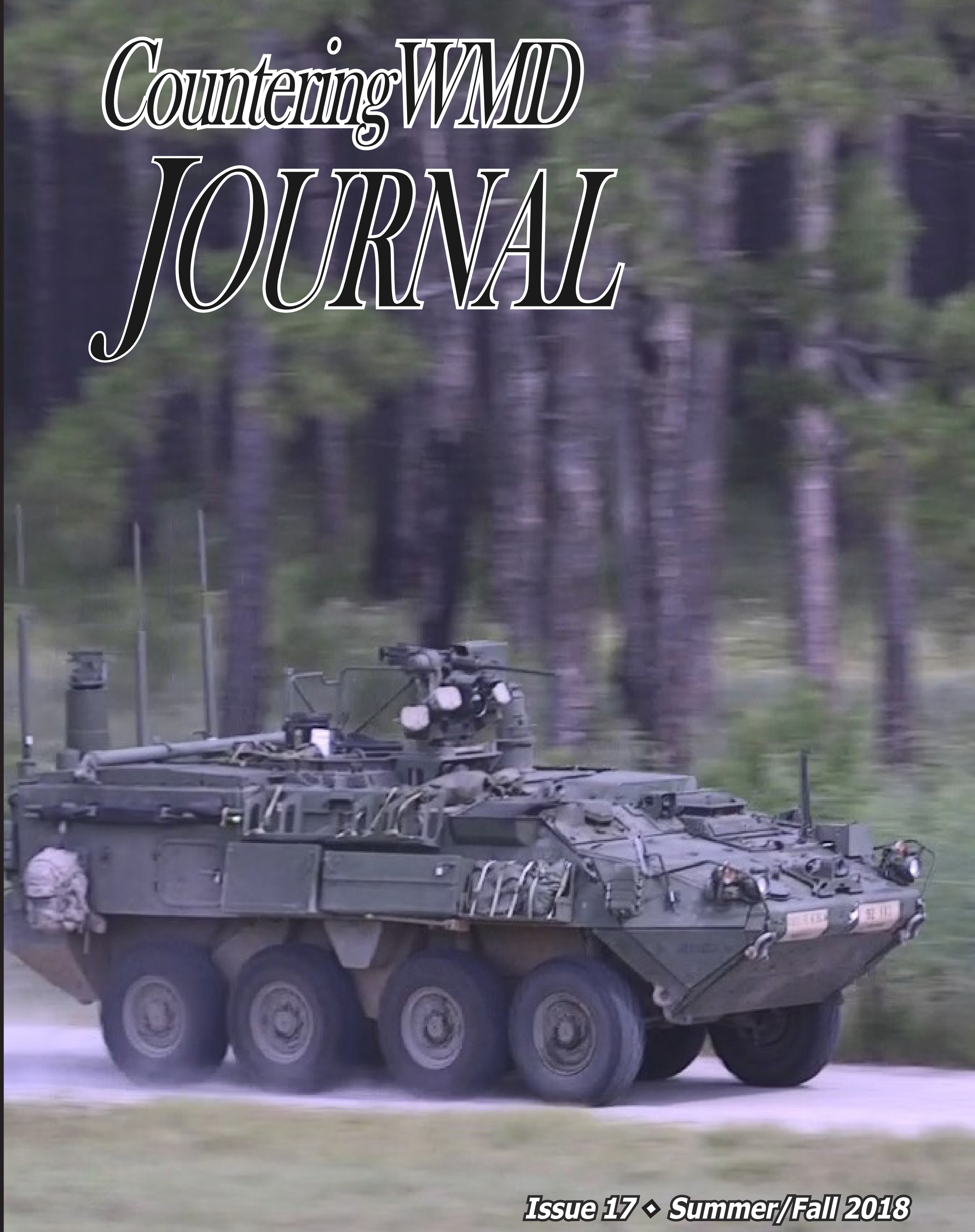
Countering WMD JOURNAL



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Countering WMD JOURNAL
U.S. Army Nuclear and Countering WMD Agency

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About the cover: The MERLIN/VIPER system is an upgrade to the Stryker Nuclear, Biological, Chemical, Reconnaissance Vehicle's (NBCRV) radiological sensor suite as part of the Manned Mounted Platform Radiological Detection System (M2PRDS) program. It vastly increases the capability of the NBCRV to detect, localize, identify, image, and report radiological threats.

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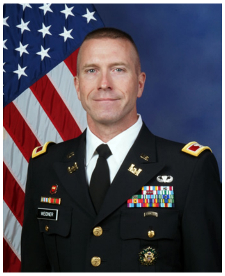
Director Notes



COL John W. Weidner
Director, USANCA

It is my distinct honor to address you as the Director of USANCA. Since my arrival in late June 2018, I've been awestruck by USANCA's unique and important role in the Army, as well as the capabilities we provide joint force and Army service component commanders. It's important for all Army officers and Department of Army civilians within the greater countering weapons of mass destruction (CWMD) community to understand how USANCA fits in to the course that our senior leaders have charted for the Army. To that end, in the following paragraphs I will review the six core functions that USANCA fulfills and link them to the new Army Vision and Strategy that the Secretary of the Army and Chief of Staff released this year. If you have not yet read those documents, you should.

USANCA has six core functions that define its existence. They are:

- Integrate nuclear weapon effects into joint operations
- Integrate nuclear deterrence, CWMD and CBRN defense policy, planning and readiness requirements
- Lead the Army CBRN survivability program
- Manage the Army Reactor Program
- Fulfill proponent functions for FA52 and ASI 5H (Nuclear Target Analyst)
- Increase interoperability with joint and multinational forces in CBRN environments

The Army Vision—our future end state—is: *The Army of 2028 will be ready to deploy, fight, and win decisively against any adversary, anytime and anywhere, in a joint, multi-domain, high-intensity conflict, while simultaneously deterring others and maintaining its ability to conduct irregular warfare. The Army will do this through the employment of modern manned and unmanned ground combat vehicles, aircraft, sustainment systems, and weapons, coupled with robust combined arms formations and tactics based on a modern warfighting doctrine and centered on exceptional Leaders and Soldiers of unmatched lethality.*

The Army Strategy establishes four lines of effort (LOEs) to chart a path of irreversible momentum to achieve the Army Vision. These LOEs are **Readiness, Modernization, Reform,** and **Alliances and Partnerships**. USANCA directly supports the **Readiness, Modernization,** and **Alliances and Partnerships** LOEs as described below.

Readiness: In a major conflict with a nuclear-armed adversary, USANCA would deploy nuclear employment augmentation teams (NEATs) to support combatant, sub-unified, and Army service component commands. These NEATs offer the only capability within the DOD to integrate nuclear weapon effects into ground combat operations, which significantly enhances the readiness of maneuver units in nuclear environments. Moreover, USANCA integrates CWMD and CBRN defense planning and readiness requirements to ensure the needed capabilities are at the right place at the right time. As the proponent for FA52 officers, USANCA also manages the life cycle functions of those officers to provide trained and ready nuclear and CWMD enablers to the Army and joint force.

Modernization: USANCA leads the Army CBRN survivability program to ensure all future mission critical equipment can withstand both the prompt effects of a nuclear detonation and chemical, biological, and radiological contamination. To fulfill this responsibility, USANCA establishes CBRN materiel survivability criteria and issues quantitative design criteria levels for appropriate equipment. A key enabler for validating Army equipment (as well as other Services and Departments) nuclear survivability is the Army's fast burst nuclear reactor at White Sands Missile Range, New Mexico. USANCA executes the Army Reactor Program and oversees the annual permitting of this reactor.

Alliances and Partnerships: USANCA enhances the interoperability of multinational forces in CBRN environments. We are the lead DOD agency for the NATO Joint CBRN Defense Capability Group and develop U.S. positions to support international standards that are often incorporated into NATO Standardization Agreements. We also provide the Chair for the America/Britain/Canada/Australia/New Zealand Capability Group Shield, which seeks to optimize interoperability among the five armies.

As you can see, USANCA's core functions not only directly support three of the four Army Strategy LOEs, we are the only organization in the Army that provides those functions to Army service component and combatant commanders. That is an awesome responsibility. It also means that we cannot fail in our mission. I am truly humbled to lead such an important and professional organization that plays a vital role in the strategic deterrence of our potential adversaries. I appreciate all that you do to support our nation. Please don't hesitate to let me know how USANCA can better support you.

Back to the Future: Integrating Nuclear and Non-nuclear Warfighting

Mr. Keith Sloan
United States Army Nuclear and Countering WMD Agency

The Need for Integration

With the end of the Cold War in 1991, the specter of nuclear use on the battlefield slowly faded until it was largely buried by the various post-9/11 counterinsurgency campaigns. But, international security has a way of going in unexpected directions, and the United States finds itself coming back full-circle to a new era characterized by the possible introduction of nuclear weapons into a conventional conflict. The 2018 Nuclear Posture Review (NPR) is the latest, though not the first, document to provide warning of this sea-change. This article examines several implications of this change, primarily the need to improve the integration of nuclear and non-nuclear planning and warfighting. It postulates that this is an essential task of the Department of Defense and critical for success in future conflicts with nuclear-armed adversaries, and that much remains to be done to address it.

The centerpiece of the 2018 NPR's assessment of the current security environment is the return of great power competition. Russia and China, in particular, have recovered or gained a great deal of power and influence, and have made it clear they seek to reverse the long-standing post-World War II international order. Indications of willingness to use force by both nations are clear, from Georgia and Ukraine, to the South and East China Seas. Russia, in particular, has made it abundantly clear that they see a role for nuclear weapons in a European conflict. To match their words, they continue to acquire non-strategic nuclear weapons at a rapid pace, having now acquired a quantity of such weapons an order of magnitude greater than that possessed by the United States. U.S. attempts to lead by example in nuclear disarmament have clearly failed. Additionally, lesser states have shown a willingness to try to "punch above their weight," by acquiring or threatening to acquire nuclear weapons, and by exploiting rifts between the stronger powers to their benefit. North Korea is the premier example, of course.

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Given the security environment described by the 2018 NPR, it becomes clear that the most likely use of a nuclear weapon would be as a result of a regional conflict gone bad; large scale nuclear conflict remains mercifully unlikely. Given the current, overwhelming conventional superiority of the U.S. military, it is only natural to expect that a nuclear-armed adversary might consider using such weapons to counter their own weakness. This is not a new observation by President Trump's administration; it was recognized during President Obama's administration as well. After all, there were periods during the Cold War when NATO first-use of nuclear weapons was the likeliest scenario because of conventional inferiority. The attitude of many in DoD and beyond is that the nuclearization of a regional conflict somehow negates or invalidates the underlying conflict. This is not the case now, much like it was not the case during the Cold War. Introducing nuclear weapons into a regional conflict does not eliminate the causes or conduct of that conflict, it merely complicates them. The conventional conflict will continue, albeit with nuclear/radiological and strategic implications that must be addressed. After all, if nuclear weapons did end a conventional fight for good, an adversary would be highly incentivized to use them for just that purpose! Ultimately, from an Army perspective, the ground force may not own the weapons, but it will own the effects of nuclear weapons on the battlefield.

Integrating the Nuclear and Non-Nuclear Fights

U.S. forces will ensure their ability to integrate nuclear and non-nuclear military planning and operations. Combatant Commands and Service components will be organized and resourced for this mission, and will plan, train, and exercise to integrate U.S. nuclear and non-nuclear forces and operate in the face of adversary nuclear threats and attacks. -2018 Nuclear Posture Review

As this guidance from the Secretary of Defense states, the nuclear and non-nuclear fights are not separate, and must not be considered in a vacuum from one another. Conventional events may drive consideration of nuclear employment by either side, and nuclear weapons use will certainly impact conventional operations. With the most likely potential battlefields the U.S. faces, the odds of introducing nuclear weapons into a conventional conflict are nontrivial. Prudence and due diligence demand that this contingency be considered, despite any lingering institutional resistance and/or bias.

Thus, conventional war plans that address nuclear-armed adversaries must include reasonable considerations for how nuclear employment – whether by the adversary, the U.S. or both – impacts conventional war plans. Obviously, no war plan can anticipate every conceivable adversary action, but likely scenarios must be examined and mitigation options considered. Intelligence will play a role in determining likely enemy courses of action with nuclear weapons, just like it does for other aspects of potential enemy activity. Ultimately, the conventional war plan must be crafted such that it supports deterrence against nuclear employment by adversaries, helping to shape the adversary's calculus to convince them that such use would be detrimental to their own interests. Communicating resolve and restraint simultaneously is a fine balancing act, to be sure, but must be a consideration of conventional planning, not just nuclear planning.

Conversely, offensive nuclear war plans must account for the prosecution of conventional war plans. Targeting, weapon selection and settings, timing, and other factors must be considered in such a way as to best support objectives of the conventional fight, while avoiding or mitigating negative impacts. Possible U.S. nuclear employment must also be credible. No adversary believes we would respond to a single nuclear event with massive retaliation, though our current arsenal is surprisingly unsuited for limited employment in a theater conflict. Fortunately, the 2018 NPR addresses this with direction to develop a low-yield ballistic missile warhead and the reintroduction of a sea-launched cruise missile capability. At present, modern integrated air defenses make employment of our only non-strategic option, dual-capable aircraft, problematic. Again, neither realm can operate in a vacuum and must make allowances for the other – there will be friction between plans and inevitable trade-offs, but a truly holistic approach is required.

Planning is always the first step, but conventional forces must also be capable of operating on a nuclear battlefield. This means much more than simply being able to operate in a radiological environment, though that remains crucial. Forces engaged in combat with a nuclear-armed adversary, for instance, must understand what actions to take before nuclear employment. How do ground forces position and protect themselves if a nuclear strike is imminent? Should a commander increase dispersion to improve survivability from an enemy strike? How will units communicate in a post-detonation environment? What impacts will nuclear strikes have on key terrain? How should the air tasking order be modified to degrade enemy nuclear, C2, or early warning capabilities? Conversely, should certain targets be placed on a no-strike list in order to avoid pushing the enemy into a "use or lose" mentality? Current doctrine is sorely lacking when it comes to nuclear employment of the joint force and must be developed – or resurrected from the Cold War and refreshed for the modern battlefield.

Training and exercising integration is a key component of readiness. At present, the only DoD academic course that specifically addresses nuclear and non-nuclear integration is the one-week Theater Nuclear Operations Course (TNOC) provided by the U.S. Army Nuclear and CWMD Agency (USANCA) in partnership with the Defense Nuclear Weapons School (DNWS). This course, while an important contributor to integration, has a relatively small audience and just scratches the surface of the training required in this area. As the NPR directs, greater emphasis on nuclear weapons is required at all levels of training and education for DoD. And where training lays the groundwork, exercises are essential to test integration, find points of friction, identify mitigation for them, and holistically examine the issue in a controlled manner. Russia, for its part, conducts very robust integrated nuclear-conventional exercises every year that receive a great deal of media coverage; U.S. efforts are hardly up to this standard.

The Benefits of Integration

The chief purpose of nuclear weapons has always been to deter an adversary from employing such weapons and the 2018 NPR reaffirms this. Deterrence is a complex and tricky mission, and the NPR addresses deterring four primary adversaries at great length. At the core, deterrence is about presenting the adversary with an unfavorable cost-benefit ratio, based on the adversary's values and views. Nuclear weapon employment should impose costs on the adversary, whether through a response in kind or other means of pressure. But it is also important to deny or degrade the benefits of nuclear employment. Effectively integrating nuclear and non-nuclear warfighting can significantly reduce the benefits of an adversary's nuclear strike. If friendly forces possess the readiness and resilience to deal with such an attack, the adversary will be less inclined to do it in the first place. An adversary is unlikely to employ a nuclear weapon if doing so does not achieve significant strategic results, and instead opens up that state for intense condemnation from other international actors. Integration supports deterrence but, if deterrence fails, it also supports the second role of nuclear weapons, achieving objectives should deterrence fail. Demonstrated capability to continue operating effectively despite a nuclear strike also supports the restoration of deterrence, likely a key goal in any conflict.

Another role of nuclear weapons is to assure our allies that we would employ our nuclear arsenal to protect them against a nuclear-armed adversary. An ability to operate on a nuclear battlefield in a place such as the Korean peninsula or in Europe supports assurance by demonstrating a credible willingness to actually employ forces under such conditions. However, as our war plans are integrated to varying degrees with those of our allies, so too must we consider how to integrate nuclear planning with them. This is obviously a simple process, as our nuclear war plans are some of our most sensitive plans. Integration requires some degree of trust with our allies. I do not advocate for necessarily passing allies our full nuclear war plans, but some level of dialogue is necessary. Each theater and ally is different, and theater commanders and national leadership need to determine what can and should be shared on a case by case basis, and when. For instance, the STRIKWARN formatted message that warns of an impending nuclear strike is defined in NATO doctrine; no such procedure exists with other allies such as Korea or Japan. Simply telling an ally to "trust us" might not always be sufficient when a crisis comes. The more preparation, thought, and integration during peacetime, the better.

One of the chief difficulties to overcome with integration is that nuclear and non-nuclear war planners speak different languages. The career fields for the two are separate and distinct, and thus there is sometimes difficulty communicating between the two. It can be as simple as using latitude/longitudes versus the Military Grid Reference System (MGRS), English units of measurement versus metric, target-oriented versus preclusion-oriented analysis, and the like. But, these differences cause confusion and miscommunication. Further, nuclear planners deal primarily with the strategic level, whereas theater planners run the gamut from the strategic to the tactical. Different perspectives, different languages, different backgrounds do not make for ease in understanding one another. Understanding nuclear effects is a particular challenge, as decades of inaccurate movies and television have ingrained many false perceptions in the American psyche that are not easily overcome. Education and training will help to address this issue.

One mitigation already in place to help with these issues are USANCA's Nuclear Employment Augmentation Teams (NEAT). NEATs consist of Army officers and deployable civilians with combat arms backgrounds who are deeply trained in nuclear warfighting issues. When augmenting a theater commander's staff or integrating into U.S. Strategic Command's headquarters, NEATs provide subject matter expertise and act as translators between the perspectives of the ground force and nuclear warfighters, helping to integrate and synchronize the efforts of both. As one senior DoD official told the author, “the nation owes a debt of gratitude to the Army for maintaining this capability.” However effective NEATs may be, they are small in number and size, and cannot be everywhere at once.

Conclusion

Nuclear employment does not eliminate the original conflict, nor does it end the conventional fight, it only complicates execution of the theater war plan and the achievement of U.S. and allied objectives. Unless nuclear and non-nuclear warfighting are integrated, the two worlds will impede one another to the detriment of U.S. and allied interests. A conventional war will not end with nuclear employment and the ground forces will still own the battle space, and must be prepared to continue the fight regardless. There is little direct cost associated with integration, though it requires changes to attitudes and mindsets, which can be more difficult than finding money at times. Integration does not lower the threshold for nuclear war; instead, it disincentivizes the employment of such weapons in the first place, thereby making nuclear use less likely.

The Army, in particular, has become complacent with regards to nuclear weapon issues after decades of counter-insurgency operations. But with the degrading security environment, preparedness to fight on a nuclear battlefield cannot be over-emphasized. The U.S. has learned time and again that failing to integrate all its elements of power in a conflict will be costly: in blood, treasure, and credibility in future conflicts. The 2018 NPR provided the clarion call to address integration. It remains for DoD to actually do it.

