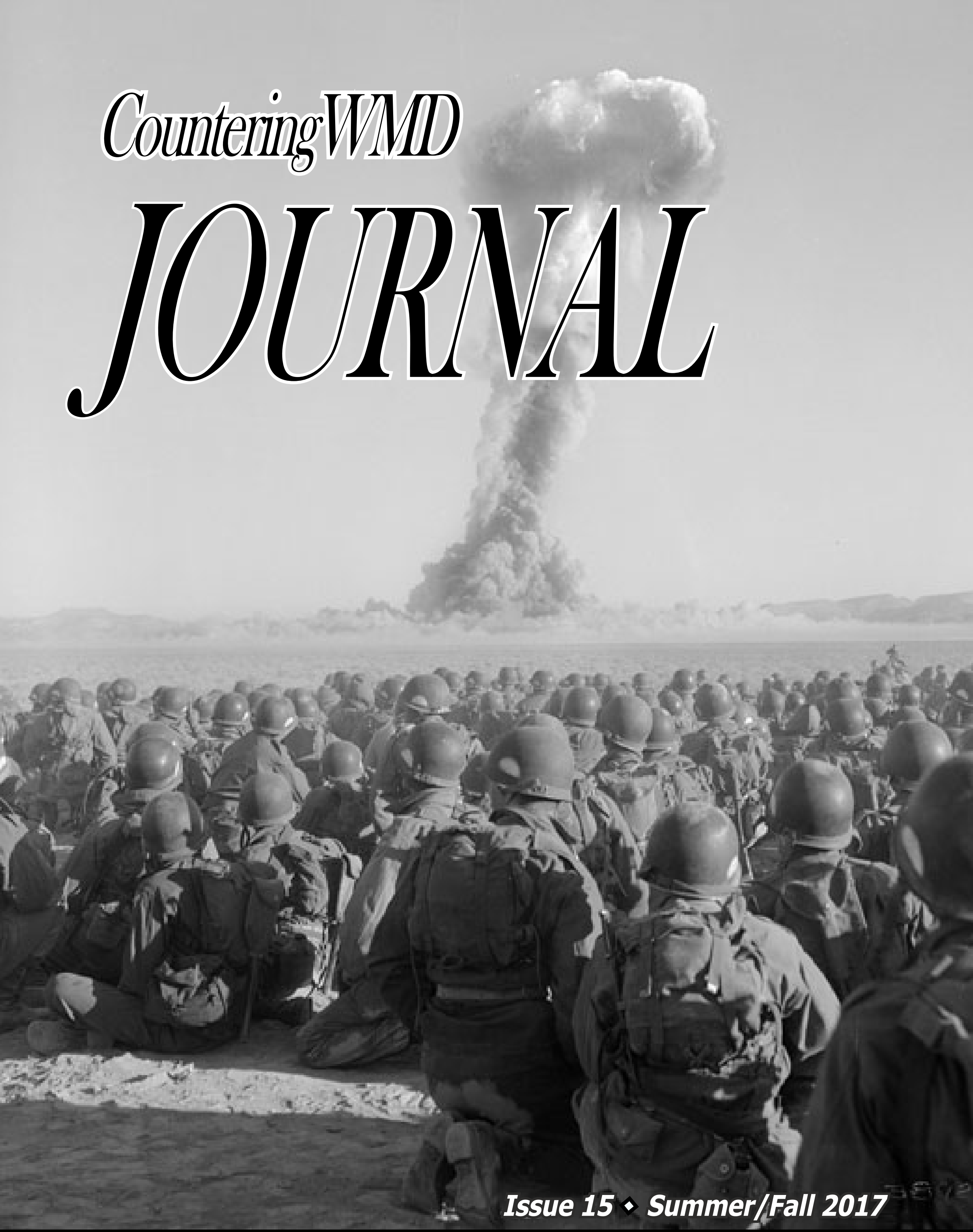
# Countering WMD JOURNAL



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**About the cover:** "Troops of the Battalion Combat Team, U.S. Army 11th Airborne Division, watch a plume of radioactive smoke rise after a D-Day blast at Yucca Flats, as the much prepared Exercise 'Desert Rock' reaches its peak." By Cpl. McCaughey, Las Vegas, Nevada, November 1, 1951. https://www.archives.gov/exhibits/picturing_the_century/galleries/postwar.html

# Inside the Journal

# Director Notes

Mr. Daniel M. Klippstein
Director, USANCA
Deputy Director of Army Strategy, Plans and Policy Directorate, HQDA

Welcome to another unique edition of the CWMD Journal. Here at USANCA we fully implemented the HQDA directed delayering effort and have been operating with our new four division organization for almost a year now. In this issue you'll find an article depicting what USANCA looks like now. As with any team undergoing a change, we had some growing pains as we modified our approach to how we perform our functions for the ARSTAF and the Army. The end result is that we have improved alignment of our unique nuclear and CWMD functions among our four divisions and have reinvigorated our efforts to provide value added subject matter expertise to the organizations – both inside and external to the Army — that count on USANCA.

The danger posed by an ever-evolving and challenging global security environment requires that our Army be prepared for a wide variety of threats. At USANCA, we are focused on supporting the Chief of Staff, Army's number one priority of readiness with a cadre of talented military and civilian personnel who are assigned responsibilities and perform missions that are accomplished nowhere else in our Army. We also constantly assess our actions and activities to ensure we are forward looking to anticipate and enable his second priority – the Future Army. I will address this in a future issue.

As I write this, members of USANCA are involved in critical nuclear and CWMD planning and operations support to Army, joint, and international forces: we have personnel deployed in support of Eighth Army and U.S. Forces Korea for exercise Key Resolve; providing theater nuclear operations expertise to support a combatant commander with preclusion oriented target analysis; and providing support to U.S. and German Army CBRNE forces for the Dragon Fire 2017 bi-lateral field training exercise in the Pacific Northwest. It's these and other real-world and training events that provide a daily reminder of the unique skill-set that members of USANCA possess and are willing and able to provide to achieve strategic outcomes.

Finally, I want to provide an update on the health of the Nuclear and Counterproliferation Officer (FA52) functional area. In my role as the personnel developer for the functional area, I have a direct role in ensuring that each Officer has opportunities available that prepares them to be a sought after member of any and every organization where FA52 Officers serve. To this end, we have made great progress in the proponent management of our functional area. The establishment of the FA52 Proponency Office within USANCA now allows the Agency to assign the necessary oversight to all life cycle management functions of the personnel development system. My assessment is that we are a healthy career field — both in numbers and quality; however, to sustain this status, I ask for your personal engagement to continue to identify and recruit talented officers to serve in this critical career field. Additionally, being part of a profession includes engaging in a professional dialogue — I encourage you to write and contribute to our professional journal as a means to exchange ideas and unique knowledge. I look forward to reading your articles and hope this issue advances the dialogue and insights to counter weapons of mass destruction.



# The Defense Threat Reduction Agency's Electromagnetic Pulse Program

Dr. John M. Les
United States Army Nuclear and Countering WMD Agency

Editor's Note: Dr. Les produced this article based on his vast knowledge of EMP and discussions with numerous DTRA employees, who currently work in this area.

**Introduction**

Since 2008, the Defense Threat Reduction Agency (DTRA) has embarked on a program path to revitalize DoD's modeling and simulation (M&S) of electromagnetic pulse (EMP) environments and the resulting effects that these environments may have on electrical systems and equipment. In the past there have been essentially only two regions of the EMP environment that have been accessible due to limited computational resources and models; the first is high altitude EMP, or HEMP, and the second is source region EMP, or SREMP. SREMP is associated with ground or surface burst EMP, and describes the EMP environment inside the so called source region, where significant ionization of the air takes place.

In each case, HEMP or SREMP, one can make certain approximations or take advantage of certain symmetries such that a reasonable, physically accurate computational model can be developed. It is the region between "high" altitude and ground burst detonations, where there is a significant modeling gap that DTRA hopes to address and fill, as well as enhancing and expanding current models. One of the height of burst (HOB) scenarios of interest to DTRA is the near surface burst, where the fireball, or more accurately, the source region, intersects the ground. For such a problem the usual contact surface burst modeling symmetries and assumptions cannot be used, and therefore the complexity of the computer model will increase.

Another EMP environment of interest is system generated EMP, or SGEMP. This environment is concerned with space based assets, such as satellites. Unlike HEMP or SREMP, where the radiation from a nuclear weapon detonation, primarily gamma rays, interacts with the air producing electron currents, and thus the EMP, SGEMP is caused mainly by X-rays generated by the nuclear burst

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interacting with the structure and components of the space system, which liberates electrons and causes currents, which in turn produces the EMP. DTRA is working to expand and enhance it SGEMP M&S capabilities, such as the development of a high performance computer (HPC) modeling capability.

Another DTRA avenue of investigation is the M&S of EMP coupling of EMP energy and its effects on electrical systems. Though the idea of modeling coupling and effects is not exactly new, current M&S resources and capabilities have greatly exceeded those of the past. Currently DTRA is working with U.S. Strategic Command (USSTRATCOM) and the United Kingdom, via the Weapon Effects Strategic Collaboration, or WESC, to develop a capability to model the effects of SREMP on infrastructure. DTRA is also working to include EMP effects in the Air Force's legacy Joint Radio-frequency Effects Model (JREM) M&S tool. Readers interested in further details concerning the EMP programs at DTRA should consult the references at the end of this article.

**This region, which lies between roughly 20 – 40 kilometers above the earth's surface, is where ... the EMP is generated.**

### Basics of HEMP and SREMP

For a HEMP event the prompt gamma ray radiation from the nuclear burst ionizes molecules in the earth's upper atmosphere creating an electron current. These electrons in turn gyrate in the earth's magnetic field generating an electromagnetic (EM) pulse. Neutrons also contribute to this electron current indirectly by the production of additional gamma rays created by neutron-nuclei inelastic scattering in the atmosphere. Below a nuclear burst at 100 kilometers, or 62 miles in altitude, lies much of the earth's sensible atmosphere, which includes the so called source region. This region, which lies between roughly 20 – 40 kilometers above the earth's surface, is where much of the gamma radiation from the weapon is converted into electron current, see Figure 1. This region is where the EMP is generated. In Figure 1, ground zero refers to the point on the earth's surface directly below the burst point.

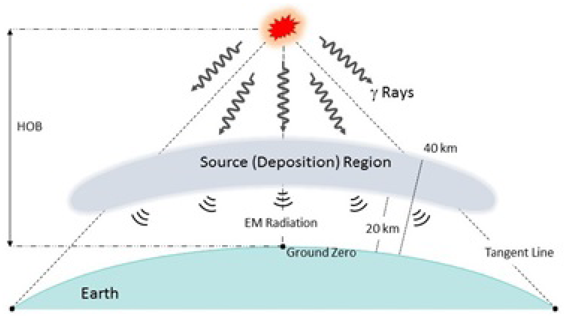


Figure 1. A HEMP event. Not shown is the electron gyration in the earth's magnetic field and the neutron radiation. EM radiation is the electromagnetic pulse.

For further details the interested reader should consult the book, The Effects of Nuclear Weapons, edited by Samuel Glasstone and Philip Dolan, third edition, 1977.

Unlike HEMP, a ground burst EMP event (HOB = 0) is affected by the presence of the ground. The ground acts not only as an additional source of ionizing radiation, by the scattering, both elastic and inelastic, of the weapon's prompt radiation; it also acts as a return path for electrons generated in the ionized air above. This return path is illustrated in Figure 2.

This return path allows for the creation of an intense azmuthial magnetic field near the ground as shown in Figure 2. Compared to HEMP, which covers a much wider area, out to the horizon, see Figure 1, the SREMP environment is much more localized in extent. The effects of SREMP



however can extend far beyond this localized region due to available conductive pathways close-in to the burst, such as above and below ground power and communication lines. Outside the source region is the so called radiated region, where the EMP falls off quickly as the inverse distance, and is much weaker in strength compared to the EM fields within the source region.

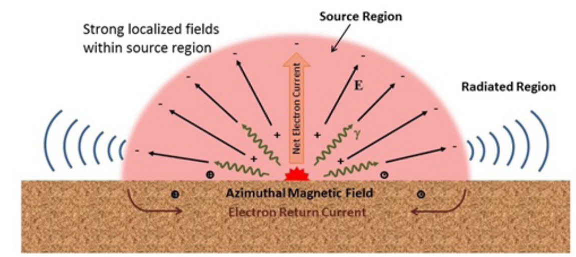


Figure 2. A SREMP event. As for HEMP the source region is where much of the air ionization takes place. E is the radial electric field caused by charge separation. Neutron radiation is not shown.

### DTRA HEMP and SREMP Program

DTRA's current EMP program effort involves a first principles based approach to the modeling and simulation of HEMP and SREMP. DTRA's perspective is that a first principles effort implies the use of detailed physics models with a limited set of assumptions, while an engineering level approach suggests less detailed models that are computationally faster running. An example of the latter is DTRA's well-known fast running EMP environment tools, HEMPTAPS and SREMPTAPS. HEMPTAPS stands for HEMP Target Analysis and Planning System, and similarly for SREMPTAPS, SREMP Target Analysis and Planning System. As the names imply, these tools are used to model HEMP and SREMP environments. The tools are fast running since they utilize databases which are created using first principle modeling codes, as well as applying appropriate symmetries which are inherent in the problem itself.

Though the first principles based tool currently under development, XEUS, for eXtensible EMP Unified Suite, allows for problems to be run on a personal workstation or computer, the power of XEUS (no pun intended) comes from the ability to run XEUS on a DoD high performance computer (HPC). This gives the user the ability to model complex problems that are computationally intensive. XEUS is a suite of high fidelity tools that DTRA has developed over the years and includes: HiFEMP, for High Fidelity EMP, LoXEMP, which stands for Low-altitude Extended EMP, and lastly, JEM 3D, which is a three dimensional (3D) Maxwell equation solver. HiFEMP is an enhanced and expanded HEMP M&S tool and is based on the old Compton High Altitude Pulse, or CHAP code. LoXEMP is applicable to ground burst and near surface burst problems, the latter of which was not possible before the development of LoXEMP. Finally JEM 3D will be used to calculate EMP fields in more complex problem domains, such as those posed by urban environments. The XEUS toolset will be used to develop a fast-running, engineering level EMP tool that will be valid for all altitudes.

**The effects of SREMP however can extend far beyond this localized region due to available conductive pathways close-in to the burst, such as above and below ground power and communication lines.**

### Basics of SGEMP

As mentioned in the introduction, SGEMP is when the prompt radiation from a nuclear explosion interacts with the structure and components of a space system, for example a satellite. Such a scenario is illustrated in Figure 3, which shows prompt neutron, gamma, and

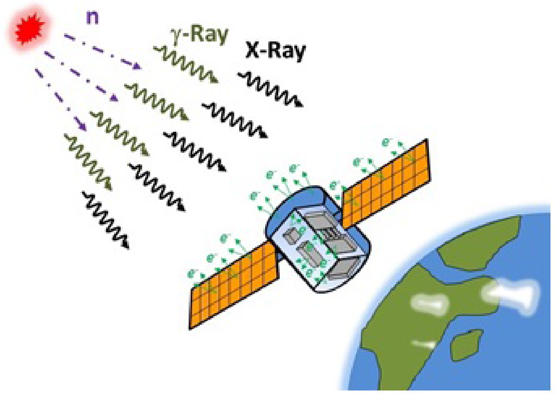


Figure 3. Illustration of radiation from a nuclear burst incident on a satellite. The picture shows incident neutron (n), gamma (γ) ray, and x-ray radiations, and electrons being ejected due to x-ray interactions with the materials that make up the satellite, both inside and outside. These electrons are a form of current which generates the EMP.

x-ray radiations from the burst. This radiation, unlike that of HEMP or SREMP, is not propagating through the earth's atmosphere for the most part, and therefore the radiation is not attenuated. For SGEMP the main concern is the effect imparted by x-rays on a system. This is because the energy range normally associated with x-rays causes a strong interaction between this type of radiation and the asset's structure and internal components. This is not to say that neutrons or gamma rays do not contribute an additional insult to the system. However, because of their energy, gamma rays are less likely to interact with a space asset. Neutrons, on the other hand, can cause displacement damage in electronic components, or through various nuclear processes generate additional gamma rays.

**Radiation induced conductivity is when radiation, through ionization, causes a material to become conductive.**

**DTRA SGEMP Program**

The main focus of DTRA's SGEMP program is twofold. The first is the enhancement of the legacy DoD M&S tool MEEC, which stands for Maxwell Equations Equivalent Circuit. The upgrade to MEEC has been designated MEEC++ to indicate that the source code has been modernized. The MEEC code has an extensive history, including underground test (UGT) validation. MEEC can be used to model satellites in a vacuum (space) or missiles/interceptors in 0-300 millitorr of air pressure. MEEC++ is a fast enough tool that it can be run on a personal computer. MEEC++ will also include an updated thin air chemistry model and a new capability, plasma enhanced aperture coupling. SGEMP aperture coupling causes undesirable electromagnetic energy to enter a system's interior from the outside. MEEC++ will be validated against the legacy MEEC tool, as well as newly acquired experimental data.

The other main SGEMP program is providing the EMP survivability user community with the capability to model much more complex (bigger) SGEMP problems through development of a HPC tool. This will be accomplished by utilizing the Air Force Research Laboratory's (AFRL's), Improved Concurrent Electromagnetic Particle-in-Cell (ICEPIC) code. ICEPIC is an established HPC code that has M&S capabilities similar to MEEC but has the advantage of being able to run on multiple processors on a much larger scale. The legacy capabilities of MEEC will be ported over to ICEPIC as well as the advanced MEEC++ features, such as automated prescription of radiation induced conductivity and new source and boundary treatments. Radiation induced conductivity is when radiation, through ionization, causes a material to become conductive. Boundary treatments refers to mathematical



boundary conditions that are necessary when solving Maxwell's EM equations.

**Basics of EMP Effects**

The major concern during an EMP event is that the pulse's EM energy will find its way into a system damaging vital electronics or components. The entry of this energy into the system and to its components is called coupling. An illustration of this is shown in Figure 4. Assuming for the moment the EMP source is a HEMP event, the electromagnetic energy generated, shown as the incident electric and magnetic fields, interacts with a system, in this instance the system is a ground based facility. The EMP field energy can enter into the facility by external means, via the power or signal line for example, or through other ports of entry, such as a door or window, or even the walls of the facility if they are electromagnetically transparent. This energy in turn can end up in electronic or electrical systems causing outright damage to equipment if the amount of energy is sufficiently high enough.

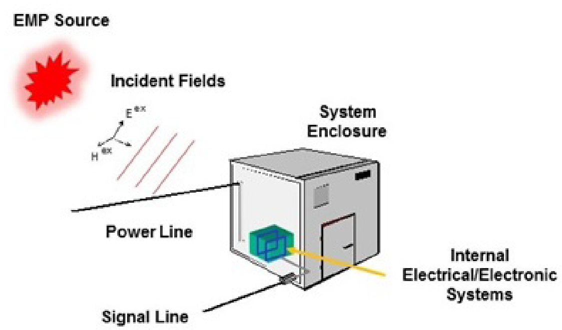


Figure 4. Coupling of an EMP source to a system and the possible effects to internal systems and components. Though the system here is a ground facility the basic idea described in the text holds true for other systems as well.

**The major concern during an EMP event is that the pulse's EM energy will find its way into a system damaging vital electronics or components.**

**DTRA EMP Effects Program**

Since 2008 DTRA has pursued some form of modeling and simulation of EMP effects. The current program focuses on two paths of development; one is the effects of EMP on electronic systems, including device upset/failure and larger systems such as transformers, the second is incorporating EMP survivability and system response prediction capability into a legacy M&S tool. The first effort involves Sandia National Laboratory's (SNL's) suite of system-circuit M&S tools, EMPHASIS (EM coupling), Xyce (Analog circuit simulator), Habanero (Mixed signal simulator), and Charon (device scale simulator). SNL will provide a special version of Xyce, a prototype, to USSTRATCOM for their operational use later next year. Additionally, experiments will be conducted to validate the models and for device characterization.

