open-source intelligence into baseline scenarios were synthesized, each representing a WMD-relevant future. This included chemical, biological, and cyber-WMD intersections.[21]

The scenarios emphasized the intersection of employment of a chemical, biological, radiological, or nuclear weapon with other operational or societal dynamics—e.g., political instability, extremist movements, or supply chain disruption.[22] Each scenario followed the "no vaporware" rule, ensuring that all capabilities depicted were either in use, available on the open market, or in advanced development.[23]

Structured Prompt Engineering

Researchers used the CLEAR framework to create prompts for the LLMs (see Appendix B). Researchers segmented each prompt into discrete labeled inputs:[24]

• Target audience: defined decision-makers, operators, or policy officials.

• Story concept: core scenario premise, based on the threatcast.

• Elements of focus: themes or operational details to emphasize.

• References: relevant open-source or analytic material to inform the AI output.[25]

This structure ensured that the AI models anchored the narrative in the intended context and operational details. The framework facilitated iterative refinement, with the analyst acting as an active editor, correcting inaccuracies, and ensuring adherence to the analytical baseline.[26] In the sample below, an excerpt quoted from the AI-generated story Epidemic of Chaos demonstrates how the CLEAR-based prompt guided the model to incorporate both epidemiological and sociopolitical dimensions.[27]

CLEAR Prompt Quoted From and Used for "Epidemic of Chaos:"

I am a graduate student focused on how AI can be used for analysis of WMD events wanting to create Fictional Intelligence (FICINT) based on a potential future that I have determined. The story created will follow "no vaporware rules" meaning that any actions or technologies used need to have a basis in current use or research. The stories should remain plausible.

Target Audience: *Senior analysts focused on the ability of a GPT to create FICINT based on the analysis that has been conducted. Political leaders that should be aware of the social ramifications of such a deliberate pandemic.*

Story Concept: *The story should follow a coordinated plan by a domestic extremist group to release Ebola virus in several U.S. cities in the lead-up to a national election. The plot should show detection, response, and the way public fear and disinformation influence the crisis.*

Elements of Focus: *Highlight both the epidemiological realities of Ebola virus disease and the social consequences, including breakdown of trust, extremist exploitation, and strain on public health systems.*

CLEAR Prompt Quote References:

• Chowell, Gerardo, and Hiroshi Nishiura. "Transmission Dynamics and Control of Ebola Virus Disease (EVD): A Review." BMC Medicine 12, no. 1 (2014): 196.

• World Health Organization. "Ebola Virus Vaccines." Accessed October 23, 2024.

Model Output Sample:

"They had studied the disease, its symptoms, its origins in Africa. They knew the American public, ill-informed and scared, would make the connection between Ebola and the black community. It would be a weapon of fear, something that would tear communities apart and force the country into chaos."

(See Appendix C for the CLEAR prompts for all FICINT stories listed above.)

Rubric Development

Researchers created a FICINT assesment rubric to evaluate narrative outputs along dimensions relevant to intelligence communication (see Appendix A):

Plausibility: technical accuracy and adherence to "no vaporware."[28]

• Operational relevance: clarity of second- and third-order effects.

• Engagement: narrative elements that sustain reader attention.

• Analytical integration: alignment with pre-existing assessments or indicators.

Researchers designed the rubric for potential IC-wide use, enabling teams to evaluate AI-generated narratives consistently.[29]

Platform Comparison

Researchers tested three AI models: ChatGPT 4 (free version), ChatGPT 4 Plus, and the specialized Chat-GPT Novel Writer model. Researchers tasked each model with producing narratives from the same scenario prompt, with some runs incorporating a supporting analytic product and others relying solely on the prompt. This allowed assessment of the impact of prior research on narrative quality.[30]

For example:

• ChatGPT 4 (free version) generated The Synthesis without additional analytic background, testing the model's ability to create a coherent, technically plausible short-form FICINT from the CLEAR prompt alone.

• ChatGPT 4 Plus produced Genomic Shadows with an accompanying analytic paper on genomic data exploition, providing context that guided the model toward more nuanced technical and geopolitical details.

• ChatGPT 4 Plus created Epidemic of Chaos, but this time with a different supporting analytic product focused on public health and extremist exploitation, resulting in richer sociopolitical dynamics.

• ChatGPT Novel Writer model generated Blood Signal with both the CLEAR prompt and detailed analytic background, enabling the production of a longer, more immersive narrative.

An excerpt from Blood Signal, generated using the ChatGPT Novel Writer model, illustrates the output depth achievable when a high-context CLEAR prompt, paired with supporting analytic material, is applied to a longer-form, narrative-focused LLM:

> *"The air inside the biocontainment corridor was cool, metallic, and smelled faintly of ethanol. Daniel moved without hurry—the way people do when they belong in a place—even as the vial in his pocket cooled, triple-sealed, and invisible to every audit log in the building."*

This article's researchers scored model outputs using the rubric, with qualitative notes on narrative coherence, technical fidelity, and the degree to which the story illuminated key threat dynamics for CWMD decision-makers.[31]

Results

The three LLM platforms demonstrated distinct strengths and limitations when applied to the same FICINT scenarios under the "no vaporware" rule.[32] Pairing prompts with pre-existing analytic products significantly improved the narrative quality, confirming the value of integrating AI into an analyst-led workflow rather than relying on the LLM to create scenarios independently.[33]

Model Performance

ChatGPT 4 (free version) produced concise, operationally relevant narratives suitable for short-form intelligence notes. Strengths included rapid generation and technical plausibility, consistent with other observations of general-purpose model capabilities in low-context environments.[34] Limitations included reduced depth and occasional loss of narrative coherence during extended outputs, echoing concerns in AI-writing assessments.[35]

ChatGPT 4 Plus Generated richer character arcs, more nuanced operational detail, and better integration of second- and third-order effects. When paired with analytic source documents, outputs aligned closely with the original threatcast and rubric criteria, similar to structured AI-assisted analysis workflows used in red-teaming for biological threats.[36]

Novel Writer GPT Delivered the most immersive narratives, with extensive world-building and layered subplots. However, the length and complexity exceeded the practical needs of most CWMD analytic products, requiring significant analyst editing to maintain focus on operationally relevant elements.[37]

Effect of Analytic Source Integration

Across all models, providing the AI with structured analytic background material improved:

• Technical fidelity: reduced factual errors and misapplication of terminology.[38]

• Relevance: closer alignment with identified indicators and warning signs.[39]

• Plausibility: stronger adherence to "no vaporware" constraints.[40]

An example from The Synthesis demonstrates the operational clarity possible when the AI is anchored to specific chemical threat pathways identified in the analytic baseline:[41]

> *"The final chemical mixture—a volatile, highly toxic blend of easily purchased pesticide analogs and chlorinated solvents—had never been used exactly like this before, but AI-powered retrosynthetic analysis suggested it would be effective."*

Similarly, in Genomic Shadows, providing the AI with research on genomic data exploitation enabled a technically accurate depiction of targeted bioweapon design.

> *"The mutation was unlike anything in the natural world; it had been designed. The larger nation had used commercial genetic databases to craft a biological weapon aimed with precision at the Naramese genome."*[42]

Rubric-Based Scoring

The article's researchers scored each story across the four rubric categories: plausibility, operational relevance, engagement, and analytical integration. This approach parallels evaluation frameworks used in applied foresight and scenario analysis.[43] Table 1 summarizes the averaged rubric scores for each model type, on a scale from 1 (low) to 5 (high).

Model	Plausibility	Operational Relevance	Engagement	Analytical Integration
ChatGPT 2 (free)	4.0	3.8	3.9	3.5
ChatGPT Plus	4.7	4.6	4.5	4.8
Novel Writer GPT	4.5	4.2	4.9	4.3

TABLE 1: Average Rubric Scores by AI Model Type

Results indicate that ChatGPT 4 Plus paired with an analytic product achieved the highest overall balance of plausibility, relevance, and integration, while the Novel Writer GPT excelled in engagement but required more editorial intervention to preserve analytic focus.[44]

Discussion

This project aimed to determine whether analyst-led, AI-assisted FICINT can improve understanding and communicating CWMD risks. The results indicate that LLMs, when guided by a rigorous threatcast, a structured prompt framework, and an evaluation rubric, can produce narratives that illuminate second- and third-order effects more effectively than traditional bulletized products.[45] At the same time, the approach requires clear methodological guardrails to avoid the pitfalls of speculation, error propagation, or inadvertent operational risk.[46]

Analyst-in-the-Loop as a Nonnegotiable

The most consequential finding is procedural rather than technical: narrative quality and operational relevance depend on the analyst-in-the-loop, highlighting the necessity of domain knowledge when leveraging LLMs (and AI generally).[47] LLMs are accelerators of synthesis, not authors of truth. When researchers paired the model with prior analytic products and iteratively corrected calculations, the model consistently adhered to the "no vaporware" constraint, retained key indicators and warnings, and surfaced human-level implications that matter to decision-makers.[48]

Epidemic of Chaos: "They didn't need to invent a new pathogen to break the city. They just needed panic, mistrust, and the right timing—to salt the rumor mill while an old virus did what it has always done."

This kind of integrated insight—epidemiology braided with information disorder and civic fragility— is difficult to convey in a slide but immediately understandable in narrative form. It parallels historical patterns of crisis exploitation documented in both extremist recruitment and pandemic-era disinformation.[49]

Communicating Second- and Third-Order Effects

Across scenarios, AI-assisted FICINT made indirect effects legible. It helped readers experience how logistics, governance, and social trust interact under stress from a WMD-relevant event.[50] In CWMD contexts, where cascading effects often cause more strategic harm than first-order impacts, inclusion of AI-assisted FICINT may be a material advantage for sensemaking, training, and red-teaming. The Ebola outbreak literature underscores how disruption of medical systems and public trust can magnify impacts beyond the biological hazard itself.[51]

Blood Signal: "The outage map looked like random failure until you laid it over the reagent shipping lanes. Then the pattern snapped into place: a patient zero of supply chains." Here, narrative compresses complex interdependencies (i.e., power, communications and biomedical logistical planning and coordination) into a single mental model that operators can recall and rehearse.

Risks, Guardrails, and Ethical Considerations

AI-assisted narrative also introduces risks requires mitigation:

• Hallucination and Overreach: LLMs will confidently fabricate plausible but false details, particularly in technical domains.[52] The rubric's Plausibility and Analytical Integration criteria, coupled with source-grounded prompts, acted as checks on this tendency.

• Operational Security (OPSEC): Rich stories can inadvertently disclose sensitive techniques, vulnerabilities, or plausible attack pathways.[53] Applying the "no vaporware" rule, excluding non-public methods, and conducting security reviews before dissemination are essential.

• Normalization and Moral Hazard: Repeated exposure to vivid attack narratives risks tacitly normalizing them or becoming an unwitting how-to. Extremist propaganda analyses show how repetition and perceived plausibility can encourage real-world emulation.[54]

• Attribution and Bias: Narrative voice may imply causality or intent where the analytic record is uncertain. This risk mirrors challenges seen in media framing of terrorism and public health incidents.[55]

Utility for Training, Exercises, and Policy Dialogues

The strongest near-term use cases are tabletop exercises, red-team injects, and policy seminars where narrative vignettes seed and pace discussion.[56] This mirrors established practice in national security gaming, where scenario realism shapes participant engagement and decision quality.[57] For senior leader engagements, a two-page story paired with a one-page analytic brief provides both perspective and evidence.

Limitations and Threats to Validity

Several limitations temper these findings:

• Model and Prompt Dependence: Outputs vary with model capability, prompt clarity, and temperature settings. Creators of FICINT should view their results as conditional on those factors.[58]

• Evaluate Efforts: Rubric scoring, while structured, still involves human judgment. Inter-rater reliability and calibration remain areas for improvement.

• Generalizability: Constrain scenarios to near-term, “no vaporware” futures. Extrapolations to more specultive horizons may not hold.

• Measurement of Impact: While participants reported improved comprehension and engagement, future research needs systematic measurement (e.g., recall, decision quality under time pressure) to quantify effect size.[59]

Scalability and Transferability

The workflow scales by modularizing components: reusable prompt templates (CLEAR), shared scenario baselines, and a common rubric. Teams can maintain a vetted library of excerpts keyed to mission-relevant dilemmas (e.g., cross-border attribution, supply-chain sabotage, and disinformation during response).[60] This enables rapid tailoring to new audiences without regenerating full narratives.

Practical Takeaways for CWMD Practitioners

First, embed narrative early in planning cycles as a complement to technical analysis, not as an after-action embellishment. Second, pair each vignette with a concise analyst note listing the indicators, uncertainties, and potential decision levers surfaced by the story. Third, treat the rubric as both an assessment tool and a design guide; if a draft scores low on the Operational Relevance category, revise toward concrete decision points, not richer prose. In short, AI-assisted FICINT is most valuable when it helps practitioners rehearse the future: not to predict it, but to feel its pressures, see its branching paths, and practice better decision-making for improved outcomes when the stakes are real.

Policy Implications

AI-assisted FICINT offers both opportunities and challenges for the CWMD enterprise. If applied with methodological rigor, use of AI-assisted FICINT can serve as a complementary analytic channel that conveys operationally relevant insights in a more visceral and memorable form than traditional products.[61] However, without clear policy frameworks, its use risks undermining analytic integrity, inadvertently disclosing sensitive techniques, or shaping public perception in ways that may be counterproductive.[62]

Institutionalizing Guardrails

Given the dual-use nature of generative AI, agencies should develop internal policies that define acceptable use cases for narrative generation in CWMD contexts.[63] This includes:

• Requiring analyst-in-the-loop oversight for all AI-generated text.[64]

• Mandating the "no vapor-ware" rule to ensure plausible, non-speculative depictions.[65]

• Establishing pre-publication OPSEC reviews for narrative products.[66]

• Creating interagency guidance on prompt construction to reduce hallucination risk and maintain analytic relevance.[67]

Integration into Exercises and Wargaming

FICINT is particularly well-suited for tabletop exercises and operational wargames, where decision- makers can encounter unfolding scenarios that blend technical threat indicators with human and political context.[68] To maximize value:

• Pair each vignette with a corre-sponding decision matrix highlighting policy levers and trade-offs.[69]

• Use multiple narrative branches to explore the impact of different decisions, reinforcing the uncertainty inherent in WMD crises.[70]

• Integrate disinformation and public reaction injects, based on observed social media dynamics during real outbreaks.[71]

Enhancing Strategic Communication

Narratives can also train communicators internally on the likely public reception of CWMD- related events. By modeling how misinformation spreads and embeds in the public sphere, agencies can test and refine message discipline under stress.[72] Creators should coordinate with DHS fusion centers, public health partners, and law enforcement entities to ensure a whole-of-government approach.[73]

Ethical and Legal Considerations

The production of vivid, AI-assisted scenarios also raises ethical and legal questions:[74]

• Attribution in Fiction: Agencies must ensure that fictional adversary actions are not inadvertently misread as official judgments about real-world actors.[75]

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• Equity and Bias: Creators should take care to avoid reinforcing harmful stereo-types, particularly in scenarios involving disease outbreaks or terrorist activity.[76]

• Public Release Criteria: Not all FICINT should be releasable to the public; classified or Controlled Unclassified Information (CUI) versions may be necessary for sensitive operational insights.[77]

Recommendations for Policy Makers

• Pilot Programs: Launch small-scale FICINT pilot projects within CWMD relevant agencies to refine workflows and validate utility.[78]

• Shared Resource Development: Create interagency libraries of vetted prompts, rubric templates, and scenario baselines.[79]

• Training for Analysts: Incorporate narrative construction and AI-prompting modules into existing analytic tradecraft courses.[80]

• Metrics and Evaluation: Develop metrics to assess the impact of FICINT on comprehension, recall, and decision-making in CWMD contexts.[81]

• Policy Alignment: Ensure FICINT policies align with broader AI governance frameworks, biosecurity norms, and intelligence oversight requirements.[82]

In sum, the policy challenge is not whether to use AI-assisted FICINT in counter-WMD efforts, but how to embed it in a way that amplifies analytic value while safeguarding against operational, ethical, and reputational risks.

Conclusion

This article demonstrates that AI-assisted FICINT, when grounded in rigorous analytic baselines and guided by structured prompting, can provide a powerful complement to conventional CWMD analysis. By integrating threat-casting methodologies with the CLEAR prompt framework and a purpose-built evaluation rubric, narratives could be produced that capture second- and third-order effects in ways that enhance comprehension and engagement.[83]

The comparative testing of three LLMs showed that model capability, prompt clarity, and analyst oversight each play decisive roles in output quality.[84] The most operationally relevant narratives emerged when high-performance models were paired with pre-existing analytic products and subjected to iterative analyst review, echoing best practices in both intelligence tradecraft and biosecurity red-teaming.[85] The findings within this article underscores that AI should be seen as an accelerant to human analytic creativity, not a substitute for it.[86]

For CWMD practitioners, the practical value lies in FICINT's ability to humanize complex technical issues, stress-test decision-making under plausible future conditions, and make abstract risks tangible for policymakers, operators, and communicators.[87] Historical accounts of covert BW programs and extremist exploitation of crisis environments illustrate that both state and non-state actors have long recognized the power of narrative in advancing operational goals.[88]

However, without deliberate guardrails—such as the "no vaporware" rule, OPSEC reviews, and bias checks—there is a risk of introducing inaccuracies, revealing sensitive capabilities, or reinforcing harmful narratives.[89] Ethical frameworks from migration and public health policy further underscore the responsibility to ensure that these narratives inform without inflaming.[90]

The policy question, therefore, is not whether to incorporate AI-assisted FICINT into CWMD work- flows, but how to do so responsibly. Using pilot programs, shared interagency resources, and embedded training supports FICINT's use for amplifying analytic clarity versus undermining it. If implemented with discipline, AI-assisted FICINT can help the CWMD community rehearse tomorrow's crises today—preparing decision-makers to recognize emerging threats sooner and act more effectively when the real-world stakes are high. ■

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Appendix A: FICINT Evaluation Rubric

Criterion	Rating Scale	Descriptors
Plausibility	1–5	Accuracy of technical details; adherence to “no vaporware” rule; feasibility of scenario given current or emerging capabilities.
Operational Relevance	1–5	Clarity in depicting operational, strategic, or policy dilemmas; explicit linkage to indicators and warning systems.
Engagement	1–5	Ability to sustain reader attention; emotional resonance; vividness of imagery without sensationalism.]
Analytical Integration	1–5	Alignment with exiting analytic baselines; incorporation of known adversary TTPs (tactics, techniques, and procedures); consistency with established intelligence assessments.

TABLE 2: FICINT Evaluation Rubric

Scoring Guidance:

• 5 – Excellent: Fully meets the criterion with no substantive deficiencies.

• 4 – Strong: Meets most aspects of the criterion; minor issues only.

• 3 – Adequate: Meets minimum expectations; notable gaps remain.

• 2 – Weak: Significant shortcomings that impair utility.

• 1 – Poor: Criterion not met; major revision required.

This rubric applies to both AI-assisted and fully human-generated narratives and can be adapted for use in red-teaming, tabletop exercises, and strategic foresight activities.

Appendix B: CLEAR Prompt Framework

The CLEAR framework is a structured method for designing prompts for large language models (LLMs) to generate Fictional Intelligence (FICINT) narratives. It is intended to ensure that outputs remain grounded in analytic reality, operationally relevant, and technically plausible.

Element	**Description**
Concise	Keep each section of the prompt short and focused. Avoid unnecessary detail in early stages to prevent model drift.
Logical	Organize the prompt so that scenario context, objectives, and constraints flow in a coherent order.
Explicit	Clearly state all rules, constraints (e.g., "no vaporware"), and any references to be incorporated.
Adaptive	Be prepared to adjust prompts iteratively based on model outputs, re- fining for clarity, accuracy, and alignment with analytic needs.
Reflective	Evaluate the outputs critically against the original analytic intent, operational constraints, and plausibility checks.

TABLE 3: CLEAR Prompt Frameword

Recommended Prompt Structure:

1. Target Audience: Define the intended readership (e.g., policymakers, operational planners, analysts).Story Concept: Outline the core scenario premise based on the threatcast or analytic baseline.

2. Elements of Focus: Identify operational, strategic, or thematic elements to be emphasized.
3. References: Provide specific open-source or classified references to inform technical accuracy and context.

Applying the CLEAR framework ensures that prompts are both analytically grounded and adaptable to different mission contexts. When combined with the evaluation rubric in Appendix A Table 2, it provides a repeatable process for producing high-quality, mission-relevant narratives.

This appendix contains the complete text of the CLEAR-based prompts used to generate each FICINT) narrative in this project. Prompts are reproduced verbatim from the original applied research project to preserve wording and structure.

The Synthesis

I am a graduate student focused on how AI can be used for analysis of WMD events wanting to create Fictional Intelligence (FICINT) based on a potential future that I have determined. The story created will follow "no vaporware rules" meaning that any actions or technologies used need to have a basis in current use or research. The stories should remain plausible.

Target Audience: Senior analysts and law enforcement officials who need to understand how lone actors can leverage AI tools for chemical weapon development.

Story Concept: A 23-year-old chemistry master's student becomes radicalized online and uses AI-enabled research to develop and deploy a chemical weapon via a commercial drone.