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Sustaining CBRN Capabilities in Execution of Large-scale Combat Operations

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Background

The need to increase readiness across the Army continues to remain the top priority for our Senior Leaders/Senior Noncommissioned Officers. A dominant Joint Force that can compete, deter, and win in this increasingly complex security environment will increase U.S. influence and strengthen cohesion among allies and partners.[1] The December 2017 National Security Strategy (NSS) lays out the President's strategic vision for protecting the American People and preserving our way of life, which includes "Defend Against Weapons of Mass Destruction (WMD)" and "Combat Biothreats and Pandemics."[2] This article discusses four major initiatives designed to promote the importance of sustaining chemical, biological, radiological, and nuclear (CBRN) capabilities in support of large-scale combat operations (LSCO).

Senior Leaders continue to bolster efforts to detect CBRN agents and keep them from being used against the American people or against our allies and partners. They also continue to think outside the box for solutions to better integrate national elements of power such as intelligence, law enforcement, and emergency management operations to ensure that frontline defenders have the right information and capabilities to respond to WMD threats from state and non-state actors.[3]

In an effort to understand the current and future environment, the first initiative consisted of using strategic venues. The first venue was the All Things Pacific (ATP) Table Top Exercise (TTX)/Wargame held 12-13 September 2018 at Joint Base Lewis-McChord. The second was the Joint/DoD Countering Weapons of Mass Destruction Coordination Conference (CWMD CC) 18-2, held 17-20 September 2018 at the National Geospatial-Intelligence Agency (NGA).

The first venue, the ATP TTX, enabled discussion on how to improve readiness, increase movement and maneuver, and the overall importance of keeping Commanders informed and equipped to make the best decision possible at the right time. One item of discussion centered on

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sustainment of individual protective equipment (IPE) and other consumables in a CBRN environment. Inconsistent consumption rates have negatively affected the supply and demand ratio of CBRN equipment. It is critical for commanders to understand what the true need is to ensure survivability on a contaminated battlefield. The U.S. Army Chemical, Biological, Radiological, and Nuclear School (USACBRNS) Assistant Commandant led a discussion focusing on the importance of CBRN mitigation and the ability for USACBRNS to use experimentation to better understand the extent of actual contamination, given updated threat models and current equipment. This allows the CBRN Enterprise to more rapidly assess and mitigate a strike, and enables the Joint Force to better protect itself from a strike. Information gained from such an experiment is also leveraged to update CBRN consumption models for IPE and other consumables within the Enterprise. This effort represents a second initiative which would "enable maneuver and movement to commanders in the execution of large-scale ground combat operations in a CBRN environment."[4]

Another discussion item involved increasing the ability of maneuver commanders to effectively use all of the CBRN defense assets available to them. This discussion supports a third initiative in which the CBRN Enterprise developed a new program that addresses the 74D CBRN expertise gap with a Total Army Analysis 21-25 74D proof of concept.[5] This new concept provides training guidance and direction from Forces Command (FORSCOM), and stresses the importance of having collaborative discussions inside a shared learning environment covering topics such as implementing and executing Tactics, Techniques, and Procedures (TTPs)/Battle Drills during training rotations (i.e. National Training Center and Combat Training Center).

The discussion also supported a fourth initiative that explored the use of CBRN Military Advisory Teams (CMAT) as a force multiplier to close the gap in available CBRN expertise at the operational unit level.[6] CMATs provide a bridge; however, the U.S. Special Operations Command (USSOCOM) and Army Leadership continue to work toward development of CWMD Leader Education Programs that can meet the institutional need. The use of Operational Contracting Support (OCS) was not fully discussed during the TTX, however, it is an essential force multiplying capability. OCS is critical to expedite the procurement of material and services in support of a CBRN response.[7] Increased incorporation of this capability ensures success of the CBRN modernization strategy. It is important when contractor personnel and equipment are anticipated to support military operations that CBRN military planners develop detailed contract support integration plans and contractor management plans as components of concept plans and operational plans (Phase 0-V), in accordance with appropriate strategic planning guidance.[8]

The second venue supporting the first initiative is the semi-annual CWMD CC (formerly known as the Global Synchronization Conference), co-hosted by USSOCOM and the Defense Threat Reduction Agency (DTRA). Those discussions centered on "CWMD strategies, plans, and policies" that seek to "prevent, protect, and respond to threats posed by weapons of mass destruction" as well as increases cooperation between the U.S. and its allies and partners.[9] The emerging WMD threats identified in the NSS from both state and non-state actors reinforce the need for the synchronization activities this venue provides.

Within each forum, the audience remained focused on outlines listed within the CBRN Operations Force Modernization Strategy, such as "maximize readiness and command emphasis across a full spectrum of conflicts, across multiple domains at once."[10] As CBRN Defense/CWMD professionals continue to close the CBRN/CWMD capability gap, and innovate toward future concepts and capabilities to reduce risk for the Joint Force, the CBRN/CWMD communities discover ways to integrate real time understanding, inherent survivability, and negate hazards effects.[11]

Conclusion

Collectively our Joint Force must continue to train and sustain efforts toward achieving and sustaining a "Ready Now" posture.[12] In addition, while the focus is on LSCO, leaders must continue to build or sustain readiness with unmatched capability across a variety of conflicts, with the ends, ways, and means to continuously secure and defend multiple domains simultaneously. This comes down to leadership, CWMD/CBRN defense knowledge/capability, a leader's ability to work through real-time movement and maneuver conditions, and how leaders mitigate CBRN hazards. Maintaining this CBRN capability with command emphasis will make the difference in achieving mission success.

One overarching message was that CBRN defense is a critical part of mission success. As such, it is important for CBRN professionals to inform their commanders about existing CBRN defense assets and clearly convey which internal and external CBRN defense capabilities exist and if there are any limitations while executing movement and maneuver. Another theme was leader development, at all echelons, is essential for U.S. Joint Forces to meeting the expectations set in the December 2017 NSS. This mindset allows the Joint Force and its allies and partners to remain proactive versus reactive in order to win the battle.

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The Large Blast Thermal Simulator is Roaring Back to Life

MAJ Andrew Lerch
United States Army Nuclear and Countering WMD Agency

The Large Blast Thermal Simulator (LBTS), constructed in 1994 at White Sands Missile Range (WSMR) by the Defense Nuclear Agency, is the largest air blast and thermal simulator in the world. It is unique for three reasons: 1) It is capable of replicating the synergistic air blast and thermal effects resulting from a nuclear detonation; 2) it can simulate weapons yields up to 300 kilotons; and 3) its test volume, at 66 feet in diameter and 570 feet long, can accommodate full-scale ground combat vehicles, fighter/rotary aircraft, and scaled structures. With the onset of the Global War on Terror, the nuclear survivability of mission critical systems took a backseat to other priorities. As a result, much of the nation's nuclear test and evaluation infrastructure atrophied due to neglect, including full closure of LBTS in 2013. Now that peer and near-peer adversary confrontation is once again a real possibility, nuclear survivability of mission critical systems is once again a Department of Defense (DoD) priority and it is vital for strategic deterrence. Anticipating this need,

Figure 1. Satellite Image of the Large Blast Thermal Simulator

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Figure 2. The Large Blast Thermal Simulator Driver Gas System

the Defense Threat Reduction Agency (DTRA) partnered with WSMR to restore the LBTS for operation by the Army Test & Evaluation Command in support of Service, combatant command, and allied partner test needs.

Historically, the air blast capability of LBTS was driven by up to 25,000 gallons of liquid nitrogen (LN2) utilizing four, 30-ton pebble bed heaters (PBHs) to convert the liquid nitrogen to gas. The PBHs are electrically driven by diesel generators over two to three days. Once hot enough (~1250° F), the LN2 is pumped into the PBHs to flash pressurize all or several of LBTS' nine driver gas tubes in less than 30 minutes. The driver tubes are all six feet in diameter and vary in length from 71-146 feet to enable pulse width control. The working ends of the gas tubes are capped with domed steel diaphragms that are simultaneously ruptured by arrays of linear shaped charges. The rapidly released gas pressure from each of the tubes generates a shock wave that merge together to drive a single planar air blast that arrives at the test article. Maximum peak overpressures on test articles were approximately 25 pounds per square inch (psi), large enough to displace armored vehicles. Today, the air blast capability is generated by a pair of large air compressors, a dryer, and a pressure booster, which directly charge the driver gas tubes. This allows for reduced shot costs and improved test fidelity when simulating phenomena such as blast-driven fire spreading.

LBTS' thermal radiation source (TRS) consisted of eight inverted rocket nozzles fueled by powdered aluminum and liquid oxygen. The TRS produced up to eight, two-meter diameter, six-meter high columns of aluminum burning at ~5000°F that were fired for a variable pulse width to generate a thermal flux at the test article up to 80 calories/cm^2-sec. The exhaust was vented through the roof by a large array of Bernoulli ejectors before the blast wave was generated. This system remains in disrepair and an analysis of alternatives is currently ongoing for its future restoration. Once refurbished, this system will not only certify mission critical systems to thermal environments, it will enable data collection for modeling non-ideal air blast effects.

Beginning in 2015, DTRA initiated a detailed study with WSMR for LBTS restoration options and preliminary development of a business model. It concluded that full restoration would take two to three years at a cost of approximately $5 million. Refurbishment efforts began in 2016 with repair of the air blast capability. Air blast achieved an initial operating capability (IOC) in 2017, and full completion of the air blast restoration occurred in the fourth quarter of 2018 with the installation of a new large air compressor suite. Following IOC, a small-scale demonstration was conducted in August 2017 with key DoD and interagency stakeholders in attendance, including WSMR and DTRA executive leadership. The test shot resulted in peak overpressures of over five psi at the test article using four driver tubes and a rented compressor. Following several subsequent driver gas system improvements, a second small-scale demonstration occurred and resulted in peak overpressures in excess of 7 psi at the test article. The fully restored air blast capability can now generate peak overpressures in excess of 25 psi. In the near future, work will commence on restoration of the LBTS thermal capability.

Past test customers included the Army, with the M1 Family of Main Battle Tanks and the Stryker Armored Combat Vehicle Family, the Air Force, the Navy, the United Kingdom, and others. Since past test operations, many of these

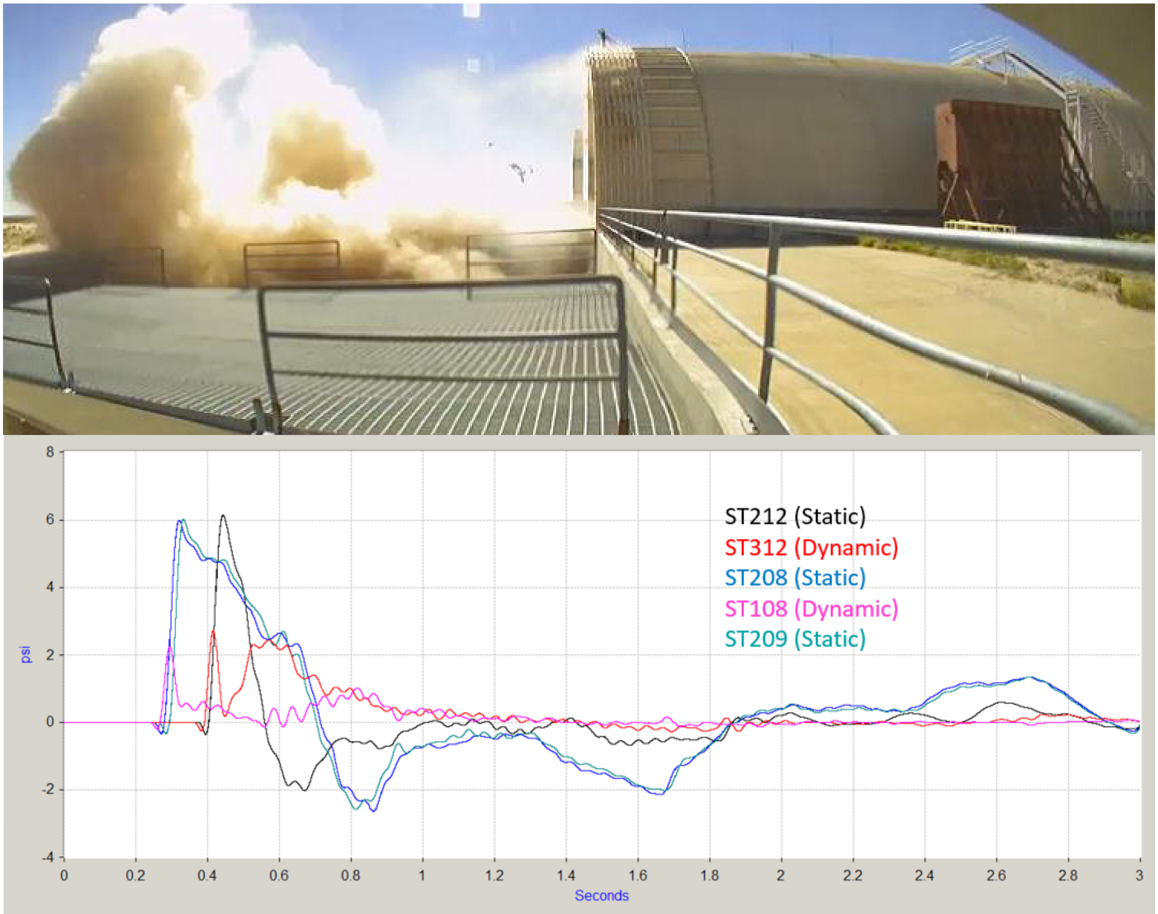

Figure 3. Photograph of a Small-scale Test of the Large Blast Thermal Simulator in August 2017 and the Resultant Pressures Measured at the Test Article

Figure 4. The Large Blast Thermal Simulator Control Room Following a Successful Test Shot in August 2017

systems have undergone significant modifications and new systems have emerged that require developmental testing. These mission critical systems have a requirement to operate through Chemical, Biological, Radiological, and Nuclear environments. LBTS is the only test capability that can qualify these systems, their subsystems, and components to high fidelity combined air blast and thermal environments. In addition, LBTS can provide experimental data in support of non-ideal air blast and fire spread modeling for US Strategic Command consequence of execution analysis requirements. The WSMR and DTRA partnership exemplifies intra-agency collaboration, which has become increasingly necessary to revitalize DoD's nuclear test capability infrastructure. As a result, LBTS stands ready to meet test customer needs. For more information on LBTS restoration and test operations, contact Mr. Randy Brady of the White Sands Test Center at randolph.m.brady.civ@mail.mil or Ms. Heather Jiles of DTRA at heather.l.jiles.civ@mail.mil.

Figure 5. The White Sands Missile Range and Defense Threat Reduction Agency Large Blast Thermal Simulator Restoration Team in August 2017

Commander Guidance for Radiation Exposure During Offensive Nuclear Operations

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Introduction

According to Department of the Army Pamphlet (DA PAM) 600-3, Commissioned Officer Professional Development and Career Management, the Nuclear Operations and Counterproliferation Functional Area (FA 52) officers are warfighters who provide the Army with a technically educated, operationally experienced, and highly trained cadre specializing in all aspects of nuclear and countering WMD strategic and operational level planning and execution. A FA52 officer is expected to possess four functional competencies: Nuclear and CWMD operations and intelligence; plans, policy, and strategy; research, development, test, and evaluation; education, training, and doctrine. FA 52 officers often lead joint, combined and interagency planning and action groups for general countering WMD activities and specific nuclear weapons issues. Preclusion analysis is a key element of the skill set, requiring an understanding of all aspects of potential impacts of nuclear weapons. A component of this is being prepared to advise the commander on the Operational Exposure Guidance (OEG) for operations in a nuclear and radiological environment. This article discusses offensive nuclear operations and the criteria used by a nuclear analyst. We must understand that reaching back to U.S. Strategic Command (USSTRATCOM), the Defense Threat Reduction Agency (DTRA), and/or the U.S. Army Nuclear and Countering-WMD Agency (USANCA), for the running of the sophisticated nuclear weapons effects codes to determine nuclear weapons effects on the nuclear battlefield, may be needed. Typical codes that provide the nuclear analyst with the information required to analyze the nuclear effects criteria discussed in this article include DTRA's Integrated WMD Toolset (IWMDT) and USANCA's Nuclear Weapons Effects Database System (NWEDS). USANCA has also worked in collaboration with DTRA to develop the Theater Nuclear Operations Planner (TNOP) tool. This toolset is designed to provide planners for theater and land component commanders with the ability to determine the effects of nuclear weapons within their operational environment. This toolset provides enhanced capabilities to conduct preclusion analysis, identify collateral concerns, develop a common operating picture to aid in maneuver integration planning, and generation of STRIKWARN/CBRN3 reports. TNOP is currently an available option in DTRA's IWMDT that is used in the Theater Nuclear Operations Course (TNOC).

Nuclear Operations Doctrine

The 2018 Department of Defense (DOD) Nuclear Posture Review (NPR) states, "…global threat conditions have worsened markedly since the most recent 2010 NPR, including increasingly explicit nuclear threats from potential adversaries." Efforts within the DOD are currently underway to review and reinvigorate military doctrine for nuclear operations. To this end, USANCA is currently working on development of Joint Publication (JP) 3-72, Nuclear Operations, planned for release in early 2019 to replace the rescinded JP 3-12. After JP 3-72 is approved, USANCA plans to develop staff planner guides that provide planners with nuclear weapon effects lookup tables to support operational units in analyzing nuclear weapons effects. This article will concisely summarize the definitions of the nuclear weapons effects criteria by extracting information provided in the references listed below; all useful documents for a professional library. JP 3-12.3 provides doctrinal procedures and notional nuclear weapon effects data for the employment of nuclear weapons. It provides guidance to those who plan, coordinate, support, and execute nuclear missions. Note that JP 3-12.3 dated 14 February 1996 was rescinded; however, much of its contents are to be incorporated into the newly developed and updated nuclear operations doctrine.

Nuclear Operations

Exposure guidance for nuclear operations will have an effect on the military readiness of armed forces personnel during combat, whether or not war is actually declared. The guidance does not focus on long term potential health effects, which may result in an increased potential for developing cancer 20 – 30 years after exposure. For operational purposes, the dose of nuclear radiation referred to is the sum of all doses from external exposure to penetrating radiation, initial (i.e., neutron and gamma) and residual fallout (i.e., gamma). Before a discussion of radiation exposure guidance can happen, it is important to understand some terminology associated with offensive nuclear operations.