The second effort that DTRA is pursuing is the incorporation of an EMP prediction capability into the Air Force's JREM tool. Currently JREM models the effects of intentional electromagnetic interference (IEMI) on systems that are non-nuclear generated, such as microwaves. Incorporation of EMP into JREM will expand the tool's spectral and temporal capabilities that will be useful to the user community as a whole. The JREM project combines experimentation with M&S to categorize upset and device response phenomenology. This is described pictorially in Figure 5.

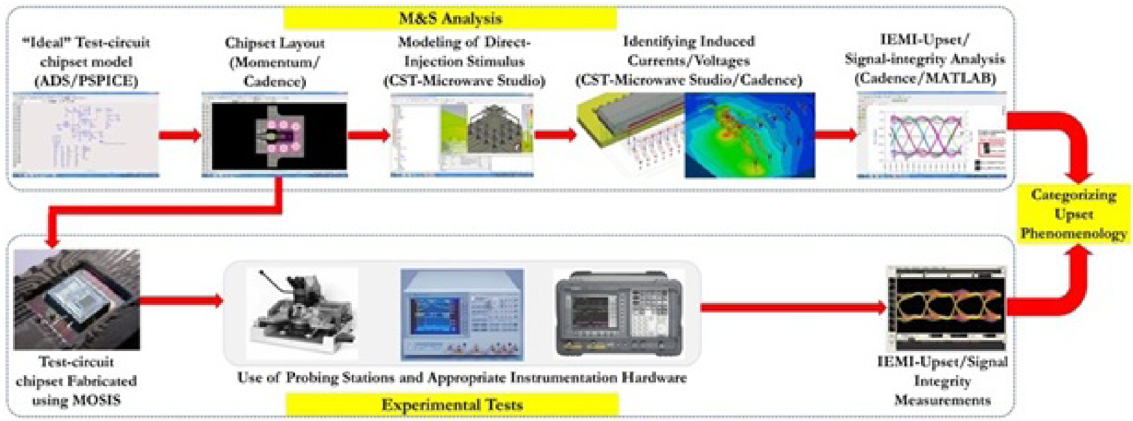


Figure 5. JREM EMP capability enhancement methodology – analysis and experimental tests. Various device and circuit modeling software, along with hardware bench testing, leads to the categorization of device response to EMP, in addition to IEMI.

## Summary

In this article we described the basics of high altitude electromagnetic pulse (HEMP), source region electromagnetic pulse (SREMP), system generated electromagnetic pulse (SGEMP), and electromagnetic pulse (EMP) effects. For each of these areas in turn, a description of the DTRA programs directed at the modeling and simulation (M&S) efforts ongoing in each of these areas of interest was provided. DTRA is furthering the development of an EMP environment capability for HEMP and SREMP that will eventually cover ground burst to high altitude EMP, a capability that currently does not exist within DoD or elsewhere. Noteworthy is the specific capability to do near surface burst EMP. This improved M&S capability is provided by the XEUS tool. For the M&S of SGEMP, DTRA is improving its legacy MEEC tool, called MEEC++, while developing a high performance computer capability by modifying, and adding to, the ICEPIC code. Finally DTRA is developing M&S of EMP effects capabilities by expanding the capabilities of Sandia National Laboratory's electromagnetic and electronics tool suite, specifically Xyce. In addition to this effort DTRA is also enhancing the Air Force's JREM code by supporting the incorporation of nuclear weapon generated EMP effects due to the differing spectral and temporal characteristics of nuclear and non-nuclear generated electromagnetic sources.

## References

1 DTRA Electromagnetic Pulse (EMP) Program Brief (to USANCA), Dr. Lisa Andivahis, 29 March 2016.

2 The Dispatch, Vol. 5, Issue 3, DTRA Information Analysis Center (DTRIAC), June 2016, http://www.dtra.mil/Portals/61/Documents/DTRIAC/Dispatch%20June%202016.pdf.



# Effects of Model Fidelity on Gamma Protection Factor Estimates Using Monte Carlo n-Particle Code 6.1

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United States Military Academy
MAJ Andrew W. Decker
Defense Threat Reduction Agency

**Abstract**

Monte Carlo n-Particle code 6.1 (MCNP6.1) is used to quantify the effects of increasing model fidelity on gamma protection factor (GPF) evaluations of a surrogate armored vehicle. These results are compared against previous experimental calculations of the surrogate vehicle's GPF. Results suggest increased model fidelity using a basic experimental design improve MCNP6.1 GPF estimates by 1% to 3.5%, which is statistically significant.

## Introduction

In the late 1980s, American physicists modeled both American and Soviet armored vehicles to determine their respective gamma protection factor (GPF) values. These computational results were then compared to experimentally determined GPF values to evaluate the accuracy and precision of the radiation transport code. The objective of this research was to quantify the effects of increasing model fidelity on Monte Carlo n-Particle 6.1 (MCNP6.1) evaluations of the GPF for a surrogate armored vehicle. In other words, to assess how improved model fidelity affects the accuracy of MCNP6.1-derived GPF estimates. A GPF is calculated as the ratio of unshielded gamma radiation dose to the shielded gamma dose, as shown in Equation 1.

$$GPF = \frac{\text{Free Field Dose}}{\text{Shielded Dose}} \qquad (1)$$

The experimentally-determined GPF for the armored vehicle surrogate was determined previously by Gates et al. using a 5 μCu source and a 16in × 4in × 2in sodium iodide detector.[1] In that research, the gamma ray source was placed 10cm from the face of the vehicle surrogate and centered both vertically and horizontally. The surrogate armored vehicle (Figure 1) consisted of an aluminum-framed cube with layers of aluminum, steel, and glass-reinforced plastic (FR-4) plates. Research by Gates et al. measured

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the GPF value of the surrogate vehicle as 1.46 ± .01 and determined the best MCNP6.1 GPF value was 1.439 ± .008.[1]

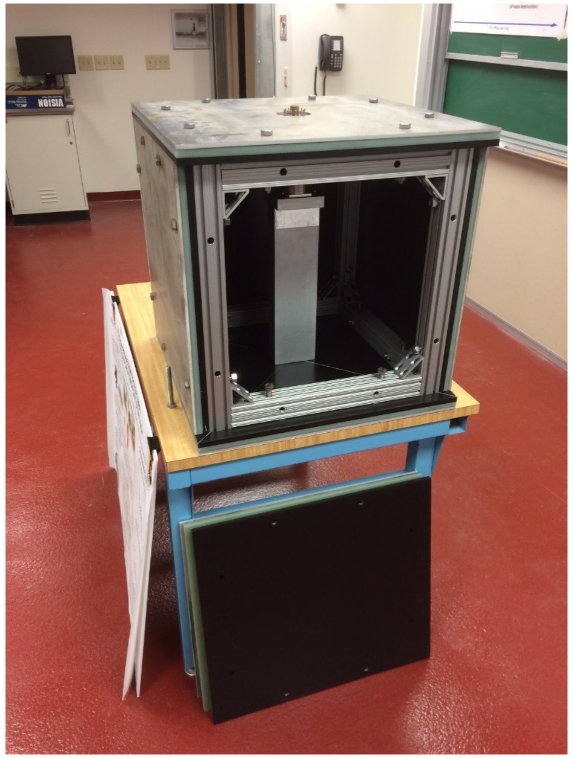

Figure 1. The surrogate armored vehicle used in the Gates et al.[1] experiment and modeled computationally in this research.

**Methodology**

The basic surrogate vehicle was modeled in MCNP6.1 as three layers of armor on all six sides, which matched the computational methodology employed by Gates et al.[1] Point A in Figure 2 illustrates the point source location during this evaluation. GPF values were computed from F6 tallies of average energy deposition recorded within the modeled detector by MCNP6.1, which were converted to dose deposited. To increase fidelity, an aluminum frame of homogenous density was modeled to account for the aluminum framing present during experimentation. Additionally, steel was added to the modeled aluminum framing to further account for the steel screws that secured the armored plates to the frame during experimental measurements.

Due to the location of the source relative to the surrogate vehicle in the Gates et al. research, the majority of photons recorded in the detector were expected not to have interacted with the surrogate vehicle frame. This was largely due to the solid angle between the source and detector. Therefore, increased fidelity from modeling the frame in MCNP6.1 was expected to produce only minimal effects to the final GPF value. Consequently, to better quantify the possible effectiveness of improved model fidelity for this experiment, the source location was adjusted vertically in MCNP6.1 to an angled position 45° relative to the vertical center of the detector. This location, indicated as Point B in Figure 3, required the majority of source gamma rays to interact with the aluminum frame before arriving within the modeled detector. Trials with this source location were conducted utilizing both the basic and improved vehicle model; however, no experimental data currently exist to directly compare against the results determined from these configurations.

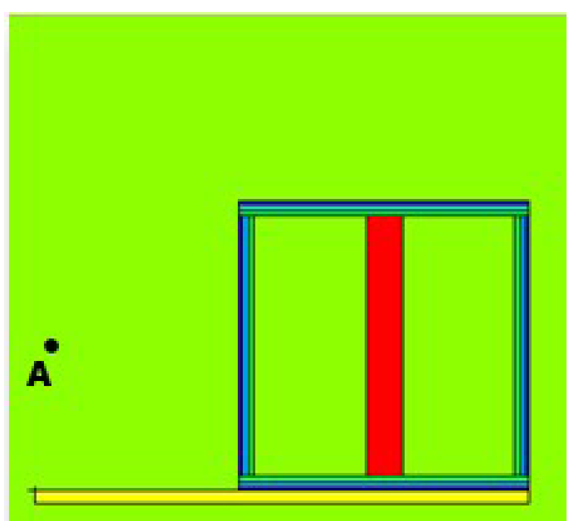


Figure 2. The surrogate armored vehicle modeled in MCNP6.1. Point A represents the source location during the initial computational assessment.



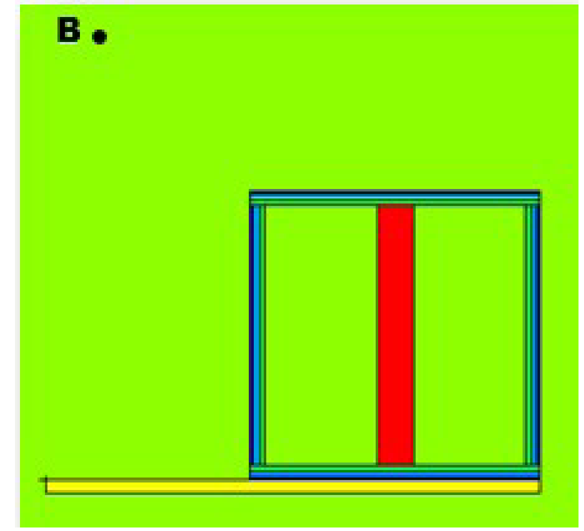


Figure 3. The armored vehicle surrogate modeled in MCNP6.1, where Point B represents the adjusted source location for the advanced configuration.

The first five trials ignored the effects of electrons in the simulation. Therefore, in order to increase the model fidelity, the surrogate armored vehicle was evaluated both with and without the aluminum frame using the Point A source position. Two trials were conducted, which included electrons and bremsstrahlung in the computation, which improved result accuracy because more particles and gamma rays were present.

**Results**

Research by Gates et al. experimentally-determined the surrogate vehicle GPF as 1.46 ± .01 and determined a MCNP6.1-derived GPF of 1.53 ± .01 using the basic model.[1] The addition of the aluminum frame to this basic configuration reduced the MCNP6.1-derived GPF to 1.52 ± .01, thereby improving the computational GPF by less than 1%. Additionally, the further inclusion of the steel screws to the modeled frame resulted in no statistically significant effect on the MCNP6.1-derived GPF value, as shown in Table 1.

As expected, results using the adjusted source location demonstrated how changes to source location can dramatically impact GPF estimates. Specifically, the addition of the aluminum frame to this computational design reduced the MCNP6.1 GPF estimate by 3.5%. When compared against the GPF found using only the basic vehicle model, that degree of difference is significant. Although these results are not directly comparable to the experimental findings by Gates et al.[1], they indicate the importance of not only accurate vehicle geometry, as shown by Erwin et al.[2], but also the importance of source location and orientation with respect to the vehicle. All of these factors contribute to the ultimate GPF values attributed to a vehicle or shelter by MCNP.

**As expected, results using the adjusted source location demonstrated how changes to source location can dramatically impact GPF estimates.**

Lastly, the inclusion of electrons and bremsstrahlung decreased the GPF to 1.446 ± .008 for the box only and 1.439 ± .008 when the aluminum frame was added. These results are slightly lower than the experimental data, thereby underestimating the capability of the armor to

| Geometry | GPF | Uncertainty |
|---|---|---|
| Experimental | 1.46 | .01 |
| Box Only | 1.53 | .01 |
| Aluminum Frame | 1.52 | .01 |
| Frame + Screws | 1.52 | .01 |
| Box Only + Angle | 1.000 | .002 |
| Frame + Angle | .986 | .002 |

Table 1. GPF results for the Gates et al. research, as well as the results of this research.

shield gamma rays. However, due to consistent source location with the Gates et al. experiment, these computational results are directly comparable and are within 1.5% of the experimental GPF value. Consequently, this research improves the computational findings of the Gates et al. research, and it quantifies the impact of improved model fidelity on GPF estimates for this experimental design.

### Conclusion

Utilizing the basic surrogate vehicle model, the MCNP6.1 GPF estimate determined by Gates et al. overestimated the experimental GPF by 4.5%.[1] The addition of the aluminum frame and screws to the model, however, provided a MCNP6.1-derived GPF within only 4% of the reported experimental GPF value. Accounting for bremsstrahlung in the calculations further reduced the MCNP6.1 GPF value to within 1.5% of the experimental value, which significantly improves the computational findings of Gates et al.

Furthermore, shifting the source location vertically produced a greater effect upon the computational GPF estimates by increasing the likelihood of photon interaction with the modeled frame. This resulted in a 3.5% change in GPF estimates using both the basic and advanced fidelity models of the surrogate vehicle. Future work will include measurements utilizing this experimental design to compare against these computational findings.

Although simplifying problems by reducing variables makes calculations easier, the addition of bremsstrahlung proved necessary for calculating the most accurate GPF value, while also underestimating it. Underestimating versus overestimating the ability for an armored vehicle to protect its contents is important because it is better to err on the side of caution when human lives are at stake. Since the ultimate goal of this research is to use MCNP to estimate armored vehicle GPF values, lives are truly at risk. Overestimating in calculations provides a false sense of security, while underestimating this value encourages extra caution and protection to maintain the safety of American soldiers.

Lastly, further geometric complications await GPF research, including air gaps, glass, and rubber, which together must be modeled to offer the most accurate simulations. Eventually, modeling of a real armored vehicle will complete the verification and validation of MCNP6.1 for estimating GPF values of armored vehicles for the US Armed Forces.

### Notes

1 T. J. Gates, C. R. Zeigler, A. W. Decker, “Validation and Verification of Monte Carlo N-Particle Code 6 (MCNP6) with Gamma Protection Factor Measurements of an Armored Box,” Department of Physics and Nuclear Engineering, United States Military Academy, West Point, NY, 2016.

2 W. J. Erwin, J. A. Clinton, J. W. McClory, S. R. McHale, “Validation and Verification of Monte Carlo N-Particle Code 6 (MCNP6) with Gamma Protection Factor Measurements,” Department of Engineering Physics, Air Force Institute of Technology, Wright-Patterson Air Force Base, OH, 2015.



# North Atlantic Treaty Organization Standardization: The Key to Successful Alliance Operations

Ms. Anita S. Walker
United States Army Nuclear and Countering WMD Agency

### Introduction

Android or iPhone: Which is better? Pose that question to a baby boomer or an eight-year old and you’re sure to get an earful. Phones have evolved to become more than just devices to make calls. These indispensable, powerful, personal assistants all communicate with voice, text, or data on one interoperable communications network around the world. You have the ability to send and receive texts, make phone calls, and share information because of common standards used by smart phone manufacturers on multiple networks (Grasshopper, Verizon, AT&T, etc.). Similarly it’s standardization that enhances the North Alantic Treaty Organization (NATO) Alliance’s operational effectiveness by increasing interoperability among Alliance forces and partner nations.

### NATO Standardization and Interoperability

Within NATO, interoperability is the ability to act together coherently, effectively, and efficiently to achieve Allied tactical, operational, and strategic objectives. There are 28 NATO member nations and many more NATO partners. Whereas the European Union has been losing members, NATO continues to grow. (In May 2016, NATO officially invited Montenegro to become its 29th member.) An alliance of 28 nations plus partners can effectively work together in joint operations only if articles are in place ensuring a smooth blending of capabilities. NATO has been improving interoperability through standardization since the Alliance was founded in 1949. The ability of NATO militaries to work together has become even more important since the Alliance has begun mounting cooperative (to include Partner) out-of-area expeditionary operations.

NATO defines standardization as the process of developing and implementing concepts, doctrines, procedures and designs to achieve and maintain the compatibility, interchangeability and commonality necessary to attain the required level of interoperability or to optimize the use of resources in the fields of operations, materiel development and administration. NATO standards covered by Standardization Agreements (STANAGs) and Standardization Recommendations (STANRECs) are the means to enhance interoperability.

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**Being able to communicate in a common language is a prerequisite for interoperability.**

### STANAG

A STANAG is a NATO standardization document that specifies the agreement of member nations to implement a standard, in whole or in part, in order to meet an interoperability requirement. STANAGs establish processes, terminology, and conditions for common military procedures, technical procedures or equipment employment among NATO member nations. They also provide common operational and administrative logistic procedures so that one Alliance member's military can use the support and supplies of another member's military.

Each Alliance member ratifies a STANAG and implements it within its own military. STANAGs are published in English and French by the NATO Standardization Office (NSO) located at NATO Headquarters in Brussels, Belgium. There are hundreds of STANAGs covering everything from language proficiency to the control of unmanned aerial vehicles.

The first STANAGs established common language standards for English and French proficiency levels. English is the military lingua franca or bridge language of NATO, and it is one of the two official languages of the Alliance, along with French. Being able to communicate in a common language is a prerequisite for interoperability.

### STANREC

A STANREC is a NATO materiel standardization document that lists one or several NATO or non-NATO standards relevant to an Alliance activity. From a civilian perspective, it may be viewed as a best practice, something to be considered in the appropriate environment or activity. A STANREC is a non-binding document that is voluntarily employed and does not require nations to implement its standards. STANRECs came into effect in November 2011.

### NATO CBRND Standardization

The NATO Joint Chemical, Biological, Radiological, and Nuclear Defence Capability Development Group (NATO JCBRND-CDG) is the working group in charge of non-medical CBRN Defence standardization efforts. There are 40+ NATO standards under the CDG's purview maintained by its seven subordinate panels: Doctrine and Terminology; Information Management; Detection, Identification and Monitoring; Physical Protection, Hazard Management; Training and Exercise; and Challenge Level. The CDG receives its guidance from two tasking authorities: NATO Army Armaments Group (NAAG) and the Military Committee Joint Standardization Board (MCJSB). (The NATO JCBRND-CDG organizational chart is shown in Figure 1.)

The U.S. Army Nuclear and Countering WMD Agency (USANCA) is DoD's lead agency and is responsible for the overall management of U.S. participation in the NATO JCBRND-CDG. The J8/ Joint Requirements Office-Chemical, Biological, Radiological and Nuclear Defense (J8/JRO-CBRND) is the Office of Primary Responsibility. In addition to USANCA and the J8/JRO-CBRND, U.S. delegates come from other organizations: Joint Program Executive Office-Chemical and Biological Defense; Defense Threat Reduction Agency; Army Edgewood Chemical and Biological Center; Army CBRN School; Army Maneuver Support Center of Excellence; and Navy Surface Warfare Center.