Elements of Focus: Radicalization pathway, use of AI for technical problem-solving, acquisition of precursors and equipment, operational deployment.

References: Open-source materials on chemical precursors, AI-assisted synthesis, and lone-actor radicalization.

Genomic Shadows

I am a graduate student focused on how AI can be used for analysis of WMD events wanting to create Fictional Intelligence (FICINT) based on a potential future that I have determined. The story created will follow "no vaporware rules" meaning that any actions or technologies used need to have a basis in current use or research. The stories should remain plausible.

Target Audience: Senior policymakers and biodefense planners concerned with genomic data security.

Story Concept: A hostile nation-state uses commercial genetic testing data to design a bioweapon targeting a specific ethnic group.

Elements of Focus: Data acquisition, weapon design process, latency of disease onset, geopolitical ramifications.

References:
- Reuters. "China's Gene Giant Harvests Data from Millions of Pregnant Women." July 7, 2021.

Epidemic of Chaos

I am a graduate student focused on how AI can be used for analysis of WMD events wanting to create Fictional Intelligence (FICINT) based on a potential future that I have determined. The story created will follow "no vaporware rules" meaning that any actions or technologies used need to have a basis in current use or research. The stories should remain plausible.

Target Audience: Senior analysts focused on the ability of a GPT to create FICINT based on the analysis that has been conducted. Political leaders that should be aware of the social ramifications of such a deliberate pandemic.

Story Concept: A coordinated plan by a domestic extremist group to release Ebola virus in several U.S. cities in the lead-up to a national election. The plot should show detection, response, and the way public fear and disinformation influence the crisis.

Elements of Focus: Highlight both the epidemiological realities of Ebola virus disease and the social consequences, including breakdown of trust, extremist exploitation, and strain on public health systems.

References:

• Chowell, Gerardo, and Hiroshi Nishiura. "Transmission Dynamics and Control of Ebola Virus Disease (EVD): A Review." BMC Medicine 12, no. 1 (2014): 196.

• World Health Organization. "Ebola Virus Vaccines." Accessed October 23, 2024.

Blood Signal

I am a graduate student focused on how AI can be used for analysis of WMD events wanting to create Fictional Intelligence (FICINT) based on a potential future that I have determined. The story created will follow "no vaporware rules" meaning that any actions or technologies used need to have a basis in current use or research. The stories should remain plausible.

Target Audience: Counterproliferation specialists and intelligence officers monitoring laboratory insider threats.
Story Concept: An insider at a BSL-4 laboratory uses AI tools to bypass security protocols and exfiltrate a high-consequence pathogen.

Elements of Focus: Insider threat indicators, manipulation of inventory and audit systems, use of AI to facilitate operational planning, covert removal of materials. removal of materials.

References:

• Texas Biomedical Research Institute – High Containment Laboratory information.

• Open-source reporting on insider threats in laboratory environments.

Radiation Protection Factor Research:
The Keystone for Conventional-Nuclear Integration (CNI)

By: LTC Andrew Decker

This article briefly describes Defense Threat Reduction Agency (DTRA) Radiation Protection Factor (RPF) research and explains its critical role in supporting Operations in a Nuclear Environment (ONE) and CNI across the United States (US) Department of War (DoW).[1] As such, the background and practical utility of RPF values are discussed, as well as the justification for renewed DoW investment into RPF research to enhance the US' military planning, survivability, and lethality on tomorrow's nuclear battlefields. Advances in DTRA RPF research directly strengthen the US' strategic and extended deterrence efforts and support all Agencies and Departments responsible for nuclear or radiological response within the homeland.

RPF Background

In the modern era of rapidly evolving global threats and operational environments, maximizing the survivability of military personnel is essential to sustaining long-term force lethality. One critical, yet largely overlooked, aspect of force protection is the degree to which US combat vehicles protect occupants against the radiation emitted from nuclear weapons. While modern US combat systems offer markedly improved shielding against ballistic and explosive attacks, the amount of protection provided to US vehicle crews against ionizing radiation remains incomplete.[2] Operation Tomodachi, conducted in 2011, first revealed significant gaps in vehicle radiation protection information, and these information gaps impeded Army operational planning, which hindered US rescue and humanitarian operations.[3] This shortfall arose from a change to the Army's vehicle capability development process in the early 1990's that removed all such RPF information requirements, despite decades of prior research and stipulations.[4] Fortunately, renewed DoW focus on large-scale maneuver combat and CNI planning is driving a reestablishment of Army scientific expertise in support of ONE. The keystone for these efforts is the determination of full RPF values for all modern US Army combat vehicles, and these values are determined from vehicle exposures to neutrons and gamma rays, the two most penetrating types of radiation emitted from nuclear weapon explosions.

Specifically, vehicle RPF values are unitless numbers calculated from the ratio of the total radiation dose outside the vehicle (i.e. unshielded) compared to the total radiation dose inside the vehicle (i.e. shielded) and are determined using the equation shown in Figure 1.

$$Vehicle\ RPF\ Value = \frac{Unshielded\ Dose\ (neutron + gamma)}{Shielded\ Dose\ (neutron + gamma)}$$

FIGURE 1. Vehicle RPF value equation

As such, higher RPF values indicate more effective radiation shielding and, therefore, greater protection for vehicle occupants. Splitting full RPF values into constituent neutron and gamma protection factors yields additional data.[5] Practically speaking, RPF values enable estimations of shielded radiation dose to vehicle crews by dividing the measured dose outside the vehicle (unshielded) by the vehicle RPF value, as shown by the equation in Figure 2.

$$Shielded\ Dose\ (neutron + gamma) = \frac{Unshielded\ Dose\ (neutron+gamma)}{Vehicle\ RPF\ Value}$$

FIGURE 2. Dose estimation equation for vehicle crew

For example, a vehicle RPF value of 10.0 means that a sudden dose of 7.0 Gray (Gy) arriving from a nearby nuclear attack would result in an estimated total dose to vehicle occupants of only 0.7 Gy, thereby ensuring they would likely survive and remain combat effective, while unshielded personnel nearby would quickly become casualties and likely perish. As such, vehicle RPF values enable accurate predictive risk assessments for combat maneuver operations in both prompt and delayed radiation environments, as well as facilitate reliable dose reconstruction efforts to assess long-term health risks to US personnel following ONE.

Practical Utility of Vehicle RPF Evaluations

Today, full RPF values remain undefined for many US Army vehicles, which means the DoW is currently unable to accurately assess the expected dose to vehicle crews operating in certain radiation environments. This information gap alone provides a compelling justification for widespread RPF evaluations of manned US combat systems; however, a variety of additional reasons also exist, including many that offer benefits relevant to domestic nuclear attack scenarios, as well.

Pre-Nuclear Attack: The 1988 technical report summarized three principal applications of RPF informaion to military operations:

> It is desirable to know the radiation protection factors of U.S. and allied vehicles since it will affect the best mode of deployment in the event of the reality, or even the threat, of nuclear war. Similarly, the protection factors of potentially hostile vehicles will affect U.S. targeting doctrine. It is also important to make known to [future] U.S. designers of vehicles . . . the best techniques for attaining good radiation protection, so that they may be implemented in an efficient and cost-effective manner.[6]

In other words, vehicle RPF information enables the optimal deployment and maneuver of US forces while under threat of nuclear attack, which thereby maximizes crew, vehicle, and unit lethality and survivability. Likewise, RPF assessments of enemy combat systems improve the efficiency of US nuclear targeting. Lastly, the incorporation of RPF considerations into the design phase of future US vehicles provides maximum battlefield radiation protection at minimum cost for next-generation combat systems.

Post-Nuclear Attack: Operation Tomodachi starkly highlighted the operational requirement of vehicle RPF values for US military units operating in radiologically contaminated environments.[7] As demonstrated by the example above, RPF values enable necessary dose calculations and facilitate predictive risk assessments for vehicle crews operating in contaminated environments. Consequently, RPF values fully equip US leaders with the capability to determine both acute health effects and risks to vehicle crews, as well as likely long-term effects to mounted personnel from sustained operations in radiation environments, even after sudden or unexpected exposures occur.

In conclusion, the benefits and relevance of RPF research apply to all Services, both before and after a nuclear attack. Therefore, all US military leaders should possess vehicle RPF information, which enable informed decision-making regarding US force deployments and maneuvers to minimize the health risks to US personnel from enemy nuclear attacks. Consequently, RPF information makes CNI possible and applies at all warfighting levels from tactical to strategic. DTRA RPF research provides a pathway to acquire this information for the DoW, thereby strengthening US warfighter confidence when fighting or maneuvering through radiological land, sea, or air environments.

Approving a Computer Code for RPF Estimates, 2013-2018

DTRA RPF research began in 2013 as a partnership between DTRA and the US Army Nuclear and Countering Weapons of Mass Destruction (USANCA), with DTRA's Nuclear Science and Engineering Research Center (NSERC) at West Point leading and sponsoring this research. Both agencies agreed that computational analysis offered the most cost-effective and reliable means of estimating vehicle RPF values, and historical precedent supported this decision.[8] Specifically, the US Army routinely leveraged computer codes during the Cold War to estimate vehicle RPF values once each code successfully underwent verification and validation (V&V). The V&V process typically included a comparison of simulated RPF estimates against physical measurements using simplified surrogate vehicles.[8]

Once validated, computer simulations facilitate reliable estimations of vehicle RPF values for any radiation exposure scenario, which is essential because RPF values may change substantially based on specific threat or environmental factors. In short, computational methods offer vastly superior analytic capability and flexibility over purely experimental alternatives, and both DTRA and USANCA recognized this fact.

Both agencies agreed upon using the Monte Carlo n-Particle (MCNP©) code, an export-controlled program developed by Los Alamos National Laboratory (LANL), due to its broad acceptance as the world's premier radiation transport modeling software.[9] However, prior to MCNP receiving DTRA and USANCA approval, the latest version of the code, MCNP6, underwent extensive V&V by NSERC research scientists between 2014-2018.[10] The code ultimately passed all NSERC technical reviews in 2019 resulting in DTRA and USANCA approving MCNP6 as a reliable tool for estimating vehicle RPF values.[11]

Vehicle RPF Measurements, 2023-2025

Despite this achievement, physical RPF experiments using US Army combat vehicles were still necessary to provide specific measurement data to compare against any future MCNP6-derived estimates. Planning for these initial experiments began in 2023 when the Air Force Institute of Technology (AFIT) proposed two RPF research investigations to test a new fast, low-cost vehicle RPF experiment design at White Sands Missile Range (WSMR) in New Mexico.[12] Subsequent successful RPF measurements by AFIT the following year proved the low-cost experiment methodology was feasible.[13] Consequently, the Nuclear Technologies Survivability Division at DTRA partnered with the NSERC to begin planning and funding full-vehicle evaluations for fiscal year (FY)25, with NSERC scientists again leading the RPF research effort.

NSERC scientists conducted initial full-vehicle RPF experiments in October 2024 using an M2A3 Bradley Fighting Vehicle (BFV) and produced the first full RPF examinations of a BFV in over 30 years. These experiments, conducted at WSMR, yielded two full RPF measurements, complete with both neutron and gamma protection factor information. Follow-on experiments conducted over five weeks in April and May 2025 produced four additional RPF values for the BFV, as well as six full RPF values for the US Army's new Armored Multipurpose Personnel Vehicle (AMPV), the first RPF values ever measured for that combat system. These results are now available in a classified DTRA Technical Report.

Despite these successes, further RPF measurements of US Army vehicles at WSMR are currently paused. Fortunately, NSERC-led RPF investigations using MCNP6 are occurring at the United States Military Academy, and NSERC scientists will compare these simulations against the BFV and AMPV measured data from WSMR to advance RPF research in FY26. However, many fielded US Army vehicles await full RPF determinations, which leaves a significant amount of simulation and experimentation incomplete, as well as US Army and DoW information gaps unfilled.

Conclusion

In a world of nuclear-armed adversaries, the DoW cannot afford to confront these threats with anything less than the best available information. Central to this belief is a clear understanding of the benefits and limitations of US military equipment, particularly the degree to which US Army combat vehicles protect against lethal radiation. Likewise, an improved understanding of enemy equipment enhances the effectiveness of current nuclear targeting processes, weapon employment, and CNI objectives. Therefore, RPF research directly improves Joint US military planning, as well as the survivability and lethality of US forces on any future nuclear battlefields. These benefits will only grow over time, as RPF analysis and validated simulations inform future vehicle design. Eventually, these scientific advances will enable US Armed Forces to confidently conduct CNI operations seamlessly across nuclear and non-nuclear battlefield environments alike, thereby maximizing the potency of US strategic and extended deterrence efforts. ■

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Institute of Technology. His email address is andrew.w.decker.mil@mail.mil

Notes

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2. Andrew Decker, M.P. Shannon, J.A. Clinton, J.W. McClory, and S.R. McHale, "Verification and Validation of Monte Carlo N-particle Code 6 (MCNP6) with Neutron Protection Factor Measurements of an Iron Box", Journal of Radiation Effects, Research and Engineering, vol. 33, no. 1-E, pp. 252-259, May 2015; Andrew Decker, “The Radiation Protection Factor White Paper,” Countering Weapons of Mass Destruction Journal, USANCA, Issue 15, pp. 28-36, Summer/Fall 2017; Andrew Decker and R.D. Prins, “Measuring Radiation Protection,” Countering Weapons of Mass Destruction Journal, USANCA, pp. 10-12, Issue 26, Spring/Summer 2023.

3. J. C. Nellis and J. F. Marquart, “Protection Factors of Combat Systems,” Combating Weapons of Mass Destruction Journal, vol. Winter/Spring, no. 8, pp. 44-46, 2012.

4. Nellis and Marquart, “Protection Factors of Combat Systems;” C. R. Heimbach, “Radiation Protection-Factor Measurements of a Lined Iron Box in Simulated Fission and Fusion Tactical Nuclear Environments,” Army Pulse Radiation Directorate, Aberdeen Proving Grounds, MD, 1985; S. Stueker, A.E. Rainis, and R.E. Rexroad, "Calculation of Residual Radiation Protection Afforded by the M113A1 Armored Personnel Carrier," U.S. Army Armament Research and Development Command, Aberdeen Proving Grounds, 1978.

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You Can't Spell "CNI" Without Army

By: MAJ Kyle Carberry, MAJ Tyler Fight, CPT Phillip Grant,
CPT Melissa Nery, and MAJ Daniel Strasser

Modern deterrence requires the ability to operate across the nuclear and conventional spectrum. Joint Publication (JP) 3-72 defines Conventional-Nuclear Integration (CNI) as the deliberate planning and execution of operations that combine both conventional and nuclear capabilities.[1] In this context, the Joint Force Commander (JFC), supported by Geographic Combatant Commands (GCCs) and the United States Strategic Command (USSTRATCOM), must offer flexible and credible response options to national leadership. The Land Component Commander (LCC) plays a vital role in this integration. Without land component contributions, nuclear plans risk disconnection from operational realities on the ground. This paper argues that the LCC enables integrated deterrence by contributing fires; survivability; Intelligence, Surveillance, and Reconnaissance (ISR); and planning integration across both conventional support to nuclear operations (CSNO) and nuclear support to conventional operations (NSCO).

The LCC supports the GCC's theater campaign plan and coordinates with USSTRATCOM planners to ensure synchronization of nuclear and conventional actions upon implementation.[2] Land forces are not merely tactical elements; they help shape strategic posture, deliver theater-level messaging, and ensure survivability in contested environments. The presence of ground forces — especially when trained, dispersed, and chemical, biological, radiological, and nuclear (CBRN)-capable — adds credibility to deterrent signaling and continuity of operations if nuclear use occurs.[3] More specifically, the LCC provides several critical capabilities essential for enabling nuclear operations.

The first of these capabilities are integrated fires and suppression of enemy air defense, commonly referred to as SEAD. Army long-range precision fires can suppress adversary anti-access/area denial systems, enabling dual-capable aircraft (DCA) to reach their targets.[4] Furthermore, the LCC is likely responsible for Cyber/Electronic Warfare (EW) Integration. Disabling an adversary's nuclear command and control or air defense networks through offensive cyber or EW operations enhances survivability of US nuclear forces.[5] To facilitate the joint targeting cycle, the LCC will provide ISR and Battle Damage Assessments (BDA) support. Ground-based ISR platforms support nuclear targeting prior to strike and provide relevant BDA post-strike.[6]

In the defensive arena of CSNO land forces protect nuclear assets, DCA bases, and critical mobility corridors, ensuring strategic forces can operate under threat. Additionally, any nuclear operation will require a robust communications and sustainment apparatus.

The LCC must maintain secure and interoperable command and control systems that connect with nuclear C2 nodes for coordinated execution. The LCC must ensure the rapid deployment, sustainment, and repositioning of conventional and nuclear-enabling forces across the theater.

Having established the conventional responsibilities of the LCC during nuclear operations, let us now examine how nuclear capabilities enable land operations via integrated deterrence, strategic messaging, and demonstrative use. Nuclear weapons are a keystone component of the integrated deterrence concept, defined as the synchronized use of nuclear and conventional tools to shape adversary behavior across the conflict spectrum, and can afford the LCC a powerful 'strategic shield.' The presence or alert status of nuclear forces serves as a strategic signal that may deter adversary escalation against US or allied conventional operations. For the LCC, this deterrent effect translates into greater freedom of maneuver and increased operational flexibility on the ground. By complicating adversary calculations and raising the perceived risk of crossing nuclear thresholds, a visible or postured nuclear capability can suppress aggression, delay enemy decision-making, and enable sustained land operations under the protective umbrella of strategic deterrence.[7]

Nested within integrated deterrence is the unique and unequivocal strategic messaging that nuclear weapons can provide. The posture, movements, and activities of land forces can serve as deliberate tools in a broader campaign of nuclear signaling, particularly during crisis stability or escalation management scenarios. While nuclear signaling is often associated with alert statuses or strategic platform deployments, JP 3-72 underscores the importance of coordinated, theater-wide actions that reinforce deterrent messaging. Ground force readiness exercises, visible repositioning near key terrain, or DCA deployments, can contribute to a joint narrative intended to demonstrate resolve or signal intent to adversaries. The LCC, through active participation in campaign design and integration with strategic communications objectives, plays a vital role in reinforcing the credibility of US nuclear posture and shaping adversary perceptions. This is especially critical when conventional and nuclear tools are employed in tandem to deter further escalation without crossing the nuclear use threshold.

If an adversary crosses the nuclear use threshold, then a nuclear weapons demonstration or a limited strike may become NSCO options available to the LCC. Demonstrative nuclear use — such as a strike in a remote or unpopulated area — may serve as a signaling mechanism to compel an adversary to reconsider further escalation. In scenarios where conventional operations stall (or become stalled) due to hardened, deeply buried, or otherwise inaccessible targets, limited nuclear use may be considered to enable access or compel adversary de-escalation. JP 3-72 describes options such as the use of tactical nuclear weapons to demonstrate resolve or to neutralize targets that are beyond the reach of conventional capabilities.[8] For the LCC, such actions can create operational openings by removing physical or psychological barriers, degrading critical enemy systems, or compelling the repositioning or withdrawal of opposing forces. Though highly escalatory, these options remain within the portfolio of the LCC and require deliberate planning and coordination to avoid strategic miscalculation.[9]

In concert with potential strategic miscalculation mentioned, other challenges to effective CNI include deconfliction in joint targeting, classification barriers limiting information sharing, and the disproportionate effects of nuclear operations on land component forces. Integrated planning teams, frequent exercises (e.g., nuclear Command Post Exercises), and CBRN-trained personnel capable of operating in post-detonation environments mitigate challenges to effective CNI.[10]

In summary, the LCC plays a central role in enabling credible, flexible deterrence options by supporting both CSNO and NSCO. Through integrated fires, survivability, ISR, and C2 alignment, the land component enhances national leadership's ability to manage escalation and execute strategic objectives. JP 3-72 makes clear that without integrated land capabilities, the deterrent power of nuclear forces may be diminished. Therefore, the land component must remain fully engaged in CNI planning and execution. ■

Notes

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6. Joint Publication 3-0, Chapter 2, Section 6.h.4.

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8. Joint Publication 3-72, Chapter 6.

9. Joint Publication 3-72, Chapter 7.

10. Joint Publication 3-72, Chapter 3, Section 4.

Winning the Dirty War:
Large Scale Combat Operations in a Biological Hazard and Threat Environment

By: MAJ Tyler Halbert, MAJ Taylor Bruff, MAJ Aaron Craig, MAJ Tim Leung, and MAJ Mithun Sheth

The history of biological warfare traces back to the 1346 Siege of Caffa, where Mongol forces hurled infected corpses over city walls to spread plague.[1] Mongols identified that plague spread from dead or sick individuals and determined that exposure to the dead would serve well as a siege tactic, enabling shock and fear while infecting a well defended and densely populated city.