Nuclear Operations Terminology

Each FA52 and 72A officer must be familiar with the jargon of the business. First, the commander may establish limiting requirements, or undesirable effects to be avoided or lessened, by restrictions imposed on the use of nuclear weapons. These are then used for preclusion analysis, evaluating the operational impact of blast, thermal, and radiation from the use of nuclear weapons while achieving the desired effects. Preclusion analysis takes into account the effects on maneuver, safety of friendly forces and equipment, obstacles, collateral concerns and the civilian population. The limiting requirements may influence the final selection of weapon yield, delivery system, desired ground zero (DGZ), height of burst and/or time of burst. The radius of safety is the horizontal distance from ground zero beyond which the weapon effects on friendly troops are acceptable. The minimum safe distance (MSD) is determined for friendly personnel safety. It is the sum of the radius of safety for a specified degree of acceptable risk and vulnerability and a delivery error buffer, the buffer distance. The buffer distance is the horizontal distance which, when added to the radius of safety, will give 99% assurance that the specified degree of risk or damage will not be exceeded. The buffer distances are equal to twice the system circular error probable (CEP). Collateral damage is undesirable civilian personnel injuries or materiel damage produced by the effects of friendly weapons. The collateral damage distant (CDD) is the minimum distance that a desired ground zero must be separated from civilian personnel and materiel to ensure with a 99% assurance that a 5% incidence of injuries or property damage will not be exceeded. It is the sum of the radius of collateral damage and the buffer distance. Damage and obstacle preclusion is expressed in terms of the least separation distance (LSD), which is the sum of the radius of preclusion and the buffer distance. Commanders can require to limit effects to avoid undesirable obstacles or damage to structures and forests.

Next, FA 52 and 72A officers need to know the Personnel Casualty Criteria terminology. Combat effective, combat ineffective, and performance degraded are Soldier performance level definitions. Immediate Permanent Ineffectiveness, Immediate Transient Ineffectiveness, and Latent Ineffectiveness are personnel radiation exposure casualty criteria. Their definitions follow and are summarized in Table 1.

Soldier Performance Levels

Soldier performance levels are used to categorize the abilities of Soldiers to perform tasks after receiving radiation exposure.

a. Combat effective. Personnel who perform at greater than or equal to 75% of normal (pre-exposure) levels.

b. Combat Ineffective (CI). CI personnel function at 25% or less than of their pre-exposure performance level. CI is manifested by shock and coma at high radiation dose levels. At lower dose levels, combat ineffectiveness is manifested by slowed rate of performance from physical inability and/or mental disorientation.

c. Performance Degraded (PD). PD personnel function at between 25% and 75% of their pre-exposure performance level. They suffer acute radiation sickness in varying degrees of severity and at different times. Radiation sickness is manifested by various combinations of projectile vomiting, propulsive diarrhea, hypertension, dry heaving, nausea, lethargy, depression, and/or mental disorientation.

Personnel Casualty Criteria Due To Radiation Exposure

Early effects of radiation in nuclear operations are particularly pertinent to the armed forces because they deal with potential immediate effects of irradiation on Soldier performance. The following categories are used to describe Soldier casualty criteria due to radiation exposure:

a. Immediate Permanent Ineffectiveness (IPI). Personnel become CI about three minutes after radiation exposure and remain so for any task until death, which usually occurs within one day. IPI is the physiological response to radiation at levels of 8,000 centigray (cGy) for both physically demanding and physically undemanding tasks.

b. Immediate Transient Ineffectiveness (ITI). Personnel become CI for any task about three minutes after exposure to the initial radiation and remain so for approximately seven minutes. Transient and brief (two to ten hours) recovery to a PD state may occur before becoming CI until death, which usually occurs in five or six days. ITI is the physiological response to radiation at levels of 3,000 cGy for physically demanding tasks or 3,800 cGy for physically undemanding tasks.

c. Latent Ineffectiveness (LI). Personnel will become PD within three hours and remain so until death some weeks post-exposure, or become CI at any time within six weeks post-exposure. LI is the physiological response to radiation at levels of 450 cGy for physically demanding tasks or 600 cGy for physically undemanding tasks.

d. Fatal Injury. Personnel who, as the result of nuclear detonations, suffer death or serious injury that results in death. Most deaths occur within six weeks. Fatal injury results from prompt external ionizing (gamma and neutron) radiation exposures ≥410 cGy for 50 % of the population

	Operational Definition	Technical Definition
Immediate Permanent Ineffectiveness (IPI)	Personnel become combat ineffective within a few minutes and never recover, usually dying within a day	Personnel become combat ineffective about 3 minutes after exposure and remain ineffective for any task until death, which usually occurs within 1 day. Radiation levels of 8,000 cGy for both physically demanding and physically undemanding tasks are the lowest doses at which personnel meet IPI criteria.
Immediate Transient Ineffectiveness (ITI)	Personnel become combat ineffective within a few minutes, but may partially recover shortly thereafter for several hours. Usually dying within a week	Personnel become combat ineffective for any task about 3 minutes after exposure and remain so for approximately 7 minutes. Personnel re- cover to greater than 75 % of their pre-exposure performance levels after about 10 minutes and remain so for about 30 minutes. Then their performance degrades for around 5 hours for undemanding tasks or 2 hours for demanding tasks, when radiation sickness becomes so severe that they are combat ineffective. They remain ineffective until death, which usually occurs in 5 to 6 days. Immediate transient ineffectiveness (ITI) is the physiological response to radiation of levels of 3,000 cGy for physically demanding tasks or 3,800 cGy for physically undemanding tasks.
Latent Ineffectiveness (LI)	Personnel become performance degraded within several hours and then perform at reduced efficiency for several weeks until death or recovery.	Personnel will become PD within 3 hours and remain so until death some weeks post expo- sure or become CI at any time within 6 weeks post-exposure. Latent Ineffectiveness (LI) is the physiological response to radiation at levels of 450 cGy for physically demanding tasks or 600 cGy for physically undemanding tasks.
Fatal Injury	Personnel die within two months.	Personnel who, as the result of nuclear detonations, suffer death or serious injury that results in death. Most deaths occur within six weeks. Fatal injury results from radiation exposures ≥410 cGy.
Serious Injury	Personnel survive but require skilled medical care for six weeks or longer.	Personnel who, as the result of nuclear detonations, suffer serious injury, which requires professional medical treatment for a period of six weeks or longer. Serious injury results from radiation exposure about 200-410 cGy.
Moderate Injury	Personnel require "treat and release" medical care only.	Personnel who, as the result of nuclear detonations, suffer non-incapacitating injury that requires some kind of medical treatment. Moderate injury results from radiation exposure about 120-200 cGy.

Table 1. Response to Acute Doses of Nuclear Radiation (Adapted from JP 3-12.3)

Dose Range (cGy)	Initial Symptoms	Time of Initial Symptoms (Begin/ End)	Performance Capability (Mid Dose Range) (Time Approximate)	Medical Care Requirement	Final Disposition Without Medical Care
0 - 75	None to slight incidence of transient headache and nausea. Vomiting in up to 5% of personnel in upper part of dose range.	6 hours / 12 hours	Combat Effective	None	Duty
75 - 125	Transient mild nausea and vomiting in 5– 30% of personnel.	3-5 hours / 1 day	Combat Effective	None	Duty
125 - 300	Transient mild to moderate nausea and vomiting in 20-70% of personnel. Mild to moderate fatigability and weakness in 25-60% of personnel.	2-3 hours / 2 days	DT: PD from 4 hours until recovery. UT: PD from 6 hours until 1 day and 6 weeks until recovery.	Medical care may be needed (at 3 to 5 weeks) for 10 to 50% of personnel to attend to infection, bleeding and fever.	Duty, less than 5% deaths at low end of exposure range. At high end of range death may occur in up to 10% of personnel.
300 - 530	Transient moderate nausea and vomiting in 50-90% of personnel. Mild to moderate fatigability in 60% - 90% of personnel	2 hours / 3 4 days	DT: PD from 3 hours until death or recovery. UT:PD from 4 hours until 2 days and 2 weeks until death or recovery	At 2-5 weeks for 20-60% of personnel; Infection, bleeding, fever, ulceration, loss of appetite and diarrhea.	Duty at low end of exposure range, less than 10% deaths. At high end of exposure ran- ge death may occur in more than 50% of personnel.
530 - 830	Moderate to severe nausea, vomiting in 50-80-100% of personnel. Moderate to extreme fatigability and weakness in 90- 100% of personnel.	Within the first hour / Days to weeks	DT: PD from 1 hr until 3 weeks. CI: from 3 weeks until death. UT: PD from 2 hrs to 2 days and 7 days until 4 weeks.	At 10 days to 5 weeks for 50-100% of personnel; infection, bleeding, fever, loss of appetite, ulceration, diarrhea, nausea, vomiting, fluid and electrolyte imbalance and hypotension.	At low end of exposure range death may occur in more than 50% of personnel at 6 weeks. At high end of exposure range 90% at 3 to 5 weeks.
830 - 3000	Severe nausea, vomiting, fatigability, weakness, dizziness and disorientation. Moderate to severe fluid and electrolyte imbalance.	Within the first 3 minutes till death	DT: PD 45 mins until 3 hrs; CI from 3 hrs until death. UT: PD from 1 hr until 7 hrs; CI from 7 hrs until 1 day; PD from 1 until 4 days; CI 4 days until death	Palliative care until death	1000 cGy: 100% death at 2-3 weeks 3000 cGy: 100% death at 5-10 days.
3000 - 8000	Severe nausea, vomiting, fatigability, weakness, dizziness and disorientation, fluid imbalance, headache and collapse.	Within the first 3 minutes till death	DT: CI from 3-35 min; PD from 35-70 min; CI from 70 min until death. UT: CI from 3 20 min: PD from 20-80 min; CI from 80 min until death	Palliative care until death	4500 cGy: 100% death at 2-3 days
Greater than 8000	Severe and prolonged nausea, vomiting, fatigability, weakness, dizziness and disorientation, fluid imbalance, headache and collapse.	Within the first 3 minutes till death	DT/UT: CI 3 minutes to death	Palliative care until death	8000 cGy: 100% death at 1 day

Table 2. Biological Effects of Nuclear Radiation (Adapted from JP3-12.3). DT = Demanding Tasks, UT = Undemanding Tasks, PD = Performance Degraded (25-75% Capable), CI = Combat Ineffective

without medical intervention.

e. Serious Injury. Personnel who, as the result of nuclear detonations, suffer serious injury, which requires professional medical treatment for a period of six weeks or longer. Serious injury results from radiation exposure about 200-410 cGy.

f. Moderate Injury. Personnel who, as the result of nuclear detonations, suffer non-incapacitating injury that requires some kind of medical treatment. Moderate injury results from radiation exposure about 120-200 cGy.

Table 2 provides initial symptoms of nuclear radiation on operational effectiveness of groups. Individual effects will vary. This data is for planning purposes only and cannot be used for the management of individual patients. All doses are expressed as midline doses (free-in-air) cGy (tissue). T he Soldiers are assumed to be healthy, rested, well- fed adults with no previous exposure (i.e., uninjured and fresh troops). Doses are based on whole body acute exposure (i.e., within 1 day) to neutron and/or gamma radiation. Biological recovery and the less incapacitating effects of nuclear radiation extending over a protracted period, may have result in lesser effects, the extent of which (for most incapacitating effects) cannot be calculated for tactical purposes. Lower doses may cause similar effects if groups or individual exposures are combined with exposure to other harmful agents or if they have blast or thermal injuries.

Soldier Risk and Vulnerability Criteria:

FA52 and 72A officers need to also understand some terminology for Soldier safety so that they can advise their commander. First, are the risk criteria. There are three risk criteria:

a. Negligible Risk. The largest radius corresponding to 1% LI, which correlates to 75 cGy for previously unexposed personnel.

b. Moderate Risk. The largest radius corresponding to 2.5% LI, which correlates to 100 cGy for previously unexposed personnel.

c. Emergency Risk. The largest radius corresponding to 5% LI, which correlates to 125 cGy for previously unexposed personnel.

Next are the vulnerability criteria. Associated with the degrees of risk is the protection personnel have from weapon effects. To account for the various situations, three vulnerability categories exist:

a. Unwarned, Exposed. Personnel in this category are assumed to be standing in the open at the time of the detonation.

b. Warned, Exposed. Personnel in this category are assumed to be prone in the open. Such a condition may exist when a unit is warned of an impending nuclear detonation but has insufficient time to gain protective shelter such as a personnel carrier or a foxhole.

c. Warned, Protected. Personnel in this category are assumed to have some protection against nuclear radiation. Tanks, APCs, foxholes, weapon emplacements, and shelters can provide such protection.

Therefore, there are nine combinations of risk and vulnerability for safety distances: unwarned, exposed negligible; unwarned, exposed moderate; unwarned, exposed emergency; warned, protected negligible; warned, protected moderate; warned, protected emergency, warned, protected negligible; warned, protected moderate; and warned, protected emergency. During nuclear operations, the commander determines the risk and vulnerability of their Soldiers. Personnel who are separated from the desired ground zero (DGZ) by a distance equal to or greater than the MSD that describes their risk and vulnerability are considered safe. Minimum safety distances associated with a warned, protected posture are called MSD 1. Minimum safety distances associated with an

Radiation Exposure Status Categories

Total Cumulative Dose (See Notes 1 & 2)	Radiation Exposure Status (RES) Category	Recommended Actions (Continue Actions from the Previous RES Categories as RES Increases)
Military Operations Other than War		
0 – 0.05 cGy	RES-0	• Routine monitoring for early warning of hazard
0.05 – 0.5 cGy	RES-1A	• Record individual/unit dose readings
0.5 – 5 cGy	RES-1B	• Initiate radiation survey and continue monitoring
5 – 10 cGy	RES-1C	• Update survey and continue monitoring • Continue dose control measures • Execute PRIORITY tasks only (see note 3)
10 – 25 cGy	RES-1D	• Execute CRITICAL tasks only (see note 4)
25 – 75 cGy (see note 5)	RES-1E	• Monitor for acute radiation syndrome symptoms
RES Categories Continue for Military Operations During Combat		
75 – 125 cGy (see note 5)	RES-2	• Any further exposure exceeds moderate operational risk
> 125 cGy (see note 5)	RES-3	• All further exposure will exceed the emergency operational risk

1 rad = 1 radiation absorbed dose = 1 centigray (cGy)

1. Radiation measurements can be in centisievert (cSv) or millisievert (mSv). However, due to the fact that the military may only have the capability to measure centigray (cGy) or milligray (mGy), the radiation guidance tables are presented in units of cGy for convenience. For whole body gamma irradiation, 10 mGy = 1 cGy = cSv = 10 mSv.
2. All doses should be kept as low as reasonably achievable. This will reduce individual Service member risk as well as retain maximum operational flexibility for future employment of exposed Service members.
3. Examples of priority tasks are those that contain risk, avert danger to persons, or allow the mission to continue without major revisions in the operational plan.
4. Examples of critical tasks are those that save lives or allow continued support that is deemed essential by the operational commander to conduct the mission.
5. Although an upper bound for RES 1E is provided in the table, it is conceivable that doses to personnel could exceed this amount. A low incidence of acute radiation sickness can be expected as whole body doses start to exceed 75 cGy. Personnel exceeding the RES 1E level should be considered for medical evaluation and evacuation upon any signs or symptoms related to acute radiation sickness (e.g., nausea, vomiting, anorexia, fatigue).
6. When an operational mission duration spans more than one calendar year and it does not exceed the annual occupational dose limit, the RES Category will be reset to RES 0 on 1 January. All radiation exposure data records are still required to be maintained by the service dosimetry centers.

Figure 1. Radiation Exposure Status Categories (Adapted from JP 3-11)

unwarned, exposed posture are called MSD 2. Negligible risk to unwarned, exposed personnel is normally specified although a higher degree of risk may be specified if operationally warranted.

Managing Radiation Exposure

The commander is responsible for managing risk for all personnel under his/her authority, and should establish Operational Exposure Guidance (OEG) for any mission that may expose a Soldier to ionizing radiation. The OEG is the maximum amount of external ionizing radiation that the commander considers a unit may be permitted to receive while performing a particular mission or missions. The OEG is set based on all of the potential hazards on the battlefield, in conjunction with any prior radiation exposure the unit has sustained using a risk analysis process outlined in JP 3-11. A course is currently under development to provide training for medical and other personnel expected to advise operational commanders on appropriate selection of OEG. This course is projected to be available on Joint Knowledge Online in December 2018.

Radiation Exposure Status

The Radiation Exposure Status (RES) provides commanders a convenient method to track dose and associated operational impact of exposure. The RES can be used for estimating the effectiveness of units or individuals during operational planning to select units or individuals with appropriate capabilities or skills to ensure mission accomplishment that results in the lowest RES after the mission is completed. The RES is based on the total cumulative dose received from exposure to penetrating radiation. It is indicated by the categorization symbols RES-0 through RES-3 (see Figure 1) based on the average exposure of individuals in a unit. The RES categories should be applied to units or sub-units (e.g., platoon-sized units).

Assessing Radiation Hazards

All exposure to nuclear radiation should be justified by military necessity to execute the mission and evaluated for mitigation options with the resources available. The danger involved in radiological exposures must be evaluated in accordance with the military situation and the state of emergency.

Where radiological hazards can be controlled and there are sufficient resources to protect personnel to a level of risk comparable to occupational standards, commanders should apply the same standards of ionizing radiation protection as would apply to any routine practice involving ionizing radiation exposure and radioactive material. Guidance is specified in AR 385-10, The Army Safety Program, paragraph 7-3, and DODI 6055.08, Occupational Ionizing Radiation Protection Program.

Selection of OEG

In time of emergency or war, when environments are uncontrolled or uncharacterized, and/or limited resources exist to reduce personnel exposure to ionizing radiation, commanders should apply operational risk management to protect personnel to the greatest extent possible. Under these conditions commanders should select OEG instead of occupational dose limits to keep dose to personnel ALARA while meeting mission priority based on the commander's accepted risk level for the mission.

The recommended levels for the exposure guidance given in Figure 4 are low enough that the primary risk is limited to an increased risk of

Recommended Operational Exposure Guidance Levels

Acceptable Risk Level \ Mission Importance	Critical	Priority	Routine
Extremely High	125 centigray	75 centigray	25 centigray
High	75 centigray	25 centigray	5 centigray
Moderate	25 centigray	5 centigray	0.5 centigray
Low	5 centigray	2.5 centigray	0.5 centigray

1 rad = 1 radiation absorbed dose = 1 centigray (cGy)

NOTE:
The commander has the authority to select any operational exposure guidance deemed appropriate, including exceeding 125 centigray, if the circumstances warrant it.

Figure 4. Recommended Operational Exposure Guidance Levels (Adapted from JP 3-11)

long-term health effects except for a critical mission with an extremely high acceptable risk. This table is intended to guide commanders and their staffs in determining an appropriate OEG.

a. Critical missions are those missions that are essential to the overall success of a higher headquarters' operation, emergency lifesaving missions, or the equivalent.

b. Priority missions are those missions that avert danger to persons, prevent damage from spreading, or support the organization's mission-essential task list.

c. Routine missions are all other missions that are not designated as priority or critical missions.

Conclusions

This document provides a refresher on important aspects of nuclear preclusion analysis. It highlights the functionality of the Operational Exposure Guidance and Radiation Exposure Status use on the nuclear battlefield. Understanding the effects on friendly and adversarial forces is a key part of providing planner support to commanders. It is intended to be a resource for the nuclear effects community, to be used in conjunction with a library and reach back resources, to provide a more effective approach to the nuclear battlefield.

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Nuclear Survivability in Future Warfare: How to Effectively Assess Requirements

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In February 2017, the Acting Secretary of the Army, Robert M. Speer, directed the Army Science Board to conduct a first-of-its kind quick reaction study entitled "Nuclear Survivability in Future Warfare: How to Effectively Assess Requirements." Sponsored by the Acting Deputy Under Secretary of the Army, the purpose of the study was to analyze nuclear hardness and survivability (NH&S) requirements for military systems and to assess the best methods to verify those requirements. Recognizing that mitigating the effects of nuclear weapons and hardening mission critical systems to nuclear environments will continue to be a requirement for US forces, the study cast particular attention on the nation's nuclear test and evaluation infrastructure, specifically pulsed neutron test capabilities. The facilities that the Army and its sister Services currently rely on have aged significantly and require replacement and/or increased sustainment costs.