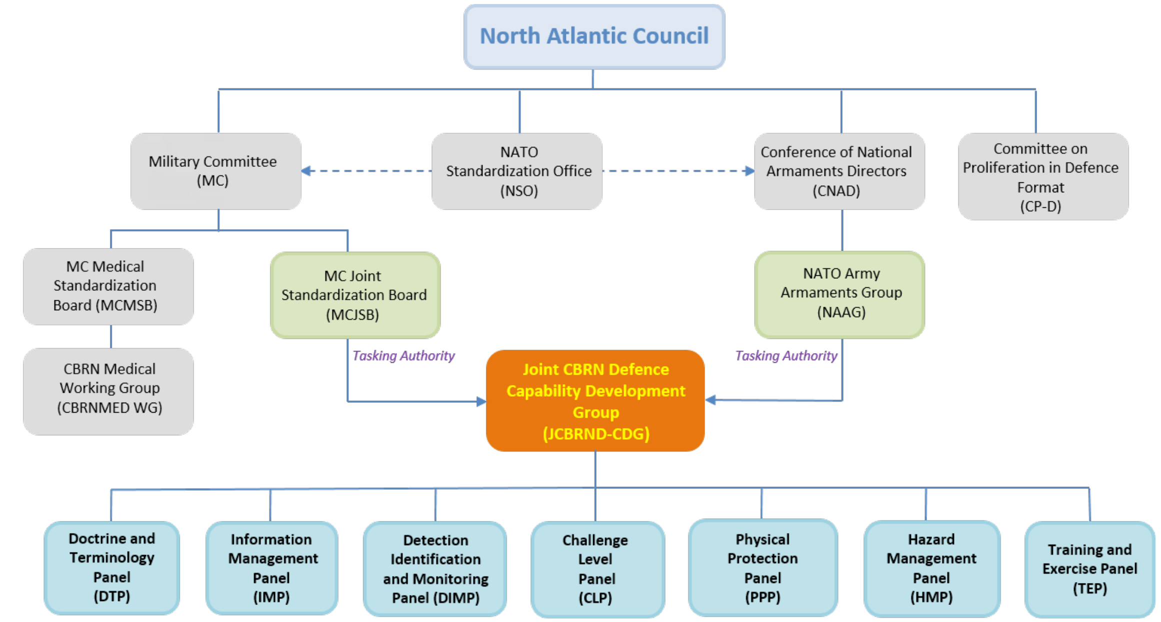


Figure 1. NATO CDG Organizational Chart

CBRN standards include materiel, doctrine, and training standards. The panels advanced several significant work in progress within the past year:

- The Information Management Panel (IMP) is finalizing the study drafts for STANAG 2103 ATP-45F Warning and Reporting and Hazard Prediction of CBRN Incidents, Operator's Manual; and STANAG 2497 AEP-45E Warning and Reporting and Hazard Prediction of CBRN Incidents, Reference Manual and is scheduled for ratification in 2017.
- The Doctrine and Terminology Panel (DTP) is finalizing the study draft for Allied Joint Publication (AJP) 3.8B Allied Joint Doctrine for CBRN Defence for ratification in 2017. The Terminology Syndicate continues to develop CBRN-related terms and definitions for NATO agreement.
- The Physical Protection Panel (PPP) finalized STANREC 4738 ED1 AEP-85 Low Burden CBRN Protective Clothing and has proposed new work on an On-the-Move CBRN Hydration System (commonly referred as a

**CBRN standards include materiel, doctrine, and training standards.**

"Camelbak") and Aircrew Individual Protection Equipment (IPE).
- The Hazard Management Panel (HMP) is drafting STANAG 4145 AEP-04 Nuclear Survivability Criteria for Armed Forces Materiel and Installations and is scheduled to review the need to update STANAG 4521 AEP-7 CBRN Contamination Survivability Factors.
- The Detection, Identification and Monitoring Panel (DIMP) is currently revising STANAG 4571 Allied Engineering Publication (AEP)-66 NATO Handbook for Sampling and Identification of Biological, Chemical and Radiological Agents (SIBCRA). Part of the update is to incorporate STANAG 4632 Deployable NBC Analytical Laboratory into AEP-66.
- The Training and Exercise Panel (TEP) began work on Allied Tactical Publication (ATP) 3.8.1 Vol IV CBRN Defence Disposition for Education, Training, Exercise, and

Evaluation and continues annual Exercises Toxic Trip and Clean Care.

- The Challenge Level Panel (CLP, previously called the Chemical Biological Radiological Challenge Level Team of Experts) is currently drafting AEP-72 VOL 5 Radiological Challenge Levels. VOL 5 will include the addition of radiological dispersion device (RDD) elements and is expected to be ready for approval in 2017.

**The NATO Defence Planning Process (NDPP) is the primary means to identify the Alliances required capabilities.**

**Validation Exercises**

STANAGs are validated by various NATO and non-NATO exercises. Exercise Precise Response is an annual NATO CBRN exercise run at the Defence Research and Development Centre (DRDC) in Canada. The main objective of Exercise Precise Response is to provide a multi-national interoperable exercise of all components of the Combined Joint-CBRND-Task Force: Command and Control; CBRN detection and identification; Counter-Improvised Explosive Device; sampling; handling evidence; contamination control; and casualty extraction. Exercise Precise Response allows the various NATO Chemical, Biological, Radiological, Nuclear and Explosives (CBRNE) elements to challenge, test and validate new tactics, techniques and procedures; instill confidence within individual CBRNE operators and specialists in their equipment and standard operation procedures; and improves interoperability and communication among the participating nations. Observations and lessons learned from Exercise Precise Response has driven changes to STANAG 4701 AEP-66.

Exercise Brave Beduin is an annual, multinational CBRN warning and reporting exercise hosted by Denmark. The exercise utilizes STANAG 2103 (ATP-45) and STANAG 2497 (AEP-45) standards and national procedures for the warning and reporting of CBRN incidents while evaluating both the standards and interoperability among NATO nations. The observations and lessons learned drive change proposals for ATP-45 and AEP-45.

**STANAGs and the NATO Defence Planning Process (NDPP)**

The NATO Defence Planning Process (NDPP) is the primary means to identify the Alliances required capabilities. It provides a framework for the harmonization of national and Alliance defense planning activities aimed at the timely development and delivery of all the capabilities, military and non-military, needed to meet the Alliance agreed security and defense objectives. The NDPP consists of five steps conducted over a period of four years: Step 1 -Establish political guidance; Step 2- Determine requirements; Step-3 Apportion requirements and set targets (goals); Step 4 – Facilitate implementation; Step 5-Review results.

During step 2, determine requirements, capabilities are identified and consolidated into a single list called the Minimum Capability Requirements (MCR) determined by NATO's two Strategic Commands based on aims and objectives expressed in political guidance. STANAGs are essential documents used to define the purpose, task, desired effect, and proficiency requirements for the capability. Working Groups, such as the JCBRND-CDG use the MCR, in addition to supplemental guidance from superior groups (NAAG and MCJSB), to prioritize and align their work with NATO's security and defense objectives.



**Conclusion**

The science of communication has seen incredible innovations over the last 140 years. From the first call from Alexander Graham Bell ("Mr. Watson, come here, I want to see you") on March 10, 1876 to Face Time and Snapchat in 2016, changes have come faster every year. Similar advances are happening across the spectrum of military operations.

Tomorrow's operational environment will be more complex. Expanded partner participation and growing threats, such as cyber capabilities and gene editing, only make interoperability, and by extension standardization, more essential. Heads of State and Government recognize this and highlighted it in the NATO Warsaw Summit Communique 9 July 2016: "Interoperability of our armed forces is fundamental to our success and an important added value of our Alliance. Through training and exercises, the development of NATO standards and common technical solutions . . . all Allies are also reinforcing their interoperability within NATO as well as with partners, as appropriate."

As a member of the most successful Alliance in history, the U.S., through the NATO JCBRND-CDG, must continue to ensure CBRN standards are relevant and reflect the current threats to the Alliance in order to safeguard the freedom and security of its members.

**References**

1 NATO Allied Administrative Publication (AAP)-3J Production, Maintenance and Management of NATO Standardization Documents, 1 Nov 2011.

2 NATO Joint CBRN Defence Capability Development Group Terms of Reference, Oct 2016.

3 CJCSI 2700.01F Rationalization, Standardization and Interoperability (RSI) Activities, 18 Mar 2015, http://www.dtic.mil/cjcs_directives/cdata/unlimit/2700_01.pdf.

# Commander Guidance for Radiological Exposures During Operations Other Than War

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**Introduction**

In accordance with Joint Publication 3-11, Operations in Chemical, Biological, Radiological, and Nuclear Environments, commanders are responsible for managing risk on behalf of all personnel under the commander's authority. According to a DA PAM 600-3, Commissioned Officer Professional Development and Career Management, the Nuclear Operations and Counterproliferation Functional Area (FA52), officers are warfighters who provide the Army with a technically educated, operationally experienced, and highly trained cadre specializing in all aspects of nuclear and combating WMD strategic and operational level planning and execution. The following are FA52 core competencies as depicted in the upcoming revision to DA PAM 600-3 along with a new career development model: Nuclear & Countering WMD (CWMD) Operations & Intelligence; Nuclear & CWMD RDT&E & Capabilities; Nuclear & CWMD Plans, Policy & Strategy; and Nuclear & CWMD Doctrine, Education & Training. Likewise, the CBRN Officer (Branch 74) is focused primarily on the development, integration, and employment of tactical capabilities that identify, prevent, and mitigate the entire range of chemical, biological, radiological, and nuclear

(CBRN) threats and hazards through CBRN operations. The Nuclear Medical Science Officer (72A) is expected to plan, lead, direct, manage, advise, and participate in activities relating to health physics and NBC medical defense associated with military operations, in particular will provide identification, evaluation, and guidance for personnel protection and for control of potential radiation hazards in working environments, materiel, munitions, and armament. All three of these job specialties are intricately woven into the operational structures of the Army. Associated with the typical duties of FA 52, 74, and 72A officers, they must be able to advise the commander on his Operational Exposure Guidance (OEG) for all related operations in a nuclear and radiological environment. Nuclear and radiological operations typically fall into two categories: wartime operations and operations other than war. For NATO, operations other than war is usually referred to a Non-Article 5 Crisis Response Operations. This article will concisely summarize those guidelines by extracting information provided in the references listed below (mostly from JP 3-11); all great documents for your professional library.

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**If radiation is encountered and the mission requires potential exposure, then the key principles of radiation protection (time, distance, and shielding) should be applied to minimize exposures.**

**Radiological Exposure Mitigation Strategies**

The commander will often have very little experience with radiation and will seek guidance on its potential hazards and ways to mitigate radiological exposure to Soldiers. When advising the commander, there are a number of methods to mitigate radiation hazards that can be provided. The most straightforward and effective way is to avoid areas with radiation hazard levels. That said, a balance of risk from all other hazards must be taken into account. If given the option, contamination avoidance is the best course of action. If radiation is encountered and the mission requires potential exposure, then the key principles of radiation protection (time, distance, and shielding) should be applied to minimize exposures (Figure 1).

| Best Practice | Summary | Example |
|---|---|---|
| Time | Cut stay time by one-half; dose reduced by one-half. | Enter radiation area only when there is a benefit to entering. |
| | | Remain in a radiation area for as long as is required to accomplish the task and no longer. |
| | | Establish stay times and upper dose limits; monitor to ensure these are followed. |
| | | Develop detailed plans for work to be done in a radiation area. |
| | | Ensure team members are trained in monitoring procedures and personal protective equipment/ individual protective equipment. |
| Distance | *Inverse Square Law* Example: Increase distance by a factor of three; decrease dose by a factor of nine (valid only for a point source). See paragraph 4-96. | If there is no benefit to being near the radiation source, back away. |
| | | Increasing distance reduces the dose rate. |
| | | Increasing distance is very effective for reducing skin beta dose. |
| Shielding | Shielding reduces dose rate or blocks radiation. | Any material between the radiation source and personnel will reduce the dose rate; however, for penetrating radiation shielding can be difficult. |
| | | Beta radiation dose can be reduced or eliminated with low density or hydrogenous materials (aluminum, plastic, or glass). |
| | | Wearing lead shielding is generally not advised because the increased time to accomplish a task usually negates the benefit of shielding. |

Figure 1. External Exposure Reduction (TM 3-11.91, Table 4.4)

Minimizing the amount of time in an elevated radiation environment minimizes dose; conversely the potential for damage increases as the radiation exposure increases. Mission permitting, units must practice tasks that will have to be performed in a radiological environment before execution so that they can be performed more quickly. Rotate personnel in and out of the radiological environment so that no single individual is excessively exposed. Sometimes forgoing the use of Individual Protective Equipment (IPE) that may slow operations can result in shortened time of exposure and minimize radiation dose.

Distance has an inverse square relationship to radiation exposure or dose, meaning that if the distance from the source is increased by a factor of X, the dose is decreased by a factor of X squared (X2), e.g., double the distance, quarter the dose. Maximizing personnel distance from the source will help to minimize dose. If only one person is needed to perform a mission in close proximity to a source, send only one. Other supporting staff can be located a greater distance away from the radiation hazard, thereby minimizing dose. Individuals should also be cognizant of their geometry in relationship to the source so that they can position themselves at the maximum distance from the source, consistent with mission accomplishment. If the source is contamination on the ground and is fairly uniformly distributed, standing or sitting some distance above the ground in a vehicle or elevated platform will also minimize dose, as well as act as a shield.

**Shielding is simply placing material between personnel and a radiation source. The reduction of the dose depends on the type of radiation being emitted, the shielding material, as well as its density and thickness.**

Shielding is simply placing material between personnel and a radiation source. The reduction of the dose depends on the type of radiation being emitted, the shielding material, as well as its density and thickness. Thicker is always better, but may be limited by weight and availability. Lead and other dense materials work well for gamma and X-ray emitters. A lower density shield would require greater thickness for the same shielding value. Lower density material such as plexiglass or aluminum should be used to shield against beta emitters. Beta interaction with high-density materials like lead can lead to significant X-ray production (Bremsstrahlung), possibly increasing dose. Neutrons can be shielded with materials that have a lot of hydrogen atoms, like plastics and water. Generally, it is not necessary to shield for alpha particles. Concrete, earth, and sand bags can work well as field expedient shielding material for all sources. In addition, vehicles will provide shielding with armored vehicles generally providing more shielding than light vehicles. Note that IPE does not provide shielding for the most part, but it can limit contamination and internal uptake of radioactive material, thereby limiting dose.

### The Radiological Threat

In addition to direct exposure to radiation and fallout from a nuclear detonation, there are many other potential sources of radiation. These sources can be broken down into four broad categories: natural, industrial, medical, and military commodities. The term toxic industrial radiological refers to any radiological material manufactured, used, transported, or stored by industrial, medical, or commercial processes. The radiation is emitted by one or more of the follow: neutrons, alpha particles, beta particles, gamma rays, or X-rays. Once radioactive material is introduced into the environment, it may be



found in air, soil, and water, or as contamination on any object.

Radioactive materials, to include fissile materials (able to sustain a nuclear fission chain), may be used by an advisary in one or more of the following ways: as a nuclear device, an improvised nuclear device (IND), a radiological dispersal device (RDD), and/or as a radiological exposure device (RED). Figure 2 summarizes the overall effects of radiation exposure as a function of dose for healthy, young adults with no other injuries.

**A non-state actor could produce an improvised explosive device (IND) from illegally obtained fissile material, such as enriched uranium and plutonium.**

A non-state actor could produce an improvised explosive device (IND) from illegally obtained fissile material, such as enriched uranium and plutonium. There would be significant technical problems that would have to be solved in order to produce the IND, but with the right expertise, it may be possible. An IND would likely be a low-yield nuclear device detonated on the ground delivering prompt radiation exposure and conventional damage and injury, as well as significant fallout.

| Acute Dose centi-Gray (cGy) Free-in-Air | Threshold Effects Within 1 Day (See Notes 1, 2) | Probability of Death Within 30 Days | Probability of Nausea/ Vomiting Within 6 Hours | Percent Expected to Require Hospitalizations | Probability of Death from Excess Cancer (40 Years After Exposure) (See Note 3) |
|---|---|---|---|---|---|
| 35 | None expected | < 1% | < 1% | < 1% | < 1% |
| 75 | Mild<br>– Nausea<br>– Vomiting<br>– Headache | < 1% | < 10% | < 1% | 1-2% |
| 125 | • Lymphocyte count drop<br>• Fever | < 1% | < 25% | < 10% | 2-4% |
| 410 | • Moderate vomiting<br>• Diarrhea<br>• Fatigue | ≥ 50% | 75% | 100% | 10-15% |
| 1000 | Performance degraded | ≥ 99% | 100% | 100% | n/a |
| 3000 | Combat ineffective | 100% | 100% | 100% | n/a |
| 8000 | • Disorientation<br>• Death | | | | |

rad = radiation absorbed dose
1 rad = 1 cGy
100 rad = 1 Gray

NOTES:

1. The probability of death is without medical treatment and for healthy adults.
2. Burns and/or trauma in combination with radiation injury increases mortality. Personnel with such injuries combined with radiation doses exceeding 100 cGy will likely require prompt medical evaluation. Personnel with combined injuries with doses in excess of 600 cGy are unlikely to survive regardless of medical intervention.
3. US citizens have approximately 41% chance of getting cancer over lifetime, averaging between 37% and 41% based upon race and ethnicity.

Figure 2. Effects of Radiation Exposure (JP 3-11, Figure D-1)

A radiation exposure device (RED) is simply a penetrating radiation source (gamma and/or neutron) that is placed, or buried where people will become exposed to the radiation emitted. An RED is relatively easily employed, but obtaining the material might be difficult. If a relatively large source of penetrating radiation could be obtained, it could be emplaced in a public location, such as a park or public building, in such a way as to maximize the probability and time of exposure to those nearby. If the source were big enough and the time of exposure long enough, exposure could lead to acute effects such as nausea, diarrhea, and erythema (reddening of the skin), leading to clinical illness and/or death.

**A radiation dispersal device (RDD) is a device, other than a nuclear explosive device, designed to disseminate radioactive material in order to cause destruction, damage, or injury.**

A radiation dispersal device (RDD) is a device, other than a nuclear explosive device, designed to disseminate radioactive material in order to cause destruction, damage, or injury. This is most often done by using a conventional explosive bundled with radioactive material. The explosive itself would likely cause most of the direct damage and injury, but the radioactive contamination may deny use of the area and complicate incident management and health services support. Another RDD mechanism could be an aircraft spreading radioactive contamination, much like a crop duster. Whichever mechanism is used, mitigation of the effects of the contamination would consume significant resources.

### Principles of Radiation Protection

The commander is responsible for managing risk on behalf of all personnel under the commander's authority. It is DOD policy to reduce exposure to ionizing radiation associated with DOD operations to a level as low as reasonably achievable (ALARA) consistent with operational risk management. Complying with the principle of ALARA must be done in the context of managing risk from all sources: chemical, biological, environmental, and combat engagement. The risk from each of these may be considerably greater than the radiation exposure. Commanders must balance risk management with the requirement of completing the military mission.

Risk management tool to track and limit radiation exposures has been developed. While the Radiation Exposure Status (RES) is used to track unit exposure level, the OEG serves as the commander's primary administrative control used to limit radiation exposure to personnel for a given mission. Operational Commanders are required to set the OEG for each mission after assessing the current RES status of the unit. Although there is currently only one radioprotectorant available in military operations for radioactive iodine, others are being research may be available in the future and should be considered for planning purposes. Finally, review the radiological risk throughout mission; revise guidance as necessary.