The 2023 Biodefense Posture Review Vision

The 2023 Biodefense Posture Review (BPR) identified that the Department of Defense must be able to continue operations under threat of a biological incident or attack.[2] To project combat power and prevail in large-scale combat operations in biologically contested joint, interagency, intergovernmental, and multinational (JIIM) environments, Combatant Commanders (CCDR) and staffs must consider several factors. CCDRs must be cognizant of the interoperability and doctrinal alignment within the Joint Force. Several government agencies will be involved in a biological incident, so the CCDR must integrate systems and teams into a cohesive and unified effort. These efforts are increasingly more important for multinational forces. Recognizing the growing complexity of biothreats, whether deliberate or accidental, the BPR emphasizes the need for a resilient force capable of sustaining operations in contaminated environments. CCDRs are expected to integrate enhanced biosurveillance, early warning systems, and deployment of medical countermeasures into planning cycles, while coordinating across interagency and international lines to bolster situational awareness and operational effectiveness. CCDRs play a pivotal role in preparing the force to detect, respond to, and recover from biological hazards through institutionalized training, doctrinal reform, and strong collaboration with allies and partners, while maintaining mission readiness and deterring adversary use of biological weapons.

Joint Factors

Joint operations inherently involve friction points between Services due to differences in both doctrine and systems. To project force and maneuver freely in a biological hazard environment, CCDRs must ensure that doctrinal alignment exists across the Joint Force. Teams from sister Services must be able to operate seamlessly toward a shared end-state, which requires commanders to understand how Service-specific doctrine nests within joint doctrinal concepts. For example, the Army's Field Manual (FM) for Chemical, Biological, Radiological, and Nuclear (CBRN) operations, FM 3-11, supports Joint Public (JP) guidance and specifically, JP 3-11, Operations in CBRN Environments. Where doctrinal gaps exist, local Standard Operating Procedures serve as critical bridging mechanisms.[3]

Effective response to biological threats depends on interoperable communications and data networks that enable a shared common operating picture (COP), allowing rapid reporting of infections, contamination levels, and treatment measures across a large area of responsibility. The COP must provide accurate, real-time visibility across all echelons and components to support timely, informed decision-making. Protecting the force further requires integrated biosurveillance, medical reporting, and CBRN defense capabilities across all Services, informed by lessons from the coronavirus disease pandemic, better known as 'COVID-19.' These lessons should drive the development of joint tactics, techniques, and procedures, also known as TTPs, with emphasis on force dispersion, sustainment control, symptom monitoring, and the flexible employment of personal protective equipment, also known as PPE. By leveraging complementary Service capabilities such as the Army's CBRN units, the Air Force's global mobility, and the Navy's deployable medical platforms, the Joint Force can sustain operations and preserve combat effectiveness in a biologically contested environment.

Interagency and Intergovernmental Factors

A biological hazard will require a whole of government effort, especially in the event of a bio-hazard incident in the continental United States (US). It will be imperative that the CCDR and staff establish clear lines of authority through Joint Interagency Task Forces and Joint Interagency Coordination Groups, identifying who is the lead for each of the response elements, the chain of communication, and ultimately where the nexus of information lies. Even more so than with a Joint Force, interoperability of systems and unity of action is paramount. The Geographic Combatant Commander (GCC) must be able to communicate with federal government agencies in order to establish and maintain a common operating picture.

Biological threats may emerge as non-selective agents affecting broad populations or as targeted agents focused on specific demographics, each posing distinct challenges for the Combatant Commander (CCDR) when developing response options. Department of Defense experiments conducted during the 1950s and 1960s determined that infection rates approaching 30 percent in major urban areas could overwhelm healthcare systems and bring them to a standstill. These activities generated predictive medical data that remains relevant for contemporary planning; they enable the CCDR to better coordinate with the Department of State on global health security and diplomacy efforts, and with the Department of Health and Human Services (DHHS) for employment of the Strategic National Stockpile within the continental US.

Multinational Factors

Geographic Combatant Commands with assigned areas of responsibility (AOR) that include international partners must consider both the efforts of those international partner forces and the efforts of international agencies such as the United Nations and World Healt]h Organization when responding to biological threats. Communication and tracking systems must be able to integrate so that the international response can be unified. Multinational organizations must be brought on board rapidly when operating in an outside the continental US theater. The host nation's presence in threat response adds a layer of legitimacy to Joint Force operations and increases the effectiveness of multinational cooperation.

The CCDR's assessment of medical infrastructure (both US and partner-nation) is an essential consideration when dealing with a biological threat environment. Understanding hospital bed capacity, access to local and regional medical supplies, and the availability of pre-positioned or shareable stocks is vital for sustaining response operations. Interoperability with foreign-built medical technologies and allied logistics networks must be exercised in peacetime to prevent friction during crisis. Effective coordination with partner nations can close critical capability gaps and extend the CCDR's ability to preserve force health while maintaining regional stability. Exercises that test these logistics chains, stockpile-sharing agreements, and distribution plans in both permissive and contested environments will expose vulnerabilities before an adversary can exploit them. The United States and Republic of Korea's bilateral agreement is a prime example of such a system, which is stressed in biannual exercises conducted on peninsula from the Joint all the way down to Division levels.

Information Joint Function Support

One of the most insidious aspects of WMDs is that they are unlikely to be employed in isolation, with adversaries seeking to generate coordinated effects across the multi-domain battlefield. In the case of biological weapons, an enemy may pair the release of a pathogen with a foreign malign influence campaign designed to shift blame onto the US or Joint Force - citing them in direct violation of the Biological Weapons Convention.[4] Such an operation could target military forces or civilian populations, with the adversary exploiting the resulting chaos to incite distrust and resentment toward US forces.[5] Through coordinated disinformation efforts, the local population may be led to believe the US was responsible for the outbreak, demanding reparations or actively resisting US presence and operations. In this context, the CCDR must not only manage the biological hazard itself but also counter hostile narratives and maintain trust with host nation governments and civilian populations. The ability to shape and protect the information environment becomes critical to preserving operational freedom and ensuring long term strategic influence.

The Information Joint Function is critical in enabling the CCDR in a biological threat environment. One of its primary contributions is shaping the information environment to maintain operational legitimacy and public trust. In the event of a bioincident, whether natural, accidental, or deliberate, the information function supports attribution efforts by countering misinformation and disinformation, ensuring the Joint Force is not falsely blamed. Concurrently, it enables timely and accurate dissemination of public information regarding the nature of the bio-threat, protective measures for local populations, and restricted or hazardous areas, thus enhancing civilian safety and reducing panic. The information function allows the US to highlight its role in mitigation and response, creating a positive narrative that emphasizes continued operational capability, humanitarian assistance, and international cooperation. In addition, a well-managed information environment can facilitate two-way communication, allowing the Joint Force to collect crowd-sourced data, monitor public reporting, and identify emerging patterns or hotspots that may indicate the spread or severity of the biological threat. By synchronizing messages between interagency and multinational partners, the information function reinforces integrated deterrence and enhances the Joint Force's ability to project stability in a contested information environment.

Training Considerations for JIIM Operations

Training is critical to operate effectively in a biological threat environment. To prepare for the complex challenges posed by biological hazards, CCDRs must deliberately integrate JIIM partners into future tabletop exercises (TTXs). These exercises should not be limited to purely military scenarios but must include interagency representation from organizations such as the DHHS, the Centers for Disease Control and Prevention, Federal Emergency Management Agency, and allied health ministries to build shared understanding, clarify roles and responsibilities, and ensure synchronized response capabilities. Realistic and recurrent TTXs will foster interoperability, identify capability gaps, and strengthen command and control across diverse organizations, particularly during fast-moving or large-scale biological incidents.

During staff training scenarios, CCDRs must ensure that medical planning is fully integrated into operational design. Training to incorporate biological threat assessments, capability assessments, and vulnerability assessments into campaign and contingency planning provides commanders with a clearer understanding of the likely operational impacts of CBRN incidents. Doing so enables risk informed decision making and supports force posture, mobility, and protection measures.[6]

Additional considerations for GCCs are the implications of different training standards across the US military services and the corresponding foreign military training in preventive measures and medical care for infectious diseases. In training exercises, other nations may reduce levels of cooperation or require a greater dependence on US forces depending on their state's preferences to prevent the spread of a biological threat or lack of industrial base to provide medical equipment. The former is detrimental, as it reduces the deterrence value in multinational training exercises in any AOR. Integrating legal, diplomatic, and procedural reviews of regulations such as Status of Forces Agreements, also known as SOFAs, host nation customs, and international health regulations into this planning effort allows GCCs to anticipate and navigate legal or policy barriers to crisis response and consequence management.

Conclusion

As biological threats continue to evolve in complexity and lethality, the 2023 BPR makes clear that operations in a biologically contested environment are an enduring requirement for the Joint Force. To meet this challenge, CCDRs must plan and operate across the full spectrum of JIIM partnerships. This includes ensuring doctrinal alignment, technical interoperability, and trust-based relationships, particularly during crisis response scenarios involving communicable and noncommunicable threats.

The Information Joint Function serves as a vital enabler in this environment, countering foreign malign influence, shaping operational narratives, and maintaining public trust. Success in a biological threat environment requires CCDRs to lead integrated planning efforts that span the full operational and strategic landscape. Through disciplined training, informed risk assessment, and robust engagement with partners, the Joint Force can maintain operational momentum, protect the force, and uphold US strategic objectives despite the unique and asymmetric challenges posed by biological warfare. ■

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Strategic Deterrence and the Role of the Land Component Commander (LCC) in a Nuclear-Enabled, Multi-Domain Environment

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> "The 2022 National Defense Strategy (NDS) states, “the Department of Defense will deter strategic attacks against the United States, Allies, and partners… using a combination of capabilities, including integrated deterrence."[1]

In today’s multipolar nuclear world, the taboo of nuclear war cannot overshadow the growing need for informed readiness among military leaders. Unlike during the Cold War, many current senior leaders lack exposure and planning for nuclear threats. Yet, the risk of nuclear conflict remains paramount, if not increasing, demanding that LCCs strike a balance between mission success and strategic restraint. Effective deterrence requires integrating escalation dynamics into planning, force posture, and coalition operations to prevent nuclear use, manage escalation, and maintain operational flexibility under nuclear-threatened conditions.

Achieving readiness depends on joint training, escalation management, and incorporating nuclear considerations into operational planning. Educating leaders on the capabilities and limitations of forces in nuclear environments is critical. As threats from China and Russia intensify, highlighted in the 2022 NDS, the Army is adapting through technologies such as Long-Range Precision Fires (LRPF), deep sensing, and Multidomain Operations (MDO). These advances support a necessary shift in mindset and capability for LCCs confronting nuclear-armed adversaries. Land-based LRPF and deep sensing provide the LCC increased capabilities and responsibilities in the MDO environment, resulting in novel dilemmas while facing a nuclear-armed adversary.

Enabling Capabilities

The 2022 NDS emphasizes the need for the Joint Force to maintain its technological and operational edge, especially in contested environments.[2] A top Army modernization priority, LRPF, aims to enable multi-domain forces to penetrate and neutralize enemy Anti-Access/Area Denial (A2/AD) capabilities, ensuring military overmatch. Although without a single, formal definition, LRPF broadly encompasses guided weapons, like precision-guided munitions, also known as ‘PGMs,’ that destroy point targets with minimal collateral damage using advanced seekers, capable of outranging enemy A2/AD, defeating countermeasures, and supporting military advantage across operations. Army Futures Command is developing LRPF capabilities such as Strategic Fires, Precision Strike Missiles, also known as ‘PrSMs,’and Long-Range Hypersonic Weapons, also known as ‘LRHWs.’

Deep Sensing.
LRPF depends on equally capable long-range targeting, making deep sensing essential.[3] The evolving nature of warfare requires the Joint Force to detect and attribute threats using resilient, integrated Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance, also known as C4ISR, systems.[4] Central to this is the Army's concept of deep sensing—collecting intelligence beyond traditional lines to support targeting and decision-making in contested environments.[5] While the current doctrinal definition offers a starting point, Army leadership envisions a broader strategic role, with deep sensing labeled as a top operational imperative for 2030.[6]

Through programs like High Accuracy Detection and Exploitation System, referred to as HADES, the Army is advancing deep sensing capabilities with multi-altitude Intelligence, Surveillance, and Reconnaissance (ISR) platforms that can operate in denied environments, utilizing communications intelligence, referred to as COMINT; signals intelligence, referred to as SIGINT; synthetic aperture radar, referred to as SAR; moving target indicator, referred to as MTI; and other technologies.[7] These systems enable the tracking of strategic deep fires area mobile threats while leveraging non-traditional platforms to reduce reliance on satellites or manned aircraft. Utilizing a layered ISR architecture enhances the ability of LCCs to make rapid, independent decisions; shortens kill chains; and supports MDO focused on speed and convergence.

Multidomain Capabilities

Multidomain capabilities, such as LRPF or deep sensing, and techniques that enable MDO, are key assets. MDO is the Army's current Operational Concept, as detailed in Army Doctrine Publication, referred to as ADP, 3-0 dated March 2025.

Multidomain operations are the combined arms employment of joint and Army capabilities to create and exploit relative advantages to achieve objectives, defeat enemy forces, and consolidate gains on behalf of joint force commanders.[8]

MDO follows AirLand Battle, first published in 1982, which focused on integrated air and land forces across extended distances with fast resupply against a primarily conventional adversary.[9] Full-Spectrum Operations, published in 2001, considered a broad spectrum of conflict but remained primarily focused on the land domain.[10] MDO considers five domains: land, maritime, air, space, and cyberspace, as well as three dimensions: physical, information, and human. These additional domains and dimensions (D&D) enable an LCC to gain asymmetric advantage over an adversary's decision cycles and add considerable responsibility to the LCC's role. While the LCC may not operate significantly outside of the land domain, LCCs must consider and plan for the influence that affects other D&Ds and vice versa. An LCC must be familiar with friendly and adversary capabilities across all D&Ds and maintain regular communication and coordination, emphasizing mission command. Considering those capabilities, an LCC is still responsible for contingency planning that ensures coverage of other D&Ds ensuring mission accomplishment in the land domain.

While these new considerations have some correlation with longstanding doctrine, there are other, more significant shifts under MDO. The LCC will have to accept or aim for temporary relative advantage instead of sustained dominance in any D&D. The spectrum of conflict is defined by competition and conflict phases and places the responsibility on all commanders to manage actions within phases as well as the transitions between phases. LCCs are also responsible for influencing an adversary to stay in or return to the competition phase. However, the largest challenge to overcome is the overall Army mindset in the face of a nuclear-armed adversary. The United States (US) Army Training and Doctrine Command (TRADOC) published the TRADOC Pamphlet 525-3-1 proposes US Army MDO for 2028.[11] One of the pamphlet's fundamental assumptions is that the US, as well as our adversaries, may threaten the use of nuclear weapons, but will not employ them. The pamphlet further specifies that operational circumstances may require with the use of nuclear weapons. The implication is that the Army does not yet have an operational concept for nuclear armed conflict and the transition back to competition and may be unprepared for such a situation.

Unique Considerations

In addition to the LCCs' defined roles, there are unique considerations to keep in mind when facing a nuclear-armed adversary.

First, leaders must consider escalation management, particularly in the context of MDO and land-based LRPFs. The LCC must understand the types of targets or domains considered adversary red lines, or thresholds, could invoke a nuclear or strategic response. These might include targeting early warning systems, which could be seen as a preemptive strike to a nuclear attack, or striking long-range fire systems, which the enemy could interpret as a decapitating strike.

Second, leaders must consider survivability. Dispersal, mobility, and resilience of command and control are essential, as adversaries may attempt to decapitate or disrupt US command nodes. As noted in the 2022 NDS, leaders must synchronize conventional and nuclear planning with Allies and partners.[12] This includes improving conventional forces' ability to operate in the face of limited nuclear attacks, denying nuclear-armed adversaries the benefit of possessing and employing these weapons.

Third, leaders must consider the strategic context. According to the NDS, "The risk of strategic deterrence failure…requires integrating nuclear deterrence with other military operations."[13] Leaders must be able to continue fighting and winning should our nuclear deterrence fail. The LCC must also show restraint during target selection and weapon selection to prevent escalation.

Lastly, leaders must consider the command implications. The LCC must adopt strategic sensitivity; every decision may have deterrent, escalatory, or signaling implications. Therefore, it is essential to "seek to avoid unknowingly driving competition to aggression"[14] by using the information domain to convey messages effectively.

Conclusion

LCCs must integrate LRPF, deep sensing, and MDO into all phases of planning and execution to maintain relevance and effectiveness in modern conflict. These capabilities enhance situational awareness; extend reach; and enable rapid, precise responses against peer adversaries. However, they also introduce complexities, particularly in managing cross-domain strategic effects and maintaining coordination across joint and allied forces. Commanders must ensure these tools are employed deliberately, with clear understanding of their strategic implications.

At the same time, the evolving threat environment demands a fundamental shift in mindset. Commanders must balance technological overmatch with strategic restraint, recognizing that each decision carries potential deterrent, escalatory, or signaling consequences. Commanders must embed escalation management and survivability planning into operations rather than treating escalation management and survivability as afterthoughts. Ultimately, integrated deterrence relies on LCCs who can think strategically, act decisively, and lead effectively under the shadow of a nuclear threat.

Since the authors wrote this article in the summer of 2025, the US Army merged TRADOC and AFC in October 2025.[15] The merge resulted in the establishment of the US Army Transformation and Training Command (T2COM). The US Army further transformed the Army Combined Arms Center to the Army Combined Arms Command (CAC) which structurally and functionally aligns as a subordinate element to T2COM. With CAC's redesignation, CAC has an enhanced responsibility throughout the enterprise for Army doctrine, education, training, and leader development. In alignment with the theme of the CWMD Journal, Issue 31, the US Army transformed three critical sites, TRADOC and AFC, now T2COM, and CAC, to strengthen the US Army's ability to rapidly modernize its workforce and adapt to remain operationally effective and lethal to achieve mission success. ■

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Redlines Written in Pencil and Redlines Written in Sand

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The dissolution of the Soviet Union left in its wake a complex dynamic between the countries of Russia and Ukraine. Despite cooperation efforts between the two nations in the years following the Cold War, they have found themselves in what is now a four-year large-scale conflict. This conflict pits Russia, a military superpower with the world's largest nuclear stockpile against Ukraine and the neighboring North Atlantic Treaty Organization (NATO), of which Ukraine desperately desires to join but is not a member. These partners recognize that while Ukraine may not be a member of NATO, its territory represents a location of strategic importance to NATO's defensive framework. The complexity and strategic challenges created by these dynamics have caused Russia to take a stricter line in its nuclear deterrence policy to limit NATO's support to Ukraine. As the conflict continued, Russia presented a series of red lines, the violation of which would possibly instigate a nuclear response. The explicit nature of these red lines represents a divergence from the ambiguity which characterized not only Russia's past nuclear deterrence policy, but also that of other nuclear weapon states. To date, Ukraine and its NATO allies have violated many of these red lines without a nuclear response from Russia. In this article we discuss how Russia's failure to act on these violations of its nuclear deterrence red lines since the beginning of the Ukraine War has reinforced the use of more ambiguous policies by other nuclear weapon states.

Red Lines and Their Role in Deterrence Defined

Allies and adversaries alike often view redlines in the context of Bugs Bunny and Yosemite Sam: drawing a line in the sand with your toe and daring your opponents to step over it. While simplistic at face value, red lines often manifest at the complex intersection of politics and military action in a multinational setting. Different parties interpret red lines differently; especially red lines developed outside of treaty obligations. As such, different parties attempted to define the term 'redline.' Polina Sinovets summarized redlines in international politics as "the manipulation of an adversary's intent through mostly public statements for deterrence purposes, referring to the deliberate crossing of a certain threshold by an adversary and relevant counteraction if this threshold is crossed.[1] Todd Sechser identified three conditions required for a compellent threat: "(a) demand a change, (b) threaten military action if that change is not enacted, and (c) be made from one state to another."[2] Taken together, both definitions define the establishment of a redlines as an exercise of political influence in which a world leader threatens military ways and means to achieve strategic ends.

Whether parties meet their strategic ends often depends on the immediate global political climate and the ability to implement military ways and means. Russia's updated nuclear policy is an attempt to implement red lines as tools in support of the achievement of their strategic ends in Ukraine.

Russian Nuclear Deterrence Policy Prior to the Invasion of Ukraine

In 2020, President Vladimir Putin introduced a document called "Basic Principles of State Policy of the Russian Federation on Nuclear Deterrence."[3] This document came as a surprise to many of the world's political leaders, as Russia had been generally protective of its nuclear doctrine. While there were snippets of doctrine from Russia's 2000, 2010, and 2014 deterrence strategies, mostly kept these and any previous policies classified. The more recent 2020 policy clearly highlighted the Kremlin's intent to maintain and overtly communicate a more robust posture with respect to nuclear deterrence. The authors wrote the document to demonstrate that the goal of Russia's deterrence policy was to prevent any aggression against the Russian Federation and its allies.[4] More importantly, the document outlined four key conditions under which Russia would consider using its nuclear weapons. These conditions included a credible warning about the use of ballistic missiles against Russia or its allies, direct response to a nuclear attack on Russia or its allies, a response to a large-scale conventional attack against Russia, and a conventional strike on nuclear forces and command and control systems.[5] While it is possible that this policy was a sincere attempt on the part of Russia to provide greater transparency concerning its nuclear deterrence strategy, it is far more likely that Russia wrote it with the intent of highlighting its ambiguity, and inherent flexibility.