To address the study, then Chairman of the Army Science Board, Dr. Jim Tegnelia (former Director of the Defense Threat Reduction Agency) formed a study group chaired by Dr. Joan Woodard (former Deputy Laboratories Director of Sandia National Laboratories). The group also consisted of Ms. Evelyn Mullen (Deputy Associate Laboratory Director of Los Alamos National Laboratory), Dr. Tom Ramos (Senior Scientist at Lawrence Livermore National Laboratory), Mr. Mike Molino (Executive Vice President of Leidos), and Ms. Vivian Baylor (formerly of Oak Ridge National Laboratory). Dr. Tegnelia served as the group's Senior Advisor and the author served as the Study Manager. Per the study's Terms of Reference, the group's tasks were fourfold:

1. Postulate the NH&S requirements for the future force, to include Service Standard Weapons and Equipment for all Services, and Strategic Weapons Systems, primarily for the Navy and Air Force.

2. Examine the future requirements of Strategic Weapons Systems as they begin to incorporate new and different materials (e.g., gallium arsenide).

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3. Determine how well each of the current US Government facilities test the postulated requirements. At a minimum, assess the following facilities:
– Fast Burst Reactor (FBR) at White Sands Missile Range (WSMR)
– Recommissioning of the Sandia Pulse Reactor
– Godiva Reactor at the Nevada Test Site
– Low Enriched Uranium Reactor/Dense Plasma Focus

In addition, assess how well each reactor will link to the Qualification Alternative to the Sandia Pulse Reactor (QASPR) model.

4. Determine whether there are novel methods, potentially without using nuclear material, to fulfill NH&S requirements assessment. For example, expanding the use of modeling and simulation.

In response to the quick reaction nature of the study, the team narrowed its scope and focused the lines of inquiry to the following areas:

1. A qualitative look at the emerging threat space (as opposed to a complex, multi-year process to establish quantitative requirements using experts from both Department of Defense [DoD] and the Department of Energy [DOE]).

2. An exclusive examination of the neutron environment

3. A review of both strategic and conventional system existing requirements

Over the course of the study, which was completed in two months, the group conducted more than twenty engagements with subject matter experts from across the DoD, the interagency, industry, and academia, to include three fact-finding trips to New Mexico, Nevada, and the National Capital Region. The study end state was a briefing with findings and recommendations to the Secretary of the Army and the Army Chief of Staff.

Study Report (actual text)[1]

On today's multi-domain battlefield, current and future forces must survive and accomplish assigned missions in a nuclear environment. A variety of nuclear weapon effects, both prompt and delayed, drive survivability requirements. While this study focused on neutron effects, DoD nuclear policy requires the Services to identify and to harden mission-critical systems to various hostile environments. Documents such as Military Standards contain the specific hardening requirements. All requirements are threat-based, drawing on the hostile environments as defined in the Defense Threat Reduction Agency (DTRA) Red Book. Specifically, strategic systems are hardened to stringent levels defined in the Stockpile-to-Target-Sequence document for each weapon system, which includes both the warhead and its delivery system.

For pulsed neutron environments, the WSMR FBR currently supports all the Services, as well as the strategic stockpile managed by the National Nuclear Security Administration (NNSA). As shown in Figure 1, Army usage is approximately 20-25%, while overall Tri-Service usage is approximately 50-60%. NNSA laboratory usage (primarily for validation and qualification of nuclear warheads) has been variable from year to year. In 2012, there was a robust test campaign of semiconductor materials and associated model validation, but in 2014 there was reduced testing due to NNSA budget shortfalls and travel restrictions. Looking across the entirety of the user base, 80-90% is for DoD tactical and strategic systems. In addition, the United Kingdom

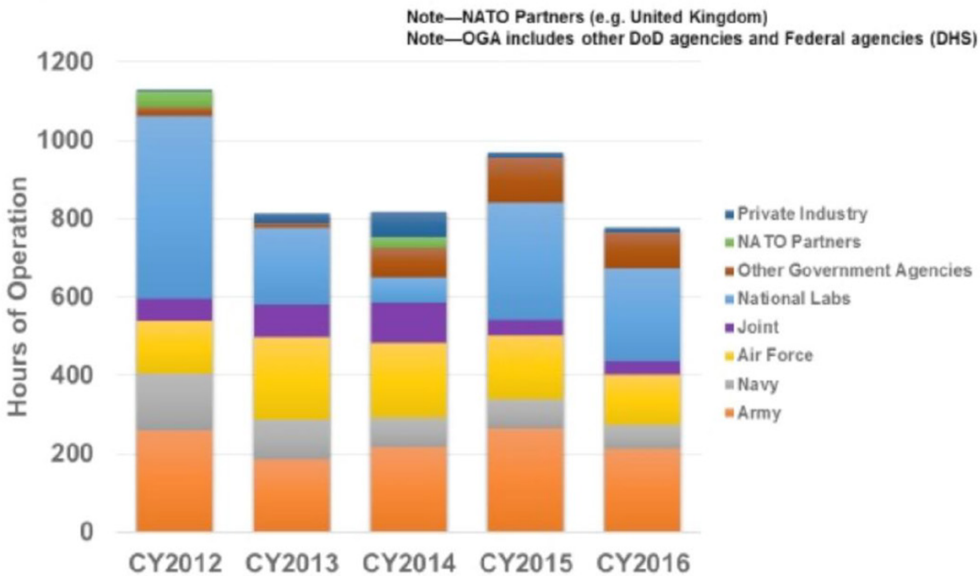

Figure 1. Fast Burst Reactor Utilization by Calendar Year

and other NATO partners use the FBR in support of their nuclear weapons programs, as governed by the1958 Mutual Defense Agreement treaty. Other users include DoD agencies such as DTRA, the Missile Defense Agency, and private industry (for dosimeters, detectors, etc.).

The WSMR FBR currently supports several DoD systems across the three Services. In the case of the Army, the test capability is essential for ensuring the survivability of ground combat vehicle systems such as the M1 Abrams, M2 Bradley, and the Stryker families of vehicles. Many systems have undergone significant modernization since their initial development, necessitating additional testing against a variety of nuclear weapon effects. In addition, new system acquisition must qualify to neutron environments and existing systems undergo routine surveillance against neutron requirements. The Army projects increased usage, beginning in 2018 and thru 2021, to support enhancements and variants of systems in production and surveillance. The Navy projects usage at the current level for the near future and the Air Force sees a significant increase in neutron test needs in the coming years. In particular, Triad modernization development and follow-on hardness surveillance will account for a significant amount of test time at the FBR.

The FBR facility (Figure 2) is permitted and regulated by the Army Reactor Office (ARO) and part of the DoD set of facilities that have joint application, which are designated as the Major Range and Test Facility Base (MRTFB). The facility uses highly enriched uranium (HEU) and requires a large security force and heightened posture. The facility has burst, steady state, indoor, and outdoor modes of operation. The combination of a narrow pulse width and relatively high fluence provide valuable test capability for electronics and are representative of

Figure 2. The Fast Burst Reactor Facility

test needs. The steady state operation mode in the outdoor test configuration provides valuable test capability for personnel survivability requirements, in addition to ground combat vehicle electronic components. Due to MRTFB policy, the Army T&E Command pays for FBR security costs, which cannot be passed on to users. Users only reimburse the direct test costs, which means WSMR typically recovers approximately half of the annual operations cost.

The FBR HEU fuel is a risk issue for sustainment. Several fuel elements are damaged and require replacement. As a result, the FBR is currently operating with the minimum fuel elements required for uninterrupted pulse mode operations. In addition, an alternate ring is employed in the center of the core as a substitute with special spacers that require annual replacement. To mitigate the potential for further fuel damage, both maximum operating point (affects fluence) and the shot rate were reduced. Further degradation in fluence would reduce the output below that required for worthwhile strategic system component testing.

The ARO has indicated that it would likely direct FBR to cease pulse mode operations if additional specific fuel elements are damaged, which would suspend pulse testing until a replacement is acquired. Current estimates indicate 3-4 years are required to procure new fuel from the Y-12 National Security Complex. The cost estimate for procurement of a complete set of fuel elements is approximately $30M. HEU fuel fabrication for a burst reactor is not a routine acquisition. It involves sophisticated fabrication techniques, specialized hardware, and the application of uranium metallurgy expertise. The current set of fuel elements has been in service since 1963.

FBR sustainment costs led the Army to request the Test Resource Management Center (TRMC) investigate alternatives that could reduce annual costs. An analysis of alternatives concluded that a low enriched uranium (LEU) pulsed reactor and a dense plasma focus (DPF) facility were attractive alternatives. A test capability requirements document (TCRD) for neutron testing was generated and development projects for a new LEU-fueled reactor and a DPF were initiated. It is important to note that several signatories to this document have since revised their assessment of future requirements, particularly regarding pulse width, and some signatories signed with significant comments about various performance parameters and system attributes which have not been resolved.

The LEU reactor project was funded by the DoD Central Test & Evaluation Investment Program (CTEIP), which is administered by the TRMC. It draws upon experience with an LEU burst reactor operated from 1963 to 1973 known as Super Kukla, operated at Lawrence Livermore National Laboratory. The current reactor design, exhibited in Figure 3, envisions 2600 kg of 20% enrichment uranium fuel and includes a large internal cavity test volume. That amount of uranium is not in the current allocation of nation's HEU reserve, managed by the NNSA. The

Figure 3. Proposed Low Enriched Uranium Reactor

pulse width of the proposed reactor is significantly greater than that of FBR and presents a risk of damaging electronics on total dose and not dose rate. In addition to fuel availability, there is a great deal of uncertainty on the cost of fuel fabrication and there is no plan for fuel qualification, which presents a significant schedule risk.

While in early development, several design issues emerged that needed resolution, including (1) cooling system performance as it affects shot rate; (2) reflector stability as it affects test reproducibility; and (3) pre-initiation (misfire) rate as it affects test cost. An LEU reactor potentially offers lower sustainment costs, but the magnitude of savings is unknown. The ARO has indicated that siting, licensing, and certification are high-risk and could take more than 7 years.

The NNSA manages the allocation of HEU fuel designated for down-blend into LEU. The LEU is primarily for use at research reactors (nationally and internationally) scheduled for conversion to LEU configurations. The NNSA allocation of the Secretarial-designated allotment of HEU for down-blend into LEU is heavily subscribed through 2028. Feedstock for the LEU burst reactor project would require a national reallocation, the timing of which is uncertain.

Overall, the design risks, licensing risks, fuel availability, and cost risks all contribute to schedule pressure, making delivery and initial operations beginning in 2023 highly questionable. Fuel acquisition is a critical path item that's currently scheduled to start at the beginning of FY18.

In addition to the LEU reactor, the analysis of alternatives conducted by TRMC identified the DPF capability, shown in Figure 4, as a potential complement to either the LEU reactor or the FBR. TRMC's science and technology portfolio is funding the development of the DPF capability for ultra-short pulse fusion neutron testing. In parallel with this development, NNSA is conducting DPF development at the Nevada National Security Site (NNSS). Based on the NNSS experience, the TRMC-funded DPF project faces significant technical risk to achieve the design specifications and there are safety and environmental risks in the transition to deuterium-tritium gas. These risks are further exacerbated by the aggressive schedule to achieve delivery and initial operations beginning in 2025.

Figure 4. Dense Plasma Focus Machine

The Los Alamos National Laboratory's Godiva IV reactor (Figure 5) is an HEU reactor currently located at the Device Assembly Facility (DAF) at the NNSS. The Godiva IV reactor, the Sandia Pulsed Reactor (SPR) III, and the

Figure 5. Godiva IV Reactor

WSMR FBR are all within the same design family. Godiva IV has a lower fluence and smaller test cell dimensions, which limit its viability as an FBR replacement. In addition, the test facility is heavily subscribed, prohibiting its ability to replace the FBR from a capacity standpoint. In addition, there are high operational and security costs at the DAF. It is unclear whether NNSA would seek a cost-sharing agreement with DoD for a portion of the support costs.

Disassembled in 2006, SPR III and its HEU fuel was sent to the NNSS for storage where it currently resides. The reactor, displayed in Figure 6, meets the TCRD key performance parameters, but the NNSA has no plan for re-commissioning the reactor. Reconstitution would likely take 7-10 years at a cost of approximately $40M. SPR III has a complete core available, but there is not a complete set of spare fuel elements, nor a current estimate of cost/schedule for fabrication of spare fuel elements.

Neither the Godiva IV reactor or SPR III meet the requirements and schedule of Triad modernization. The proposed LEU reactor, even with its optimistic schedule of delivery and initial operations beginning in 2023, does not meet the Triad modernization timeline. In addition, the LEU reactor does not meet all the Services' test requirements, particularly with respect to pulse width, as expressed to the ASB study team during the course of this study.

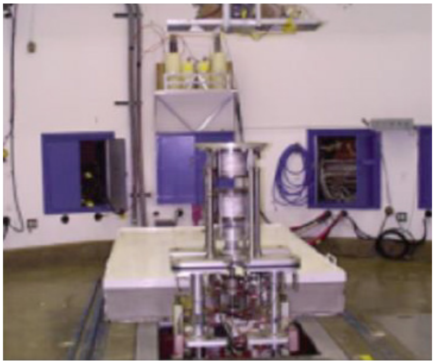

Figure 6. Sandia Pulsed Reactor III

With the shutdown of SPR III in 2006, NNSA decided to develop a modeling and simulation (with experimental verification and validation) capability to serve as an alternative process to qualification with an HEU-fueled pulsed reactor. The primary model set is the Qualification Alternative to the Sandia Pulsed Reactor (QASPR). Experimental validation and verification are essential to the development of QASPR. The QASPR tools are mature for small circuit qualification, which along with system design techniques and strategies, qualify warhead arming, fuzing, and firing (AF&F) systems for upcoming warhead life extensions. Currently, and for at least the next five years, the FBR is necessary for risk reduction validation of the QASPR models. QASPR's modeling and simulation capabilities aren't mature enough to replace testing that definitively qualifies all systems, beyond the AF&F, in support of Triad modernization. While advanced materials demonstrate enhanced survivability in certain electronic components and are being applied in life extension programs, other electronic components (sensors, etc.) rely on materials that require testing. In addition, reliance on modeling and simulation alone does not reliably address uncertain future threat scenarios and newly evolving materials.

With respect to current FBR sustainment concerns, examination of facilities like the WSMR FBR has shown that engineered modifications to a test facility can lead to substantial savings in security costs. Currently, annual security costs are on order of several million dollars. The Army Provost Marshal General's office establishes the security guidelines that govern FBR facility security. One of the key elements of a strong security posture is delaying the adversary from gaining access to the special nuclear material. Engineered vaults offer the ability to delay access time in order to allow for greater security force response time. For example, Sandia National Laboratories applied engineered solutions to the SPR III fuel storage facility that increased delay time and resulted in annual savings. Additionally, Sandia developed a concept for an underground SPR III facility that was estimated to achieve security savings and pay back in a relatively short period. In addition, the absence of a disposition plan for FBR's HEU fuel, it would likely remain on site at WSMR for many years during which the security posture will remain unchanged in the absence of security enhancements.

The tenets governing the MRTFB compelled the Army to seek alternative test capability solutions that lower annual costs. The Army, as the custodian Service, is responsible for all costs (including security and maintenance) other than those directly attributed to the cost of testing. The original solution to the neutron test capability problem contained three elements: (1) new HEU fuel elements for the FBR; (2) a new LEU reactor; and (3) the DPF. Some viewed new HEU fuel as a "maintenance" cost and not "developmental" in nature, making it noncompliant with one of the criterion for CTEIP investment.

In addition, under the management and contracting approach implemented by the executive agent, Program Executive Office for Simulation, Training, and Instrumentation (PEO STRI), the same contractor that conducted the analysis of alternatives and support to the TCRD is subsequently conducting the development programs for the chosen alternatives. This gave the ASB study team the perception that key acquisition decisions lacked independence and objectivity. Lastly, it was determined that there was a lack of comprehensive collaboration with subject matter experts in the nuclear community, such as Los Alamos National Laboratory, Lawrence, Livermore National Laboratory, or Sandia National Laboratories, particularly with respect to the reactor design. While interactions are occurring, they are limited in nature.

In summary, the study findings were as follows:

1. There is a lack of nuclear community agreement on neutron survivability test requirements despite a signed Test Capability Requirements Document.

2. There is significant lack of concurrence in the nuclear user community for the LEU reactor development to meet performance requirements, costs, and schedule.

3. The cognizant Services and agencies believe that the FBR fuel hedge acquisition should be funded immediately to reduce the risk associated with current re-fueling strategy.

4. The current management construct and funding processes as applied to this nuclear test capability resulted in high-risk proposals.

5. Strategic and conventional system requirements exist and there are emerging threats that require fast-pulsed neutron test environments.

6. The Army and the other Services are the principal users of FBR.

7. Neutron survivability testing is significant for Triad modernization through at least 2027.

8. There are no existing facilities that other than

the FBR that can support Triad modernization timeline.

9. Significant risks (technical/costs/schedule) must be overcome for the LEU reactor to be a viable future FBR alternative.

10. Significant risks (technical/costs/schedule) must be overcome for the DPF to be a viable test capability.

11. The QASPR program depends on FBR for at least the next 5 years.

From these findings, the study team made the following recommendations for action by the Army:

1. Immediately, the DoD Test Resource Management Center (TRMC) or the Army T&E Command (ATEC) should acquire new fuel elements for WSMR FBR sustainment.
-Four-year acquisition
-Y-12 production facility currently scheduled to commence shutdown in 2021 for move to new facility (window of opportunity is closing)
-FY18 start—leverages the National Aeronautics and Space Administration ongoing fuel fabrication

2. TRMC or ATEC should fund activities exploring engineered security for the WSMR FBR.

3. Prior to the next decision point, the Under Secretary of Defense for Acquisition & Sustainment should direct the conduct of independent red-teams:
-Nuclear weapon effects/survivability experts should red-team the Test Capability Requirements Document
-Nuclear pulse reactor and fuel design experts should red-team the LEU reactor
-Plasma physics experts should red-team the technical feasibility and direction of the DPF project

4. The Army Office of the Provost Marshal General should determine security posture and costs for LEU-based reactor at WSMR.

5. PEO STRI should commence regulatory planning and siting analysis, consistent with Army Reactor Office direction, for possible LEU reactor.

6. PEO STRI, in consultation with the Army Nuclear and Countering WMD Agency, should evaluate safety and relocation of DPF experimental facilities prior to the use of Deuterium-Tritium gas.

Conclusion:

In response to a time sensitive study request, the Army Science Board analyzed a critical test and evaluation issue and provided recommendations to the Army on a path forward for pulsed neutron test capabilities to support ongoing and emerging test needs. The FBR was found to be the most effective test capability and it was determined that procurement of new FBR fuel elements is the optimal course of action for the Army to follow.

References:

1. *Nuclear Survivability in Future Warfare: How to Effectively Assess Requirements* (Washington, DC: Dept. of Defense, May 2017).