### Radiation Exposure Status (RES)

RES provides a convenient method to track radiation dose and associated operational impact of exposure. Since RES is directly related to effects of tactical interest, it can be used for estimating the effectiveness of units (or, in exceptional cases, of individuals) and is considered 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. Tracking RES includes keeping and maintaining RES records. RES is an estimate, indicated by the categorization symbols RES-0 through RES-1 used for all operations other than war (see Figure 3), which may be applied to a unit, subunit, or exceptionally, to an individual. RES categories RES-0 through RES -3 are used for nuclear warfare, which will be discussed in the next article. RES is based on total cumulative dose received from exposure to penetrating radiation. The total cumulative dose is most accurately determined by using a dosimeter. If a dosimeter is not used, then the dose can be an estimated based on radiation monitoring data and total exposure time.

| Total Cumulative Dose (See Notes 1 & 2) | Radiation Exposure Status (RES) Category | Recommended Actions (Continue Actions from the Previous RES Categories as RES Increases) |
|---|---|---|
| 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<br>• Initiate specific mission protocols or goals |
| 0.5 – 5 cGy | RES-1B | • Initiate radiation survey and continue monitoring |
| 5 – 10 cGy | RES-1C | • Update survey and continue monitoring<br>• Continue dose control measures<br>• Execute PRIORITY tasks only (see note 3) |
| 10 – 25 cGy | RES-1D | • Execute CRITICAL tasks only (see note 4)<br>• Medical evaluation recommended upon normally scheduled return to home station |
| 25 – 75 cGy (see note 5) | RES-1E | • Monitor for acute radiation syndrome symptoms |
| 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 centi-Gray (cGy)

NOTES:

1. Radiation measurement in either centisievert (cSv) or millisievert (mSv) is preferred in all cases. However, due to the fact that the military may only have the capability to measure centi-gray (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 = 1 cSv = 10 mSv.
2. All doses should be kept as low as reasonably achievable. This will reduce individual soldier risk as well as retain maximum operational flexibility for future employment of exposed soldiers.
3. Examples of priority tasks are those that contain the hazard, 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 limit should be considered for medical evaluation and evacuation upon any signs or symptoms related to acute radiation sickness (e.g., nausea, vomiting, anorexia, fatigue).

Figure 3. Radiation Exposure Status Guidance (JP 3-11, Figure D-2)



Return to TOC

All individuals of the unit or subunit are assigned the same RES based on the determined dose. If personnel are reassigned, the unit RES is determined by the average dose of the individuals assigned. All personnel who have received radiation exposure during operations should be evaluated by medical personnel, and appropriate entries documented in their individual medical record in accordance with multi-Service TTP and NATO standardization agreement (STANAG) 2521, CBRN Defence on Operations (ATP 3.8.1 VOL 1), January 2010. Figure 3 defines the RES categories as a function of dose received by the unit and describes the precautions required for units in each of the RES categories. In operations other than war, or non-article 5 crisis response operations, units and/or personnel RES categories are only RES-0 to RES-1E. RES-2 and RES-3 pertain to nuclear warfare, when military operations may require that peacetime regulations on limits of nuclear radiation exposure and requirements for nuclear radiation protection be exceeded. However, all exposure to nuclear radiation should be justified by military necessity to execute the mission with the resources available. The danger involved in radiological exposures must be evaluated in accordance with the military situation and the state of emergency.

**The commander's decision to expose personnel to ionizing radiation should be balanced with mission requirements and all other risks.**

**Operational Exposure Guidance**

According to JP 3-11, the commander must determine the radiological risk. Commanders should establish an OEG for the following situations:

1. All missions with the potential for ionizing radiation exposure.
2. Units conducting radiological decontamination for personnel or equipment.
3. Units conducting immediate or operational decontamination.

In order to assess the radiological environment risk, it is necessary to estimate the potential dose and dose rate from radiological sources that may be encountered during the mission. This will determine the severity of the radiological threat. Next, determine the likelihood of encountering this radiological threat. This will determine the probability of exposure. Figures 4 and 5 provide severity and probability of radiological threat descriptions. Once the severity and the probability of the hazard are determined, Figure 6 correlates the two to determine the level of risk associated with the hazard.

The commander's decision to expose personnel to ionizing radiation should be balanced with mission requirements and all other risks. In combat, it may be necessary to exceed safe levels of radiation exposure due to mission requirements or as a consequence of enemy action. The risk management process goal is to achieve the lowest possible overall risk consistent with mission accomplishment. Once the level of radiological risk is assessed, the OEG is set for each platoon or equivalent unit and for each mission. The OEG should be based on the importance of the mission and the acceptable tolerance to ionizing radiation effects in comparison to other risks associated with the mission.



| Level of Severity | Mission Impact | Associated Potential Dose and Dose Rate |
|---|---|---|
| Catastrophic | • Expected loss of ability to accomplish mission | • Total dose > 450 centi-Grays<br>• Encounter source/environment with dose rate > 200 centi-Grays per hour |
| Critical | • Expected significant degradation of mission capabilities in terms of the required mission standard<br>• Inability to accomplish all parts of the mission<br>• Inability to accomplish the mission to standard if hazards occur during the mission | • Total dose > 200 centi-Grays<br>• Encounter source/environment with dose rate > 10 centi-Grays per hour |
| Marginal | • Expected degraded mission capabilities in terms of the required mission standard; mission capability will be reduced if hazards occur during the mission | • Total dose > 75 centi-Grays<br>• Encounter source/environment with dose rate > 0.5 centi-Grays per hour |
| Negligible | • Expected effect will have little or no impact on accomplishing the mission | • Total dose > 25 centi-Grays<br>• Encounter source/environment with dose rate > 0.01 centi-Grays per hour |

1 rad = 1 centi-Gray

Figure 4. Severity of Radiological Threat (JP 3-11, Figure D-3)

| Probability of Event | Impact on Personnel |
|---|---|
| Frequent – 1 in 500 | • Expected to occur several times or continuously over the duration of a specific mission |
| Likely – 1 in 1,000 | • Expected to occur during a specific mission or at a high rate but intermittently |
| Occasional – 1 in 10,000 | • May occur as often as not during a specific mission<br>• Occurs sporadically |
| Seldom – 1 in 100,000 | • Not expected to occur during a mission<br>• Occurs rarely as isolated incidents |
| Unlikely | • Occurrence not impossible but can assume will not occur during a mission<br>• Occurs very rarely |

Figure 5. Probability of Radiological Threat (JP 3-11, Figure D-4)

| Severity \ Probability | Frequent | Likely | Occasional | Seldom | Unlikely |
|---|---|---|---|---|---|
| Catastrophic | Extremely High | Extremely High | High | High | Moderate |
| Critical | Extremely High | High | High | Moderate | Low |
| Marginal | High | Moderate | Moderate | Low | Low |
| Negligible | Moderate | Low | Low | Low | Low |

Figure 6. Level of Radiological Risk (JP 3-11, Figure D-5)

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

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

Figure 7. Recommended Operational Exposure Guidance Levels (JP 3-11, Figure D-6)



Figure 7 is intended to guide commanders and their staffs in determining an appropriate OEG as defined for mission importance given these mission definitions:

1. Critical missions are those missions that are essential to the overall success of a higher headquarters' operation, emergency lifesaving missions, or the equivalent.
2. Priority missions are those missions that avert danger to persons, prevent damage from spreading, or support the organization's mission-essential task list.
3. Routine missions are all other missions that are not designated as priority or critical missions.

In current Army and Joint doctrine, U.S. military personnel become restricted from ever again engaging in operational radiological missions once they have exceeded 125 cGy (rad) dose accumulation. During nuclear warfare operations, military commanders can set their OEG for dose limits for U.S. forces at any level, the risk analysis for extremely high-priority missions, to include lifesaving, with a maximum OEG of 125 cGy (rad). For operations other than war, also based on mission priorities and risk analysis, military commanders limit OEG levels to 75 cGy (rad) and below. The next article in the CWMD Journal will focus on nuclear offensive warfare doctrine and Soldier safety concerning nuclear weapon effects, including initial nuclear and residual radiation exposure.

Ongoing actions at USANCA – Multiple federal agencies within the U.S. government (i.e. NRC, DOE, and OSHA) have determined that the annual radiation safety dose limit will be 5 cGy (rad) for whole body exposure. While this exposure is maintained in occupational health records in perpetuity, it gets zeroed annually towards a new annual dose limit. Consistent with that practice, USANCA has proposed that when a RES category does not exceed the 5 cGy (rad) in one calendar year for an individual, a RES reset will take place, thus adjusting the unit RES category. Historically, this was an understood practice in commercial industry, but not clearly articulated in military doctrine. USANCA is attempting to correct this and allow for greater flexibility for unit commanders engaged in radiological or nuclear operations.

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# The Radiation Protection Factor White Paper

MAJ Andrew W. Decker
Defense Threat Reduction Agency

The purpose of this paper is to establish a foundation for current and future Radiation Protection Factor (RPF) research sponsored by the Defense Threat Reduction Agency (DTRA). Specifically, this document provides the background, justification, and campaign plan for RPF research, as well as highlights the current progress and ultimate objectives for this study. Even at this early stage, RPF research is expected to impact and enhance the planning, protection, and warfighting capabilities of every Department of Defense (DoD) Component Service, the Department of Homeland Security (DHS), and eventually American allies.

### Background

> Today, the Cold War has disappeared but thousands of [nuclear] weapons have not. In a strange turn of history, the threat of global nuclear war has gone down, but the risk of a nuclear attack has gone up. More nations have acquired these weapons. Testing has continued. Black market trade in nuclear secrets and nuclear materials abound. The technology to build a bomb has spread.[1]

When President Barack Obama made these remarks in 2009, the specter of nuclear attack appeared clear. Unfortunately, the threat has only increased since then and presents an even more critical concern to American leaders today. While the current risk primarily stems from hostile nation-states, we must remember non-state actors and terrorist groups remain committed to acquiring nuclear weapons technology, as well.

Over the past two decades, US Army vehicle shielding against conventional weapons and improvised explosive devices has improved markedly, yet the degree of protection against radiation is currently unknown for the majority of vehicles in the Army inventory. This shortfall first became evident during Operation Tomodachi in March 2011 when radiation protection information was requested by, but unavailable to, operational decision-makers in Japan. It was revealed that DoD regulations no longer required the Army to obtain such information for vehicles and shelters.[2] In an apparent effort to reduce costs, the requirement to provide radiation protection information was removed from capability development documents following the end of the Cold War.

To address this gap between requirements and capabilities, DTRA and the US Army Nuclear and Countering Weapons of Mass Destruction Agency (USANCA) established a multi-year plan to quantify RPF values for modern Army vehicles. A RPF is calculated from the ratio of radiation dose outside (unshielded) compared to the dose present inside the vehicle (shielded) and may be determined using the equation

$$RPF = \frac{\text{Unshielded Dose (neutron + gamma)}}{\text{Shielded Dose (neutron + gamma)}} . \quad (1)$$

Since neutrons and gamma rays represent the two most biologically significant sources of radiation following a nuclear detonation, a more detailed analysis of vehicle RPF can be obtained by defining both the neutron protection factor (NPF) and the gamma protection factor (GPF):[3]

$$NPF = \frac{\text{Unshielded Neutron Dose}}{\text{Shielded Neutron Dose}} , \quad (2)$$

$$GPF = \frac{\text{Unshielded Gamma Dose}}{\text{Shielded Gamma Dose}} . \quad (3)$$

Consequently, a RPF is an additive combination of the GPF and NPF components, as shown in Equation 1. The implication to be drawn from these three equations is the larger the RPF value, the better the degree of protection afforded by the vehicle or shelter.

### Justification

Limited RPF information exists today within Army and Joint publications, and much of what is published is contradictory. This is due, in part, to a reliance on obsolete vehicle data and poor assumptions, which by themselves provide compelling justification for renewed RPF research; however, a variety of additional reasons also exist. It can be useful to delineate whether these reasons apply "before" or "after" a nuclear attack, and many can equally apply in cases of nuclear accident response.

**In an apparent effort to reduce costs, the requirement to provide radiation protection information was removed from capability development documents following the end of the Cold War.**

Before a Nuclear Attack: The three principle applications for reliable RPF information are summarized in the following statement from a 1988 Defense Technical Information Center report:

> It is desirable to know the radiation protection factors of U.S. and allied vehicles since it will affect the best mode of deployment in the event of the reality, or even the threat, of nuclear war. Similarly, the protection factors of potentially hostile vehicles will affect U.S. targeting doctrine. It is also important to make known to [future] U.S. designers of vehicles . . . the best techniques for attaining good radiation protection, so that they may be implemented in an efficient and cost-effective manner.[4]

In other words, accurate RPF information assists military commanders and staffs in deciding how best to deploy US forces during the threat of nuclear attack, thereby greatly enhancing the odds of crew and vehicle survivability. Additionally, RPF estimates of enemy systems improve operational and strategic targeting of hostile

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formations, which increases the efficiency of US targeting and associated effects. Lastly, combat vehicle developers benefiting from RPF analysis can integrate radiation protection into the design of new systems, thereby providing superior radiation protection for future vehicles while reducing long-term costs.

**Leaders from all DoD Services must possess accurate RPF information to support informed decisions, both before and after a nuclear attack...**

After a Nuclear Attack: Although US Armed Forces have never faced a conventional or unconventional nuclear attack, Operation Tomodachi revealed that US military leaders tasked with conducting operations in radiologically contaminated environments require accurate RPF information for their vehicles. "Currently, ground component commanders are hindered in making exposure decisions without established PF information on their systems".[2] DTRA RPF research will enable necessary exposure rate calculations, which will assist commanders and staffs in identifying optimal routes, avenues of approach, and schemes of maneuver through contaminated terrain. Likewise, RPF information will support staff analysis of possible threat courses of action in relation to radiologically contaminated areas. Additionally, RPF data will greatly improve the accuracy of predicted risks and health effects associated with sustained operations within radiologically contaminated areas. Commanders must often weigh the risks to service member health and safety across multiple courses of action to achieve mission accomplishment. RPF research will provide a quantifiable analysis of the radiation health risks to soldiers for military decision-makers to consider.

Although initiated on behalf of USANCA, the justifications for renewed RPF research apply equally across all Services within the US Armed Forces. Leaders from all DoD Services must possess accurate RPF information to support informed decisions, both before and after a nuclear attack; this applies equally for tanks, ships, aircraft, and amphibious assault vehicles. DTRA RPF research will provide this information, thereby making warfighters more confident and capable when operating in radiologically contaminated environments, whether encountered on land, sea, or air. Consequently, the expected applications for this research offer substantial benefits across all DoD Component Services, from the tactical to strategic levels.

### Research Progress

Following the revelations from Operation Tomodachi, both DTRA and USANCA agreed that computational analysis offered the most cost-efficient and reliable means of estimating RPF information – a decision based on precedent. During the Cold War, the Army routinely utilized computational methods to determine vehicle RPF values, once each code underwent verification and validation (V&V) against laboratory measurements of simplified surrogate vehicles.[3-8] Additionally, computational methods enable RPF estimates for a variety of radiation exposure scenarios, which is essential because RPF values can change dramatically based upon a variety of factors. In short, computational methods offer vastly superior analytic capability and flexibility over experimental alternatives.

DTRA ultimately selected Monte Carlo n-Particle (MCNP), an export controlled radiation-transport code developed by Los Alamos National Laboratory (LANL), for this task due to its broad acceptance as the world's premier radiation-transport modeling software. However, before providing RPF estimates for US Army vehicles,



the latest version of the code, MCNP6, must first undergo extensive V&V for that purpose. Ongoing V&V efforts today leverage experiments utilizing simplified surrogate vehicles, similar to the methods described in Cold War era code validation documentation.[3-8]

DTRA RPF research first began in 2013 at the Air Force Institute of Technology (AFIT) with an exploratory comparison of MCNP6 NPF estimates of a steel surrogate vehicle against experimentally measured NPF values of the same. Completed in 2014, NPF results differed by less than 1%[9], which strongly supported further evaluations of MCNP6 RPF estimations.

Based upon this initial success, a program manager was appointed from DTRA's Nuclear Science and Engineering Research Center (NSERC), which is located at the United States Military Academy (USMA) at West Point, New York. An RPF research campaign plan was drafted and approved, which incorporated a series of increasingly complex experimental parameters to compare against MCNP6 RPF estimates. As shown in Figure 1, variations in materials and geometry, either simple (S) or complex (C), as well as source energy spectra, either mono- or poly-energetic, established a logical, sequential V&V process for MCNP6-derived RPF estimates for the US Army. The experimental portion of this plan is scheduled to culminate in 2019 with an experiment using a military vehicle, with the final V&V report published the following year.

Additionally, the RPF campaign plan relies heavily upon research integration across the DoD degree-granting institutions, all of which provide the benefit of low-cost research and student involvement with the drawback of slower research

## RPF Experiment Schedule

| | Experimental Parameters | | | | | |
|---|---|---|---|---|---|---|
| | Material (S/C) | Geometry (S/C) | Source (Mono/Poly) | PF (NPF/GPF/RPF) | Proponent | Planning Requirements |
| AY14/15 | S | S | Mono | NPF | AFIT | |
| | S | S | Poly | NPF | USMA | vehicle #2 and 6 steel pla[illegible]s |
| | S | S | Poly | GPF | AFIT | |
| | **S** | **S** | **Poly** | **NPF** | **WSMR** | vehicle #3 a[illegible]x[illegible]C) coupons |
| AY15/16 | C | S | Mono | GPF | USMA | Complete |
| | C | S | Mono | NPF | USNA | |
| | C | S | Poly | RPF | AFIT | |
| | **C** | **S** | **Poly** | **RPF** | **WSMR** | |
| AY16/17 | C | S | Poly | GPF | USMA | |
| | C | S | Poly | NPF | USNA | |
| | C | S | Mono | RPF | NPS | |
| | S | C | Poly | RPF | AFIT | |
| | **S** | **C** | **Poly** | **RPF** | **WSMR** | 3x CGS w/ steel plates |
| AY17/18 | S | C | Mono | GPF | USMA | |
| | S | C | Mono | NPF | USNA | |
| | C | S | Poly | NPF or GPF | NPS | |
| | C | C | Poly | RPF | AFIT | |
| | **C** | **C** | **Poly** | **RPF** | **WSMR** | complex plates for 3x CGS |
| AY18/19 | C | C | Mono | GPF | USMA | |
| | C | C | Mono | NPF | USNA | |
| | C | S | Poly | NPF or GPF | NPS | |
| | Final Validation with US Army Vehicle | | Poly (WSMR) | RPF | AFIT | Final Validation Experiment |

This schedule projects a NET V&V experiment for MCNP6 by ~Spring 2019, while minimizing technical risk throughout by ensuring every experiment conducted at WSMR is completed at AFIT beforehand.

Figure 1. Schedule of RPF experiment parameters used to coordinate and synchronize the research efforts of DoD degree-granting institutions to collectively V&V MCNP6 for RPF estimates of military vehicles.