Russian Nuclear Deterrence Policy Following the Invasion of Ukraine

In November 2024, just four years after the publication and release of its 2020 nuclear deterrence policy, and just two years after the Russian invasion of Ukraine, Russia released an update to this policy titled Basic Principles of State Policy and Nuclear Deterrence.[6] While this policy was quite similar to the 2020 deterrence strategy, it asserted new language about Russia's lower threshold for the potential use of nuclear weapons as part of its deterrence strategy. Key to this new strategy were modifications to the 2020 publication of the four key conditions under which Russia would consider nuclear use.[7] Among the key changes was the addition of the condition: aggression against the Russian Federation and or the Republic of Belarus, posing grave threat to their sovereignty and or territorial integrity.[8] In essence, Russia considers an attack on Belarus as an attack on Russia itself and will take necessary measures to protect it. In addition, one of the more interesting aspects of this doctrinal update is that Russia now considers the support from a nuclear power to a non-nuclear power as a joint attack against Russia.[9] Although Russia does not formally state it, it is not unreasonable to deduce that this statement was an obvious reference to the war in Ukraine and an attempt to dissuade the U.S. or NATO allies from intervening in the war. It is evident from the last two publications of its nuclear policy that Russia is lowering its thresholds for nuclear use and continuously modifying its policies to suit its current needs. The current rhetoric certainly suggests that Putin has prepared to use nuclear weapons in defense of not only its national sovereignty, but also in support of its expansionist efforts in Ukraine. This new policy clearly demonstrates Russia's more recent efforts to establish clear red lines in support of a more aggressive deterrence posture.

Violation of Russian Redlines

One of the starkest examples of a violation of a red line established by Russia's current nuclear deterrence policy and rhetoric involved a conventional attack into Russia. On August 6, 2024, Ukraine launched a successful surprise attack into Russia's Kursk Oblast. At its height, they controlled upwards of 1,000 sq km of Russian territory. This clear violation of

Russia sovereignty did not illicit a nuclear response. Instead, Russia refused to recognize the attack as a conventional invasion of its borders, but rather as an act of terrorism.[10] The us further exasperated this violation when it authorized the Ukrainian military to utilize long range ATACMs to support its operations in the Kursk Oblast and strike targets within Russia.[11]

The final red line violation we will discuss involved a direct conventional attack on Russian nuclear deterrence capability. On 01 June 2025, Ukraine launched Operation Spiderweb and conducted a deep penetration drone attack on strategic Russian airbases that resulted in the destruction of multiple Russian nuclear capable bombers and other airframes. This attack was very visible and had a direct impact on the capability of the air leg of Russia's nuclear triad. However, once again no nuclear response was forthcoming on the part of Russia.[12]

Other Examples of the Use of Red Lines

Russia is not the only nation that uses redlines to achieve its strategic ends. There are several historical examples leaders and politicians drawing red lines, and though all had varying short term impacts. However, there is a common trend of the imposition of redlines resulting in a wide scope of impacts, often outside the frame of reference in which the nation draws the line. Those impacts are not always beneficial to the nation which imposed them. A very high-profile example of a political redline is the 2013 statement by President Obama on August 20, 2012, concerning the use of chemical weapons by the Assad Regime in Syria:

"We have been very clear to the Assad regime, but also to other players on the ground, that a red line for us is we start seeing a whole bunch of chemical weapons moving around or being utilized. That would change my calculus. That would change my equation."[13]

While this statement did not contain the explicit threat of violence included in many of Putin's statements concerning red lines, it did create a definable and unambiguous condition that the Syrian government could violate, or not.[14]

When the Assad regime violated it with little immediate response, it had several cascading effects. The statement inadvertently created an avenue for Russia to gain greater influence in Syria and gave legitimacy to the Assad regime through its later apparent willingness to cooperate with the UN and the OPCW to dispose of chemical weapons.[15] Furthermore, it demonstrated the US' unwillingness to act unilaterally regardless of the level of provocation.[16] Lastly, the US's administration's redline statement, and its subsequent violation became a political sensation, that the administration's domestic political opponents and internationals adversaries would use to characterize any subsequent efforts to deter the Assad as non-consequential half measures.[17]

Another example of red line employment concerns Iran's nascent nuclear weapon program and the resultant intervention by Israel and eventually the United States. Several US Presidents have stated that Iran cannot possess a weapon; Israel has gone one step further in stating that Iran cannot have the capability to produce a nuclear weapon.[18] Once Israel began its recent bombing campaign against Iran, this red line put the United States in position where it felt compelled to support Israels bombing against Iran's nuclear infrastructure in June 2025 with strikes of its own. While the long-term impacts of these attacks remain unclear it is apparent that the US' use of a red line limited the flexibility of its response.

Avoidance of Explicit Red Lines in the Nuclear Deterrence Policies of Nuclear Weapon Capable Nations

The are several recent examples of conflicts involving one or more nuclear powers. These include India-Pakistan, India-China, North Korea-USA, and Syria-USA among others. The deterrence policies of the nuclear powers involved in these conflicts generally avoid the use of unambiguous red lines; the crossing of which would automatically trigger a nuclear response.

These nations recognize that use of explicit red lines would put them into the undesirable position with Russia in the current Ukraine conflict. Repeated red line violations have slowly eroded Russia's credibility as Russia has failed to execute a nuclear response.

India and China both officially espouse a no first use policy. Some may consider this to be the establishment of a red line-based deterrence in contradiction to our thesis, however many researchers in deterrence theory believe that the true meaning behind their policy stance is far more ambiguous. Over the decades since they gained nuclear capability, what India considers to be first use by an adversary has expanded from a nuclear attack to a chem/bio and/ or large-scale conventional attack against Indian civilians or forces. As such, their deterrence policy is more of a retaliatory response based upon calculated ambiguity.[19]

The evolution of China's no first use policy has not been as overt, with the leadership firmly sticking to the party line on deterrence in public statements.[20] However, there are analysts, particularly in the US, who believe that this official no first use policy may be an intentional propaganda ruse. They argue that it costs China nothing to claim a no first use policy and contributes well to the non-aggressive persona that China is trying to present to the world. Even analysts who believe that China's no first use policy is credible, recognize the intentional room left for ambiguity concerning what would elicit a retaliatory response.[21]

A no first use policy grants a superior moral position afforded only to the more powerful nuclear weapon capable nations. As such Pakistan and North Korea make no attempt to mask the inherently ambiguous nature of their nuclear deterrence policy with the kind of political platitudes that India and China espouse. In fact, Pakistan has overtly rejected the adoption of a no first use policy. Its leaders see no advantage in simplifying India's assessment of retaliatory risk by pronouncing a red line, ingenious or not.[22] This ambiguity retains Pakistani flexibility to respond to threats while maintaining deterrence against a better armed adversary.

Multiple conflicts have occurred between India and Pakistan, yet little international fervor has highlighted or scrutinized Pakistan's threat of nuclear use and the conflicts have remained limited in nature. The apparent success of Pakistan's policy against a stronger adversary strengthens the argument for the use of ambiguity over explicit redlines when attempting to preventing large scale conflict.

The leaders of North Korea have followed a similar chain of logic in their own nuclear deterrence messaging. In 2022 they passed a new law in which they stated what would trigger a nuclear strike on the part of North Korea. The stated mission of their nuclear arsenal is not limited to deterrence/retaliation but also includes the repulsion of conventional enemy attacks and preemptive strikes if they consider enemy attacks imminent. The number and variety of triggers provided is such that according to their doctrine, North Korea would consider themselves justified in responding with a nuclear strike to a wide range of provocations or threats. Adversaries of North Korea have denounced such doctrine as destabilizing to the international security environment, but the leaders of North Korea clearly see the value in introducing further ambiguity into the risk assessments of the South Korean and US forces who are in opposition to them.[23]

Conclusions

The discussion over redlines and the intended purpose for defining them can prove to be a challenging task when trying to equate them to a potential response from an adversary. Although they may seem as if a nation writes them as a direct statement of causality, history has shown us that this is not always the case. Instead, these statements often foster strategic inflexibility in the face of a persistently ambiguous strategic environment and thus have a short half-life of efficacy. Russia's apparent failure to recognize these limitations has placed them in an undesirable geopolitical position. They have inadvertently created a situation where there is a distinct chance that Russia's deterrence policy and rhetoric will completely desensitize and increase their involvement in Eastern Europe's international security structure. This eventuality which would compromise Russia's desired end state: regaining dominance in Eastern European affairs. This end state motivated Putin to invade Ukraine in the first place. Ultimately, the other nuclear weapon states have recognized Russia's miscalculation and its resultant overplaying of hard redlines as an example that other nations should now or not follow. ■

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Introducing a Test of Audience and Message:
A Strategic Reassessment of Weapons of Mass Destruction (WMD) Non-State Terrorism

By: Brianne Bernhardt

> "The continued failure of counter-WMD policy, planning, and intelligence to recognize and adapt to the new, network-centric proliferation environment will persist until new, more imaginative ways of thinking and behaving are embraced."[1]

Introduction

The defense and intelligence community (IC) continue to face the persistent challenge of assessing which non-state terrorist groups may employ weapons of mass destruction (WMD). With an overwhelming influx of information, this question remains difficult for analysts to answer with precision. For the Department of War (DOW), WMD terrorism is not only an abstract intelligence challenge but a concrete operational concern. Safeguarding duty stations outside the continental United States (US), especially in sensitive environments, requires integrating predictive threat models into force protection and planning. Both policymakers and military commanders depend on timely, accurate, and actionable intelligence to shape policy, contingency planning, and allocation of limited counter–chemical, biological, radiological, and nuclear (CBRN) assets. Yet the rapid evolution of technology, coupled with shifting priorities in US national defense strategy, complicates the task.

As US strategy repivots toward the great power competition posture, resources for counterterrorism have become constrained, raising the risk that unconventional actors may exploit potential gaps in preparedness. Existing non-state terrorist WMD threat assessment models tend to rely on speculative forecasting and lack scalable, data-driven frameworks for proactive evaluation. This article addresses that gap by proposing an empirical testing of a theoretical model by Dr. Daniel Gressang, which suggests that determining three key variables, a group's audience, message, and societal relationship, may allow analysts to assess the potential for a group's WMD use.[2] While the model has been cited in terrorism literature by renowned CBRN experts like Gary Ackerman and Victor Asal, researchers have not yet empirically tested the model.[3]

Preliminary collection, analysis, and comparison efforts indicate that the model offers practical applicability for differentiating groups that may consider WMD use from those unlikely to escalate to such capabilities. While initial results are promising, a more expansive investigation could improve the accuracy of results by casting a wider net of potential actors, accounting for various sectarian and secular motivations. The purpose of this paper is therefore twofold: to propose a framework for testing Gressang's theoretical model and to highlight how its application could

inform national security priorities. Adopting a structured tool for anticipating mass-casualty threats may allow for the efficient allocation of resources by those tasked with combating the complex threat landscape.

This article uses the accepted definition of 'weapons of mass destruction' as CBRN weapons capable of causing mass casualties. 'WMD,' 'mass-casualty weapons,' and 'CBRN' are sometimes used interchangeably to discuss this class of weapons.

Counterterrorism Today

In the 1990s and early 2000s, the world saw emerging attacks and attempts by terrorists to pursue and employ WMD. Notably, cases like the 1995 Aum Shinrikyo sarin gas attacks, the 2001 Anthrax attacks, and later Islamic State chemical attacks in Iraq and Syria further complicated threat assessment efforts for the US Government (USG), which, throughout that period, carried out the Global War on Terrorism.[4] In the years after the 9/11 attacks and the US-led war, focus gradually shifted away from countering terrorism to adversarial states such as Russia, China, North Korea, and Iran. The diversion towards mediating Russia's invasion of Ukraine, the ongoing Gaza conflict, and other events have trumped counterterrorism priorities. This shift in focus can be seen in subsequent annual threat assessments released by the Director of National Intelligence (DNI) and in the accompanying testimony of the DNI before Congress.[5] As indicated by testimony, counterterrorism remained an area of focus more for the Federal Bureau of Investigation and the Department of Homeland Security, although much of that focus shifted to domestic extremism.[6]

After two decades of aggressive post-9/11 counterterrorism efforts, experts say the US is experiencing 'counterterrorism fatigue,' a tendency among both society and policymakers to disengage from what society and policymakers may perceive as a drawn-out struggle.[7] As counterterrorism is no longer a popular pursuit politically, the community must keep in mind that terrorists often benefit from complacency. Equally important is to recognize that complacency in the face of a shifting threat landscape has contributed to past intelligence failures to predict mass casualty attacks, such as the 9/11 terrorist attacks. Al-Qaeda and its affiliates remain active in Somalia and across Africa and continue to remain a threat that the US IC previously underestimated. With other active groups like Abu Sayyaf in East Asia, Jama'at Nusrat al-Islam wal-Muslimin in the Sahel, Islamic State-Khorasan Province, referred to as ISIS-K, domestic extremist groups and more, the threat of non-state terrorism remains persistent, with dwindling resources and capabilities to counter them.[8] Unlike traditional deterrence strategies focused on state adversaries, terrorist groups are not bound by the same cost-benefit calculus.[9] As Ackerman attests, terrorists generally fail to subscribe to traditional notions of deterrence.[10] In areas where deterrence may fall short, experts must attempt to understand the adversary better and reevaluate respective approaches.

Evolving Threat Landscape

With recent advancements in technology, terrorists are leveraging the internet to facilitate extremist activities and to inspire others via propaganda to carry out attacks.[11] For the counterterrorism community, the potential of terrorists taking advantage of rapidly emerging technologies to aid the development of WMD may also be worth considering. Excluding minor isolated incidents, terrorists once faced significant economic and technological hurdles in developing WMD. However, modern technology has lowered these barriers. Gregory D. Koblentz describes a scenario in which an individual could purchase a pesticide drone online for under $1,000 and use it to disperse a chemical agent over an urban area, causing significant physical and psychological harm.[12] While payload limits and cost remain constraints, rapid improvements in drone technology are eroding these limitations. Israel's APUS 25 Tactical VTOL Drone, for instance, can remain airborne for 8 hours and carry up to 10 kilograms.[13] The risk is not hypothetical; in 2015, a drone carrying radioactive material landed on the roof of the Japanese Prime Minister's residence.[14] Though the event caused no injuries, it highlighted the growing interest among malicious actors in using unconventional delivery systems for CBRN attacks. The Islamic State's general employment of chemical weapons in Iraq and Syria proved to be of similar concern but were constrained to the battlefield.

Aside from widespread internet access and advancements in potential delivery systems, the growth of artificial intelligence has opened the possibility to manipulate Large Language Models (LLMs) to assist in WMD development.[15] Widely accessible LLMs can be utilized by a malicious actor who may lack expertise in normal circumstances to overcome an area of ignorance and fill a knowledge gap to, for example, develop biological agents and toxins. Everything considered, modern technology creates opportunities for threat actors to explore new avenues of terrorism, specifically threat actors who may otherwise be deterred from doing so by insufficient knowledge and resources. On the other hand, just because the technology is readily accessible to manipulate and thus weaponize, it does not necessarily mean that every group will recognize this and seek to capitalize on it.

Terrorists may adopt new technologies to seek out more sophisticated weapons, also known as tactical innovation, likely increasing the possibility of employing WMD.[16] Equally compelling is the notion that selection consideration for WMD use follows a motivation for exponentially greater attention, fear, or disruption. As the Western world becomes cognitively desensitized to terrorist attacks, which have traditionally been bombings and shootings, it is arguably more difficult to impact people these days.[17] This begs the question: could the subsequent increase in cognitive desensitization of civilian populations, in turn, serve as a motivation for terrorists to seek WMDs?

Which Groups Pose the Greates Threats?

The terrorism literature lacks consensus on the potential for WMD use. Competing assessments of how terrorists potentially consider and use WMD often appear to address different topics.[18] This could be due to the complex natures of both WMD and terrorism alike. Even so, several pertinent observations can be made. The most common approach is that ideological motivations may provide for the most accurate predictive assessment. It is generally held that religiously-motivated terrorists are more likely to consider WMD use due, in part, to their ability to transfer responsibility for their actions to the deity they claim directs or guides their activities.[19] A terrorist motivated fundamentally by religion might justify acts in the name of a deity (or a non-corporeal deity), thus making their defined mission more difficult to measure than, say, the average political or social terrorist. However, predictive models that narrow down on strictly sectarian motivations might leave room for bias or inaccurate assessment and ignore entire subsets of potential actors. A study conducted by the Consortium for the Study of Terrorism and Responses to Terrorism at the University of Maryland found that researchers failed to highlight a significant relationship between the pursuit of WMD and a group's religious ideology.[20] Subsequent caveats emerge between religion and the use of unconventional weapons that may be perceived as playing god; biological weapons, often genetically modified, could be frowned upon by those that hold strong religious beliefs–the terrorist itself may become morally averse against using WMD.[21]

Others propose a widened approach, suggesting that groups with grandiose worldviews, millenarian ideologies, or deep feelings of humiliation are less likely to refrain from employing mass-casualty terrorism than those with clearly defined objectives.[22] In line with this view, some identify single-issue extremists, right-wing groups, and social revolutionary or secular left-wing factions as among those most likely to contemplate the use of WMD.[23] The terrorist may also take into account the perception of WMD use by its own members, acting as a deterrence in itself.[24] Concern may arise that the use of WMD may discourage fundraising and recruitment, rather than encourage it. This theory would eliminate most non-state terrorist groups in consideration for WMD and may be casting a net that is too broad, without accounting for possible fundamental motivations, or even for groups that are traditionally withdrawn from society and do not require support from them. An alternative theory is forecasting WMD events from an innovation/capability perspective. Adam Dolnik emphasizes the role that tactical and technological innovation play in the progression of terrorist organizations to use of high-end WMD agents.[25] Dolnik also suggests that predictive threat assessments of future terrorist violence can be conducted by identifying distinct characteristics of especially innovative terrorist organizations.[26] Similarly, Ackerman and Asal advocate for studying innovative indicators of terrorist organizations, like how they learn from mistakes, adopt new tactics, and shift strategies over time. These may point to identifiable changes in the proclivity of a group to pursue CBRN.[27]

A significant research gap in predicting WMD terrorism results from the low number of terrorists, especially non-state terrorist groups, that have successfully employed WMD. This further complicates predictive efforts and may account for the lack of consensus within academia. Which subset of non-state terrorists that are more likely to pursue WMD can be answered by examining the actors' prior and concurrent behavior. However, when limited information regarding attacks is available, in part because such attacks have occurred in few circumstances, experts may turn to a strategic framework that accounts for multiple aspects of motivation.[28] Referenced numerous times in the literature since 2001, the model proposed by Gressang suggests consideration of a group's

The Model

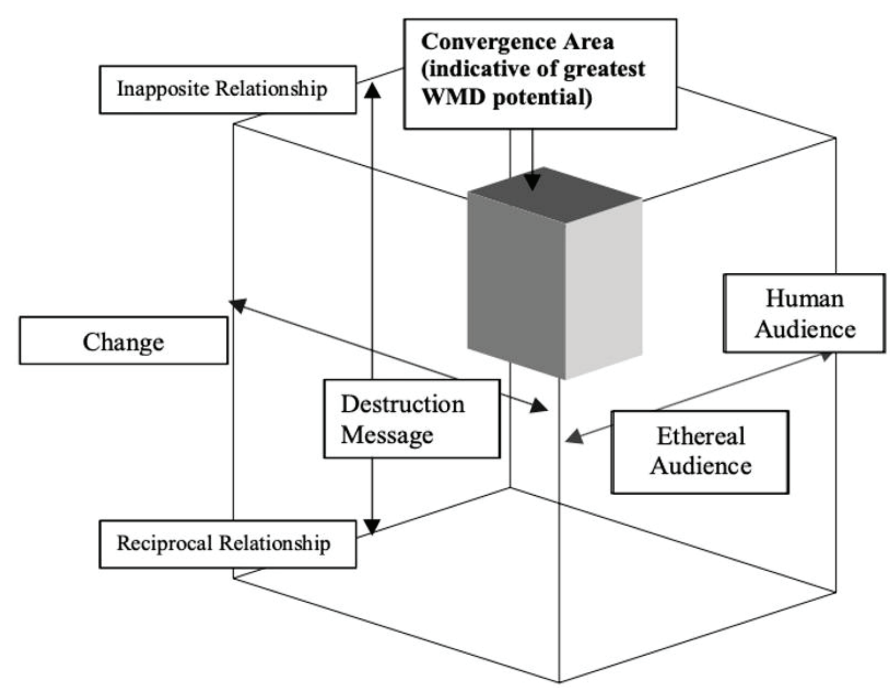

FIGURE 1: Daniel Gressang. Adapted from "Audience and Message: Assessing Terrorist WMD Potential," 2001, Terrorism and Political Violence.[29]

audience, messaging, and societalin-teraction and may offer a high reliability and benefit to academic discourse.