CBRN Vignette 18-1 "Nuclear Disablement Team Dilemma"

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This CBRN vignette is part of an ongoing series of scenarios developed as a training tool for decision makers at all levels–tactical to strategic. The goal is to foster thought, discussion, and to support training. Readers are encouraged to send possible solutions to the Countering Weapons of Mass Destruction Journal as a means of interaction with the CBRN community. The author's solution, along with selected readers' solutions, will be published in future journal issues.

Situation:

Background: The National Government of Transia is losing its sovereignty due to economic depression and political unrest. Joint Task Force-Elimination (JTF-E) (Figure 1) has two areas of interest in the Joint Task Force Freedom (JTF-Freedom) Area of Responsibility (AOR) (Figure 2): the Transia Nuclear Power Plant, vicinity 085159 and the National Nuclear Refinement and Research Facility (N2R2F), vicinity 210245.

Friendly Forces: You are the CBRNE Officer for JTF-E. JTF-Freedom is your higher headquarters, and is responsible for stability operations in the country of Transia. JTF-E is composed of 1/4 Heavy Brigade Combat Team (HBCT), A Company/2-3 General Support Aviation Battalion (GSAB) with 8 x UH-60s, and 55th Explosive Ordnance (EOD) Company with 1 Nuclear Disablement Team (NDT) (Figure 3 and Table 1). JTF-E's mission is to rapidly and efficiently exploit and disable nuclear or radiological Weapons of Mass Destruction (WMD) infrastructure and components in Transia. The intent is to deny near-term production capability or reuse of WMD by renegade elements of the Transian military or criminal organizations, and to facilitate follow-on WMD Elimination operations as required.

Enemy Forces: There are renegade elements of the Transian military in the Area of Operations (AO). Unit sizes range from teams to battalions, plus criminal organizations (some with international connections).

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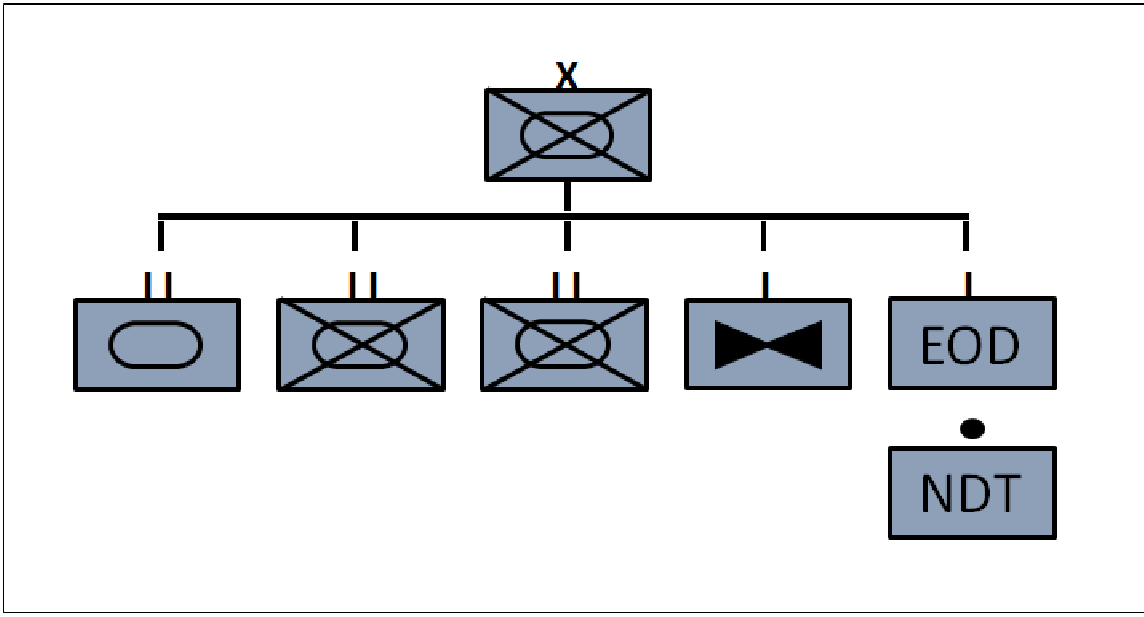

Figure 1. Joint Task Force-Elimination (JTF-E)

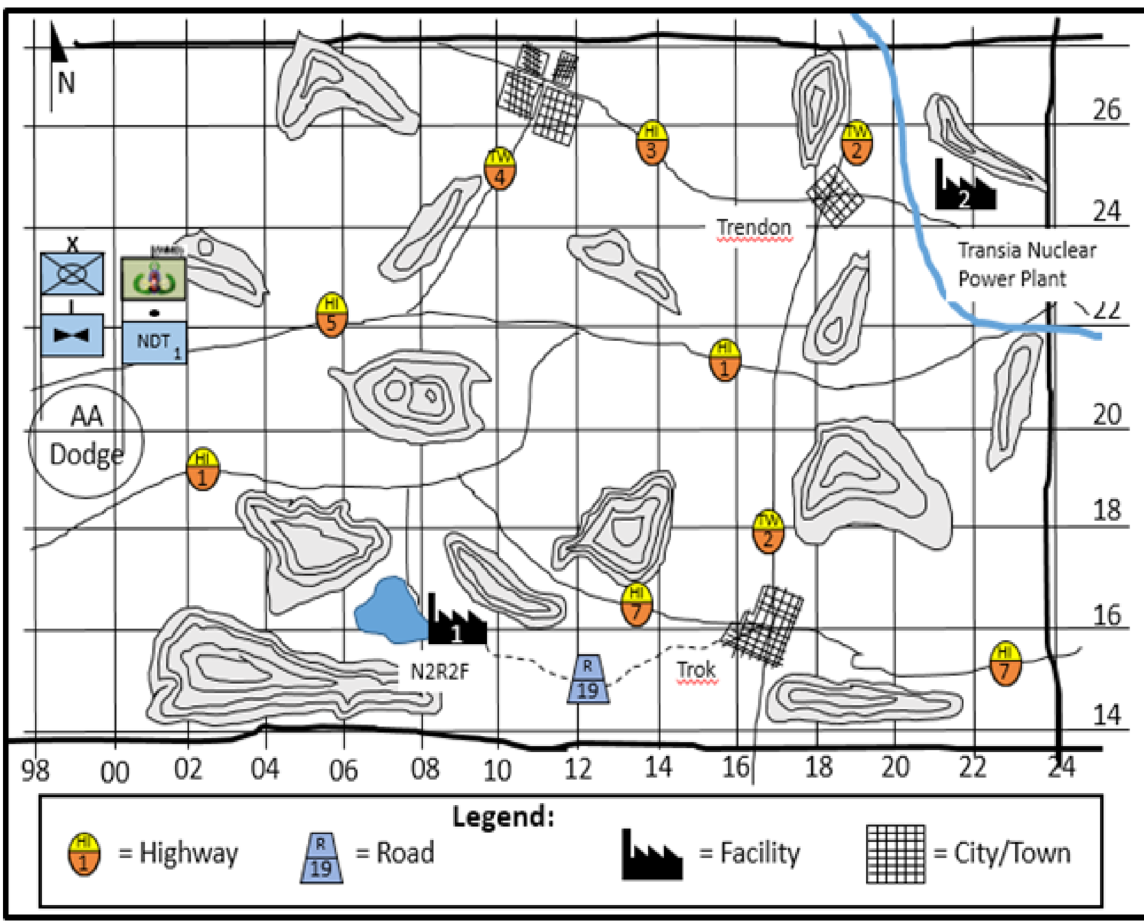

Figure 2. Joint Task Force Elimination Area of Responsibility

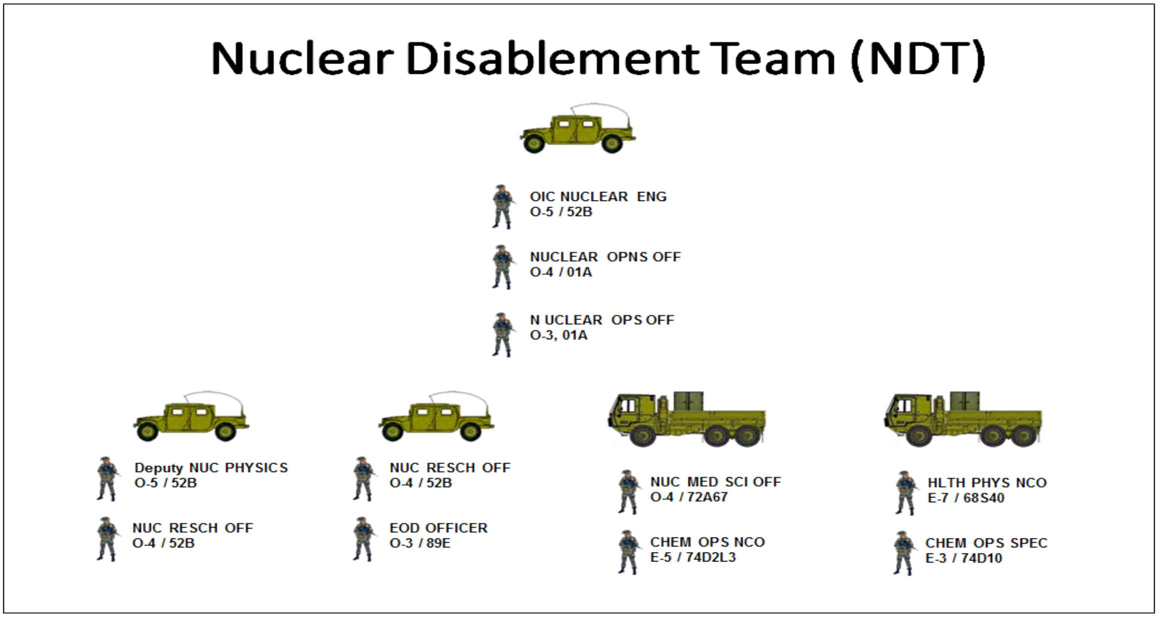

Figure 3. Nuclear Disablement Team Personnel and Equipment

Nuclear Disablement Team (NDT)

Mission and Capabilities

Mission: To rapidly and efficiently exploit and disable nuclear and radiological infrastructure and components OCONUS in permissive or uncertain environments to deny the near-term reuse capability by enemy forces and to facilitate follow-on WMD-elimination operations

Capabilities:

- The exploitation of nuclear facilities and of nuclear fuel cycle, weapon development, and radiological sites.
- When directed, the disablement of nuclear infrastructure to demilitarize by reducing or removing the military weapons capability.
- The characterization of radiological/nuclear materiel and process before weapon system assembly.
- The collection, packaging, securing and evacuation of radiological/nuclear samples that pose an immediate threat to friendly forces and for intelligence/forensics analysis.
- Coordination with higher headquarters to assist with facility and process disablement planning execution, and other radiological/nuclear operations.
- Advice to the commander regarding radiological/nuclear issues in their AOR and support to other technical forces.

Table 1. Nuclear Disablement Team Mission and Capabilities

Target A: Transania Nuclear Power Plant*:

The Transia Nuclear Power Plant is a three-unit nuclear power station located in Trabók Province, 10 miles west of Trendon and is on the east bank of the Trendon River. The plant generates over 2,000 megawatts (MW) of electrical power. Transia 1, built by Centralized Energy Company, was a 275-megawatt pressurized water reactor that began operations in 1962. The first core shut down in 1974 because it did not meet international regulatory requirements. The Transia 2 and 3 are four-loop pressurized water reactors completed in 1974 and 1976, respectively. Transia 2 generating capacity is 1,032 MW, and Transia is 3 1,051 MW. Both reactors use uranium dioxide fuel of no more than 4.8% U-235 enrichment. Steel-reinforced containment concrete domes protect the Transia Nuclear Power Plant reactors. Mr. Ivan Meteropol is the Director of the Transia Nuclear Power Plant and directly employs about 1,000 full-time workers. Mr. Meteropol and most of the workers live in the city of Trendon. There are three distinct work forces employed at the Transia Nuclear Power Plant: the Security Force, the Support Staff, and the Technical Staff. The Security Force is a semi-professional force; they are not as well-trained or equipped as the Transian Army, but still quite devoted to the security of the Transia Nuclear Power Plant. The Support Staff supports both the Security Force and the Technical Staff. The Technical Staff operates the power plant.

Target B: National Nuclear Refinement and Research Facility:**

The primary mission of the N2R2F is to refine uranium dioxide fuel for the Transia Nuclear Power Plant. Additional missions include research and development of a fledgling nuclear weapons program and general nuclear research. Nearly half of the N2R2F funding comes from unsecured government and international research grants. Dr. Nicoli Severious is the director and lead scientist of the N2R2F. The N2R2F also employs three work forces: the Security Force, the Support Staff, and the Technical Staff. The Technical Staff is small and is considered the elite of the facility; it includes all of the facility scientists and operators. Dr. Severious maintains a home in the eastern (wealthy) portion of the city of Trok, along with most of the Technical Staff. The Support Staff and Security Force live mostly in the poorer sections of Trok or in cheap mobile home-like structures around the dirt road leading to the N2R2F. The Security Forces are poorly trained and equipped by the contracted security company (Graywell Overwatch Security and Protection). The Support Staff supports both the Security Force and the Technical Staff, but they are routinely underpaid and are considered the lowest tier of the three work forces. Besides the ongoing refinement of yellowcake into Highly Enriched Uranium and the refurbishment of three older nuclear weapons, the facility supports several ongoing research projects, including fission science and technology, nuclear security and technology, and isotope development and production.

Requirement:

The author's solution, along with selected readers' solutions, will be published in future journal issues. After reviewing the situation, outline your issues and write a fragmentation order (FRAGO) for the deployment and employment of an NDT to conduct disablement operations at the two Nuclear Facilities in the AOR. Consider including the following items: 1) strategic messaging; 2) prioritization of the two sites for exploitation; 3) task organization; 4) unit tasks and purposes; and 5) rationale. Readers wanting to submit their solutions to the scenario should provide the FRAGO to the author at daniel.p.laurelli.mil@mail.mil.

*Transia Nuclear Power Plan is based on Entergy's Indian Point Energy Center (IPEC) in Buchanan, NY.

**National Nuclear Refinement and Research Facility (N2R2F) based on Oak Ridge National Laboratory in Tennessee.

References:

1. *ATP 3-37.11, Chemical, Biological, Radiological, Nuclear, and Explosives Command* (Washington, DC: HQDA, Aug 2018), F-1 – F7.

2. “Nuclear Disablement Team Operations in Operation Iraqi Freedom: Part 1,” *NBC Report Fall/Winter 2003*, 9-12.

CBRN Vignette 17-1 "The Decontamination Trial" - Author's Solution

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The following is the author's solution to the CBRN Vignette 17-1, published in Issue 15 of the Countering WMD Journal. The author's solution is only one possible solution to the CBRN Vignette presented.

Situation:

The enemy has conducted unconventional (chemical) artillery attacks across the 1-4 Heavy Brigade Combat Team (HBCT) Area of Operations (AO) and a conventional artillery attack on the Brigade Support Area (BSA). The attack on the BSA restricts the brigade's ability to conduct resupply operations to units in the AOR, limiting support to the 55th Chemical Company (Combat Support).

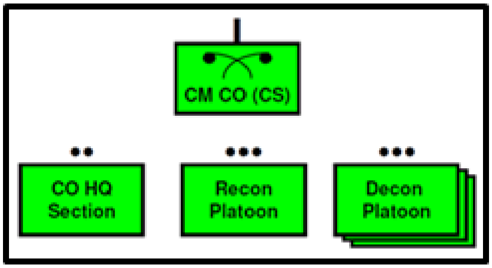

Figure 1. 55th Chemical Company

Mission:

The 55th Chemical Company (Combat Support) conducts thorough decontamination operations in order to prepare the 1-4 HBCT Area of Responsibility (AOR) for future operations.

Intent:

My intent is to conduct thorough decontamination operations to restore the maximum firepower of the 1-4 HBCT prior to the enemy's attack in the next 24-28 hours.

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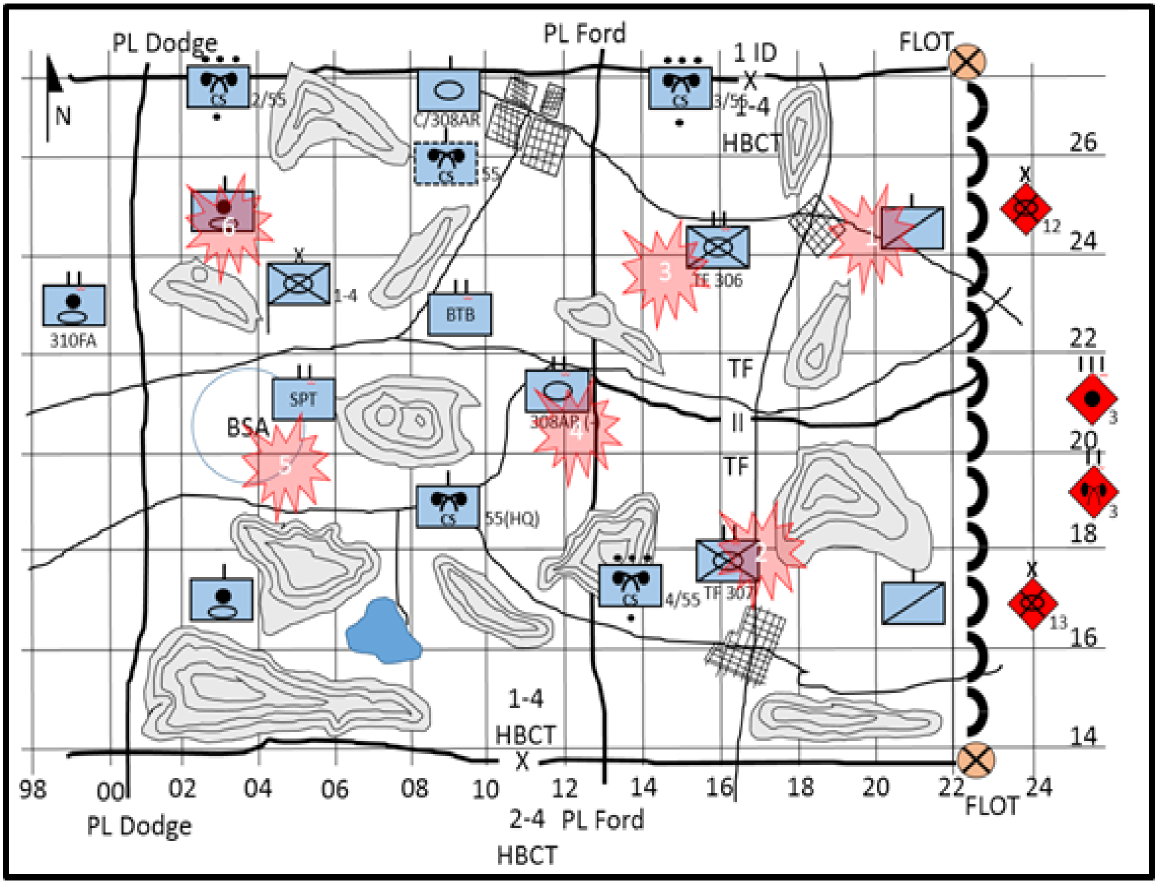

Figure 2. 1-4 Heavy Brigade Combat Team

My priority of support is:
1) 310 Field Artillery (FA) Battery
2) Task Force (TF) 306 Mechanized (Mech) Company
3) Task Force (TF) 307 Mechanized (Mech) Company
4) 308 Armor (AR) Company (-)
5) Scout Company

Task to Subordinate Units:

1) Task: 2nd Platoon-55th Chemical Company (Combat Support) with a reconnaissance team from (1st Platoon) deploy to vicinity 030270 and conduct thorough decontamination of 310 FA Battery.
Purpose: To restore the HBCT's field artillery battery.