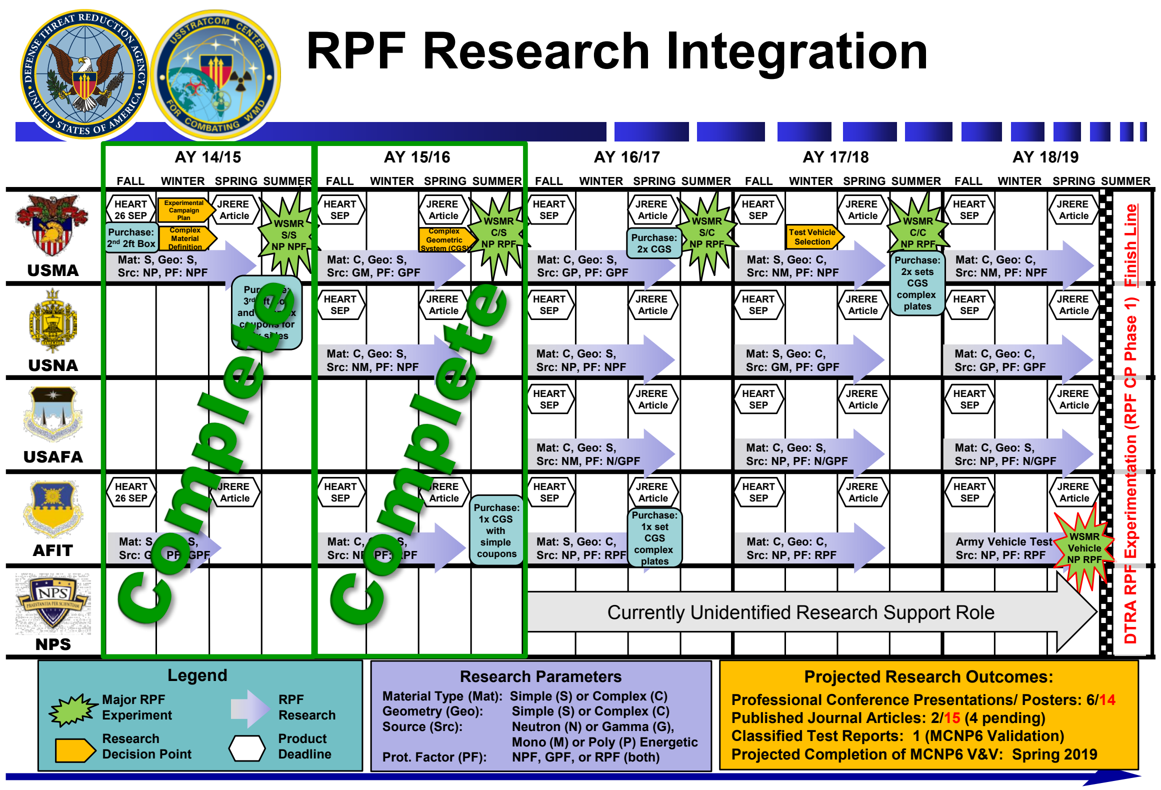


Figure 2. RPF research integration across the DoD degree-granting institutions, as well as anticipated research outcomes. RPF experimentation is expected to be complete in Spring of 2019.

progression driven by academic year (AY) schedules. In addition to USMA and AFIT, the United States Naval Academy (USNA), the United States Air Force Academy (USAFA), and Naval Post-graduate School (NPS) were identified early on as potential contributors to RPF research. The degree of integration, as well as the current progress of RPF research, is illustrated in both Figures 1 and 2, which together constitute Phase 1 of the RPF Research Campaign Plan.

In AY 14/15, RPF research integration produced a successful V&V of MCNP6-derived GPF estimates at AFIT,[10] as well as an initial RPF research project at USMA. Most notably, AY 14/15 culminated in a NPF experiment conducted at the White Sands Missile Range (WSMR) Fast Burst Reactor (FBR), which yielded extremely relevant results due to its combined neutron and gamma ray spectra.[11] This experiment also marked the initial support of RPF research by students and faculty from USNA. All experimentation conducted in AY 14/15 utilized the same steel surrogate vehicle previously used at AFIT.

RPF research supporting the V&V of MCNP6 during AY15/16 maintained the original simplified vehicle geometry; however, the shielding layers included steel, a glass-reinforced plastic (FR-4), and aluminum, which simulated a vehicle frame, anti-spallation liner, and skin, respectively. These new materials, as well as their layered configuration, provided a more challenging problem for MCNP6 to adjudicate. Regardless, MCNP6 proved successful in estimating NPF values for the surrogate vehicle at USNA[12] and during two GPF studies conducted at USMA, one




Figure 3. A storyboard describing the 2015 Joint NPF research conducted by DTRA at the WSMR FBR, which incorporated students and researchers from DTRA, USMA, USNA, and AFIT.

of which also modeled the head of an anthropomorphic phantom.[13-14] AY 15/16 concluded with another successful series of experiments conducted at the WSMR FBR, this time also evaluating MCNP6 estimations using the complex shielding materials. Early results of this research appear promising; however, data analysis is still ongoing.

Bolstered by shared DTRA and USANCA interest in quantifying RPF values of military vehicles, preliminary examinations were conducted and proved successful.[9-14] Future DTRA V&V efforts will evaluate experimental measurements and simulations using complex geometries and multi-layer, nonhomogeneous materials when exposed to various neutron and gamma ray spectra. As mentioned earlier, the formal V&V of MCNP6 for US Army vehicle RPF estimates will culminate in an experiment using an actual Army combat vehicle, which will support Phases 2 and 3 of the RPF Research Campaign Plan.

**RPF Research Campaign Plan**

The RPF Research Campaign Plan consists of three-phases. These phases are designed to build upon and support one another as research continues to develop and the number of stakeholders increases. Following the culmination experiment conducted in Spring 2019, Phase 1 is scheduled to conclude in 2020 with the publication of an official report on the V&V of MCNP6 for RPF estimates on behalf of DTRA, USANCA, and the US Army. Although evaluations of MCNP6 will continue, Phase 1 provides the

Return to TOC

literature and academic basis for future vehicle RPF determinations and policy decisions using MCNP6. Principal among the Phase 1 objectives is to develop, standardize, and validate the specific methodology for both computational and experimental RPF evaluations.

Phase 2 is scheduled to begin in 2020 at the completion of Phase 1; however, it constitutes a multi-year effort and will not conclude until all combat system RPF values requested by the Component Services are provided. This process will likely initiate with US Army vehicles before expanding to include systems and vehicles from other DoD Component Services. Additionally, as this research deals primarily with health effects on the human body, anthropomorphic phantom studies will also be incorporated throughout. These data are expected to inform the Army's Office of the Surgeon General (OTSG), as well as those of the sister Services.

Lastly, Phase 3 focuses on both Service and Joint policy implementation and publication updates. Materiel Commands should become involved during Phase 3, which ensures RPF analysis will inform the development of future combat systems, thereby providing greater radiation protection at reduced cost. Additionally, MCNP6 acceptance by the DoD will likely support similar applications on behalf of the DHS, which will improve the design of radiation-hardened vehicles and equipment used domestically. Although the completion date for Phase 3 remains as yet undefined, this phase will conclude once RPF information becomes widely available to US military commanders, where it can routinely inform military planning, decision-making, and consequence analysis.

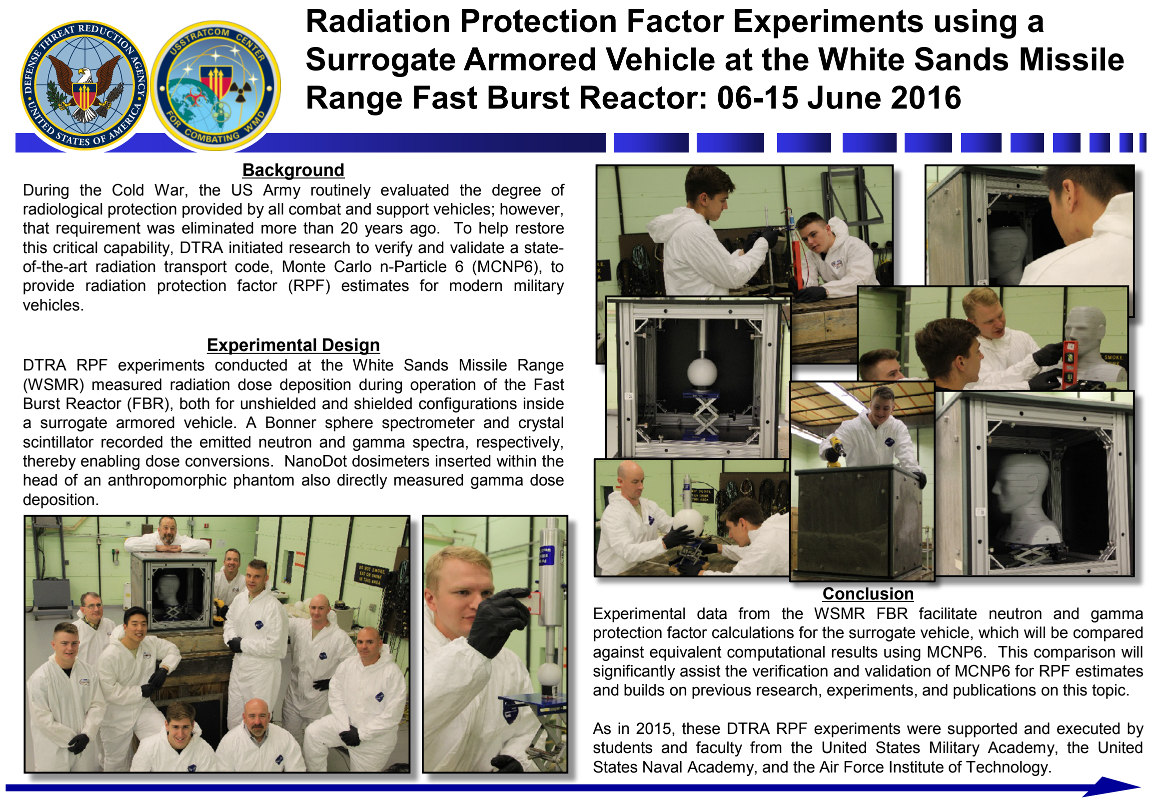


Figure 4. A storyboard describing the 2016 Joint NPF and GPF research conducted by DTRA at the WSMR FBR, which again incorporated students and researchers from DTRA, USMA, USNA, and AFIT.



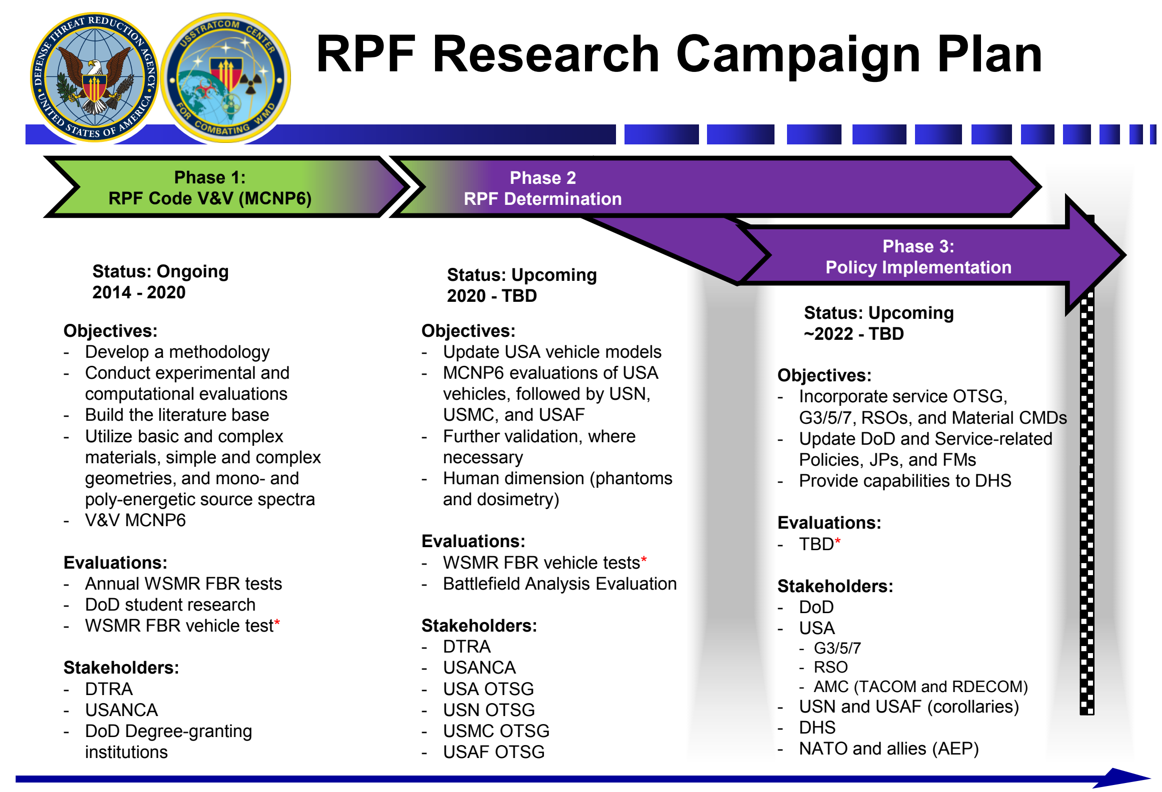


Figure 5. Depiction of the multi-year, three-phase RPF Research Campaign Plan.

Together, these three phases provide a simplified but comprehensive implementation strategy for RPF research across the Joint and Inter-Agency workspace. The results will better inform military and civilian leaders, as well as improve American survivability and effectiveness in combat. Figure 5 depicts the three phases of the RPF Research Campaign Plan in a single graphic.

### Conclusion

In a world shared with nuclear-armed adversaries and extremist groups intent on acquiring nuclear weapons, America cannot afford to face these threats with anything less than the best information. Central to this belief is a clear understanding of the benefits and limitations of our own equipment, specifically when it comes to ionizing radiation. Likewise, better insight into enemy capabilities enhances the effectiveness of current targeting processes and weapon systems. Taken together, reliable RPF information guarantees fewer American casualties and increased US weapon effectiveness. The list of benefits will only expand in the future, as RPF analysis informs new vehicle and equipment designs, eventually enabling America and her allies to seamlessly operate across nuclear and non-nuclear environments.

For these reasons, DTRA sponsors and supports RPF research today, recognizing the urgent need to fill gaps between military requirements and capabilities. Waiting until America's military confronts the realities of a nuclear battlefield is as untenable an outcome as it is avoidable.

And at that point, it will be too late.

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# The Revitalization of Theater Nuclear Operations Planning

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Increased tensions with nuclear armed adversaries in the USPACOM and USEUCOM areas of responsibility (AORs) over the last several years have prompted a shift in policy considerations in which an escalation of a conventional conflict with a nuclear armed adversary is now considered the most likely scenario for future nuclear weapons use. This change increases the requirement at the Geographic Combatant Command (GCC) level to integrate flexible and adaptive regional nuclear planning into conventional operations.

The end of the Cold War marked the beginning of a twenty-six year period of relative relief from the threat of massive nuclear conflict. As a result, the resident nuclear planning and operations expertise within GCC staffs has steadily declined. In response to the lack of resident expertise and the increased requirement for regional nuclear planning experience at the GCC level, the U.S. Army Nuclear and CWMD Agency (USANCA) develops, trains, and deploys Nuclear Employment Augmentation Teams (NEATs). These teams, codified in the 2008 Nuclear Supplement to the Joint Strategic Capabilities Plan (JSCP-N) and the Chairman of the Joint Chiefs of Staff Instruction Emergency Action Procedures (CJCSI EAP) Vol. VIII, deploy on request to assist with the integration of nuclear weapons effects into conventional operations. These teams are designed to augment Corps and above staffs during periods of increased hostilities. The teams provide expertise on nuclear operations and will participate in planning, training, and exercises to become familiar with each command's operational plans and procedures.

USANCA's NEATs are scalable, tailorable support packages composed of active duty military and DA civilians. Each team is typically led by an O-5 FA-52 (Nuclear and Counterproliferation Officer) who serves as the team lead and senior planner. Teams also include a targeting officer (CW4-CW5) to facilitate the integration of nuclear targets with conventional operations. A nuclear effects modeler is frequently integrated into a team and brings a suite of analytical tools to conduct consequence of nuclear execution modeling and nuclear vulnerability analysis.

Over the last two years, USANCA has increased deployments of NEATs in direct support of GCC exercises and planning. Since April of 2015, USANCA has deployed NEATs several times to multiple

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locations in the USEUCOM and USPACOM AORs to support joint and allied exercises as well as to advise and assist GCC or other Corps and above staffs with detailed operational planning. During joint or allied exercises, these teams provided preclusion analysis and hazard prediction capability, the ability to integrate nuclear and conventional targets, reach back support to the nuclear enterprise in the national capital region, and increased coordination with U.S. Strategic Command.

**During joint or allied exercises, these teams provided preclusion analysis and hazard prediction capability, the ability to integrate nuclear and conventional targets, reach back support to the nuclear enterprise in the national capital region, and increased coordination with U.S. Strategic Command.**

In addition to deploying teams to support exercises or assist GCCs with theater planning, USANCA and the Defense Nuclear Weapons School (DNWS) are working jointly to revise and enhance the Theater Nuclear Operations Course (TNOC). TNOC is designed for planners, support staff, and targeteers and provides an overview of nuclear weapons capabilities, and effects as well as a U.S. nuclear policy and joint nuclear doctrine. From November 2015 through June 2016, the team working to revise TNOC sought out feedback for revisions, piloted a new course workbook, and expanded the course content. The new course content now includes additional instruction on the nuclear planning and approval process, nuclear policy, targeting, and modeling, with practical application woven throughout. DNWS and USANCA conducted a pilot course with the new material in June 2016 and fully rolled out the new course content in August. Along with the collaboration between DNWS and USANCA to enhance TNOC, DNWS has now certified three USANCA personnel as TNOC instructors. These instructors now provide a capability to deploy independently or as part of part of a NEAT to

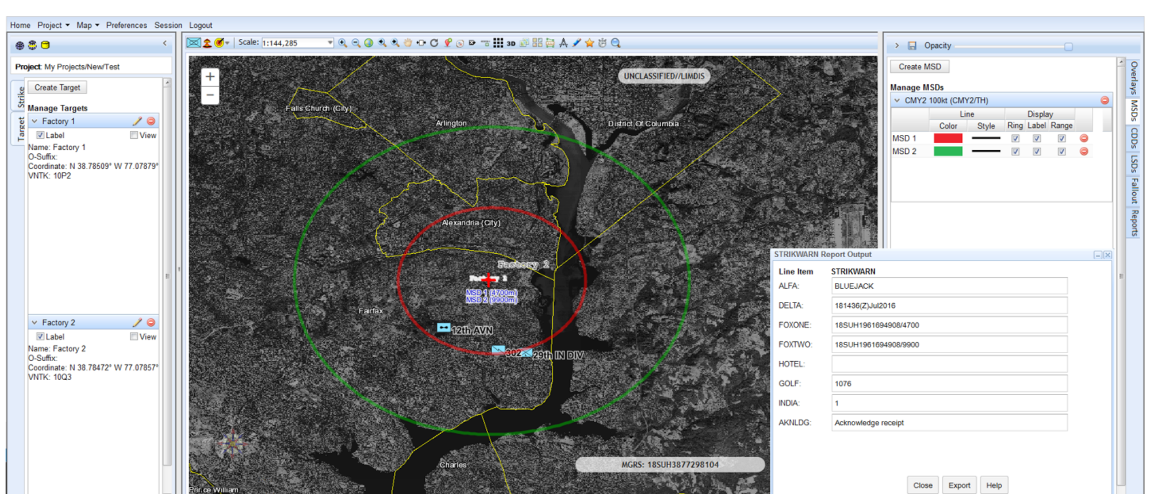


Figure 1. The TNOP tool's graphic user interface will allow users to integrate a command's common operating picture with no strike targets, restricted targets, and proposed nuclear strike targets in order to conduct comprehensive preclusion and vulnerability analysis. The TNOP tool will also be capable of exporting tactical message traffic (STRIKWARNs, CBRN 3 reports) directly to the battle command and control systems (BCCS) such as CPOF, AFATDS, and JWARN.




Figure 2. The TNOP tool will have the capability to conduct basic target analysis to provide commander's with the feasibility of achieving the desired effects against enemy targets.

provide TNOC training for GCCs, or major commands and Army Centers of Excellence.