The interaction of these variables offers a structured way to evaluate intent. Groups that answer primarily to a divine audience, embrace destructive messaging, and reject reciprocal ties to society should, in theory, be more predisposed to WMD use. Gressang's model (illustrated above) identifies three variables, with the convergence of the three variables representing the highest propensity for WMD consideration. The first variable is the terrorist group's core audience. Groups addressing an ethereal audience, such as a deity, may be more willing to employ mass-casualty weapons, as divine mandate can be invoked to bypass cognitive and social barriers to extreme violence. By contrast, groups engaging a human audience tend to impose self-limiting thresholds on violence, shaped by the audience's tolerance and potential backlash. The second variable is the group's underlying message. Change-oriented terrorists seek to reorder social or political structures rather than annihilate them, requiring some degree of societal continuity; this may make them less likely to employ WMDs. Destruction-oriented terrorists view annihilation as the goal, unconstrained by concerns over social survivability. For these actors, the elimination of societal structures or populations aligns directly with their objectives, suggesting a predisposition to mass-casualty weapon use. The third variable is the group's relationship with society. Groups maintaining a reciprocal relationship, whether positive or negative, would tend to avoid WMDs, as public reaction may remain a key consideration. In contrast, those in an inapposite relationship, marked by severance and indifference to societal response, face fewer psychological or cognitive barriers in weapon choice and targeting. While such detachment may increase the propensity for WMD consideration, it does not guarantee their use. To accurately predict the actions that terrorists may or may not take, one must consider their underlying motivations, thus, develop a better understanding of them, but how can a complex theory such as Gressang's be tested on actual non-state actors?

Methodology

To test the applicability of Gressang's theory, the motivations of real-world non-state terrorist groups are to be analyzed and compared to their respective actions, if any, in the WMD realm. Potential target groups for analysis are far too numerous to address; a small number of representative organizations within several broadly defined categories were used to assess the viability of a more in-depth investigation. Since the terrorism literature holds little consensus over the types of groups that may consider WMD, examining both secular and religiously motivated groups provides for an analytically useful comparison. As so, testing included the following non-state terrorist groups:

- **Right-wing groups:** Aryan Nations, National Socialist Movement, and the Order.

- **Left-wing groups:** The Weather Underground, Symbionese Liberation Army, and Red Army Faction

- **Religious groups:** World Church of the Creator, al-Qaeda, and Aum Shinrikyo

Most of these groups were chosen because they are no longer active. The groups have not employed WMDs, with Aum Shinrikyo included as the exception. As noted in prior research, "meaningful results are only possible if one compares organizations that have pursued or used CBRN weapons to the vast majority who have not."[30]

To test the theory, open-source intelligence on each organization, including propaganda materials, communiqués, manifestos, and other relevant publications, was gathered for analysis. Each of the three variables can be inferred from the communicative aspects of the groups' acts, based on the notion that each act conveys implicit messages about goals, audience, and expectations of societal interaction. A dictionary was developed from the General Inquirer, mapping words and phrases to each of the three variables—audience, message, and societal relationship—used to evaluate available data.[31] Preliminary analysis using world cloud visualizations to depict the variables for each group were created, then compared to the group's history of WMD use to provide an indication of the model's reliability.

Results

For a future, more in-depth test, compiled texts will be processed through dictionary-based analytical software to quantify the degree of each index for each group. These results will then be compared to incident data from the Global Terrorism Database maintained by the University of Maryland. As a follow-on, pending encouraging preliminary results, a full comparative analysis will allow for the assessment of the model's correspondence with historical and current patterns, ultimately indicating the degree of its applicability in differentiating WMD-prone groups from those unlikely to pursue such capabilities. With the first and most critical step of threat assessments being an accurate identification of a subject, actor, or group, this research opens up the possibility of the initial model's incorporation into structured threat management approaches utilized across the USG.

Conclusion

While counterterrorism operations are generally led by the US IC, the responsibility for decontamination and remediation of resulting threats rests with DOW, its partner agencies, and local emergency response units. Both prevention and mitigation of WMD threats require a whole-of-government approach. As an open-source, low-cost process, the application of Gressang's model is available to those tasked with considering the threat of WMD use by violent non-state actors across military, civilian, religious, medical, and educational facilities. ■

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Designing Shock Tubes to Further Understand Traumatic Brain Injuries

By: MAJ Ivan N. Cho

Abstract

Blast-induced traumatic brain injuries (bTBI) are a growing concern for military personnel, first responders, and civilians necessitating research into the mechanisms of blast-wave neurological damage.[1] This article focuses on developing an optimized shock tube, a crucial tool for simulating blast waves, to provide controlled conditions that advance bTBI research. By using improved simulation software like Ansys Geometry and Fluent, this article addresses challenges like achieving realistic blast wave profiles and amplitude manipulation with shock tube obstacle design scenarios. Beyond military applications, findings will hold value for civilian safety in scenarios involving industrial accidents and terrorism, contributing to future bTBI preventive measures and therapeutic advancements. This is key in exploring new techniques and simulations for blast loading that produces bTBI. Environmental elements affect the applied loading and changes to pressure while impulse and pattern can produce different responses. Thus, following a continuous refinement of the simulated loading expected from relevant explosion scenarios and devices, researchers can support manufacturing of a more accurate research shock tube.

Introduction

In recent years, there has been a growing recognition of the profound impact of blast-related incidents on military personnel, first responders, and civilians alike.[2] Among the various consequences of explosive events, bTBI have emerged as a critical area of concern, demanding comprehensive research to understand the intricate mechanisms underlying blast-induced neurological damage.[3] As blast-related incidents continue to pose significant threats globally, an urgent need exists for advanced experimental platforms that can accurately simulate blast wave conditions and facilitate in-depth inves-tigations into their effects on the human brain.

This article contributes to the evolving field of blast wave research by focusing on the design and optimiza-tion of a state-of-the-art shock tube. The shock tube, a fundamental tool in blast wave simulation, plays a pivotal role in creating controlled and reproducible experimental conditions. A well-designed shock tube not only enhances the preci-sion of bTBI research but also opens avenues for exploring potential mitigation strategies and protective measures.

The multifaceted nature of bTBI necessitates a multidisciplinary approach, merging principles of fluid dynamics, biomechanics, neurobiology, and materials science. By integrating these diverse fields, this article addresses key challenges associated with shock tube design. Key challenges to shock tube design include achieving realistic blast wave profiles, obtaining precise control over impulse, and incorporating simulated, surrogate models for the human head.

The significance of this research extends beyond the immediate implications for military personnel, encompassing broader applications in civilian settings, where accidental explosions, industrial accidents, and acts of terrorism pose persistent threats to public safety. Consequently, this article contributes to both the advancement of blast wave research and to the development of effective preventive measures and therapeutic interventions for bTBI. Using systematic exploration of shock tube design parameters, experimental methodologies, and the subsequent analysis of blast wave effects on the brain, this article provides a comprehensive foundation for future research in the critical realm of bTBI.

Methodology

Designing a shock tube for bTBI research involves careful consideration of the implications and the methodology to ensure accurate and reliable results. A bTBI is a complex and serious condition, and research in this area is crucial for developing effective treatments and preventive measures. Due to the complexity, research from all avenues, from causation to characterization to mitigation, is ongoing at multiple research institutions. Implications and methodology considerations include, but not limited to:

1. TBI research involves subjecting living organisms to controlled shocwaves, which raises ethical concerns.[4] Researchers must ensure that their work adheres to ethical guidelines and that the benefits of the research outweigh potential harm to subjects.

2. Developing a shock tube requires strict safety measures to protect both researchers and subjects.[5] Adequate safety protocols, protective gear, and secure experimental environments are essential to prevent accidents and ensure the well-being of all involved.

3. It is crucial to design the shock tube to replicate conditions that mirror those causing traumatic brain injuries in humans.[6] The relevance of the experimental setup to real-world scenarios is essential for trans-lating findings into effective clinical applications.

4. The shock tube design should allow for the replication of experiments to ensure the reliability of data.[7] This involves maintaining consistent conditions and accurately measuring variables to facilitate comparisons between studies.

Once researchers establish and overcome these circumstances and methodology considerations, developing a shock tube that can generate controlled shockwaves with characteristics like those observed in traumatic events is the final step. Researchers must adhere to size, shape, and materials ensuring the design and characterization of the shock tube to achieve reproducible and realistic results.[8] This includes choosing an appropriate biological model for TBI research, such as animal subjects or tissue cultures, considering physiological and anatomical similarities to humans. The chosen model should allow for the study of both immediate and long-term effects of traumatic brain injuries.

Using advanced statistical methods for data analysis to extract meaningful insights from the collected information to include error margins will be necessary for drawing accurate conclusions and establishing the significance of the findings. This ties in together with collaborating with experts in relevant fields to validate the shock tube design and methodology. Engaging with neuroscientists, biomechanical engineers, and medical professionals can enhance the robustness and applicability of the research.

Ultimately, designing a shock tube for traumatic brain injury research requires a multidisciplinary approach, considering ethical implications, safety precautions, and methodological rigor. Accurate replication of real-world conditions and thorough data collection and analysis are essential for advancing our understanding of traumatic brain injuries and developing effective treatments.

Ansys

The simulation software used in the follow-on data capture was Ansys Fluent. Ansys is an analysis software that provides its users with an understanding of how their product will work or not work in real conditions.[9]

Ansys is also known as engineering simulation software or finite element analysis software. Ansys analyzes a wide range of problems related to mechanical product design and civil structure design by using numerical techniques. These design models, such as a sod shock tube, allow researchers to further test strength, elasticity, toughness, distribution, and temperature.[10]

A sod shock tube has numerous practical applications such as the design of supersonic vehicles and high-power lasers and studies of high-pressure, high-temperature chemistry.[11] Another very important application of a sod shock tube is its use in validating computational fluid dynamics codes. Figure 1 illustrates how the flow evolves in a sod shock tube after the diaphragm is taken off at t=0 seconds.

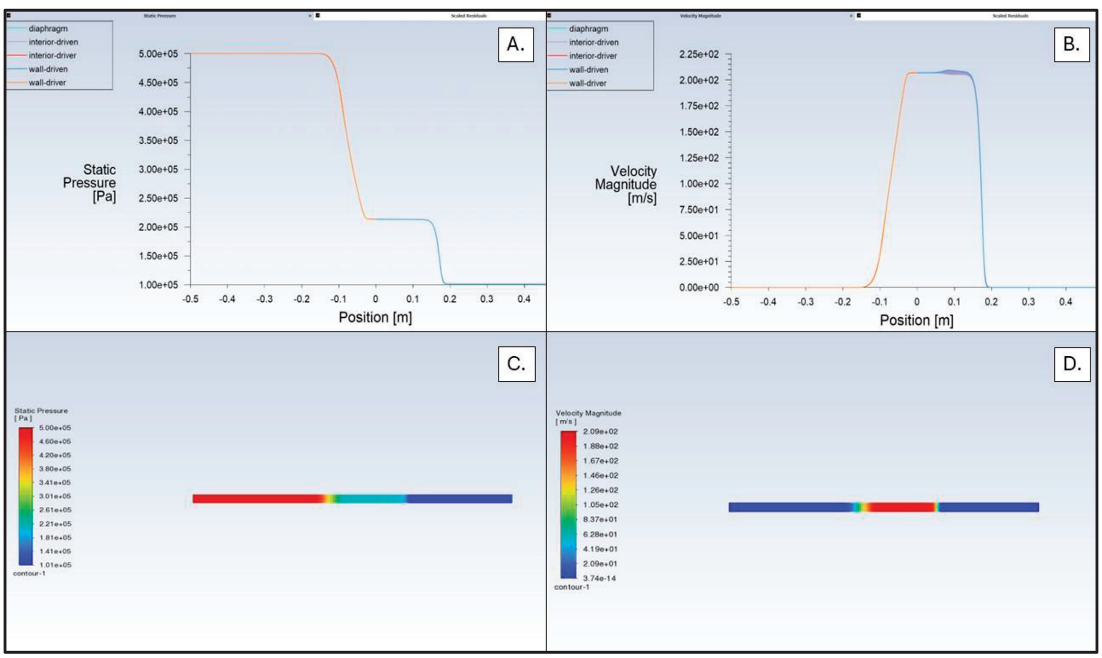

FIGURE 1: Sod shock tube (A.) Static pressure graph. (B.) Velocity magnitude graph. (C.) Static pressure release within the 2D sod shock tube. (D.) Velocity magnitude within the 2D sod shock tube.[12]

Researchers commonly use sod shock tubes as a foundation for accuracy and computational fluid dynamic codes and problem sets.[13] These simplistic shock tubes evolved into the three-dimensional (3D) versions of shock tubes readily seen in other Ansys simulations like Ansys Geometry and Ansys Fluent.

Design Theory

When an explosive charge detonates inside a container, the detonation products rapidly compress the surrounding gas, producing a sharp rise to peak pressure over a very short time interval. As the resulting shock waves propagate outward from the source in all directions, the shock waves interact with the container boundaries, including the sidewalls and base. These interactions lead to reflections that may overlap and converge, depending on the container geometry.[14] The container shape strongly influences the nature of these reflections. In cases where shock wave reflections are superimposed, local pressures can increase signi-fi-cantly, reaching levels approximately 4 to 10 times greater than the initial incident pressure. The magnitude of the reflected pressure depends on the specific reflection mechanism. As the shock waves continue to propagate, energy within the container gradually dissi-pates, resulting in changes to the pressure distribution and the overall propagation state inside the container.[15]

Compared with explosions occurring in free space, confined detonations exhibit distinct characteristics in their overpressure time-history profiles. As the initial peak pressure increases, the time separation between the first and subsequent pressure peaks also increases. Shock tubes are commonly used to investigate blast loading on structures of various geometries, both individually and in arrays, because they provide a controlled method for generating a rapidly rising pressure profile representative of blast loading. This capability is particularly important in bTBI biological testing. In free-field conditions, the overpressure is typically characterized by a single peak following a Friedlander waveform. In contrast, real-world confined or semi-confined blast scenarios often involve multiple pressure peaks. Therefore, the development of shock tubes capable of reproducing at least two distinct pressure peaks is critical for accurately capturing the relevant blast loading phenomena.

For the loading of multiple obstacles, an important finding has been that the shape of the obstacle is of secondary importance. The primary characteristic has been identified as the blockage ratio of the obstacles, which is the measure of the restricted volume that the shock wave has to propagate through.[16] Researchers may incorporate additional concepts when designing novel blast protection obstacles involving sudden volume expansion, a change of direction of the wave, and the use of perforated walls.

Design Scenarios

As mentioned previously, the front face of a container loaded by a blast wave experiences a reduction in the pressure magnitude due to the container’s shape. This concept, termed as ‘clearing,’ occurs in addition to the free-field blast pressure decay, due to the presence of the free edges in a finite-sized structure. The peak reflected overpressure of the shock wave does not change, however, because the incident shock wave reflection is essentially instantaneous and is unaffected by ‘clearing.’[17]

As an example, when the shock front impacts a point on the front face of a structure, it reflects, leading to a sudden increase in pressure at that convergence point (or Mach stem). On reflection, the direction of travel of this newly formed wave reverses, whereas in the surroundings of the structure, the undisturbed blast front continues to travel ahead.[18] There is a pressure discontinuity that propagates inwards from the edges of the structure, leading to the formation of an expansion wave to counteract the pressure gradient. Unlike the discontinuous and sudden nature of the shock wave, the expansion wave is a continuous, acoustic wave.[19] Therefore, the results indicate a progressively lowered reflected pressure over the front face of the structure, starting from the edges and then to the center.

Relative to the air velocity behind the reflected wave, the expansion (clearing) wave travels near the speed of sound. the air velocity in the reflected region is essentially negligible, especially for cases where the incident and the reflected waves are planar with no other disturbances. This enables the clearing wave to propogate rapidly. This then leaads to a substantial pressure reduction on the face of such a finite structure during the 'clearning' time.[20] At the end of this 'clearing' phase, researchers measure the pressure to follow the stagnation pressure.

Such idealized clearing behavior, however, becomes increasingly questionable when the scale of the structure is comparable to the stand-off distance of the explosion. The rise in terrorist and explosive-related activity in recent decades has redirected research efforts from isolated small shelters to modern urban buildings.[21] The scaled sizes of the target structures such as wooden and concrete-based structures would be comparable to the scaled distance from the explosive. This is because urban terrorist attacks commonly involve explosive charges ranging from 5 to 1000 kg, detonated at stand-off distances of only a few meters.[22] For these conditions, one can no longer assume ‘clearing’ effects to equalize quickly relative to the duration of the blast wave. This translates well to effects seen for bTBI analysis and characterization of head injuries suffered from off-angled blast waves.

Research has demonstrated that ‘clearing’ waves are initiated from different free edges at different times when an explosion occurs at an oblique angle to a tall building, which will render the simple relations incorrect.[23]

While ‘clearing’ always implies a reduction in the blast wave pressure, researchers have used single degree of freedom models to demonstrate that ‘clearing’can produce a counter-intuitively higher displacement for certain time-distance ratios.[24] This led researchers to consider two different structural geometries for collecting the necessary shock tube data: obstacles with straight surfaces and edges, and obstacles with curved surfaces.

Several researchers have studied the role of ‘clearing’ on obstacles with straight surfaces over the last few decades, primarily to understand the limitations of the existing simplified shock tube models used in bTBI characterization. Modernized technology along with continuous data capture has resulted in the approximated start times of ‘clearing’ at each point, and then the deviation from the non-cleared (reflected) pressure is predicted in terms of a relief function, or Hudson parameter, or a Friedlander profile.[25] This concept of tracking the deviation from the reflected pressure is a noticeable shift from the earlier methods, where reliance on stagnation pressure as the baseline value was paramount. This was also the result of decades of data captured for injuries sustained in the Middle East. Obstacles with straight surfaces, such as building walls, were significant directional reflectors.

For obstacles with curved surfaces, one major difference is that the ‘clearing’ load is further reduced because of the relieving effect provided by the three-dimensional nature of the surface.[26] Complex structures, such as hemispherical domes or other cuboids, quantified the inaccuracies in using existing conventional models to obtain overpressures. The concepts to capture this type of data used scaled distance and inclination angle at a location on the structure as inputs. Discrepancies of up to 150% for overpressure and up to 90% for impulse were reported, as ‘clearing’ plays an important role in this reduction.[27] Thus, load estimation on curved surfaces for such blast parameters has been an ongoing area of research in the last few years due to its complex, unpredictable nature.

However, because this study does not aim to estimate the response of specific structural types or compare the accuracy of the two obstacle geometries, the following scenarios focus on data collected from obstacles with straight edges and faces.

Baseline Simulation, Basic Shock Tube, No Obstacle:

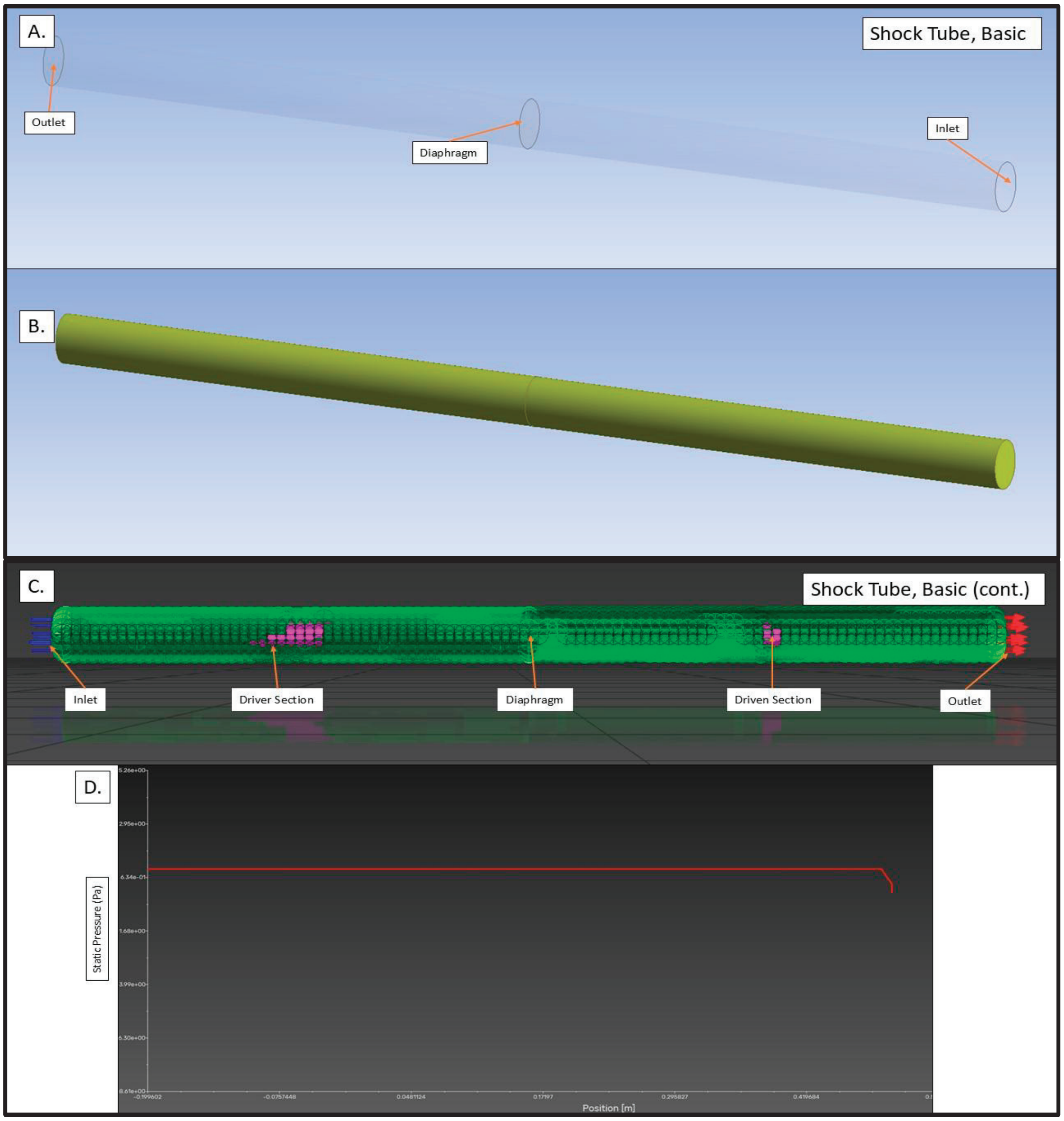

FIGURE 2: Base shock tube with no obstacle. (A.) Ansys Geometry of the volume and outline of the shock tube. (B.) Volume fill of the shock tube. (C.) Mesh fill of each section of the shock tube. (D.) Static pressure within the shock tube.