2) Task: 3rd Platoon -55th Chemical Company (Combat Support) with a reconnaissance team from (1st Platoon) deploy to vicinity 150260 and conduct thorough decontamination of TF 306 Mech Company.
Purpose: To restore one of HBCT's maneuver elements (primary) and the Scout Company (secondary).

3) Task: 4th Platoon -5 -55th Chemical Company (Combat Support) with a reconnaissance team from (1st Platoon) deploy to vicinity 135165 and conduct thorough decontamination of TF 307 Mech Company (first priority) and 308 AR(-) Armor Company (second priority).
Purpose: To restore one of HBCT's maneuver elements.

4) Task: 55th Chemical Company (Combat Support) (HQ) deploy to vicinity 090180 and

conduct mission command operations.
Purpose: To maintain command and control of all subordinate elements.

Following completion of thorough decontamination operations, the platoons of the 55th Chemical Company (Combat Support) re-assemble vicinity 150260 and the TPUs conduct water resupply at Far Lake (vicinity 0817). 55th Chemical Company (Combat Support) then consolidates for follow-on operations.

Rationale:

Given the limited amount of time (24-48 hours) and decontamination assets, along with the Brigade Combat Team Commander's (BCT CDR) guidance (only conduct thorough decontamination operations), the 55th Chemical Company (Combat Support) must prioritize the efforts of the three organic Decontamination Platoons. Here is my justification for prioritization of decontamination equipment and downgrading units from Mission Oriented Protective Posture (MOPP) 4 to MOPP 2:

1) As the HBCT's longest-range organic combat system, the Field Artillery Battery will be essential for disrupting any attack across the Forward line of troops (FLOT). Being in MOPP 2 as opposed to MOPP 4 will greatly increase the Battery's ability to conduct fire missions and will make it simpler to resupply of the 155mm guns.

2) The two contaminated Mech companies (TF 306 and 307) are the next priority since they will be the first combat forces to engage the advancing enemy forces (12th and 13th Mechanized Armor Brigades).

3) While it is important to decontaminate the armored company (308 AR(-)), it is imperative that the other contaminated units in 1-4 HBCT downgrade to MOPP 2 first. The commitment of the Brigade reserve could be delayed until decontamination operations are complete, improving the reserve's ability to operate on the battlefield.

4) While the Scout Company will require decontamination, it is the lowest priority since it possesses the fewest combat systems. Even while contaminated, the Scout Company could theoretically conduct reconnaissance operations, providing the Brigade Combat Team Commander situational awareness. As time permits, the Scout Company can rotate through the decontamination site for TF 306 (vicinity 150260). Since the Scout Company was contaminated by a non-persistent agent; the effectiveness of the agent will degrade over time (weathering).

West Point Cadets Train to Fight and Win in a CBRN Environment

LTC Keith McManus
United States Military Academy

Thirty nuclear engineering majors and minors from the Department of Physics and Nuclear Engineering participated in an Applied Radiation Detection Exercise at the Aachen MOUT site on Thursday, November 1st. Cadets in NE452, the nuclear instrumentation and shielding course, were required to participate in the exercise as part of a laboratory requirement for the course. They organized themselves into search elements and volunteer leaders developed hasty plans for four scenarios. Teams had to choose the proper detection gear for the scenario, conduct pre-mission equipment and radio checks, and develop a plan for the actions they would take on each objective. The detachment commander, Cadet Andrew Solomonides, and his team chiefs, CDTs Hollis Shoptaw and Mitchell Brown, briefed their plans to COL Mark Weathers, the USMA G3, prior to each team moving down range with their selected radiation detection equipment.

The Department of Civil and Mechanical Engineering also provided the use of a Polaris MRZR, which was employed for ultra-light ground tactical movement as well as to simulate constrained air insertion where seating is limited.

Figure 1. Cadet Mitchell Brown briefs COL C. Mark Weathers, USMA Deputy Chief of Staff for Operations on his team's actions to resolve a scenario involving a large activity (~1 curie) radioactive source based on the following real-world incident that took place in Iraq in 2003.

LTC Keith McManus is the Deputy Director of the Nuclear Engineering Program at the U.S. Military Academy. He has taught courses in Instrumentation and Shielding, Reactor Engineering, Fundamentals of Nuclear Engineering, and Introductory Physics. He has a B.S. in Engineering Physics from the U.S. Military Academy, a M.S. in Health Physics from the Illinois Institute of Technology, and is a Ph.D. Candidate in Nuclear Engineering at the University of California, Berkeley. He was previously assigned as the Future Capabilities Chief for the Technical Support Groups at the Defense Threat Reduction Agency. His email address is keith.d.mcmanus.mil@mail.mil

In addition to the cadets, several other groups participated in the event. Members of the West Point Fire Department HAZMAT team visited the site to observe training and see the advanced radiation detectors. Researchers from Lawrence Berkeley Laboratory and a USMA-bound student studying at UC Berkeley tested and demonstrated scene data fusion (SDF) onboard an unmanned ground vehicle on loan from the USMA Robotics Research Center. SDF combines gamma-ray data with location data acquired by visual and LiDAR sensors to create a 3D map of the radiation field.

During the after action review, cadets stated how much they appreciated the realism of the scenarios, the access to advanced radiation detection equipment on loan from DTRA Contingency Operations Department, the use of the Polaris MRZR, and the chance to execute hasty planning under ambiguous conditions. Additionally, the use of role players speaking foreign languages and the requirement to don tactical gear down range added to the realism and depth of the exercise. The recommendations for improvement will be incorporate to next year's event and should give cadets more hands-on time and possibly involve other entities such as the Department of Military Instruction, the Department of Foreign Languages, and maybe even the Army West Point Grill Club.

After the exercise, Cadet Maxwell Mueller conveyed, "this was by far the best practical exercise that I have participated in in my time as a cadet. This detection exercise gave us the opportunity to apply academic knowledge in real-world scenarios. The ability to use detectors that we have studied in class truly gave us perspective and insight not only into nuclear engineering but also in the complex counter-WMD missions that the military encounters."

LTC Keith McManus, the course instructor and deputy program director, based the scenarios loosely on historical incidents involving radiological or nuclear material. The first scenario involved an informant with knowledge of terrorists with ties to Abu Sayyaf that were trafficking special nuclear material. He employed Cadet Jesson Penaflor, an exchange cadet from the Philippines majoring in nuclear engineering, as an informant and allowed him to speak only Filipino. The search team adjusted quickly and tasked Cadet Reniel dela Cruz to head down range to translate.

Figure 2. A Filipino villager, played by Cadet Jesson Penaflor, shares his knowledge of suspicious shipping casks being stored in the village with Cadet Reniel dela Cruz. Both are exchange cadets from the Philippines.

A plutonium-shipping container with Cyrillic markings provided by the DTRA Nuclear Science and Engineering Center (NSERC) was loaded with sources that mimicked plutonium well enough to cause a medium resolution detector to alert the user to the suspected presence of plutonium. Since no plutonium was actually present, this provided a teaching opportunity regarding false positives and techniques to improve data collection.

The second scenario was based on an actual incident that took place in Iraq in late 2003. Two large activity sources were mistakenly taken when looters removed large poles from a radiological testing site for use in their villages for field irrigation.

LTC McManus used a Quick Erect Antenna Mast (QUEM) on loan from the Logistics Readiness Center to simulate the large pole and secured a source of nearly 1 curie in the end. Cadets were told that an individual reported to a nearby hospital with signs of radiation sickness and interviewed a notional neighbor played by Cadet Demar Gale, a Class of 2020 nuclear engineer, whom only spoke Arabic. The team had to find the source, estimate its activity, and determine the limits of the radiation area where it was safe for public access until the source could be properly shielded and removed.

Figure 3. Cadet Benjamin Goehring and his team await the results from radioisotope identification device, which gives near real-time field presumptive analysis for gamma-ray spectra.

Figure 4. Cadet Nicholas Donze prepares to extend a telescoping survey meter to keep himself a safe distance from the high radiation area that a 1-curie source produces. Cadet Carlan Ivey trails with a handheld Geiger-Mueller counter to monitor the exposure rate.

The third scenario used the Urban Assault Course (UAC) Station 4 multi-story building as a former nuclear research facility. The commander sought to use it as his headquarters for the multi-month mission of surveying the nearby nuclear infrastructure. Cadets were required to determine if the building was safe to occupy. Teams identified and mitigated a dozen sources located throughout the building.

Figure 5. Cadet Ammon Okazaki prepares to enter the former nuclear facility with a Handheld Radiation Monitor (HRM) that will help him detect and locate potential radiation hazards.

Figure 6. Cadet Samuel Oliver uses a smartphone to monitor the radiation detection backpack he is carrying. The same information is telemetered via radio or cellular data back to the mobile command post for real-time situational awareness.

The fourth scenario involved sources that were known to be missing from an inventory of a facility and were suspected of being hid in nearby

Figure 7. Cadet Maxwell Mueller attempts to identify the radioactive source after his teammates initially used larger equipment to detect the presence of a source.

tunnels. The UAC tunnel complex was used and three sources of varying strength and energy were placed in the tunnel system. Cadets had to think through the size and configuration of the detection systems they chose, while still meeting the require-

Figure 8. Cadets Bickus, Gilliland, Goehring, and Solomonides discover elevated gamma-ray radiation readings as they emerge from a leg of the tunnel complex.

Figure 9. Handheld Radiation Detector

Figure 10. CPT Vanderlip demonstrates gamma-ray Scene Data Fusion (SDF) onboard a unmanned ground vehicle (UGV) to cadets at the tunnel scenario to highlight the utility of remote sensing.

Figure 11. Cadets Wineinger, Polen, Parga, and Ryu exit the tunnel complex after mapping the location of radiation sources stored inside.

CBRN Interoperability with ABCANZ Partners: Past, Present and Future

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"The history of the failure of war can almost be summed up in two words: too late.

**** Too late in comprehending the deadly purpose of a potential enemy.***

**** Too late in realizing the mortal danger.***

**** Too late in preparedness.***

**** Too late in uniting all possible forces or resistance.***

**** Too late in standing with one's friends."***

General Douglas MacArthur
United States

In 1947, the United States, Britain and Canada—English speaking nations—developed the "Plan of Effect Standardization" to continue the close cooperation that had developed during WWII between the three armies. These nations came together because they shared a common language and also because they shared a common trust—one built on shared adversity and bloodshed. The original term "ABC" represented the three nations in terms of interoperability. Australia was added and the term "ABCA" came into use after ratifying the Basic Standardization Agreement in 1964. The New Zealand army, who was granted observer status in 1965, was granted full membership in 2006 and the inception of the current term "ABCANZ" became the norm. The importance of the United States Marine Corps' interoperability was highlighted in 2004 when their participation was formalized as an Associate Member.

The purpose of the current ABCANZ Armies program is to accomplish the following:

- Improving interoperability in the land domain using doctrine, technology, human and procedural solutions
- Accepting requirement of a need to analyze interoperability gaps, deliver products, and exchange ideas
- Acting as a mechanism for cooperation and collaboration between Armies, at multiple echelons
- Developing and enduring mutual trust and shared understanding which enhances our ability to fight and win together

The program endstate is for the ABCANZ Armies' to be able to execute routinely integrated command and control within a two star headquarters led by an ABCANZ nation with subordinate ABCANZ force elements, capable of conducting full-spectrum operations immediately upon arrival; within 90 days from national notification. The main effort through 2020 is achieving command interoperability from the Battle Group to the Divisional-level with priority focus areas in Command Information Systems; Information/Knowledge Management; Intelligence, Surveillance and Reconnaissance; Intelligence Fusion; Fires; and Sustainment.[1]

Although not a main effort, Chemical Biological Radiological Nuclear (CBRN) interoperability, is a key supporting effort and is just as important as the above named priority focus areas. The “red line” for the use of chemical weapons has been crossed in contemporary operations to the point where their employment in intrastate conflict appears to be almost expected. Countering Weapons of Mass Destruction (CWMD) operations and operations in a CBRN threat environment significantly add complexity to an already complicated coalition interoperability problem. For example, the difficult task of intelligence fusion may be impossible to overcome due to international laws or treaties such as Treaty on the Non-Proliferation of Nuclear Weapons (NPT). Coalition forces operating in a nuclear threat environment may find it difficult, if not impossible, to share information between nuclear weapons states and signatories of the NPT while conducting CWMD missions. Likewise, sample management or chain-of-custody for suspected chemical or biological agents may be limited due to the Chemical and Biological Weapons Conventions. CBRN contaminated environments may also hinder Coalition Combat Services Support and Health Service Support operations due to one or more nations in the coalition not having the proper personal protective equipment. Many of these incidents may occur at the operational or tactical level where CBRN subject matter expertise are lacking. For these reasons, establishing a coalition Counter CBRN Fusion Cell early in the planning and execution phase of training and real world missions to advise the Joint Task Force (JTF) Commander will enhance ABCANZ partner forces’ ability to conduct full spectrum land operations in any CBRN threat environment.

“There is at least one thing worse than fighting with allies—and that is to fight without them.”

Sir Winston S. Churchill

United Kingdom

The United States (US) has never fought a major war single handedly and history demonstrates the challenges of coalition warfare. During the first Gulf War, the US assembled and mobilized the forces of 38 nations. Even with the quick success of the conflict, difficulties in employing an effective fighting force were evident. Interoperability issues of coalition warfare surfaced during the buildup phase of the war and continued throughout. An example of interoperability could be when Australia decided against sending some of its F-111C aircrafts because of issues with jam-resistant radios, electronic countermeasure pods, and Identification-Friend-or-Foe (IFF) equipment, which were deemed too costly.

More than a decade after the first Gulf War, during Operation Enduring Freedom (OEF) in Afghanistan, coalition friendly fire led to several fatal incidents. The Americans killed approximately 10% of the 144 Canadians who have perished in OEF.[2] Like the African Operations of the 1990s and previous conflicts, interoperability problems continued among multinational forces. The equipment multinationals brought with them was not interoperable and problems arose in situations that required one national contingent to cross over borders to reinforce another nation's forces.[3] Intelligence fusion and exchange of information in coalition warfare is also crucial to containing fratricide. Nevertheless, information and knowledge management between representatives of coalition states remains challenging due to compatibility between systems.

During the invasion of Iraq in March 2003, incompatibility in coalition collaboration caused more issues and, in some situations, led to deadly consequences. Australian Hornet pilots aborted several dozen bombing missions—ordered by their American commanders—because of incompatible rules of engagement. The friction developed due to a misaligned understanding of what were legitimate military targets and that dropping their bombs would result in an alarming number of civilian casualties. In the same month, two American A-10 fighter pilots bombarded four British reconnaissance patrol vehicles even though the vehicles had signals that they were coalition forces. The fratricide between the British and Americans—two close allies—was worsened as the convoy and the pilots operated on different radio frequencies.[4]

CBRN interoperability encountered similar challenges during Operation Iraqi Freedom (OIF). After the attacks on September 11th, 2001, the international community quickly offered to support the United States in its response. The United Kingdom (UK) Permanent Joint Headquarters (PJHQ) sent a large planning contingent to Tampa and later the PJHQ deployed with the U.S. Central Command (USCENTCOM) forward headquarters in Qatar. Other ABCANZ partners joined as liaison, planners, and observers. The UK Joint Nuclear Biological Chemical (NBC) Regiment and Sampling & Identification of Biological/Chemical Agent (SIBCRA) teams were among the operational forces that participated in combat operations. The interoperability issues experienced in previously described coalition conflicts again manifested. Difficulties arose with hazard response, CBRN reconnaissance, sampling and sample management and evacuation, and CBRN warning and reporting. CWMD Exploitation, border interdiction and counter-Scud missions played an important role in addition to traditional passive defense. Each ABCANZ partner came with capabilities to offer to these missions as well as support requirements.

The USCENTCOM CBRN support structure was formed from across the coalition. The USCENTCOM J3 CBRN Cell received a UK deputy and the PJHQ received US liaison. Like today, compatible automated warning and reporting software was unavailable and the NATO CBRN messages had to be manually transmitted. USCENTCOM established a CWMD Coordinating Cell that met twice daily. It was comprised of the Joint Staff, SG, component liaison officer, intelligence community, special operation forces, chemical and biological weapons scientists, and engineers from the UK. These coordination meetings were useful to leverage expertise and respond to conflicts in national policy.

While large scale CBRN exposure did not occur during the conflict, some of the issues identified early in OIF, such as dress states, vaccination policy, contaminated remains, and decontamination standards remain unresolved today. That said, many of the processes used today for WMD exploitation and elimination were conceptualized and tested by the USCENTCOM staff. While the JCBRN Coordinating Cell addressed some shortfalls, a true Joint Counter CBRN fusion cell would have better addressed national requirements within a JTF. It is with this vision, protecting our coalition forces, that the ABCANZ Counter CBRN project was proposed to ABCANZ National Directors.

In a pristine operating environment—absent of any CBRN threat and fighting against a limited adversary—interoperability between coalition forces is difficult but manageable. Against a peer or regional adversary with a range of CBRN capabilities, not having interoperability, particularly CBRN compatibility between allied nations, may have deadly consequences—thousands of lives lost, defeat on the battlefield, and National Interests jeopardized. A capable adversary will use CBRN capabilities to exploit to any seams in ABCANZ Armies' Command Information Systems; Information/Knowledge Management; Intelligence, Surveillance and Reconnaissance; Intelligence Fusion; Fires; and Sustainment. For example, adversaries, may mix conventional fires with chemical weapons to exploit vulnerable coalition members or complicate and delay counter-battery. Adversaries may also sicken air or sea port of debarkation employees with biological contamination to slow Reception, Staging, Onward Movement & Integration (RSOI), rapid resupply, or evacuation operations. A more capable enemy may even employ high radiation contamination as a form of area denial. ABCANZ forces need to continually work towards the endstate of interoperability in order to mitigate these vulnerabilities.

Coalitions are complex and maintaining one requires constant interactions between political and military leaders of different nations across the full spectrum of operations from all levels of war. As challenging as a coalition may be to manage, there are significant advantages for creating one in response to a threat. A coalition may provide military advantage and/or political benefits. In the past, joining forces brought numerical military advantage to a coalition. For example, Europeans came together against Napoleon Bonaparte in the early 19th century. No single nation could defeat Napoleon on the battlefield. The Allies also needed to come together to defeat Nazi Germany and Imperial Japan during World War II.