While NEATs and a revamped TNOC are enhancing GCC's ability to conduct regional nuclear planning, USANCA is also working in conjunction with the Defense Threat Reduction Agency (DTRA) to develop an improved software application to assist regional planners. The Theater Nuclear Operations Planner (TNOP) tool has been in development since December 2015 and is a modeling application that will provide commanders with a single interface to conduct preclusion analysis, Soldier & mission critical equipment vulnerability analysis, no Strike / Restricted Target identification, and critical infrastructure vulnerability analysis. The tool will have the capability to integrate nuclear operations into a headquarters' common operating picture and automatically generate STRIKWARN & CBRN reporting messages. Finally, the software will assist with understanding and planning for post-strike consequence management.

**USANCA is also working in conjunction with the Defense Threat Reduction Agency (DTRA) to develop an improved software application to assist regional planners.**

The recent change in policy guidance demands that the Joint Force maintain a robust, adaptive planning capability to integrate nuclear and conventional operations. While much of this resident expertise has been lost at the GCC level since the end of the Cold War, USANCA's NEATs are steadily working to support GCCs as they integrate regional nuclear planning into their conventional operational plans. In addition, a revamped TNOC curriculum and the ability to push out mobile training teams to GCC staffs has the potential to significantly improve regional nuclear planning capability, while the TNOP software will streamline the process and allow commander's to better visualize and mitigate the effects of nuclear operations. Although the Joint Force has made significant strides in the area of regional nuclear planning in recent years, there is still a long way to go and we look to GCCs to identify their shortfalls so agencies like USANCA, DTRA, and DNWS can continue to support in the most effective manner possible.

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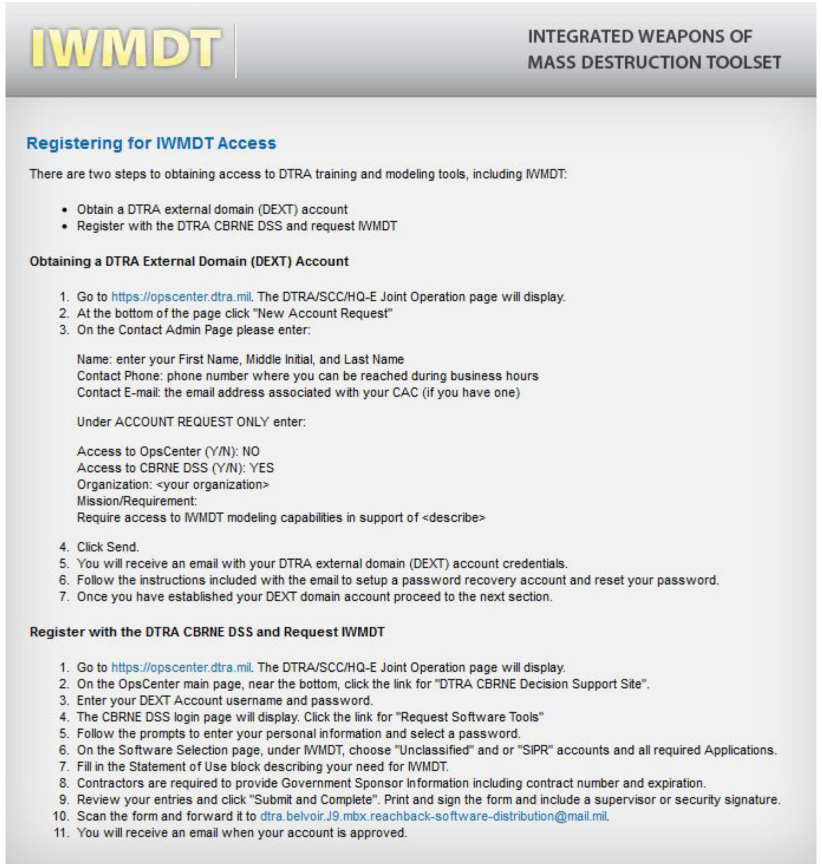
The TNOP tool referenced in this article is part of a larger toolset managed by the Defense Threat Reduction Agency (DTRA). The Integrated Weapons of Mass Destruction Toolset (IWMDT) is available on unclassified, Secret, and Top-Secret networks. To gain access to this and other web based modeling tools you can go to https://iwmdt.dtra.mil, and click register.


IWMDT

INTEGRATED WEAPONS OF MASS DESTRUCTION TOOLSET

**Registering for IWMDT Access**

There are two steps to obtaining access to DTRA training and modeling tools, including IWMDT:

- Obtain a DTRA external domain (DEXT) account
- Register with the DTRA CBRNE DSS and request IWMDT

**Obtaining a DTRA External Domain (DEXT) Account**

1. Go to https://opscenter.dtra.mil. The DTRA/SCC/HQ-E Joint Operation page will display.
2. At the bottom of the page click "New Account Request"
3. On the Contact Admin Page please enter:

   Name: enter your First Name, Middle Initial, and Last Name
   Contact Phone: phone number where you can be reached during business hours
   Contact E-mail: the email address associated with your CAC (if you have one)

   Under ACCOUNT REQUEST ONLY enter:

   Access to OpsCenter (Y/N): NO
   Access to CBRNE DSS (Y/N): YES
   Organization: <your organization>
   Mission/Requirement:
   Require access to IWMDT modeling capabilities in support of <describe>

4. Click Send.
5. You will receive an email with your DTRA external domain (DEXT) account credentials.
6. Follow the instructions included with the email to setup a password recovery account and reset your password.
7. Once you have established your DEXT domain account proceed to the next section.

**Register with the DTRA CBRNE DSS and Request IWMDT**

1. Go to https://opscenter.dtra.mil. The DTRA/SCC/HQ-E Joint Operation page will display.
2. On the OpsCenter main page, near the bottom, click the link for "DTRA CBRNE Decision Support Site".
3. Enter your DEXT Account username and password.
4. The CBRNE DSS login page will display. Click the link for "Request Software Tools"
5. Follow the prompts to enter your personal information and select a password.
6. On the Software Selection page, under IWMDT, choose "Unclassified" and or "SIPR" accounts and all required Applications.
7. Fill in the Statement of Use block describing your need for IWMDT.
8. Contractors are required to provide Government Sponsor Information including contract number and expiration.
9. Review your entries and click "Submit and Complete". Print and sign the form and include a supervisor or security signature.
10. Scan the form and forward it to dtra.belvoir.J9.mbx.reachback-software-distribution@mail.mil.
11. You will receive an email when your account is approved.



# Preventing Weapons of Mass Destruction Proliferation - Leveraging Special Operations Forces to Shape the Environment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The greatest danger of another catastrophic attack in the United States will materialize if the world's most dangerous terrorists acquire the world's most dangerous weapons.

—The 9/11 Commission Report[1]

In 1998 the leader of the al-Qaeda terrorist group, Osama bin-Laden, stated that acquiring Weapons of Mass Destruction (WMD) to defend Muslims was a religious duty.[2] To further clarify their position, al Qaeda released a statement in 2002 saying they felt justified to "use WMD to kill four million Americans."[3] It is highly unlikely the al-Qaeda desire for WMD died with bin-Laden in 2011. The current al-Qaeda leader, an Egyptian surgeon named Ayman al-Zawahiri, personally led al-Qaeda's strategic nuclear and biological acquisition programs prior to bin-Laden's death.[4] These were not makeshift, amateur programs. Al-Zawahiri focused on recruiting highly educated scientists and running multiple, separately compartmented bioweapon development programs.[5] Al-Qaeda simultaneously scoured the globe seeking to purchase nuclear weapons or the nuclear fuel to create their own.[6] Despite significant disruption to al-Qaeda operations, their strategic patience and long view remain concerning.

ISIL has not been as overt as al-Qaeda in stating their desire to acquire WMD, but they appear to be actively seeking the opportunity, even if not as organized and strategically oriented as al-Qaeda. In 2015, ISIL has sought to buy alleged nuclear materials in Moldova and used captured chemicals as weapons in Iraq and Syria.[7] There should be little doubt ISIL would use even more catastrophic weapons if they acquire them.


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Multiple U.S. national strategies state that countering the proliferation and use of WMD is among the highest national priorities and requires a whole of government effort.[8] Countering WMD proliferation is not a simple task however, as proliferation involves a broad range of actors, materials, technologies, activities, and legal considerations that have implications on the roles of military and civilian government departments. Considerations such as risk, time sensitivity, geographic location, and international relations further complicate the situation. Despite the challenges of countering WMD (CWMD), the U.S. Government (USG) must dedicate the necessary resources to defeat the clear desire of terrorist groups to obtain and use WMD in mass casualty attacks against U.S. citizens and our allies.[9]

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In order to provide guidance to organizations within the Department of Defense (DoD), the Secretary of Defense issued a new DoD Strategy to Counter Weapons of Mass Destruction in June, 2014 with a "focus on cooperative efforts to shape the security environment and take early action against adversaries."[10] In support of national and DoD CWMD strategies, U.S. Special Operations Command (USSOCOM) seeks to understand how Special Operations Forces (SOF) can better support WMD counterproliferation efforts and what the appropriate balance between WMD risks is.[11]

The CWMD mission area is so broad it is necessary to limit the scope of this paper to leveraging SOF to counter the proliferation of illicitly trafficked weapons, materials, supporting equipment, and knowledge. For a broader view of the DoD challenge in CWMD, particularly WMD-Elimination, see efforts such as a U.S. Army CWMD strategic study.[12]

Understanding the options for how SOF can better support WMD counter-proliferation efforts first requires the answers to three other questions: what are the primary risks and threats to U.S. interests from WMD proliferation; what are the key elements to disrupting or defeating a proliferation network; and what unique capabilities can SOF provide?

This paper argues the critical shortfall to preventing WMD proliferation is a lack of detailed understanding of proliferation networks by U.S. and partner security forces. This failure to understand the environment leads to a lack of timely indications, warning, and actionable intelligence needed to conduct time sensitive operations against fleeting WMD proliferation targets. To mitigate this shortfall, USSOCOM must build WMD expertise within SOF and collaborate with USG and partner nation organizations to conduct WMD counterproliferation related Building Partner Capacity (BPC) and Operational Preparation of the Environment (OPE) activities.

**SOF Attributes**

SOF are known for their creativity and flexibility as well as their limited ability to quickly grow capacity and operate long-term without support of other partners.[13] These attributes underpin the development of SOF theory.

The first attempts to define Special Operations theory by McRaven, Kiras, and Spulak focused on the tactical and strategic elements of "Direct Action" combat operations.[14] It was William Harris though that defined the principle of SOF conducting Irregular Warfare (IW) by, with, and through partners.[15]

Harris' defines IW as strategic competition against irregular threats in the domain of weak government institutions.[16] The IW characteristics Harris defines extend beyond typical irregular threats such as guerilla war or subversion into WMD counterproliferation. The difficulty in IW of projecting power over distance, achieving strategic effect through tactical action, and coalition building are equally applicable to CWMD activities.[17] Harris further defines tenets of SOF IW operational art that can extend to WMD counter-proliferation campaigns. Particularly relevant are the cognitive and physical access needed to develop an understanding of the operational area.[18] It is in this IW domain SOF have the greatest opportunity to significantly improve U.S. WMD counterproliferation effectiveness.

**WMD Risks**

This paper limits the definition of WMD to Chemical, Biological, Radiological, and Nuclear (CBRN) weapons. Assessments of the risk of WMD use vary greatly within policy and academic communities, largely due to the difficulty in quantifying the probability of acquisition of the wide spectrum of weapon quality materials and delivery methods by state and non-state actors.[19]

The wide range of CBRN materials and weapons also constitute a wide range of strategic risks. Understanding potential costs and probability of use helps quantify the risk and time sensitivity associated with each type and defines the relative roles of SOF and law enforcement.

Figure 1 below conceptually quantifies risk and suggests a threshold above which there is a role

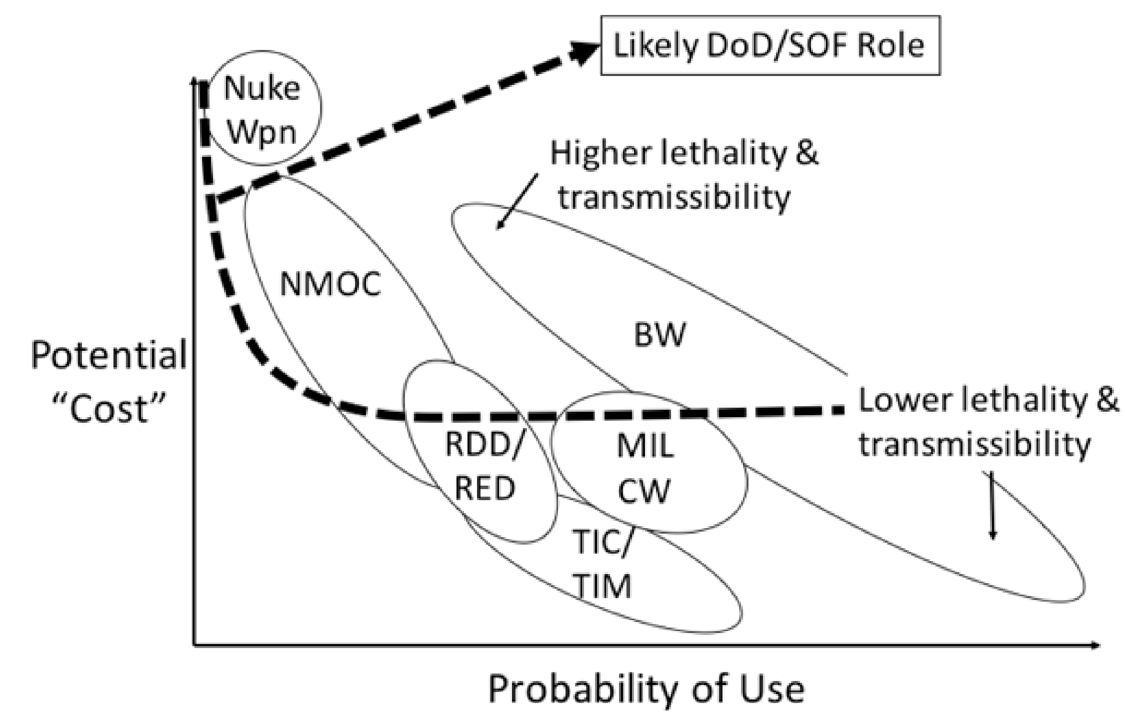


Figure 1. Conceptual representation of the range of potential costs (lives, infrastructure, security increases) of WMD terrorism versus probability of use. Dotted line represents the conceptual threshold for DoD/SOF employment given sufficient quantities of materials of concern, notwithstanding political considerations.

for low density, high demand SOF.[20] As an example, for sufficient quantities or types of Nuclear Materials of Concern (NMOC), Radioactive Dispersal/Exposure Devices (RDDs/REDs), or Biological Weapons (BW), SOF may be the key element of a USG response. While Chemical Weapons (CW) and Toxic Industrial Chemicals/Materials (TIC/TIM) are generally below the threshold, there are situations where the political or operational situation may include a SOF response. Ultimately, the proposed threshold indicates the need for SOF to have experts across the spectrum of CBRN threats.

**Fundamentally, WMD proliferation pathway defeat is a counter-network operation much like counter-terrorism and counternarcotics and overlays many of the same transit zones as other illicit goods.**

### WMD Proliferation Networks

WMD proliferation, regardless of whether between state or non-state actors, requires a pathway comprised of a network of people.[21] Fundamentally, WMD proliferation pathway defeat is a counter-network operation much like counterterrorism and counternarcotics and overlays many of the same transit zones as other illicit goods. These transit zones typically occur in locales with weak institutions subject to exploitation similar to IW. Every network has its own unique characteristics, but there are common elements that provide a basis for developing plans to defeat them.[22]

### Leadership

Different leadership styles influence the form and direction of the proliferation network. Shoko Asahara was the leader of the Japan-based Aum Shinrikyo terrorist network. Eerily similar to ISIL, Aum Shinrikyo is a religious based organization seeking to bring about the apocalypse. They attempted to hasten the process in 1995 when they released sarin nerve agent on the Tokyo subway, resulting in 12 deaths and nearly 6,000 injured. Aum Shinrikyo also had an active biological weapon program where they sought to develop or acquire many agents. Asahara was a dynamic personality who recruited young scientists to develop weapons as well as disaffected elites to finance operations.

Osama bin-Laden and Ayman al-Zawahiri, the previous and current leaders of al-Qaeda are undoubtedly familiar to SOF forces conducting counterterrorist operations. As previously discussed, bin-Laden strongly supported, and al-Zawahiri personally led, al-Qaeda's WMD proliferation efforts. Al-Zawahiri recruited for and managed multiple compartmentalized anthrax development programs as well as leading the effort to purchase nuclear weapons and material.[23] There is no indication that al-Zawahiri's desire to acquire WMD has lessened with his assumption as the leader of al-Qaeda.

These significantly different personalities and approaches to leading WMD seeking organizations highlight networks do not fit any one model and require a flexible approach to understanding a network and its' leadership. After 15 years of intensive counterterrorism operations, SOF are in a unique position to kinetically target leaders or leverage their information operations expertise to deter terrorist network leadership from seeking WMD.



### Scientific and Technical Expertise

Successfully acquiring and effectively deploying WMD generally requires highly educated and trained scientific and technical experts, particularly if a state or non-state actor seeks to develop their own WMD vice acquire a stolen product. The skills and infrastructure needed to develop and weaponize each type of WMD are well known. SOF, in collaboration with the intelligence community, can leverage the persistent presence of their activities to identify experts who would be useful to a proliferation network and conduct counter-recruitment information operations to dissuade them from joining a network.

### Communications

Networks must be able to communicate internally to manage operations as well as externally with potential suppliers or purchasers of illicit goods. Terrorist networks are increasing their use of social media as recruitment and propaganda tools. Identifying and exploiting these communication means offers military and law enforcement agencies the opportunity to disrupt and defeat these networks. SOF have considerable capability to intercept, analyze, and exploit these types of communications as well as leveraging information operations to shape the environment.

### Logistics

Whether a state or non-state actor seeks to proliferate, they must transport materials, people, and weapons. These relatively visible activities offer opportunities to deconstruct and exploit the network. SOF, working with other USG agencies and host nation partners, can leverage persistent presence to exploit the logistics nodes as well as develop plans for and facilitate interdiction operations.

### Intelligence, Surveillance, and Reconnaissance (ISR)

Non-state actors in particular may leverage ISR activities to identify potential CBRN materials and facilities they can target for theft. SOF can leverage their ISR, direct action, and information operations expertise to assist partners in assessing the risks to CBRN facilities and developing techniques to improve security.

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### Weapon Delivery

If a terrorist network is able to acquire WMD, they must also possess a delivery method. These delivery methods and their detectable signatures can vary widely. Deploying radiological and nuclear devices requires as little as a backpack or a rental truck. Chemical and biological weapons however require a dispersal mechanism, typically airborne, to be effective. One approach is for SOF to support partners by educating and training them on these signatures and mobilizing the population to be aware of and report unusual requests for items such as sprayers and crop dusters.

### Network Disruption

Evaluating these common network components, it becomes apparent there are three broad sets of capabilities needed to disrupt or defeat a proliferation network. Network analysis identifies critical nodes and links. Non-lethal targeting facilitates deterring and disrupting network activities. Lastly, there is a need for lethal targeting capabilities against network nodes likely to be fleeting in nature. These three capabilities reside in U.S. SOF, but there is also an opportunity to leverage security cooperation activities to enable partner nations to develop their own WMD counterproliferation capabilities and act as a force multiplier. The challenge then is to identify how best to leverage the irregular warfare skills of limited SOF assets to support WMD proliferation pathway defeat.

Evaluating SOF core activities and their conduct during phase zero shaping operations, two trends become evident.[24] The first is activities such as direct action, counterterrorism, and information operations require a detailed cognitive understanding of the environment where the networks operates. The second trend is that most activities are with coalition partners that enables the physical access needed to develop a cognitive understanding of the environment. Thus, the key to SOF better supporting WMD counterproliferation is to extend their core activities into WMD specific phase zero cognitive and physical access efforts by using existing BPC and OPE mechanisms.