After creating the sod shock tube, the next step was to create the baseline shock tube. This would allow simulations through an open, unobstructed shock tube to see the effects of blast wave propagation in "free space" in a controlled and contained environment on a diaphragm. The design is for a 1m long shock tube, bisected (500mm) evenly to place the diaphragm. The thickness of the shock tube was set to 15mm with an internal radius of 30mm with an initiation source of at-sea level air, as seen in Figure 2A. When scaling up from air, whether it is pressurized helium or oxyhydrogen-driven blast waves, the error bars are about ±1% of the measured increased changes. So, using air as the normalized beginning factor provided a baseline for blast wave characterization.

As in the following scenarios, the mesh originates from a solid fill. The model fills the unimpeded shock tube geometry and volume with air, as shown in Figure 2B, enabling Ansys Geometry to generate the mesh (Figure 2C) that drives the subsequent simulation. The 250 simulations were run, by the author of this article, with 2 second intervals in between to create the static pressure versus position graph shown in Figure 2D. There is a steady line as the air passes through the driver section into the diaphragm and into the driven section. It is not until the end of the driven section (~450mm from the diaphragm) that there is a loss of static pressure indicated by the simulation. However, as previously mentioned within the Design Scenarios section in this article, shock tubes will have a single peak or drop-off in these closed environments.

The next step in the simulation task is to try and emulate and observe the second peak seen in real-world scenarios. The study systematically divides the simulations into three categories: a single solid obstacle, multiple solid obstacles, and multiple offset obstacles. If one of these three categories provided a higher likelihood of emulating a real-world scenario, the next simulation scenario would be to create a design modifying the initial category for more accurate characterizations.

Using the same schematics as the baseline shock tube, the study introduces a linear, single-piece solid obstacle into the container. The study introduces a solid-core internal flange at the bisection of the driver section (250 mm from the inlet) with a thickness of 10 mm and an internal radius of 10 mm. The fill and mesh steps follow the same procedure, as shown in Figures 3B and 3C, but the fill is absent where the solid internal flange is located. The available space allows the air to interact with the newly formed obstacle. The meshing process also highlights noticeable interactions at the flange location, as shown in Figure 3C. These interac-tions created challenges for Ansys, particularly in the finely meshed areas surrounding the unfilled volume. After introducing the obstacle, Figure 3D illustrates the effect of the flange on the static pressure. About 100 mm from the diaphragm puncture, the simulation captures the primary peak, followed by a smaller secondary peak at 250 mm from the diaphragm. The obstacle provided enough reflection onto the system to create a secondary peak, but potentially too much reflection directly back into the initial shock front (not productive enough to amplify the initial shock front, but rather "cancel" some of its energy) to create a noticeably observable secondary peak.

Simulation 1, Internal Linear Ring:

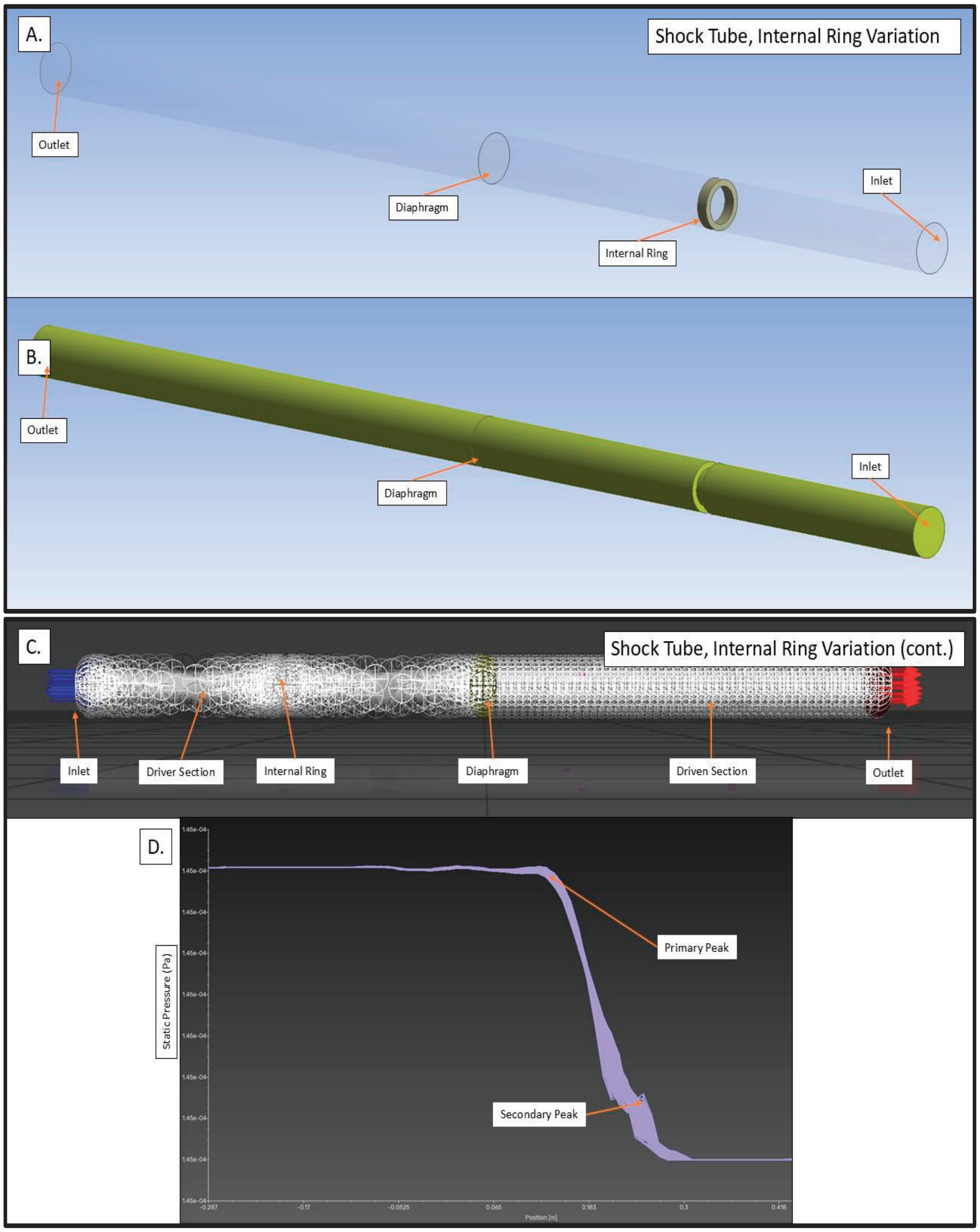

FIGURE 3: Shock tube with internal flange. (A.) Ansys Geometry of the volume and outline of the shock tube. (B.) Volume fill of the shock tube. (C.) Mesh fill of each section of the shock tube. (D.) Static pressure within the shock tube.

Simulation 2, Chopped Internal Linear Ring:

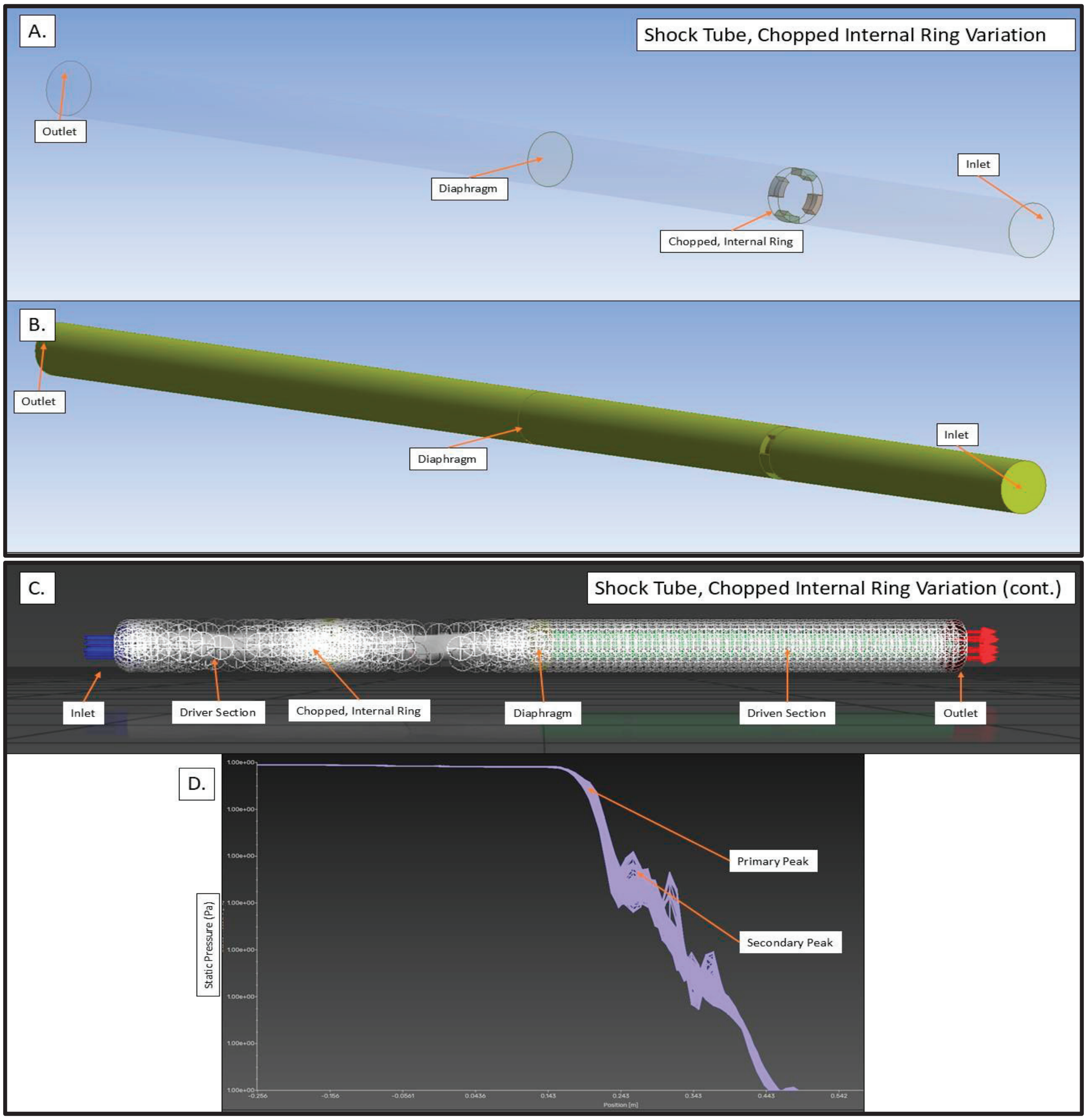

FIGURE 4: Shock tube with chopped internal flange. (A.) Ansys Geometry of the volume and outline of the shock tube. (B.) Volume fill of the shock tube. (C.) Mesh fill of each section of the shock tube. (D.) Static pressure within the shock tube.

Simulation 2 used the same dimensions as Simulation 1 for the internal, solid-core flange, but separated the ring into eight, equal volumes. The study removes four of the volumes, as shown in Figure 4A, while leaving the remaining four volumes as obstacles within the container. Figure 4B shows the fill volume used in the simulation.

Like Simulation 1, Figure 4C reveals a complex mesh near the location of the “chopped” flange. However, the main difference between the meshes in Simulations 1 and 2 is that Simulation 2 runs a simpler algorithm, due to fewer volumetric gaps in the four filled volumes.

Using the same simulation setup and number of runs, the resulting data produces the graph shown in Figure 4D. This graph shows a clearer separation of peaks, including observable third and fourth peaks, compared to Figure 3D. The difference likely arises from air being forced through the gaps where the internal flange previously occupied space, combined with multiple rebounds from the existing flange quadrants. Based on the future simulations, this is an observation worth noting based on potential variations that could likely affect the prospective intended results.

Simulation 3, Chopped Offset Internal Ring:

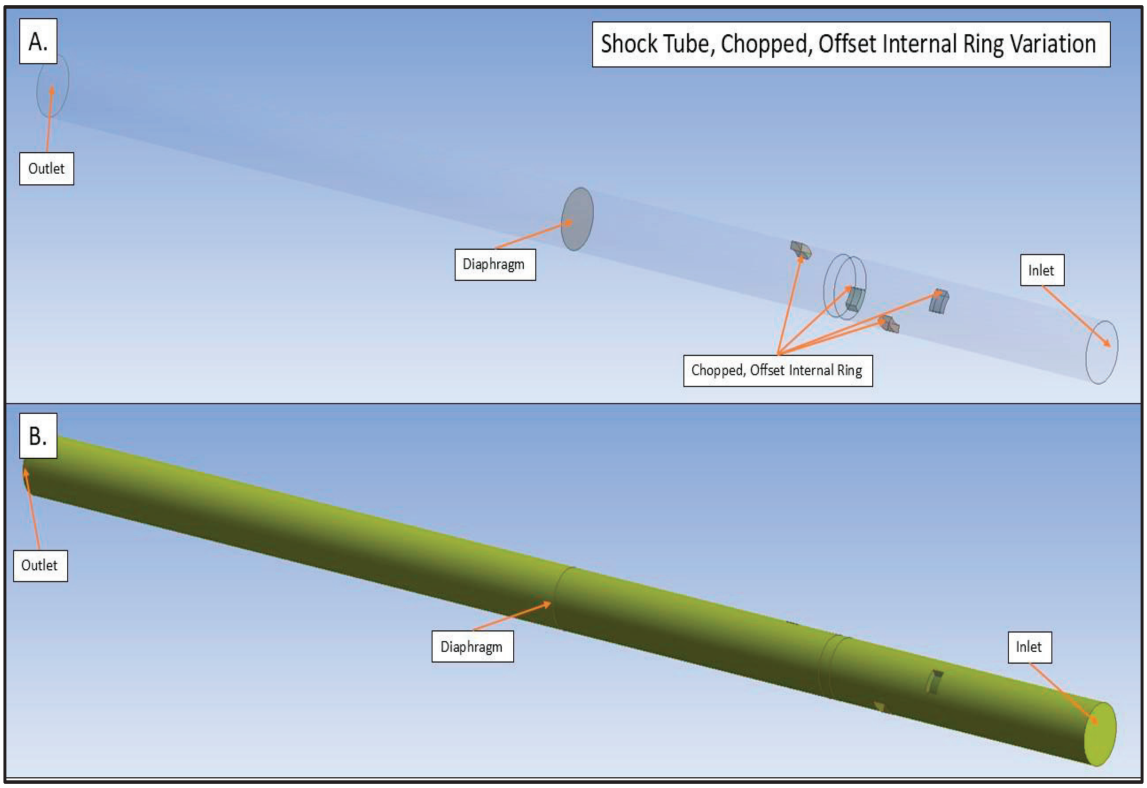

FIGURE 5: (Part 1) Shock tube with offset, chopped internal flange features. (A.) ANSYS Geometry of the volume and outline of the shock tube. (B.) Volume fill of the shock tube. (C.) Mesh fill of each section of the shock tube. (D.) Static pressure within the shock tube.

Simulation 3, Chopped Offset Internal Ring:

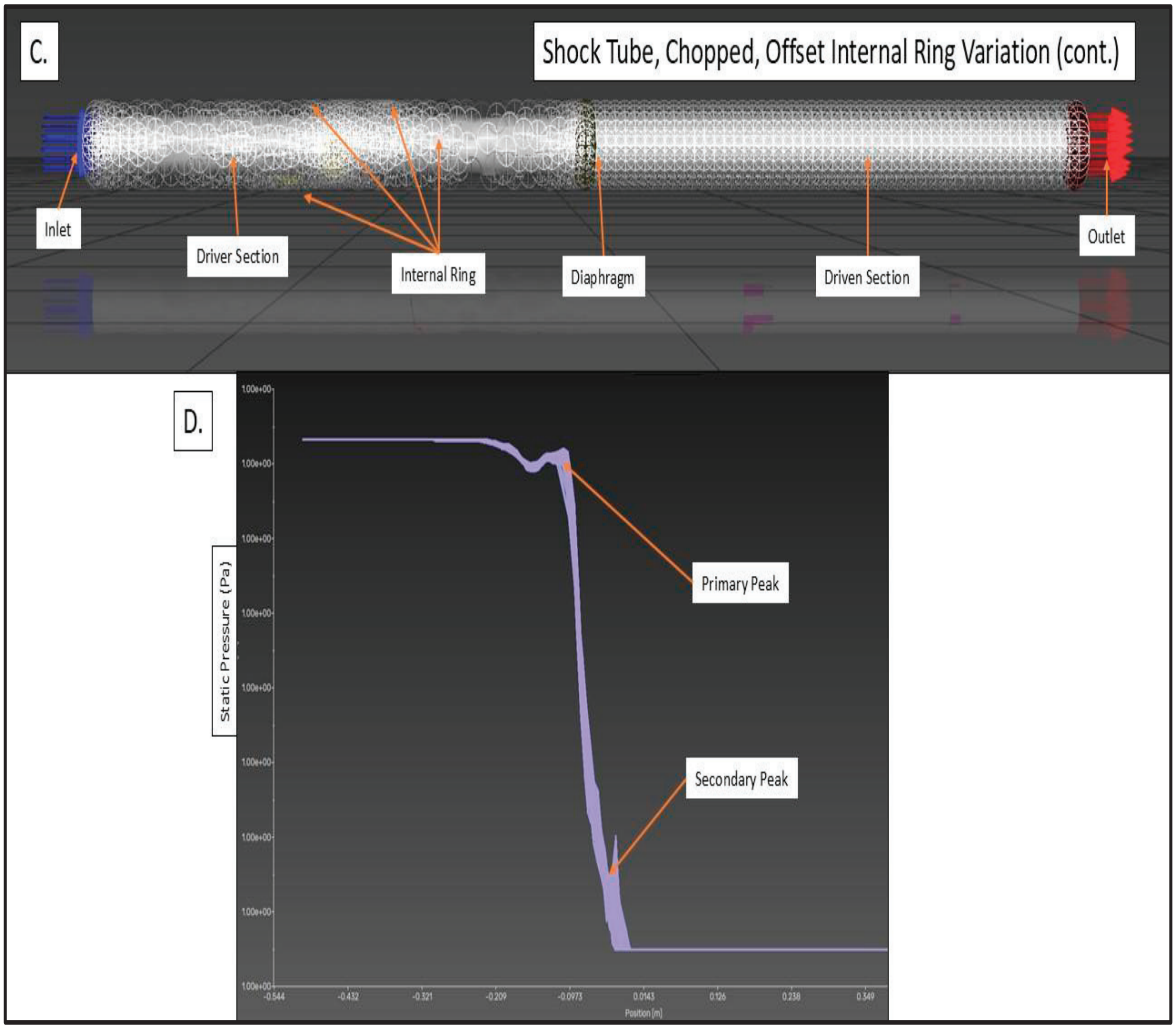

FIGURE 5: (Part 2) Shock tube with offset, chopped internal flange features. (A.) ANSYS Geometry of the volume and outline of the shock tube. (B.) Volume fill of the shock tube. (C.) Mesh fill of each section of the shock tube. (D.) Static pressure within the shock tube.

Using the same dimensions as in Simulation 2, the “chopped” internal flange sections were offset by 50 mm, with one section remaining in its original placement, one section positioned 50mm towards the diaphragm, and two sections towards the inlet in 50mm intervals, as seen in Figure 5A. Figure 5B displays the volumetric fill in Ansys Geometry. Compared with Simulations 1 and 2, Simulation 3 produces a less complex mesh. Ansys’s meshing (Figure 5C) applies a more uniform approach, filling the evenly spaced gaps throughout an otherwise uniform container. The mesh now consists of consistent quadrilaterals, in contrast to the irregular patterns observed in the previous two simulations. The smaller gaps allow Ansys Geometry to fine-tune the connections between angles created by the missing quadrants.