In future wars, the advantage of forming a coalition may be entirely political in nature. For example, coalition objectives—particularly CWMD objectives—may be focused on political rather than military objectives. The Proliferation Security Initiative (PSI) brought together the International Community to interdict shipments of WMD, their delivery systems, and related materials. PSI training exercises and boarding agreements have allowed the US to achieve its political CWMD objective by improving interdiction efforts with the international community.[5] Due to international laws, the US could not achieve this CWMD objective on its own. Forming a coalition brings a form of legitimacy within the international community that allows members to conduct certain CWMD operations that a single nation could not or would not undertake unilaterally.

Libya's decision to eliminate its WMD program is another example how a coalition can come together to achieve a CWMD objective. In this case, the U.S. and UK's joint efforts, especially in the area of intelligence sharing, allowed policy negotiators to persuade Colonel Ghadafi's regime to disclose and dismantle all WMD programs.[6]

In theory and in practice, nations sharing the burdens of fighting increases the likelihood of prevailing by having more troops and resources available in addition to enhanced legitimacy to prosecute the war. From the U.S. perspective, these benefits may be limited. In certain conflicts, coalition warfare increased the burden of fighting to the U.S. and decreased the likelihood of winning, while not enhancing the legitimacy of the campaign at all. In some cases, vast technological differences between the U.S. and other nations has caused an over-reliance on the U.S.' most capable units performing the most difficult missions. Nevertheless, coalition forces must continue working together to overcome differences across the Joint Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities-Policy (DOTmLPF-P) in order to improve coalition armies' ability to shoot, move, communicate and sustain on the battlefield while preventing fratricide. In principle, interoperability, at all levels of command will lead to success in a range of military operations.

Mutually beneficial alliances and partnerships are crucial to our strategy, providing a durable, asymmetric strategic advantage that no competitor or rival can match….Every day, our allies and partners join us in defending freedom, deterring war, and maintaining the rules which underwrite a free and open international order.

National Defense Strategy of the United States of America 2018

ABCANZ Armies routinely conduct operations within the structure of an alliance or coalition. An adversary may employ CBRN weapons against forces in an effort to weaken, divide, or destroy the multinational efforts. The threats include home-made (non-state) toxic hazards, emerging threats using advanced scientific processes, to conventional weapons of mass destruction (WMD) stockpiles. However, over the past 17 years of counter-insurgency operations, CBRN knowledge, skills, experience and equipment has lagged in operational priorities, such that ABCANZ Armies general purpose forces' CBRN readiness posture has atrophied. All ABCANZ Armies' have recognized this issue, which they are countering through modernization program and strategies.

ABCANZ Armies have established policies, procedures, and doctrine for ensuring the survivability of their forces to operate in a CBRN threat environments as a deterrent to adversary employment of WMDs. The ability of the ABCANZ forces to operate in CBRN environments must be known and assessed on a regular basis according to the nature of the operating environment. Chemical, biological, radiological, and nuclear are components that are threats or potential hazards with adverse effects in the operational environment. Adversaries are not constrained by legalities of nations or western armies, the asymmetric advantage that can be gained by small threat groups having CBRN capability is disproportionate. Threats and hazards have the potential to cause personal injury, illness, or death; equipment or property damage or loss; or mission degradation. When an improvised device also utilizes a CBRN hazard in order to produce effects, it becomes an improvised chemical, biological, radiological device (ICBRD). As conflict moves into the urban and littoral environment, there is an increased preponderance of industrial facilities which provide non-weaponized CBRN threats. Commanders and staff need to understand and fully grasp the implication associated with each of the CBRN threats and hazards to fully grasp the influences each has on the decisions making process.

JTF Commanders and their staffs must consider CBRN threats and hazards during integrating processes (Intelligence Preparation of the Battlefield (IPB), targeting, risk management) and continuing activities (liaison, information collection, security operations, protection, terrain management, airspace control). The integrating process of IPB enables CBRN planners to address threats and hazards through operational and mission variables which informs commanders on how to limit effects of the contamination on friendly forces. The continuing activity of information collection should direct reconnaissance and surveillance towards confirming CBRN specific priority intelligence requirements (PIRs). These actions are critical to the CBRN integrating activity of hazard awareness and understanding which supports the maneuver commander's ability to seize, retain, and exploit the initiative in order to maintain a relative position of advantage on the battlefield.

In order for ABCANZ Armies to be effective, JTF commanders at all echelon will need trusted CBRN counsel and an appreciation of coalition members' CBRN capabilities and limitations, as well as an understanding of their domestic political interests and motivations for being in the coalition. Commanders will need to maintain a sharp focus and work diligently to ensure the cohesion of the coalition is preserved under a CBRN threat environment and not allow adversaries to exploit any real or perceived CBRN vulnerabilities. A capable JTF commander will need to be able to make decisions about a wide range of competing priorities concerning their own nation and those of the contributing nations. The decision making—difficult under conventional conflict—will be even more challenging under a CBRN threat environment. JTF commanders at all echelon will need to determine clear CWMD objectives that are in line with the political intent of the various nations within the coalition, and must also ensure these are well understood by all members. In some cases, the JTF commanders may need to compromise to achieve the objective—ensuring that they do not compromise on the objective of achieving victory. Having a coalition C-CBRN Fusion Cell to provide trusted council to the JTF Commander is critical to future mission success.

"If you want new ideas, read old books. If you want old ideas, read new books."

Ivan Petrovich Pavlov
New Zealand

Historically, CBRN staffs were embedded in HQ J2 cells. The United States embeds CBRN staff in the J3 and J5 staffs. The CBRN reporting EXERCISE BRAVE BEDUIN, a multinational exercise of NATO nations, and the recent removal / disposal of Syrian chemical weapons (CW) stockpile has demonstrated a need to regenerate counter CBRN specialist augmentation within operational HQs. Figure 1 depicts a notional C-CBRN Fusion Cell. The cell is scalable and task-organized to respond to any CBRN incident. The function of the coalition cell is to provide commanders and staff at echelon the CBRN expertise necessary to conduct land operations, in a potentially contaminated operational area. Furthermore, such a cell overcomes the problem of using different CBRN warning and reporting systems to conduct attack and incident warning to coalition forces. The C-CBRN cell will support

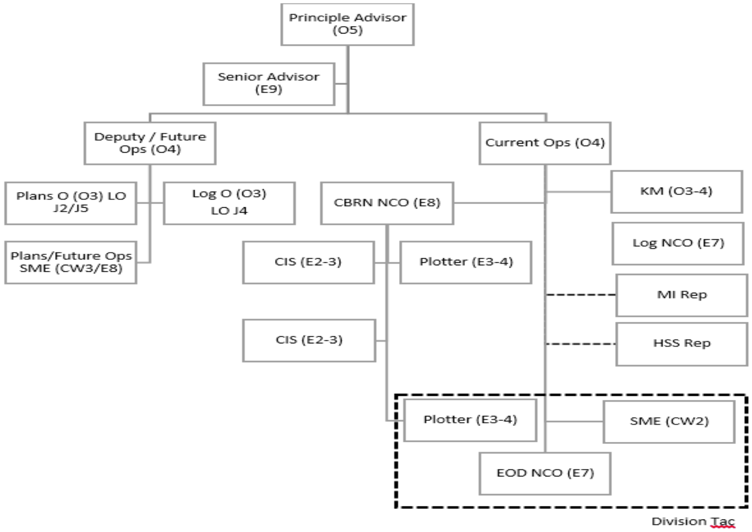

Figure 1. Notional Coaltion Chemical, Biological, Radiological, and Nuclear Staff Fusion Cell

coalition headquarters operations at the two-star level that are not adequately addressed in NATO doctrine. This adhoc cell operates in a CBRN threat environment that may involve complex, deliberate or contingency operations executed in any environment to:

(1) Facilitate accomplishment of overall military objectives
(2) Minimize the effects of a CBRN incident on combat operations
(3) Support conventional forces executing limited CWMD missions
(4) Provide assistance to a civilian populace affected by a CBRN incident
(5) Facilitate transfer to stability operations

Developing concepts, and modernizing doctrine or equipment is not enough. ABCANZ Nations must also continually assess and validate concepts in a dynamic warfighting exercises. As a proof of principle, the ABCANZ program has develop a Concept of Employment for a C-CBRN Fusion Cell as described above. ABCANZ nations validated the concept in a STAFFEX (Figure 2) and will assess the CONEMP in a Joint Warfighting Assessment. Below are the perspectives of each ABCANZ on the importance of coalition warfare and CBRN interoperability past, present and future.

The STAFFEX highlighted that interoperability gaps can develop in equipment and training if agreed standards are not followed. It is essential that ABCANZ nations ensure gaps once closed do not re-open and create integration issues for future coalition activities. Standards need to be advertised and remain accessible to those involved in equipment acquisition and training, with processes in place to ensure these standards are followed and remain current. CBRN national caveats must be addressed throughout all phases of operations and each ABCANZ nation's CBRN capabilities must be understood prior to a coalition

Figure 2. ABCANZ Staff Exercise

deployment in a CBRN threat environment. The STAFFEX reinforced the need for interoperability in dress states, vaccination policy, contaminated remains, and decontamination standards.

One axiom remains the most important element to success of any coalition operations, and the STAFFEX was no exception. The quality of the people matters. Not everyone can handle the complexity of a coalition CWMD operation under pressure and in a high threat, time-constrained environment. The observation is not new or profound, but remains fundamentally important. For example, during the C-CBRN Fusion Cell STAFFEX, New Zealand's (NZ) Lt Col McDonald, Commander of the NZ 2nd Engineer Regiment, quickly took charge of the ad-hoc cell and overcame technical and national boundaries to achieve the cell's daily complex tasks. New Zealand, the smallest member of the ABCANZ coalition, had the least to offer in terms of resources and equipment. Nevertheless, the quality of the people they brought to the fight was on par with the largest and most well-resourced nation. The coalition STAFFEX clearly demonstrated the need for resilient, complex problem solvers, who have interpersonal skills that transcend national boundaries. Lt Col Terry McDonald and his team from New Zealand (MAJ Michael Pettersen, Capt Kenneth Long, and W02 Matt Doyle) have these qualities. They were adaptable (Engineers able to support CBRN operations), they were versatile (able to lead, follow and provide subject matter expertise where needed), and agile (able to adapt quickly when the mission and requirement changed).

"The process through which this team has developed a CONEMP for a C-CBRN Fusion Cell is an exemplar of how multi-national cooperation can rapidly deliver enduring change for the warfighter. From conceptual development, through the STAFFEX, and onto validation within a multinational training environment, the team has developed processes that must be taken forward as best practice within the realm of developing interoperability solutions. In this critical area of conceptual development the team must be commended for their work and the product ready to be employed as needed by ABCANZ Armies."

COL A.J. Maskell (UK)
Chief of Staff ABCANZ Program Office

The STAFFEX demonstrated the speed at which the five armies can come together and operate towards a common purpose. In terms of CBRN interoperability, ABCANZ nations are de-conflicted and moving toward compatibility. The exercise provided everyone involved the intellectual environment that will prepare them for the challenges of the upcoming JWA and potential CWMD operations and operations in a CBRN threat environment. In order to achieve full compatibility, ABCANZ nations must regularly integrate coalition CBRN objectives, as described in the CONEMP, into national collective training and multinational exercise such as TALISMAN SABRE and HAMEL STAFFEX. Nations must include CBRN considerations in exercise planning cycles from initial conception. The final report from the project will inform CBRN change initiatives across the DOTmLPF-P, resulting in a validated CONEMP that will influence NATO and the

Figure 3. ABCANZ Staff Exercise Participants

larger CBRN community of interest. Through the Counter CBRN Cell Fusion CONEMP development, STAFFEX validation, and Joint Warfighting Exercise, the ABCANZ Project Team develops and maintains an enduring mutual trust and shared understanding with coalition partners which enhances the US Army's ability to fight and win tonight.

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Major Pettersen (New Zealand) was commissioned in 1991. He deployed on assignments in Malaysia, Fiji, Europe, Sinai, Lebanon, Israel, Egypt, UK, USA, Sri Lanka, Canada, and UAE.

MAJ Alex Prentice (Canada) is the SHIELD-CBRND desk officer at the Canadian Army Doctrine Centre. An Artillery officer, he attended the University of Guelph, Ontario.

The Treaty on the Prohibition of Nuclear Weapons: Treaty Status at Its One Year Anniversary

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After four weeks of negotiation, the Treaty on the Prohibition of Nuclear Weapons opened for signature on September 20, 2017.[1] Led by the International Campaign to Abolish Nuclear Weapons, which later won a Nobel Peace Prize for its work, the Treaty seeks to establish an international norm against nuclear weapons use, testing, stockpiling, and the encouragement or assistance in the development of nuclear weapons programs. The Treaty will enter into force after 50 states have ratified or acceded to it.[2] As of October 1, 2018, 19 nations had ratified the Treaty.[3] The likelihood of the Treaty ever entering into force, however, is remote.

Treaty negotiations were boycotted by all of the current nuclear weapons states, and many states that fall under nuclear umbrellas.[4] The US, alleged to have led the boycott, refers to the Treaty as "wholly unrealistic" in the current Nuclear Posture Review.[5] Without the support of nuclear weapons states, the positive impact of the Treaty is of course limited. While the Treaty could ultimately serve to establish a customary international law norm against nuclear weapons use, the persistent objector doctrine creates an exception for states that have consistently protested a newly emerging rule of international law.[6] It is unlikely, then, to have any impact on future nuclear weapons use. There is, however, the potential for the Treaty to have a negative impact on nuclear safeguards and security. Such potential has persuaded some states—such as Switzerland—to refrain from ratifying the Treaty.[7]

The Treaty, characterized as an attempt to "reclaim political agency," falls short of its ideal in a number of respects.[8] The Swiss Federal Department of Foreign Affairs' Report of the Working Group to analyse the Treaty on the Prohibition of Nuclear Weapons indicates some of these shortfalls in its argument against joining the Treaty. Switzerland, which is not a party to NATO, has a long history of supporting international humanitarian objectives, being the repository for the Geneva Convention and host state of the International Committee of the Red Cross. Noting that "[g]eopolitical and security considerations were explicitly not a priority" in the Treaty negotiations, the Swiss report describes accession to the Treaty as risky in that it would "limit Switzerland's freedom of action" from joining in a "defence alliance which is based on nuclear deterrence" should that ever become an

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option for self-defense.[9] The report also notes that any impact the Treaty may have on disarmament "is likely to happen in liberal democracies with highly developed civil societies rather than in states with little to no critical public opinion" representing "a risk that western nuclear states and their allies would be militarily weakened" in comparison to non-Western nuclear weapons states.[10] It is further unclear how the Treaty will interact with the Nuclear Non-Proliferation Treaty (NPT), the cornerstone of nuclear nonproliferation law internationally, or the Comprehensive Test Ban Treaty. There is some concern that the Treaty will detract from the maintenance of its predecessors, "encouraging fragmentation and further polarization."[11]

Finally, the Swiss report notes that the Treaty does not require signatories to adhere to the IAEA's additional protocol establishing verification procedures.[12] This is perhaps the most detrimental aspect of the Treaty, as it works against international nonproliferation norms. In a future, nuclear-free world, the incentive to develop nuclear weapons may, paradoxically, be higher than it is now.[13] This necessitates stringent safeguards requirements to verify the absence of undeclared nuclear activities and material. The NPT requires signatories to maintain safeguards agreements, but adherence to the Additional Protocol—which addresses shortcomings in the comprehensive safeguards agreement initially established by the IAEA pursuant to the NPT—"has been an ongoing argument in IAEA and NPT fora" by a number of states that refuse to accept the more stringent safeguards requirements.[14] Rather than require the highest safeguard standards for nations acceding to the Treaty, it simply requires of non-nuclear weapons states that they maintain the IAEA safeguards they are obligated to at the time the Treaty enters into force.[15] No nuclear weapons state is likely to dismantle its nuclear stockpile—as required by the Treaty—without the most stringent verification regime adhered to by all state parties to the Treaty. Moreover, this provision could clearly work against persuading signature of the Additional Protocol by states that have resisted pursuing it, and ultimately the nonproliferation goals the Additional Protocol is meant to achieve. As John Carlson, a counselor to the Nuclear Threat Initiative and former Director General of the Australian Safeguards and Non-Proliferation Office, has noted, "[a]ny state that refuses to accept the most effective safeguards standard is not serious about achieving disarmament." And, further, "[d]isturbingly, this could indicate that some of the states concerned want to keep open a nuclear option."[16]

The U.S.' 2018 Nuclear Posture Review reflects these concerns, stating that the Treaty seeks disarmament "without the prerequisite transformation of the international security environment" and that it could "damage U.S. security and the security of many allies and partners who rely on U.S. extended nuclear deterrence."[17] This is in line with the Swiss position against ratifying the Treaty, that "it would be counterproductive to jeopardise established forums and principles without effectively advancing the core concern of further disarmament measures."[18] Many challenges must be overcome to set the stage for a world without nuclear weapons. The negotiation of the Treaty on the Prohibition of Nuclear Weapons, concluded after only four weeks, while well-intended, could ultimately have adverse consequences for overcoming those challenges. It is unclear if the Treaty ultimately comes into force, what, if any, positive impact it may have.

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Employment Obstacles of Title 10 Responders to Homeland Disasters: A Qualitative Case Study

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Background

As a former Defense Support to Civil Authorities (DSCA) cell officer in charge (OIC) at the Joint Task Force-Civil Support (JTF-CS) in Fort Eustis, VA, I learned many lessons from a Title 10, 32, and 14 perspective on how each service or title authority deploys and employs their forces. In the past, I have either planned or deployed to most of the annual National Special Security Events (NSSE) that are currently being supported. I have grown to appreciate the joint planning process with sister services as well as federal, state, and local responder communities. Supporting these NSSEs takes coordination and dedication to ensure that deployment and employment plans are ready to be executed with several contingencies in place. Almost always, staff planning for NSSEs requires coordination among military and civilian responders from the federal, state, and local responder community. However, all of the staff planning for NSSEs and other events such as hurricanes, snow storms, floods, and other natural disasters require quick, agile planning and coordination usually within weeks or days before or after an event. Lessons learned from Hurricane Katrina highlighted many failures of command authority, command and control, Posse Comitatus Act (PCA), Robert T. Stafford Relief, Emergency Assistance Act (Stafford Act), and Economy Act (EA) conflicts.[1] Nevertheless, the military and civilian responder communities banded together to mitigate human suffering and prevent further damage to property. Despite the lessons learned from Hurricane Katrina, along came Hurricane Sandy or "Super Storm Sandy" as some news agencies called it. Hurricane Sandy swept across the northeastern United States and caused damage along coastal communities with more than thirteen feet of storm surge.[2] New York Harbor had 30 foot waves and in Atlantic City, New Jersey, the waves topped 40 feet.[3] To have seven states receive more than five inches of rain in such a short time is rare.[4] Hurricane Sandy is a good example of just how destructive a natural disaster can be with overflowing waterways that caused floods, destroyed homes, businesses, roads, and caused basic utility infrastructure damage. This researcher likes to think that the lessons learned from Katrina would have influenced the response to Sandy. One

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Command and Control lesson learned was regarding unity of effort for which the mitigation measure was to develop the Dual Status Commander (DSC) concept.[5] BG Swezey from the State of New York National Guard was the first "no notice" DSC for Hurricane Sandy.[6]

After moving from JTF-CS and starting a new position at Fort Leonard Wood, Missouri, I began a three-year study to define the problems of Title 10 responders and contemplate a suitable and feasible solution.