**The challenge then is to identify how best to leverage the irregular warfare skills of limited SOF assets to support WMD proliferation pathway defeat.**

**Building Partner Capacity**

The 2015 National Security Strategy highlights that in addition to maintaining the capability to act decisively against direct threats, the U.S. will also leverage all instruments of national power to build the capacity of partner nations to counter terrorist and WMD threats.[25] To this end, DOD recognizes the importance of partnering with both members of the USG interagency and foreign partners to counter WMD proliferation.[26] As highlighted during a U.S. Army force design and employment strategy study, a lack of international partner willingness and capability to conduct CWMD increases U.S. requirements.[27] Effective BPC efforts can help overcome partner institutional resistance and facilitate development of the weak institutions that can't effectively counter irregular threats like proliferation and trafficking networks.

The multitude of different USG agency BPC programs complicates WMD proliferation pathway defeat efforts due to different legal authorities and funding mechanisms. For example, many DOD CWMD programs are limited to working only with foreign military forces, which often are not responsible for pathway defeat activities.[28] Agencies such as the Department of State (DOS), Department of Homeland Security (DHS), and the National Nuclear Security Administration (NNSA) also have programs that work with partner nations for portions of the counterproliferation mission area. SOF frequently work in this complex environment and have had great success in similar interagency counterterrorist and counternarcotic efforts.

The unique ability of SOF to conduct regional education and training, and understand partner nation dynamics can maximize the effectiveness of BPC activities. A key opportunity flowing from SOF conducting BPC with partner nations in likely WMD transit zones is expanding relationships and leveraging persistent presence to gain increased understanding of the environment.

**Operational Preparation of the Environment**

One of the most unique, and critical, SOF capabilities is their ability to work with foreign



partners to develop a cognitive "deep understanding of local conditions and cultures, which allows for nuanced and low-visibility shaping of the environment."[29] This deep understanding often comes through conducting OPE to prepare for potential future operations. OPE has proven successful in disrupting terrorist networks and can logically be extended into countering WMD proliferation.[30]

Geographic Combatant Commands (GCCs) leverage SOF through their assigned Theater Special Operations Commands (TSOC) to conduct OPE activities prior to crises. These activities are critical to enabling cognitive access to the operational environment, building relationships and physical infrastructure, and developing targets.[31] OPE leverages host nation expertise to enable persistent surveillance as part of target development and provides the Combatant Commander (CCDR) and the USG with improved situational awareness.[32] Most importantly, the improved indications and warning enhance the ability of the USG to shorten the time needed to project specialized WMD trained forces over intercontinental distances to safely interdict WMD.[33]

To successfully conduct OPE, Kenny describes a framework for SOF to develop a country level plan.[34] After defining the current threat needed to justify commitment of resources, SOF must assess current USG and partner ability, and shortfalls, to understand and attack the network. With this assessment complete, SOF then develop capabilities and define force and support requirements to mitigate those shortfalls. As SOF are likely to have a limited number of WMD experts, the threat and partner capability assessments are critical to identifying the priority locations to conduct OPE.

With these OPE and BPC considerations in mind, USSOCOM must pursue several lines of effort to better support WMD counterproliferation.

**Build a Conventional CWMD Force**

With the tapering of the wars in Iraq and Afghanistan, there is an opportunity to build the level of CWMD capability within conventional SOF and build a bench of experts that understand the mechanics of WMD terrorism. The desire of ISIL and al-Qaeda to obtain WMD highlights the importance of regaining focus on the CWMD mission and the nexus to terrorism and other transnational threats.

Successfully accomplishing OPE and BPC to counter WMD proliferation networks requires expertise across the spectrum of acquiring, developing, and deploying the different CBRN weapons. This needed expertise ranges from strategic planners across DoD, operational planners at the TSOCs and GCCs, and tactical on the ground executors at the operational detachment level. When conducting BPC, the partner nation must identify the most appropriate organizations to receive training and commitment necessary funding and personnel.

Growing CWMD expertise requires training and educating both SOF as a whole and a cadre of dedicated subject matter experts. For the force as a whole, incorporate WMD proliferation awareness training in curricula such as SOF qualification courses. USSOCOM must also develop training and education programs for a small but dedicated cadre of CWMD subject matter experts.

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The U.S. Army Special Operations Command recognized the challenge of developing subject matter experts in other aspects of SOF operations and started pilot programs that can extend to the WMD counterproliferation mission. The Volckmann Operator concept embeds a language qualified SOF operator within a foreign SOF unit.[35] This operator routinely rotates on multi-year tours to the same country and progressively works with higher levels of leadership as they increase in rank over time. Extending this model to WMD trained operators working with priority country military and civilian security forces enables OPE and BPC CWMD efforts while building the global SOF network.

### Gain Interagency Support

Despite national strategies declaring WMD proliferation prevention as a whole of government priority, there is no single organization responsible across the USG for coordinating the full spectrum of WMD proliferation prevention activities.[36] As there are a large number of organizations within the USG that conduct these efforts, it is important to maximize the key principles underlying interagency coordination: facilitating unity of effort, achieving common objectives, and seeking common understanding.[37] The lack of a coordinating body and resulting challenges limits the effectiveness of USG proliferation prevention efforts. More specifically, it hinders the ability of SOF to effectively perform CWMD OPE and BPC.

**Despite national strategies declaring WMD proliferation prevention as a whole of government priority, there is no single organization responsible across the USG for coordinating the full spectrum of WMD proliferation prevention activities.**

The second pilot effort, the "Powell Program," enables achieving the next goal of improving collaboration with the USG interagency and tying together tactical knowledge to strategic effect. This initiative leverages the regional experience of Army Special Forces Warrant Officers by assigning them to positions such as the State Department country desks, congressional liaison offices, and other interagency organizations to increase unity of effort.[38] The program incorporates professional education by sending officers to earn a graduate degree in an appropriate discipline to ensure adequate credibility within these interagency organizations. USSOCOM must adapt the Powell Program to assign SOF CWMD experts to key members of the interagency such as the State Department Bureau of International Security and Nonproliferation and the National Counterproliferation Center (NCPC). Assigning these SOF WMD experts to homeland security agencies also enables improved Defense Support to Civil Authorities (DSCA) and reduces the seam between agencies conducting pathway defeat activities internal and external to the homeland.

Assigning SOF CWMD experts to these types of organizations opens tremendous opportunity to improve coordination and campaign planning of OPE and BPC activities between DoD and other USG agencies. Getting the right education matters as well. Organizations such as the Joint Special Operations University (JSOU) and service SOF schools should work with academic institutions with CWMD related programs and ties to the policy community such as the Naval Postgraduate School and Georgia Institute of Technology to develop educational programs that meet SOF needs.

### Gain Necessary Resources

Fully implementing these recommendations requires resources such as additional authorities and funding. The DoD generally operates under Title 10 United States Code (USC) legal authorities, which generally limits security cooperation engagements to foreign military partners.[39] In the CWMD arena, the Title 10 limitation is particularly challenging as civilian homeland security agencies (i.e., Ministry of Interior) lead WMD proliferation prevention activities in most partner nations.

A solution to both the authorities and funding issue is for DoD to collaborate with the DOS to develop a "1204-like" legislative proposal. Title 10 USC 1204 is a 2014 National Defense Authorization Act (NDAA) law resulting from collaboration between DoD and DOS that gives DoD, with concurrence from the DOS, the authority to train and equip partner nation civilian and military WMD Consequence Management forces.[40] Legislation similar to 1204 focused on WMD counterproliferation efforts would provide clarity of purpose and better enable unity of effort across the interagency.

There is a need for additional personnel, training, and equipment at the regional Theater Special Operation Commands (TSOC) and subordinate forces as executing OPE and BPC activities falls under their purview. USSOCOM must identify a model for a CWMD "cell" in the TSOCs and acquire the necessary personnel billets. The cell must provide support to the GCCs as they better incorporate CWMD activities into their theater security cooperation and contingency plans. There is considerable CWMD operational planner level knowledge currently in the Defense Threat Reduction Agency (DTRA). As USSOCOM increases CWMD OPE and BPC activities, they should leverage DTRA bandwidth to support operational and strategic planning efforts with the interagency and within DoD. These planners can then ensure CWMD equities are adequately captured in critical DoD guidance and plans.

Conducting OPE and BPC activities adds little value if the developed information is not captured and distributed to other organizations that support the WMD pathway defeat mission. The DoD via DTRA is in the process of developing and fielding a CWMD-Situational Awareness program. "Constellation" is a hardware and software program of record intended to provide a tool for the CWMD community of interest, to include the interagency, to populate with activity data and distribute to appropriate agencies and partners.[41] The SOF OPE and BPC activity data and network analysis is undoubtedly among the most useful and timely information so it is critical that USSOCOM interface with the Constellation program team to shape the program requirements and overall utility of the system.

**SOF must act as a CWMD force multiplier due to their skills and bandwidth, but there are execution challenges to overcome.**

### Execution

SOF must act as a CWMD force multiplier due to their skills and bandwidth, but there are execution challenges to overcome. Foremost is collaborating with the interagency policy community and the GCC and TSOC staffs to identify priority countries and risks to focus their CWMD measures.

SOF must develop a CWMD OPE and BPC concept of operation (CONOP) for those priorities. To facilitate CONOP development, USSOCOM should request the DoD Threat Reduction Advisory Committee fund an iteration of the John Hopkins University Applied Physics Lab led "Opportunity Analysis" program. This analysis would develop a baseline OPE and/or BPC model, using IW tenets, the TSOCs can adapt to their particular regions.

The U.S. Embassy Chief of Mission (COM) in a partner nation, typically the Ambassador, must approve OPE and BPC activities. The COM approval usually requires first gaining the trust and confidence of the interagency representatives in the embassy and the relevant DOS country or functional desks. The collaborative prioritization process and CONOP socialization is a key element of gaining that trust and confidence.

The COM is often unaware of CWMD concerns, so SOF must educate them and their staffs with a Strategic Appreciation of the problem and present the proposed CONOP showing the importance of OPE and BPC. An approach proven successful in the USEUCOM region is to leverage natural disaster preparedness and WMD consequence management activities as a "foot in the door" to also begin building WMD pathway defeat capabilities.[42] SOF must leverage ongoing TSOC and GCC security cooperation activities and exercises as an opportunity to gain and expand cognitive and physical access in support of WMD pathway defeat efforts.

**Conclusion**

The potential use of WMD by terrorist and adversarial state actors is the greatest threat to U.S. security and interests, but the lack of coordination across USG agencies unnecessarily increases risk. The USG and DOD must build and leverage the global SOF network through CWMD OPE and BPC activities to provide the early warning needed to mitigate fleeting opportunities to eliminate catastrophic WMD risks. It is imperative that SOF leverage their IW expertise to gain cognitive and physical access to critical WMD pathway operational areas. They must also build CWMD capability into their forces for these strategic pathway defeat missions and acquire both the resources and interagency support needed to execute this mission set. With the potential extreme consequences of a WMD attack, the question is not whether SOF can afford to expand CWMD activities, but whether the USG can afford for them not to. The American people will no doubt recognize the price in blood and treasure of reacting to a WMD attack is far higher than the relatively minimal costs of prevention.

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42 COL Lonnie Carlson, author, recently departed as CWMD planner in USEUCOM J5.



# The Role of Tactical Nuclear Weapons in Strategic Deterrence

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The world's nuclear powers are not only modernizing their strategic nuclear forces, but continue to develop and exercise significant quantities of tactical low-yield systems. Russia, in particular, has also shown signs of a nascent nuclear employment strategy expressing willingness to use low-yield nuclear weapons for de-escalation control of a conventional conflict. Considering these realities, how important is parity for the United States in maintaining a tactical nuclear option, and is the current arsenal sufficient to maintain deterrence in an evolving nuclear landscape?

## Background

Since the Army turned in the last of its theater nuclear weapons in the early 90s, an immediate decline in understanding nuclear operations began. Coupled with over 14 years of conventional conflict, a generation of Soldiers and Leaders are unaware and unprepared to fight and win on a nuclear battlefield.

### Strategic v. Tactical Weapons

For the purpose of this article, the classification of a weapon as strategic or tactical will be not related to yield or range, but to function and purpose of the weapon and its delivery platform. It should be noted that any use of a nuclear weapon will be considered a "strategic" event with global ramifications. A weapon being identified as "tactical" does not imply that the weapon would be more readably usable, or that its effects would be any less destructive than a strategic weapon when employed, but by the manner in which it employed and the objective of its employment: tactical weapons (often referred to as non-strategic nuclear weapons) have non-strategic employment systems, such as artillery or short-range rockets. Strategic weapons have strategic delivery systems, such as long-range bombers or intercontinental ballistic missiles (ICBMs). In addition, tactical

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weapons would be used under the guise of meeting tactical/operational ends, but ultimately cross seamlessly into having strategic implications.

The Cold War

The United States Army of the Cold War faced the significant challenge of stopping a conventional Russian invasion of Europe. Lack of parity in tactical formations favored the Russian conventional military, and as such, the United States needed to offset that advantage and purchase trade space for forces to rally in the defense of Europe. To do so, the Army would employ a wide variety of tactical nuclear weapons that provided firepower with less man power to slow the Russian advance. Weapon systems ranged from nuclear landmines for area denial and destruction of key lines of communications, short and mid-range rockets and missiles, to tube artillery with enhanced radiation weapons capable of generating greater casualties amongst large Russian formations. These weapons would continue to grow in size, capability and number, eventually bringing the arsenal in Europe and Korea into the thousands.

The US Cold War arsenal was robust and redundant in order to operate at all levels of war and to maintain a survivable and responsive set of options for the President and Theater Commanders. For the purpose of this article, only theater level Army assets deployed in the Cold War will be addressed, even though a large number of Air force and Navy ground and air missile/bomber options existed.

Russian Tactical Nuclear Weapons

While Russia and other adversaries may currently comply with limitations on strategic nuclear weapons numbers and types, there are no incentives for the Russians to enter into discussions of arms control of tactical weapons, which they deem necessary to ensure the defense of the Russian homeland. The Cold War has been reversed in conventional capability. While Russia maintained a decided advantage in conventional power through the 80s, forcing the United States and NATO to rely on tactical nuclear weapons to offset this capability gap, defensive support provided by the Warsaw Pact no longer exists, and like the United States Army of the Cold War, Russia finds itself potentially unable to deter the conventional threat, and a "forced" reliance on tactical nuclear weapons to balance the scales against NATO now exists. For this reason, Russia, by some assessments, has thousands of tactical weapons ready to serve in a battlefield capacity as compared to the United States' and NATO's Dual Capable Aircraft (DCA) delivered weapons, which are limited in number. Our adversaries' capable Integrated Air Defense Systems (IADS) would make delivering nuclear weapons via DCA and bombers exceedingly challenging. Additionally, a reliance on strategic weapons may be affected by counter-missile capabilities or could risk escalation by a perceived strategic response. Russia's large number of short and medium range nuclear weapons (rockets, missiles, artillery, bombs and ground and air-delivered cruise missiles) are capable of penetrating air space and impacting the battlefield with yields that sometimes far exceed levels that the United States maintains on strategic platforms (i.e. megaton class). This lack of parity in systems could force the United States to escalate in retaliation solely based on a lack of options that could achieve success through proportionality.

**For this reason, Russia, by some assessments, has thousands of tactical weapons ready to serve in a battlefield capacity...**



Retirement of US Tactical Systems

The Intermediate-Range Nuclear Forces Treaty (INF) signed in 1987 would precipitate the elimination of nuclear weapons in Europe with a range of 500-5,500 km. The Pershing Missile (108 total deployed), and Ground Launched Cruise Missile (GLCM, 256 total deployed) would be removed completely. Many saw this reduction as an opportunity to replace the aging Army weapons with limited range (targetable only on German soil) with a system that would not violate INF, yet provided enhanced capability. At the time, the Lance Missile, not covered by the INF, was an inaccurate system and was in need of much improvement. Previously, in 1981, the Army had conducted a conceptual study in conjunction with the Departments of Energy and Defense entitled Corps Support Weapon System. This study was to identify the feasibility of utilizing the Army Tactical Missile System (ATACMS) currently in development as a nuclear replacement for the Lance. The program later called Follow on to Lance (FOL) would be hindered by policy decisions, specifically the Congressional stipulation in 1985 that the developed missile could not be nuclear capable.

Department of Defense Testimony before Congress in 1987 highlighted the concept for the FOL program and emphasized the utility in exploring the nuclear option. It identified the ATACMS as a strong candidate for the Lance follow-on for three reasons: First, the Army could take advantage of development work already invested in conventional ATACMS and add the necessary requirements for it to become nuclear-capable. This approach would cost significantly less than developing an entirely new nuclear-capable system from scratch. Second, creating a dual-capable system would increase overall survivability by coalescing the conventional and nuclear-capable systems together, making them essentially indistinguishable to the enemy. Third, adding the nuclear capability to the ATACMS is in the interest of our allies as they plan to produce and field the MLRS. Although the Senate would approve the option to include ATACMS into the feasibility study in 1987, the capability was never realized.

With the end of the Cold War, Russia recovered all nuclear weapons from satellite states, hoping for a similar American response in Europe. In June of 1991, President George H. W. Bush unilaterally cut the non-strategic arsenal across the board and removed all Army non-strategic nuclear weapons from Europe. In addition, removal of the Tomahawk Land Attack Missile Nuclear (TLAMN) from surface vessels would further reduce the United States' theater arsenal and effectively remove the capability of a unilateral non-strategic nuclear response. By 1994, all references to an Army nuclear capability were removed from DoD literature.

US National Policy

Current National policy (Presidential Policy Directive 24) maintains that large scale Nuclear War is no longer the primary nuclear threat to the United States and its allies, but a conventional conflict with a nuclear armed adversary will more than likely be the scenario in which a nuclear weapon would be used. Russia, China, North Korea, and Pakistan have not only continued to build, modernize, and diversify their nuclear arsenal, but have articulated new nuclear

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weapons policies as well. These policies range from posturing, threatening, or demonstrating use to pause an ongoing conventional conflict ("escalate to win"). As in the case of Russia, the use of a nuclear weapon could be used to offset conventional weaknesses and to change the tempo of an adversary's offensive operations in order to end the conflict on favorable terms.

**As our adversaries continue to grow and modernize their nuclear programs, a growing number of policy makers believe the US is at an increasingly disadvantageous position with respect to non-strategic nuclear capabilities.**

This change in the nuclear calculus is not only visible to nuclear-armed states, but by the allies that rely on the assurance of the United States' nuclear arsenal. Middle Eastern nations who currently do not have a nuclear program in place see the potential to "buy in" to the nuclear players without developing or maintaining the capability to develop, build, or maintain weapons. Other allies perceive a degradation in US capability to deter regional adversaries, which could lead technically-savvy nations like the Republic of Korea and Japan to develop their own nuclear programs, adding to global proliferation concerns. As our adversaries continue to grow and modernize their nuclear programs, a growing number of policy makers believe the US is at an increasingly disadvantageous position with respect to non-strategic nuclear capabilities. The potential abdication of Russia from missile treaties and China's purposeful ambiguity will further widen the non-strategic gap.

NATO Policy

The NATO Strategic Concept of 1999 states, "The fundamental purpose of the nuclear forces of the Allies is political: to preserve peace and prevent coercion of any kind of war. They will continue to fulfill an essential role by ensuring uncertainty in the mind of the aggressor about the nature of the Allies response to military aggression."

**Revitalization of US Tactical Nuclear Forces**

The decision to revive tactical nuclear forces should be viewed through the lens of current and future security of the United States, Allies, and Partner Nations; the need to maintain an effective and credible nuclear deterrent; and the understanding that nuclear threats will continue to increase from known nuclear states, states with nuclear aspirations, and aspiring non-state actors. Therefore, new and innovative deterrence concepts, strategies, and capabilities must be developed to offset emerging nuclear threats. Tactical Nuclear systems provide POTUS with a wide range of options to respond to these threats. This enhanced capability need not be the size and scope of the Cold War inventory, but a limited force required to create a credible, non-strategic deterrent.