Unlike the earlier simulations, Simulation 3 exhibits two notable differences in the results (Figure 5D). First, the third and fourth peaks observed in Simulation 2 disappear. Second, the remaining peaks occur much closer to the diaphragm. To verify this behavior, the program ran an additional cycle for 250 iterations with 2-second intervals, producing similar results. The velocity magnitude graphs show comparable velocities to previous simulations, but the air arrives more quickly, likely due to the absence of obstacles along its path to the diaphragm. But the distinct secondary peak made this a promising position and layout of obstacles to emulate a potential real-world scenario.

Simulation 3A, Chopped Internal Spaced-Out Ring:

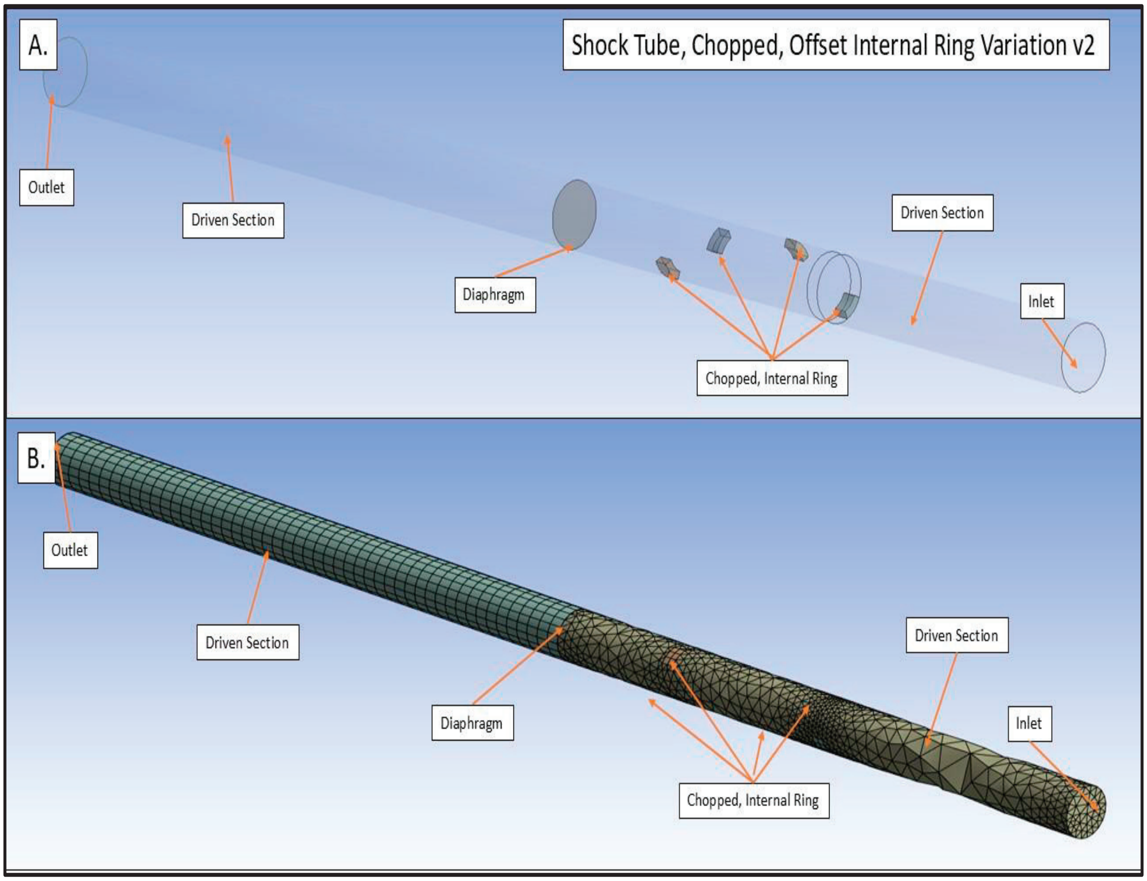

FIGURE 6: (Part 1) Shock tube wiht a variation of the offset, chopped internal flange features (A). Ansys Geometry of the volume and outline of the shock tube (B). Mesh fill of each section of the shock tube (D). Static pressure within the shock tube.

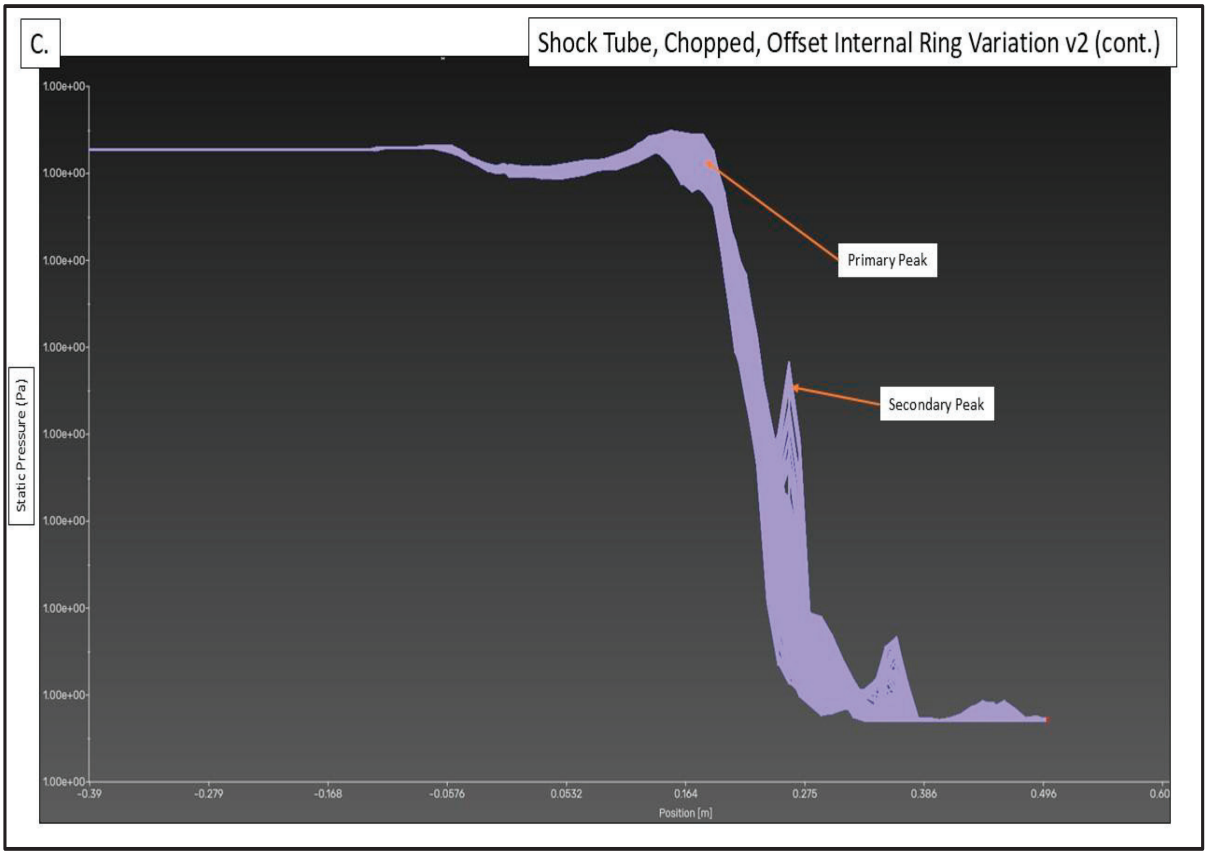

FIGURE 6: (Part 2) Shock tube wiht a variation of the offset, chopped internal flange features (A). Ansys Geometry of the volume and outline of the shock tube (B). Mesh fill of each section of the shock tube (D). Static pressure within the shock tube.

Because Simulation 3 exhibited the most consistent secondary peak behavior, the author designed a variation using the same specifications but with 50 mm intervals between the “chopped obstacles.” In this layout, three of the four sections were moved closer to the diaphragm, positioned equidistantly, while one section remained in its original location, as shown in Figure 6A. Figure 6B shows the resulting mesh, consistent with the approach used in the other simulations.

Figure 6C presents the static pressure graph. The third and fourth peaks reappear, with much clearer distinction than in Simulation 2, and the secondary peak becomes significantly more pronounced. Compared with previous simulations, Simulations 1 and 3 – the graph exhibits greater variation, as indicated by the amplitude difference between the lowest and highest observed pressures. This effect likely arises from positioning obstacles closer to the diaphragm, which slightly displaces air that would otherwise strike the diaphragm perpendicularly due to reflections from the two obstacles nearest the diaphragm.

Simulation 3C, Chopped (Thicker) Internal Spaced-Out Ring:

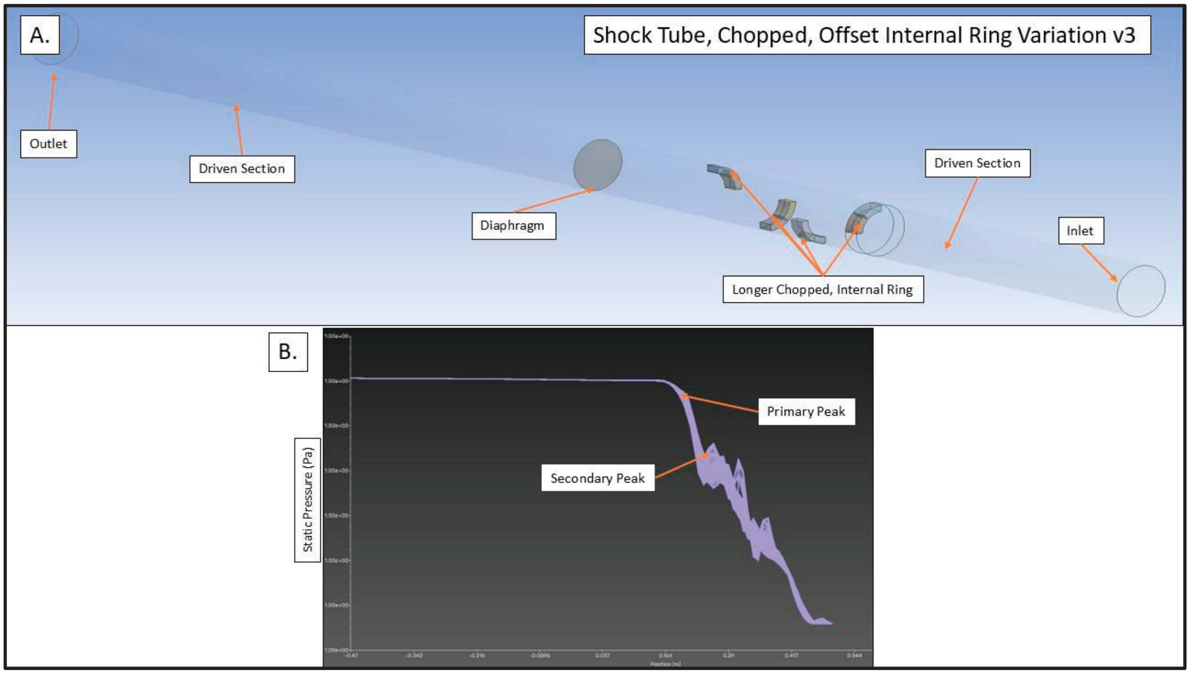

FIGURE 7: Shock tube with a variation of the offset, chopped internal flange with longer features. (A.) Ansys Geometry of the volume and outline of the shock tube. (B.) Static pressure observed within the shock tube during simulations.

To rule out anomalies, additional variations of Simulation 3 were conducted, including the addition of an extra section to the existing chopped, offset ring. The length of the previous sections was doubled, as shown in Figure 7A, while maintaining offset distances at 50 mm and section thickness at 10 mm. Figure 7B shows that static pressure iterations produce similar peaks to those observed in Simulation 2, including clearly defined tertiary and quaternary peaks. The shape, amplitude, wavelength, and timing of the secondary, tertiary, and quaternary peaks closely resemble those observed in Simulation 2.

Reduced variation in these peaks across iterations, compared with Simulation 3a, was also observed. This reduction likely results from decreased error ranges in each simulation cycle due to increased consistency and rigidity of the system. The longer sections, which adhere more closely to the internal surface of the shock tube, may limit air movement in random directions, contrib-uting to the observed consistency.

Simulation 3C, Chopped (Thicker) Internal Spaced-Out Ring:

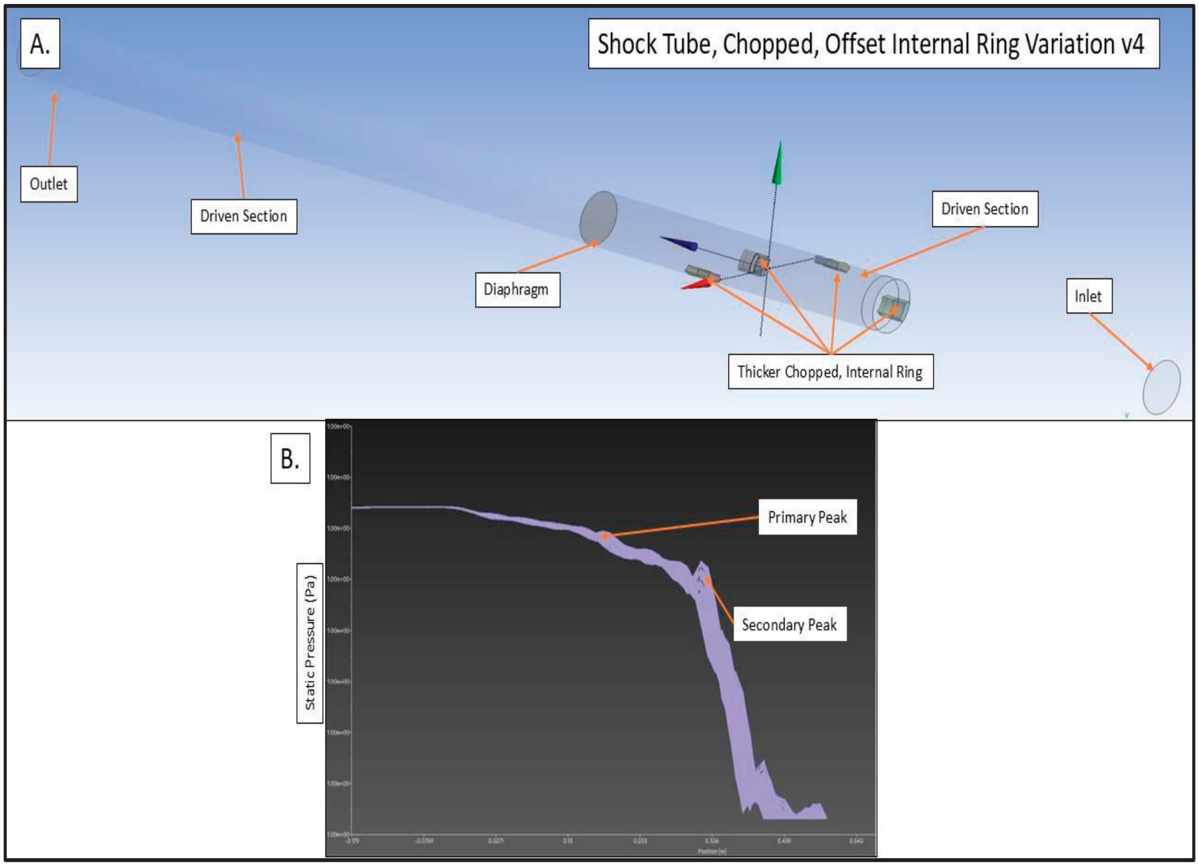

Figure 8. Shock tube with a variation of the offset, chopped internal flange with thicker features. (A.) Ansys Geometry of the volume and outline of the shock tube. (B.) Static pressure observed within the shock tube during simulations.

Figure 8. Shock tube with a variation of the offset, chopped internal flange with thicker features. (A.) Ansys Geometry of the volume and outline of the shock tube. (B.) Static pressure observed within the shock tube during simulations.

Figure 8A illustrates the changed geometry of Simulation 3c, with thicker flange sections. The sections were spaced evenly, as in Simulations 3a and 3b, but their thickness was increased to 20 mm.

Tertiary and quaternary peaks remain observable, although they are less pronounced than in Simulations 3a and 3b. A large range persists between the lowest and highest observed pressures within each iteration, like Simulation 3a. This behavior is likely attributable to the reduced surface area at the face of the blast, perpendicular to the initiation of the air wave. In this scenario, it appears the thickness is not as impactful when it comes to manipulating blast wave pressures.

Future Research Studies

Shock tubes in general may require specialized equipment or explosives to generate peak static overpressures consistent with those observed in every simulation scenario shown in Figures 3-8. However, with slight adjustments to obstacle designs, the peak static overpressures can not only be observed but also manipulated to provide non-idealistic scenarios emulating real-world applications and bTBI.

Future design studies would involve emulating different initiated gaseous forms other than just air. Emulating pressures closer to either real-world situations or observing different densities reacting to the created simulations would be extremely helpful in determining the efficacies of that shock tube in recreating a bTBI-like scenario. Once a simulation is designed to emulate real-world scenarios, a shock tube can be constructed around that design to enable experi-mental testing. This approach provides the medical, engineering, and design prevention communities with a means to study bTBI in a more realistic environment.

Summary

Because of its prevalence in conflicts in the Middle East, bTBI has been referred to as the signature and most frequently treated injury among warfighters in both training and combat. Shock tubes, as noted by multiple researchers, remain a relevant tool that advances medical and explosive research as their structure, design, and capabilities continue to evolve. As simulation tools achieve higher accuracy, each simulation must be refined extensively before imple-menting and constructing a shock tube for real-world testing. Although financially more feasible than using live explosives in a blast zone, running multiple shock tube iterations remains time-consuming and costly. Ensuring that each design has undergone multiple validated simulation runs is therefore essential.

Continued research using simulation-based approaches bridges gaps in operational data and military-sourced databases for bTBI-inducing scenarios. Analysis of these simulations provides insights into the mecha-nisms underlying mild bTBI, allowing the medical and explosives communities to develop improved protection strategies and enhance mitigation measures. ■

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Nuclear Infrastructure Exploitation Team 2 Earns Prestigious Sibert Award from the United States Army Chemical Corps

By: Walter T. Ham IV

The Nuclear Infrastructure Exploitation (NIX) Team 2 earned the prestigious MG William L. Sibert Award for team or detachment during the United States (US) Army Chemical Corps' Awards ceremony on FORT Leonard Wood, Missouri.

FIGURE 1: NIX Team Members

Soldiers from NIX 2 were honored for strengthening their ongoing partnership with their South Korean counterparts and serving on the Federal Bureau of Investigation (FBI)-led National Technical Nuclear Forensics Task Force.

The Sibert Award program recognizes excellence among the Chemical, Biological, Radiological, Nuclear, Explosives (CBRNE) units in the Active Component, Army National Guard, and US Army Reserve.

MG William L. Sibert, the awards namesake, is considered the "Father of the Chemical Corps" for establishing the Chemical Warfare Service.

The other winners were the 95th Chemical, Biological, Radiological, Nuclear (CBRN) Company, 17th Combat Sustainment Support Battalion, 11th Airborne Division, for the active component; the Illinois National Guard's 445th Chemical Company, 44th Chemical Battalion, for the National Guard; and the 414th CBRN Company, 457th CBRN Battalion, for the Army Reserve.

COL Alexander Lovasz, the Chief of Chemical and US Army CBRN School Commandant, presented the awards to the winners.

FIGURE 2: LTC Christopher Gunderson

NIXs directly contribute to the nation's strategic deterrence by staying ready to characterize, assess, and disable nuclear and radiological Weapons of Mass Destruction infrastructure and components to deny near-term capability to adversaries.

The NIXs include Nuclear and Countering Weapons of Mass Destruction (FA52) officers and Soldiers with Explosive Ordnance Disposal (EOD), nuclear medical science, and health physics areas of expertise.

LTC Christopher Gundersen, the team leader of NIX 2, said his team was recognized for its many achievements during the previous year.

Gundersen said that in addition to training with its South Korean counterparts, NIX 2 served on the FBI-led joint service and interagency nuclear forensics task force that stays ready to collect and package samples of radioactive fallout that enable partner agencies to conduct forensic analysis for attribution.

"[NIX] 2 experienced a challenging yet successful year in terms of operational readiness and organizational excellence. It negotiated the demands of its world class training pipeline while balancing two operational priorities – our Republic of Korea partnership training and the National Technical Nuclear Forensics mission," said Gundersen.

"More impressive was its ability to do so while conducting community outreach, mission essential tasks-based training, developing strategic partnerships with the Department of Energy and NATO allies, and developing force modernization solutions," said Gundersen.

A native of Montclair, Virginia, and graduate of James Madison University, LTC Gundersen served as a Field Artillery officer and Logistics officer before becoming a FA52 officer. He has deployed to Iraq, Afghanistan, and Kuwait.

"The highlight of the award ceremony was representing the 20th CBRNE Command in front of the entire CBRN and Chemical Corps community," said Gundersen. "I greatly enjoyed interacting with the other awardees representing all Army components and US Army CBRN School Senior Leaders. Another highlight was observing the US Chemical Corps Distinguished Member of the Corps and Hall of Fame inductions which I found to be very motivating and inspiring."

The NIXs are part of the 20th CBRNE Command and the US military's premier and deployable CBRNE formation.