Research Method

A qualitative study was chosen using a holistic single-case study design to analyze military and civilian perspectives to answer four questions:

Q1. What were the constraints or obstacles during the Hurricane Sandy response of Title 10, 32, and 14 responders?

Q2. How are the constraints or obstacles different according to Title perspectives?

Q3. How did the Title 10, 32, and 14 military and civilian responders adapt to overcome the restraints and obstacles during the Hurricane Sandy deployment?

Q4. How do military leaders and staff members from Title 10, 32, and 14 with their civilian counterparts at the command, supervisory, as well as the tactical level responders of government plan to mitigate obstacles for future natural disaster responses?

Due to time and travel constraints, a semi-directed/structured telephone interview survey was selected as the most optimal means of gathering data over great distances. All interviewees and their specific agencies provided signed informed consent forms/permissions prior to any interview.[7] Each individual interview was recorded and then transcribed into social science software program called NVivo. The transcribed data was placed in the program, analyzed, and interpreted into main themes and sub-themes. Figure 1 illustrates how the study participants were divided into Title authorities and types of civilian responders and planners.

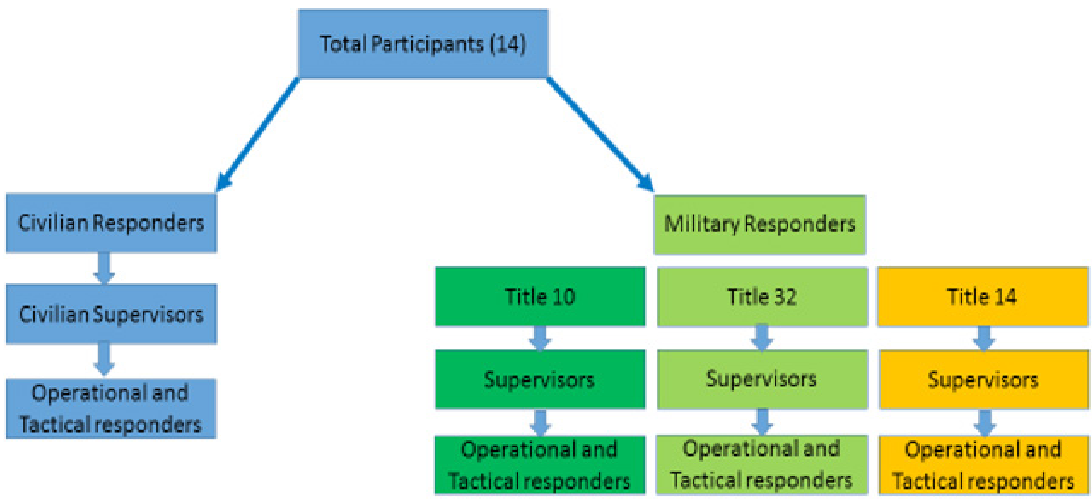

Figure 1. Distribution of Survey Participants

Main Themes

Five main themes were discovered. However, they are not independent from one another. For instance, legal constraints of Title 10 are codependent on the main theme of inter/intra-service communications and mission assignment procedures. The main theme threshold was more than 51% of the participants mentioned it in their survey answers. The five main themes and the frequencies that they occurred are presented in Table 1.

Survey Results

Main Themes	Frequency of Occurence	Percentage of Population thet Mentioned the Theme
Political Environment	88	100%
Inter/Intra Service Communication	48	85%
Federal Capabilities Pushed Forward without Proper RFAs/MAs	48	79%
Legal Constraints (Title 10)	45	72%
Mission Assignment Procedures	38	64%

Table 1. Main Themes

Political Environment

The most prevalent theme with participants was the constraints or obstacles that the political environment caused. Several high-level decisions were made that affected all the military and civilian responders in New York and New Jersey. One might think that political pressure would only affect the strategic and operational force, but the political environment also affected responders at the tactical level as well.

Lack of Inter/Intra-Service Communications

The lack of inter/intra-service communications was the second most prevalent response from participants. However, data analysis leads this researcher to conclude that most misinterpretations or no communications were made at the strategic or operational response levels. It appeared that at the tactical level, where most of the response work happens, communications issues were almost a non-issue.

Title 10 Forward Deploying was Misunderstood

The Title 32 and civilian perspective of Title 10 assets moving to Fort Dix was misunderstood by Title 32 and civilian responders and planners. Most of the participants who were not Title 10 looked at the forward deployment as the military or the federal government overstepping the bounds that Title 10 require for official request for assistance or forces and a Presidential Declaration.

Legal Constraints

Unfortunately, because of fiscal constraints as well as Posse Comitatus, Title 10 military cannot often take part in large DSCA training exercises and real-world exercises. Fiscal constraints and Posse Comitatus further separate Title 10 from performing law enforcement tasks. The overall civilian perception of Title 10 was that given the past 10 years of fighting a war, civilian planners were not sure that Title 10 military would know how to handle US citizens, like the use of force continuum, which is a legal or law enforcement requirement when dealing with US citizens who have certain constitutional rights.

Mission Assignment Procedures

There are a variety of different tasks and deliverables that staff planners develop for response solutions where leadership pairs Title 10 Soldiers with Title 32 Soldiers. Although combining different Titles into various staff sections can develop better courses of actions, the consensus of all participants was that the integration prolongs the time it takes to make response decisions and for implementation.

Several participants also stated that mission assignments take too long to produce and come back down from the Title 10 chain of command; Title 10 mission assignment processes are too slow to keep up with the fast pace of the Title 32 and 14 response operational tempo.

Findings and Implications

There have been researchers who studied Hurricane Sandy and the mishaps that plagued military forces deployed in support to civilian authorities.[8,9,10,11] Military personnel, as well as civilian responders, saw adversity and had to overcome obstacles when attempting to organize a response to mitigate suffering and further property damage. Due to the possible large magnitude of homeland disasters, it is imperative that the local, county, state, and federal assets be prepared to mitigate the devastating effects to people and property.[12]

Political Environment

Based on the findings, the researcher discovered that the primary obstacle of Title 10 was the political environment. All of the participants highlighted the need to restrict political interference when inappropriate requests were not for the overall good of the response operations. Federal, state, and local responders trained to respond to natural and man-made disasters in conjunction with federal and state military forces were the experts in planning and execution. Participants gave personal accounts of how the political environment adversely affected response operations. Although, some participants recognized the political pressure as an obstacle and dealt with situations as they developed, others were in circumstances in which the political pressure inhibited timely decisions, slowed response times, and wasted financial resources. These situations, according to some participants, were some clear violations of the Stafford and the Economy Acts. The results presented in this study are consistent with current DSCA research that (a) strategic leadership can hamper response operations based upon incorrect or mismanaged information and (b) despite the enactment of the Stafford Act, political pressure can make Title 10 branches of service execute operations within the homeland without the proper Stafford Act request for assistance.[13,14,15,16,17] Additionally, the results are consistent with other DSCA researchers that have identified restrictions of Title 10 authority. Lastly, the restriction of Title 10 authority was, according to many participants, unnecessary.

Lack of Inter/Intra- Service Communications

The second main theme was Inter/Intra-service communications mentioned by 85% of the participants. Two separate focuses of this theme emerged: The need for standardized communication equipment, and the necessity for military branches to communicate with each other for mission command and economy of force. The findings corroborated the fact that communications are an obstacle not only for the military units, but also for civilians. Through the standardization of responders' lexicon, by using the National Incident Management System (NIMS) and the Incident Command System (ICS), responders from different locations were able to speak the same langauge and fielding compatible communication equipment to enable effective communication between military and civilian personnel is already a solution.[18] However, current financial constraints have made the implementation of this solution slow. Researchers found that communication problems are consistent with the findings from this study between agencies and services.[19,20] This gap reinforces the requirement to plan for the future by learning from past mistakes.

Legal Constraints

The third theme was the fact that the federal government, specifically the Title 10 forces, was forward deployed and actively looked for mission assignments (MAs) to execute. Although active Title 10 forces can deploy to a federal installation without an MA or Request for Forces (RFF) from the local, state, or federal emergency management systems, this movement was looked at by state and local responders as leaning too far forward without employment requests by the civilians and Title 32.[21] This situation did not violate any state or local statute as it could be considered prepositioning or even training—a situation that happens all the time. However, Title 10 cannot employ their capabilities without proper requests from local, state, or federal civilian responders unless the unit deploys under the Immediate Response Authority (IRA).[22] This requirement is an authority that has a time limit associated with the Commander's IRA. Other authorities discussed the limitations of the federal military during DSCA missions but did not explain the differences between deploying to an operational area and employing federal capabilities within the operational areas.[23,24,25,26]

Understanding the distinction between deployment and employment is critical for non-Title 10 responders and emergency managers to avoid any conflicts with the Stafford and possibly the Economy Acts.[27] Through analysis of the discussions with interviewees, it became clear that the federal forces were "going out and looking for MAs to be conducted by Title 10"—a practice that is not standard for these Title 10 responders.[28] The standard practice for Title 10 employment to a response, in accordance with the Stafford Act, is to allow the statutory framework governing the Act of declaring Presidential emergencies to take place.[29] Then, after the Presidential declaration of emergency is made, federal resources may be utilized pursuant to the emergency declaration.

Seventy-nine percent of the participants clearly depicted several instances of trying to influence the MA process to get Title 10 resource missions. The reason for this high percentage was not because the state responders could not handle the response, but rather it was the political pressure forcing the issue. The pressure came from the highest levels of government to the military leadership at the tactical level. Although political leaders might have had good intentions, the constant push to get Title 10 MAs inhibited planning, making mission execution more difficult for the Title 32 and civilian responders.

Mission Assignment Procedures

The last theme identified through analysis was the MA procedures. The MA process through the Title 10 channels seems calculated and methodical for several reasons. First, the process ensures that the requested mission is validated as being within the capabilities and legal authority for the unit of execution. Second, the process acts as an accounting tool for expenditures of resources and future monetary reimbursements. And finally, the process is codified within the ICS and NIMS for requesting capabilities and resourcing the request through local and state first before Title 10 resources are used.

However, the downside of the Title 10 process is that the MA process is too rigid and, in some cases, takes too long to change in order to obtain Title 10 resources. An example of an MA process being too hard to change and taking too long occurred when an Army Reserve unit was tasked for several days to pump out water and sludge from underneath buildings. The unit completed the MA earlier than expected. The unit went back to a staging area to standby for further orders. The DSC of New York wanted to repurpose this asset to something else. However, the process took so long that the MA was eventually assigned to another unit while the Title 10 unit was on standby. This example demonstrated a non-effective and non-efficient use of the Title 10 personnel and equipment. Eventually, other Title 32 resources had to be diverted to the same task. This diversion was a waste of time, man hours, and money. Other researchers have expressed difficulties with the Title 10 MA process and the proper use of their authority and the implications from a victim's point of view are delayed responses to save lives and prevent further property damage.[30,31,32,33,34]

Recommendations

The purpose of this research was to examine the perspectives of Title 10 forces who respond to disasters to gain a better understanding of the obstacles that they face. It is important to note that the responses to the research questions from civilians mirrored those of their military counterparts. As such, the data were validated.

This researcher discovered the importance of communication and how political influencers can positively and negatively affect response operations. The researcher has determined that elected and appointed officials can often hamper response operations regardless of good intentions. The ICS was designed such that the units that use it would have a common lexicon and would understand the duties and responsibilities of each response person, and specific universal unit classifications.[35] This system is like the structure of a military chain of command but adapted to suit the duties and responsibilities of civilian response personal. When responders adhere to the ICS, it limits any influences that could negatively affect a response. There is no avoiding political influence, but sticking to the NIMS and the ICS would potentially mitigate some of the negative influences, at least at the tactical level.

The second theme revealed was overcoming Inter/intra service communications problems. This theme was divided into two categories: the actual equipment used to communicate between services and understanding normal military protocol. The simple solution is to standardize the equipment used during DSCA missions. However, understanding the fiscally restrained acquisition process, and getting the same radios, software, and training for all disaster response units would take time and would need to be budgeted for several years. The United States Northern Command (USNORTHCOM) is responsible for the United States and the military actions coordinated within its political boundaries. Understanding who owns the operational response space and maneuvering within it is standard military protocol. For instance, the Navy and Marine Corp deployed and employed forces to NY and NJ areas without an MA or RFF. These movements and employment were wrong according to the majority of participants and violated several Acts. However, to explain how wrong this movement and employment of Title 10 troops were, all a person would have to do is move the scenario to the United States Central Command (USCENTCOM) area of responsibility (AOR). The USCENTCOM AOR is commanded by a Combatant Commander and within that region units passing through or having an operational need to operate within the designated US CENTCOM boundaries must communicate their intent to the commander in charge of that area or movement cell and coordinate the movement with other assets already within the area. These standard military movement protocols are generally understood by Title 10 commanders, planners, and responders. According to the majority of responses, if military commanders had thought of the USNORTHCOM AO as US CENTCOM's AO, there would be little doubt that the Navy and Marine assets would not have deployed to Hurricane Sandy's response area without permission.

The third recommendation is to mitigate federal forces pushing forward in advance of the formal request for support. Lessons learned from Hurricane Katrine revealed slow response times and support of Title 10 because of no pre-staging of resources.[36] After Hurricane Katrina and during Sandy, the military had pre-positioned resources at federal military or federally owned posts or bases. The normal rule, according to Title 10 participants, is that the standard practice is to deploy to an area of operations to pre-stage resources but not until a Presidential Disaster Declaration has been published and a request for assistance has been submitted can they employ. Balancing funding, personnel, and equipment demand planning for the probable request of federal assistance and requires quick deployment of liaison officers to key locations. Having advance notice of the request for federal assistance will shorten the time to alert, assemble, and deploy resources. However, in the future, without official documentation, federal forces have to develop courses of action to deploy assets to federally-owned locations and develop contingencies to employ assets until official documentation is obtained.

The fourth recommendation pertains to legal constraints and how they restrict the use of Title 10 during the response. This researcher has found the same legal constraints as many other researchers who highlighted Title 10 impediments during domestic responses with mostly the restriction of Posse Comitatus.[37,38,39] Posse Comitatus restricts Title 10 from conducting law enforcement type activities under normal circumstances.[40] The President can, for a short time, authorize Title 10 troops to protect federal assets such as nuclear power plants or the rights of citizens when they are violated.[41] Due to Hurricane Katrina, the counsel of Governors developed the DSC concept where a Title 32 general officer is trained and certified by USNORTHCOM to command Title 32 and 10 forces during a disaster response. The DSC concept was executed in New Jersey and New York. However, in New York the DSC had to divert Title 32 forces to accomplish law-enforcement type activities when Title 10 resources were not actively engaged.[42] This diversion of Title 32 forces to other missions because of Title authority was a waste of time and resources, according to several participants. The DSC concept does increase unity of effort at the tactical level, however, it does not mitigate increased mental rigor required of the joint planning staff to use title specific units that are available to conduct specific tasks.

A clear recommendation is to change the Title 10 responders to Title 14. Title 14 is the legal authority under which the U.S. Coast Guard is governed.[43] Title 14 is a federal Title that is not restricted to the state from which the Title 32 forces come, but rather the continental US.[44] When Title 10 forces are converted to Title 14, serving under a DSC along with the planning staff, they could use all the federal forces for law-enforcement type activities and non-law-enforcement activities. With this recommendation, the planning staff does not have to find a unit with the proper Title authority. The concept of turning Title 10 responders to Title 14 can make use of unit specific capabilities. One such capability that can be utilized is a Military Police (MP) unit. An active duty MP unit performs law enforcement functions daily and would be the best unit for law enforcement tasks versus a Title 32 unit with no training in law enforcement activities.

Lastly, are the mission assignment procedures for Title 10 resources. According to participants, the MA process can be slow for Title 10. The example of the New York DSC attempting to change a MA in order to divert a Title 10 asset elsewhere was said to be so slow that the MA had to be filled by activating another unit while Title 10 resources were on stand by and not utilized. The mission assignment process can be a waste of manpower and money. The recommendation of the researcher would be to assign Title 10/14 resources to the DSC for just a period of time to fulfil an initial MA. Then the DSC could use these assets within the limits of the resource. For an example, when a horizontal engineering unit constructs a road and finishes early, a DSC can repurpose the unit to execute health and welfare checks without attempting to attain another MA. This concept would involve a policy change in which military personnel vets requests for assistance and allows commanders of these units to make decisions whether or not the assigned unit could effectively conduct the mission.

Future Research

Researchers should build on these findings by examining Title 10 obstacles through civilian and military decision-making processes to request federal resources and communication equipment and institutionalize title authority education. Future researchers could examine the perceived effect of changing Title 10 to Title 14 capabilities that deploy to a disaster area through table top exercises and real-world National Guard and Federal culminating exercises similar to a Vigilant Guard or a Vibrant Response. Future research could improve the speed and effectiveness of civilian and military responders who participate in disaster response. Modifying policies and doctrine would allow leadership to reorganize and eliminate obstacles that Title 10 responders habitually encounter when deploying to disasters.

Conclusion

This study was the first qualitative project in which obstacles of Title responders during Hurricane Sandy were explored. Additionally, this researcher offered solutions to mitigate Title 10 obstacles during homeland disasters. Through semi-structured interviews with civilians and military members from Titles 10, 32 and 14, this researcher examined how these obstacles effected the integration and effectiveness of the response to Hurricane Sandy using Title 10 assets.

The qualitative case study utilized a modified interview instrument designed with permission.[45] Using this instrument allowed the researcher to gather the data necessary from military and civilian participants from New York, New Jersey, and Virginia. Data were collected during 14 telephone interviews from current and past civilian and military responders, planners, and leaders who were deployed in support of Hurricane Sandy. The interviews provided the researcher with in-depth primary descriptions (from participants) regarding the obstacles for which they planned during and after the Hurricane Sandy response. The qualitative case study design provided the researcher a method of data collection as well as a way to analyze data pertaining to the topic of interest. An in-depth understanding of the aforementioned main themes of political pressure, Inter/Intra communications difficulties, legal obstacles, Title

10 pushing forward without official MAs, and the time and effort to complete a RFF to MA cycle would help military and civilian planners prioritize pre-deployment training as well as mitigation techniques to avoid any of the aforementioned obstacles. This researcher provided a comprehensive approach to exploring Title 10 obstacles that not only affected Title 10, but also Title 32 and civilians. Through in-depth interviews, the researcher analyzed the data that resulted in five main themes and 24 sub-themes.

This researcher provided clear recommendations for improvements to civilian and military leaders, planners from local, state, federal agencies, scholars, and policy makers who are interested in improving joint response operations. These recommendations are designed to encourage other researchers to dive deeper into military deployment of resources. Also, this study could contribute to improving training and education among military and civilian responders. It is important to note the merits of using this study to inform table top exercises (exercises without actual moving units) with alternative means of responding to requests for assistance. New response measures such as the use of Title 14 can be exercised in real-world field training. The resulting analysis from this field training should yield improved response times during operations to protect property from further damage as well as save lives. During extreme disasters requiring federal assistance, federal military help to plan for resources should always be included. Using economy of effort techniques and policy changes would improve the saving of human lives and the prevention of further property damage. This objective should be a top priority for strategic and tactical planners and responders. Finding ways to mitigate obstacles that inhibit these two tasks should be funded, exercised, and practiced because human life is precious.

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