Soldiers and Army civilians from the 20th CBRNE Command deploy from 19 bases in 16 states to confront and defeat the world's most dangerous hazards in support of joint, interagency, and multinational operations.

In addition to the NIXs, the Aberdeen Proving Ground, Maryland-based 20th CBRNE Command, is home to the majority of the active-duty US Army EOD technicians and CBRN specialists, as well as the 1st Global Field Medical Laboratory, CBRNE Analytical and Remediation Activity and Weapons of Mass Destruction Coordination Teams. ■

FIGURE 3. NIX 2 Earns the Sibert Award

Walter T. Ham IV

was the Deputy Public Affairs Director for the 20th CBRNE Command, the US Department of War's premier multifunctional and deployable CBRNE formation. A retired US Navy Chief Journalist with a Master's Degree in nonfiction writing from Johns Hopkins University, he previously served as a Pacific *Stars and Stripes* reporter and a civilian public affairs for the US Navy, US Air Force, US Coast Guard, and US Department of War, formerly the Department of Defense.

Walter retired in 2025 from the 20th CBRNE Command and can be reached at wthjhu@yahoo.com. The US Army Nuclear and Countering Weapons of Mass Destruction Agency and the *CWMD Journal* team wishes Walter and his family success in their future endeavors. We thank him for his contributions to the *CWMD Journal* and to the communicty at large.

A House of Dynamite:
The United States Army Nuclear and Countering Weapons of Mass Destruction Agency's Review

By: Rohin Sharma

Summary

The movie "A House of Dynamite" offers stellar acting and excellent cinematography. Although entertaining and keeps audiences on the edge of their seats, the movie's scenario steps over the line of plausibility into fiction.

With *"A House of Dynamite,"* Kathryn Bigelow produced an enjoyable and dramatic movie, with excellent cinematography and brilliant acting. For casual audiences, it is certainly worth the two hours (or Netflix subscription) to watch. However, like her older movies (The Hurt Locker, Zero Dark Thirty), "A House of Dynamite "takes liberties that while making it more entertaining, also detract from the realism of the epicted scenario.

FIGURE 1: "A House of Dynamite" Movie

"A House of Dynamite" (HoD) is essentially a 3-part movie, oriented by a 19-minute timeclock that weaves all the sections together. The movie begins with a "bolt out of the blue" missile launch, presumably from North Korea. This sets off the process for identifying the target, determining the point of origin, and executing an interception. The first scene is largely focused on the Ground Based Mid-Course Missile Defense (GMD) operations center at Fort Greely, although there are cuts to the White House Situation Room (WHSR). The floating X-Band radar correctly pinpoints the incoming missile, and determines the target is Chicago. However, after launching two interceptors, the GMD fails to destroy the missile.

After the failed intercept, the movie restarts 19-minute sequence, and focuses largely on STRATCOM headquarters (there is still overlap between all locations). After the missile fails to intercept, the STRATCOM Commander (played by Tracy Letts as a kind of wannabe Curtis LeMay) discusses retaliatory options. Believing that this could be the beginning of a massive nuclear first strike, he recommends a full- scale retaliation against all perceived adversaries, without confirming the actual origin of the attack.

The final sequence focuses largely on DC, emphasizing the role of the Secretary of Defense (SECDEF) and the President of the Unites States (POTUS). The sequence starts with the SECDEF playing golf and grieving the recent loss of his wife. POTUS is at a political event, from which is whisked away when the incoming missile is detected. Upon hearing that the missile is about the impact Chicago, the SECDEF tries to evacuate his estranged daughter, taking away from his actual duties. After getting through to her and realizing that there is nothing he can do, he is evacuated from his office. During the evacuation, he commits suicide by jumping off the top of the Pentagon.

The movie ends with POTUS struggling to determine response options. During the evacuation, he is in and out of communications and must rely on his immediate

military aide (e.g., a Navy Lieutenant Commander) for guidance on potential response options. While it exceeds his authority, the military aide recommends the most aggressive nuclear response. The movie ends with POTUS leaning towards a massive response, although his final decision is not made clear.

The Good

As mentioned, the movie is entertaining, keeping the audience riveted until the end. The acting is fantastic, with the always excellent Idris Elba playing the role of POTUS and Jared Harris (of Chernobyl fame) acting as a distracted SECDEF. Rebecca Ferguson brilliantly fills the role of WHSR watch officer, balancing both no-nonsense competence with compassion for those around her.

The Bad

Unfortunately, the plot devices that make HoD entertaining also make it completely unrealistic. There are several glaring issues:

1. **One Nuclear Weapon:** The thought that a thinking adversary would send one nuclear weapon to attack the United States is highly unlikely. es, it's possible that a rogue element with Russia or North Korea can do this, but it would still result in a massive retaliatory event that couldn’t conceivably play out in the aggressor’s favor.

2. **No Escalation:** In HoD, the bolt out of the blue attack reminds me of the book Nuclear War: A Scenario, where one missile launch leads to a catastrophic nuclear exchange. From a movie perspective, I understand why they didn’t depict a process of escalation. Part of the movies strength was the character development from each of the protagonists—something that could have only been done during peacetime conditions. However, to think that a potential adversary could launch with absolutely no warning is dubious.

3. **Missile Defense Interception:** As mentioned earlier, the Ground Based Interceptors (GBIs) fail to intercept the missile. Again, it would be a short movie if the GBIs work, but to launch only two interceptors is an unlikely scenario.

4. **The 19-Minute Time Clock:** In my view, this is the most troublesome part of the movie. While this might make the film riveting for the audience, it makes it completely unrealistic from a policy perspective. Apparently within 19 minutes we can have:

• Mass evacuation of all key leaders in DC

• A tense negotiation between the Russian Foreign Minister and Deputy National Security Advisor

• An intel brief from the National Intelligence Officer responsible for North Korea (while she is on vacation)

• The attempted evacuation from Chicago of the SECDEFs daughter

• Mass deployment of B-2 bombers

• POTUS deciding to call for a massive retaliatory strike against all our adversaries (without knowing the actor who attacked the U.S. and what the potential damage would be)

Of all these issues, the last one is most troubling. Due to pressure from the STRATCOM Commander and his own mid-ranking military aide, POTUS feels it necessary to retaliate even before the missile has struck. In reality, POTUS would likely wait until he has an idea of the damage to the U.S. (which the movie depicts as a forgone conclusion) as well as culpability for the attack. He can then choose a laundry list of options to retaliate at a time and place that suits him. I understand it makes the movie more entertaining to have the time clock, but to think that any commander or POTUS would retaliate under such time constraints with limited information is unlikely.

5. **Damage Assessment:** In the film, we are told that according to FEMA estimates, the casualty assessment of a missile strike in Chicago is 10 million people. While this maybe an engaging plot device, there is no way to know if this information is accurate. The missile could have a conventional warhead, a low yield warhead (several times smaller than the Hiroshima weapons), or no warhead at all. The assumption that 10 million people are going to die is what makes POTUS choose the aggressive retaliation

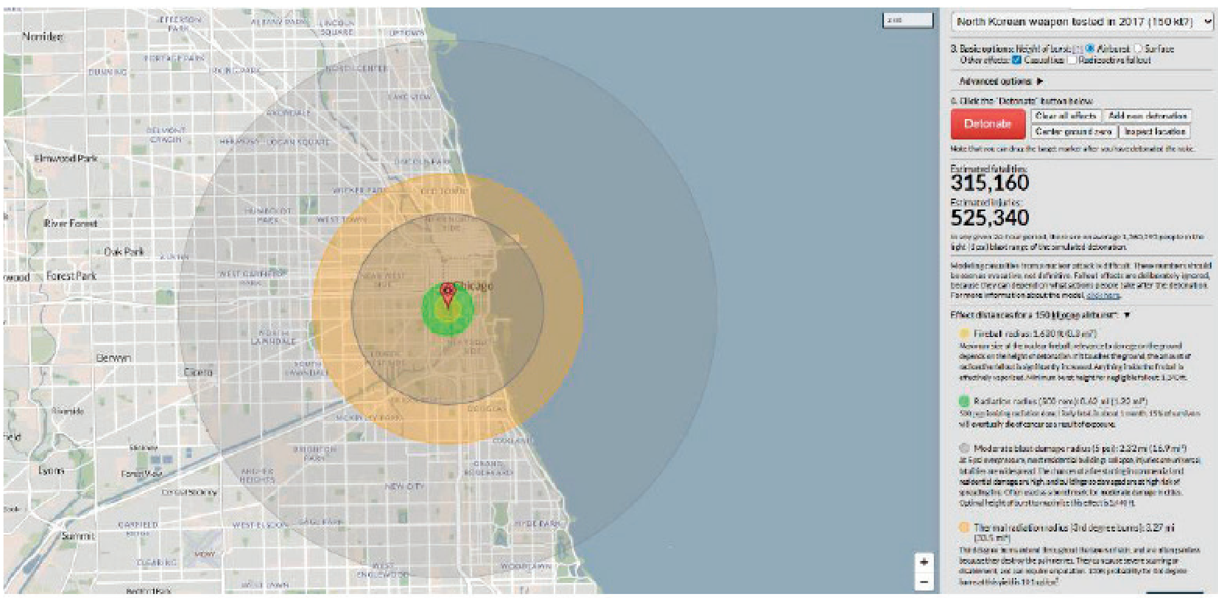

FIGURE 2. Casualty depiction of a 150 KT bomb in Chicago courtesy of Nuke Map

option, but there is no way of knowing the casualty count beforehand. I will also say that if there is a small or no warhead, it's unlikely the SECDEFs daughter will be killed, obviating the need for him to commit suicide.

According to the website NUKEMAP, there would be 315,160 fatalities from a 150KT warhead (the largest the DPRK has tested). Still a lot of deaths, but far less than the 10 million number brought up.

The Comically Unrealistic

There are some parts that all national security experts will unbelievable:

1. **Consulting the National Intelligence Officer (NIO):** There is a scene where the NIO responsible for the Democratic People Republic of Korea (DPRK) is consulted while on vacation, which is laughable on its face. It is far more likely that there is a DPRK expert on a watch floor that could answer the question faster and in a more secure manner. Unlike the movie, she wouldn't provide vague

guesses on the origin of the missile and would hopefully give more concrete facts.

2. **Navy Commander providing retaliatory advice:** Due to the evacuation, POTUS is alone with his military aide (the “football carrier”). Ignoring the massive national security apparatus at his disposal, POTUS relies on this early to mid-career O-4 for the merits of a possible world ending options (who of course gives him the most aggressive scenarios). I hope that guy paid attention to his strategy class at the Naval Academy.

3. **SECDEF Jumping off the Pentagon:** The SECDEF suicide scene is bordering on absurd. Jumping off the top of the Pentagon would probably lead to severe, painful injuries and a slow death. Also, the helipad at the Pentagon is not on top of the building so I am not sure where he is actually located.

Conclusions

As mentioned, this movie is entertaining. The acting is stellar, the cinematography is excellent, and while flawed, the storyline keeps the audience on the edge of its seat. However, as discussed previously, this is not a realistic scenario and should have minimal implications for actual nuclear weapons policy. ■

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FIGURE 3. Scene clips from the movie "The House of Dynamite"

Integrated Deterrence and Conventional-Nuclear Integration:

Cold War Lessons for Today's Warfighter

By: Paul Sigler

"The past is never dead. It's not even past." –William Faulkner

I should confess up front that I am a fan of Faulkner, a man who made a Nobel-Prize-winning career out of examining in prose the many ways in which the past continues to haunt the present. This quotation from Requiem for a Nun kept echoing through my head while reading Gregory Giles and Harrison Menke's report on how Cold War lessons inform our modern debates on nuclear policy, posture, and readiness.

For many readers of the Countering Weapons of Mass Destruction Journal (Countering WMD Journal), this review might seem a bit like deja-vu. In Issue 29, the authors published a short extract of their book-length report that presented sections on Army conventional-nuclear integration efforts, Soviet approaches to the same, and recommendations for the warfighter as the world returns to a geostrategic environment characterized by "a new wave of nuclear saliency."[1] It serves as an excellent synopsis of the larger work. If this review leaves you dissatisfied, feel free to take a second look at their summation from last year.

The Defense Threat Reduction Agency approved the report for public release in 2025 and distributed print copies to selected audiences in September 2025. Although the formatting process remains underway for publishing the digital version, educators across the Services have already identified a great deal of academic value in this work, despite its limited distribution to date. Extracts of the report are in use by the Army War College and the Army Functional Area 52 (Nuclear and CWMD Officer) qualification course as required reading. Additional Joint Professional Military Education (JPME) integration is likely to follow as JPME institutions work to implement the enduring Special Area of Emphasis for Strategic Deterrence and Countering Weapons of Mass Destruction outlined in the latest version of the Chairman of the Joint Chiefs of Staff Manual (CJCSM) 1810.01A.[2]

The enthusiasm with which nuclear and CWMD educators have greeted this work might seem puzzling to some. After all, the history of Service-level nuclear weapons development during the Cold War is already well documented. A skeptic could be forgiven for wondering if this report produces anything that is fundamentally new or instructive.

The authors address this question head-on in their executive summary, which notes that while many elements of the strategic and operational environments have evolved since the Cold War, several attributes remain largely unchanged. Those include Russian determination to exploit perceived gaps in the escalation ladder, North Atlantic Treaty Organization (NATO) dependence on forward-deployed United States (US) nuclear weapons, proliferation of dual-capable weapon systems, and the critical importance of nuclear survivability—both for weapon systems and nuclear command, control and communications (NC3).

Perhaps the most striking commonalities center on systemic nuclear anxieties within European nations, concerns within their defense leadership about the potential for rapid escalation from conventional to nuclear conflict, and a general lack of nuclear awareness across both military and civilian leadership on both sides of the Atlantic Ocean. These conditions are both inextricably linked and stubbornly self-reinforcing. It is difficult to familiarize leaders with intra-conflict escalation management without integrating nuclear capabilities into combined training and experimentation, and it is difficult to carry out realistic combined training with a generation of leaders beholden to nuclear fallacies and myths.

It is difficult to familiarize leaders with intra-conflict escalation management without integrating nuclear capabilities into combined training and experimentation, and it is difficult to carry out realistic combined training with a generation of leaders beholden to nuclear fallacies and myths.

While the Joint Force is making progress on both fronts, the authors' point remains valid. These perennial trends, in fact, are the key to understanding the true value of their work.

The authors also note conditions that have changed since the end of the Cold War. For one, there are more players involved—strategic deterrence is increasingly multi-polar; the number of nations under the US nuclear umbrella has increased due to NATO expansion; and allies in the Indo-Pacific increasingly seek a greater role in operationalizing regional deterrence. Escalation dynamics are complicated by the increasing global reach of multidomain capabilities and the intermingling of the systems through which nations conduct both targeting and NC3. The information environment is increasingly chaotic, prone to manipulation by malign actors, and hostile to US assurance messaging.

Russia made use of these strategic conditions during the extended conflict in Ukraine, in which its reliance on nuclear posturing increased as its conventional capabilities fell short. As noted by the authors, this is a trend that will likely continue to drive down Russia's perceived nuclear threshold. Concurrently, the theater nuclear forces available to the Supreme Allied Commander Europe have dwindled since the end of the Cold War, with perhaps the most significant loss being the loss of mobile and responsive Army Pershing II intermediate-range ballistic missiles.

The passage of time has not been all bad for the Joint Force and NATO. Ballistic missile defenses have vastly improved in both capability and capacity, while increased acceptance of joint, combined, and multidomain operational constructs add an array of conventional capabilities which can be employed to bolster deterrence and widen the menu of response options available to the Joint Force Commander. An important caveat here is that expanded conventional options are only advantageous if the staff actively seeks to integrate them into joint and combined options packages. The menu is meaningless to those who insist on ordering whatever they saw scribbled on the chalkboard outside the restaurant.

With the backdrop established, the authors outline the varying schools of thought with respect to conventional-nuclear integration (CNI).[3] First, there are those who would opt to revert to the approaches taken by the Services during the Cold War. Many senior leaders—some of whom began their careers during the Cold War—find this to be a comfortable stance. The physics of nuclear weapons, after all, has not changed. Neither have the basic means of delivery. There is a comforting logic in seeking to dust off old manuals and revive forgotten skills.

A second school of thought is that the global, bipolar Cold War competition between the Union of Soviet Socialist Republics (USSR) and the West was a unique moment in history. Adherents might argue that changes in geopolitics, technology, and methods of warfighting have changed so drastically that starting from a clean slate would be a more useful way to achieve integration of conventional and nuclear capabilities. Consider, for instance, the proliferation of capabilities that enable global, near-real-time precision targeting, adoption of layered air defense systems, and the development of offensive cyber and electromagnetic attack capabilities that may be able to hold some NC3 systems at risk. One might well argue that revival of old operating models—built on outdated assumptions—is fraught with risk.

A third school might push back against the idea of CNI altogether. In an argument reminiscent of those levied against Herman Kahn's "escalation ladder," member of this school contends that any attempt to integrate conventional and nuclear forces risks further lowering the nuclear threshold.[4]

Joint concepts and doctrine have effectively sidelined this viewpoint in the present day. Yet, as readers walk through the way each Service developed its nuclear capabilities across nearly five decades, the argument against "nuclear warfighting" appears numerous times as Defense Department officials struggle to determine which programs will advance their strategic objectives, and which require divesting. Echoes of this debate are unlikely to ever completely fade away, especially amongst political leaders charged with making defense investment decisions in full public view.

Perhaps unsurprisingly, the authors argue that neither of the first two schools of thought are satisfactory. Certainly, some lessons from the Cold War still hold sway. Yet the strategic landscape, operational capabilities, and risk tolerances have changed in the 35 years that have elapsed since the USSR fell. A fresh approach, fully informed by decades of operational experience, seems the most credible way forward.

With that in mind, the true value of this study is its ability to provide a detached, informed review of how each Service approached either integrating nuclear weapons within its general-purpose forces (e.g., army divisions, tactical air wings, naval surface or sub-surface combatants, etc.) or otherwise sought to synchronize conventional nuclear weapons into a cohesive approach to theater-level combat. While this might seem at first glance to be a distinction without a difference, it allows the authors to point out specific instances where a Service might have achieved organizational integration of nuclear capabilities without also achieving operational synchronization of their effects.

The report is organized by Service; lack of true "jointness" in either concept or organization during most of the period makes this an unfortunate necessity. However, Chapter Six ties together the high points of these individual Service histories into a series of insights and recommendations for implementing CNI within the current strategic environment. Readers can easily extract this chapter as a stand-alone essay—the recommendations are credible even without having read the preceding historical narrative. Yet, with the knowledge of the many approaches that the Services and the Defense Department attempted-- and often abandoned-- across six decades, the final chapter becomes even more meaningful.

The recommendations are well-covered in the authors' previous article. I will avoid re-stating them here. All of the recommendations are well-supported by extensive research within the study or within the over 500 primary sources referenced in its bibliography.

There is one recommendation that is worth some additional discussion however, because it gets to the true reason why this study is so essential to JPME students. Recommendation number five states that warfighters should "**raise awareness of CBRN threats across the Joint and Allied force**." This is a familiar exhortation, but it feels incomplete. Warfighters often use "CBRN" as a euphemism when the word "nuclear" would do. That is the case here. Warfighters are already well aware of nuclear threats, but lacking knowledge and context, they are unsure of how to relate those threats relate to their own unit's mission. This is true whether they are serving at the tactical or the operational level. The natural approach to any unsolvable problem is to transfer it to someone else. In the minds of many warfighters, CBRN problems belong to CBRN specialists. Problem solved.

The value of this study is that it makes clear that nuclear effects and capabilities are integral to warfighting with a nuclear-armed adversary. Moreover, it takes the "unsolvable" problem of nuclear synchronization, and provides scores of attempted solutions across Services, domains, and eras. Faced with this history of what nuclear warfighting looked like in the past, and what is required for the future, military professionals will—reluctantly—be forced to accept that the problem is solvable. What they require is context, backed by thorough historical vignettes.

That is exactly what this study provides, and why you will be seeing it in war college reading lists for many years to come. ■

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Notes

1.Giles and Menke, "Integrated Deterrence and Conventional-Nuclear Integration (CNI): Cold War Lessons for Today's Warfighter," CWMD Journal: Issue 29, 6.

2. CJCSM 1810.01A, Outcomes-Based Military Education Procedures for Officer Joint Professional Military Education, 12 February 2026, A-5.

3. JP 3-72 defines conventional-nuclear integration as the "seamless planning and operation of joint and combined conventional and nuclear forces, in sequence and in parallel, across the competition continuum." (JP 3-72 Joint Nuclear Operations, 2024, I-4)

4. Kahn, Herman, On Escalation: Metaphors and Scenarios, Penguin Books, Baltimore, 1965.

Countering WMD Journal

Call for Articles: Countering WMD Journal
Issue 32, focus on "Survivability"

The Countering WMD Journal is currently considering all submissions for publication in Issue 32 which will have a theme of "Survivability" for the 2026 fall/winter period. The deadline for consideration for publication in Issue 32 is September 17, 2026.

FIGURE 2: Misty Castle III, a 4,744 ton conventional explosive test, conducted at White Sands Missile Range in June 1985.

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