Currently, the remnants of the US non-strategic nuclear capability is employed by a limited number of air-delivery platforms. The 60+ year-old B52 Stratofortress is the primary platform programed to deliver the current Air Launched Cruise Missile (ALCM). The ALCM, while considered a non-strategic nuclear weapon, is delivered by the United States' premier strategic bomber, which muddles the line between strategic and non-strategic use. Future systems such as the Long Range Stand-Off (LRSO) will be delivered by not only the B52, but the B2 and follow on B21.



The B2 Spirit stealth bomber is the primary platform for penetrating modern IADs to deliver a nuclear gravity bomb (B61 or B83). Again, as with the B52, the B2 is viewed as a strategic bomber deploying a "non-strategic" nuclear weapon, albeit perhaps not in a strategic role. Though currently capable, as enemy IADs continue to improve, penetration will become less assured in the near future even as the future Joint Strike Fighter (JSF) is fielded. The limited number of B2 platforms, which also serve a conventional role, could limit our non-strategic delivery capability through attrition or conventional tasking.

While current DCA in the form of the F-15, F-16 (NATO) and PA200 (NATO) are certified delivery platforms for the B61, the ability of these aircraft to penetrate modern IADs is questionable. DCA currently reside only in Europe with extremely limited projection outside of the European theater of operations.

Regions in the Pacific and the Middle East can only rely on the B52 or B2 for non-strategic nuclear delivery, and only with a significant lead time for planning, integration, and execution. This integration comes with a support package that places extensive requirements on the assets of a theater commander and will impact ongoing conventional operations. These issues notwithstanding, the Air component of the Nuclear Triad still provides the only real means of what could be perceived as a non-strategic retaliatory response. Use of the ICBM/SLBM risks creating the perception of escalation as the yield, overflight, and strategic nature of employing intercontinental missile systems denotes, to many nations, the beginning of Nuclear War.

Increased Flexibility and Deterrence

The US is faced with a multi-dimensional threat. As such, a full range of options should be considered that are both capable and credible in providing the appropriate level of assurance to the US and its allies. The capability to respond to a wide variety of threats with a wide variety of capabilities will complicate adversary decision-making and cause the adversary to question the costs of theater use of a nuclear weapon. Understanding the higher threshold for strategic use, the adversary would then be forced to consider impacts of a retaliation of theater tactical weapons, whose use is much more palatable than strategic employment. The United States cannot address the full spectrum of targeting categories with the actively shrinking strategic arsenal. If tactical nuclear weapons were an option, the US could hold strategic targets at risk with tactical mobile survivable weapons, releasing strategic weapons to hold key intercontinental targets at risk, which would be critical in the face of a reduced Nuclear Triad.

**...a full range of options should be considered that are both capable and credible in providing the appropriate level of assurance to the US and its allies. The capability to respond to a wide variety of threats with a wide variety of capabilities will complicate adversary decision-making...**

Potential platforms to provide this capability could be developed from either the conventional arsenal at hand, or assets recently removed from the nuclear arsenal, such as the TLAM-N. Assets capable of delivering intermediate and short range engagement utilizing Multiple Launch Rocket Systems (MLRS), or the Army Tactical Missile System (ATACMS) could rapidly deploy to deliver low yield tactical effects with a variety of ranges from 30 to 300 km. Advances in the B61 through current Life Extension Programs

(LEPs) would facilitate the use of a Nuclear Explosive Package (NEP) already in the inventory and modified for mating with a conventional system within the Army structure.

**If tactical nuclear weapons were an option, the US could hold strategic targets at risk with tactical mobile survivable weapons, releasing strategic weapons to hold key intercontinental targets at risk, which would be critical in the face of a reduced Nuclear Triad.**

Development of these platforms would provide the President and Theater Commanders with a rapidly deployable system that could tailor a flexible response in all theaters of operations. This would eliminate reliance on an aircraft's ability to penetrate into highly contested airspace or the requirement to use an ICBM/SLBM.

Treaty Ramifications

Development of an Army tactical weapon system would conform to the treaties currently in place. The Missile Technology Control Regime (MTCR) and INF limit ballistic missile technology by imposing payload restrictions and limiting ranges from 500-5,500 km, for the MTCR and INF, respectively. Neither of these treaties would be violated through the inclusion of a US tactical nuclear weapon system. In addition, the restriction currently in place to not support new military missions or provide new military capabilities is unilateral, self-imposed, and not codified in treaty or law. Of note, Russia has been suspected of violating the INF in 2015 and again in 2017, with testing and deployment of a ground and sea-launched nuclear-tipped cruise missile.

Russia

Attempting to incorporate tactical weapons into current or future treaties will be met with extreme resistance from Russia. While Russia is concerned about China at its borders, it sees NATO and the US as the primary threat to survival of Russia as a nation. This approach would be costly to the United States and its Allies, as negotiations with Russia would increase Russia's claims/legitimacy to its demands to remove US weapons from NATO, thus undercutting NATO's capability and posture and potentially the organization at large. A tactical nuclear option that is ground-delivered and harder to defeat may create conflict with Russia's current tactical nuclear hegemony. Russia uses their nonstrategic weapons as a means to:

- Deter external aggression;
- Equalize/offset conventional superiority of adversaries;
- Maintain combat stability of engaged Russian forces;
- Use to De-escalate conventional conflicts;
- Conduct a limited theater strike while avoiding escalation to intercontinental reprisals.

As hostilities increase globally, a tactical nuclear weapon could serve to balance the power of a region, provide assurance to partners and allies, and provide a flexible response option should deterrence fail.

Figure 1. The Russian SSC-8 Cruise missile recently introduced potentially violates the 1987 Intermediate Range Nuclear Forces Treaty (INF), with an assessed range between 300 and 3,400 miles.

## Conclusion

The development of an Army tactical nuclear weapon system must be informed by previous experiences, yet bring a modern perspective to its utility. The United States Army must always posture to ensure security needs are met for the nation and its allies. Therefore, all means by which to provide security should be given consideration. However, development of an Army tactical nuclear system would not be without issue. Cost in a fiscally constrained environment; an increase of nuclear weapons systems at a time of nuclear drawdown; messaging of an increase in nuclear capability; and public outcry are among but just a few issues that an Administration would face.

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2 "Nuclear Posture Review," https://www.defense.gov/News/Special-Reports/NPR (accessed March 15, 2017).

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4 Ryan Browne, "Russia deploys missile in apparent treaty violation," http://www.cnn.com/2017/02/14/politics/russia-cruise-missile-spy-ship/ (accessed April 3, 2017).

# CBRN Vignette 17-1 – The Decontamination Trial

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The CBRN vignette is a training tool for decision-making (tactical to strategic level) to support training and foster thought and discussion. The following CBRN vignette serves as the first in an ongoing series of settings developed by US Army Nuclear and Countering Weapons of Mass Destruction Agency (USANCA). Readers are encouraged to send possible solutions for the CBRN Vignette to the *Countering Weapons of Mass Destruction Journal* as a means of interaction with the CBRN Community. The author's solution, along with several reader solutions, will be published in following issues of the magazine.

**Situation**

Friendly Forces: You are a Commander of 55th Chemical Company (Combat Support) in support of 1-4 HBCT (see figure 1). The 1-4 HBCT currently defending and preparing to support 1st ID offensive (Main Effort) in the North (see figure 2).

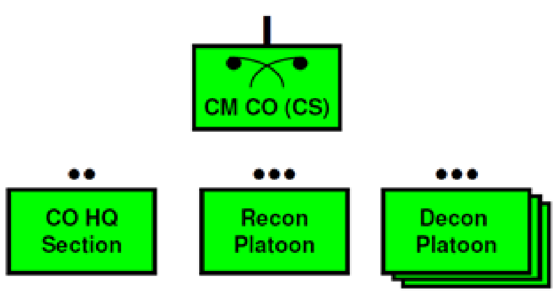


Figure 1. 55th Chemical Company Organization

Enemy Forces: 12th and 13th Mech-Armor Brigades are in prepared defensive positions, supported by the 3rd Artillery Group (composed of 4 Battalions of 152mm) and 3rd Offensive Chemical Battalion. The 3rd Offensive Chemical Battalion can provide the Artillery Group with a range of munitions including Tear gas, Phosphorous, GD, HD and some VX. The enemy has conducted conventional and unconventional (Chemical) artillery attacks in preparations to conduct a limited offensive operations as a spoiling attack (within the next 24-48 hours) against 1st ID, prior to their offensive operations.

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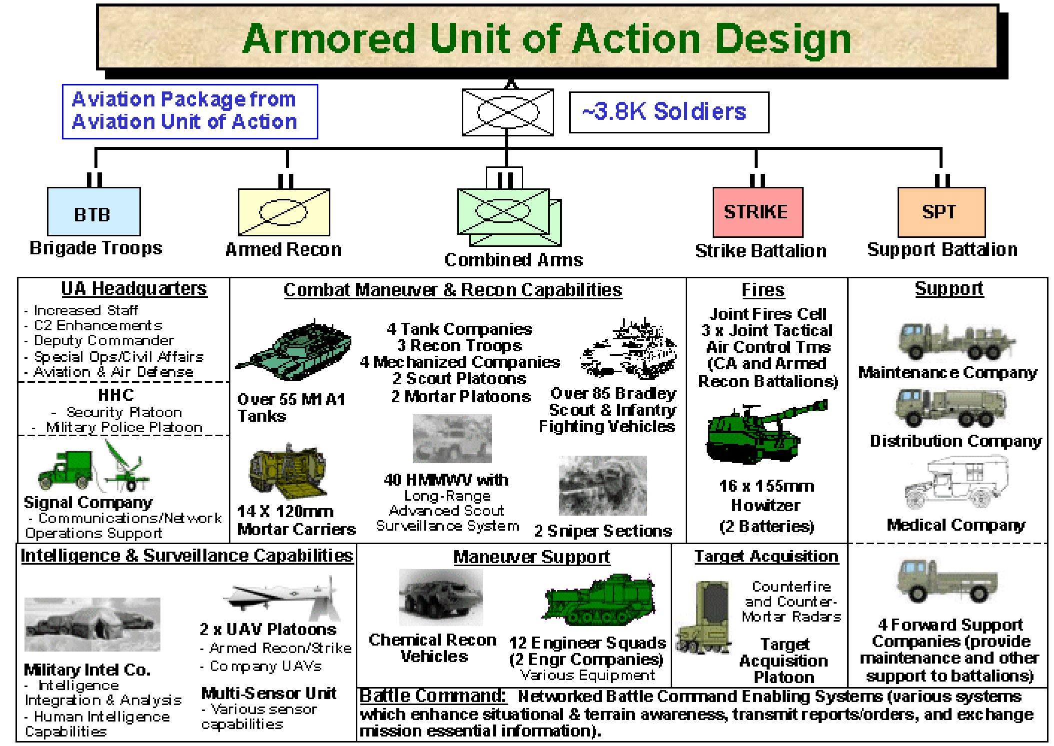


Figure 2. 1-4 HBCT Unit of Action Organization[1]

As a preemptive strike, the Enemy 3rd Artillery Group supported by the 3rd Offensive Chemical Battalion launches multiple artillery (Chemical and conventional) missions across the 1-4 HBCT area:

| Attack # | Location | Unit | Agent/Munition |
|---|---|---|---|
| 1 | 201241 | Scout Company | GD |
| 2 | 155175 | Mech Company | HD |
| 3 | 155235 | Mech Company | VX |
| 4 | 110210 | Armor Company | HD |
| 5 | 040202 | BSA | HE, CS, and White Phosphorus |
| 6 | 025245 | FA Battery | HD |

Table 1. Chemical Attack Information

Limitations: The 55th Chemical Company (082255) is co-located with the C Troop 308 Armored Recon has only organic water transportation. The only approved water source for decontamination operations is Far Lake (0817). The 1-4 HBCT Commander guidance is to conduct thorough decontamination (not operational decontamination). He is willing to accept risk in recovering less personnel and equipment from thorough decontamination, verse more personnel and equipment from operational decontamination. Additionally he wants personnel in mission oriented protective posture (MOPP) 2 opposed to MOPP 3 or 4, while conducting combat operations.

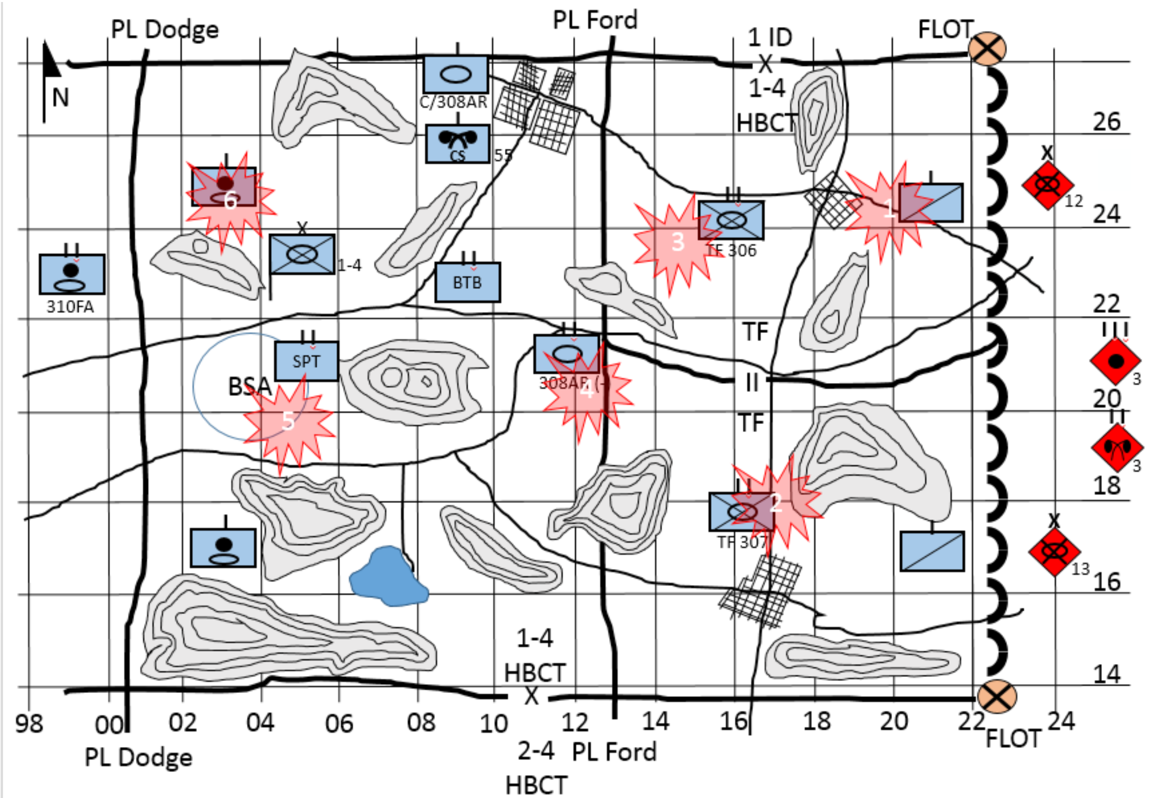


Figure 3. 1-4 Operational Graphics

**Requirement**

After reviewing the situation, outline your issues and write a fragmentary order (FRAGO) for the 55th Chemical Company determining your plan including your thorough decontamination priorities, locations, and rationale to address all the contamination with chemical attacks before engaging the 2 Mech-Armor Brigades in order to generate the maximum firepower. Readers wanting to submit their solutions to the scenario can provide the FRAGO to USANCA care of daniel.p.laurelli.mil@mail.mil.

**Notes**

1 http://www.globalsecurity.org/military/agency/army/bct-heavy.htm.



# USANCA 2.0 – A new structure to support the Future Force

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United States Army Nuclear and Countering WMD Agency

For many of us currently assigned to a "headquarters" organization, we are all too familiar with re-structuring, re-organizing, and personnel reductions as the Department of Defense must cut authorizations and programs in order to meet tighter fiscal constraints. All of Headquarters Department of the Army (HQDA) underwent a recent manpower and structure analysis by an outside independent consultant firm in order to determine the optimum organizational design for a leaner Army Headquarters. USANCA, as a field operating agency of the Army G-3/5/7, was also required to undergo a similar analysis, which coincided with an internal Agency review. On June 1, 2016, Mr. Klippstein, Director, USANCA, approved an Agency re-organization as part of the mandated HQDA "delayering," efforts.

In October of 2014, the Director tasked USANCA leadership to analyze the Agency's mission and current structure to determine if USANCA was properly organized to effectively support the Army of 2025. USANCA was facing the potential loss of twenty percent of its civilian and military workforce due to required HQDA restructuring cuts in fiscal years 2017 through 2019. However, many of the missions and functions currently performed by the Agency are of critical importance to the Army and the Department of Defense. Any changes to USANCA's structure that included loss of authorizations had to ensure that the Agency's mission essential functions could still be performed. USANCA was also required to conform to the re-organization business rules instituted by the outside independent consultant. These included guidelines for span of control and no authorizations for deputies below the two-star level of authority. USANCA's previous organization chart (figure 1) showed three "operational" divisions, each headed by an O6 or GS-15, a headquarters and a Deputy Director.

At the same time, Army Regulation (AR) 10-16, *US Army Nuclear and CWMD Agency*, which describes in detail the eleven primary functions of the Agency, was up for its required periodic review. Whatever organizational structure was approved, it still had to be able to support the Agency's required functions as defined by AR 10-16 and other regulatory documents, such as: AR 5-22, *Force Modernization Proponent System*; AR 50-7, *Army Reactor Program*; AR 600-3, *Army Personnel*

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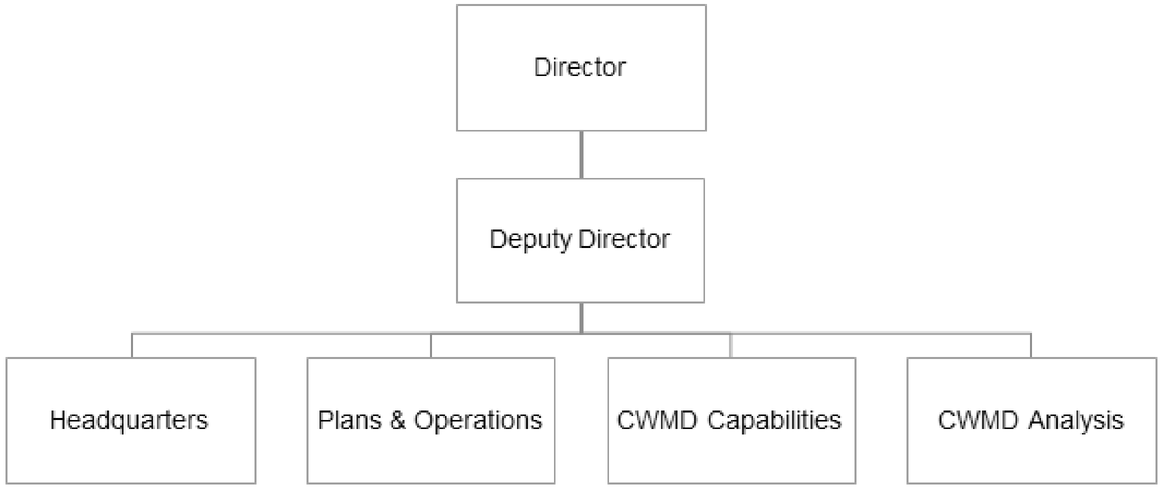


Figure 1 – USANCA's previous organization chart

*Development System*; and the HQDA General Order which assigns functions and responsibilities to the Deputy Chief of Staff, G-3/5/7. As of this journal's publication date, AR 10-16 was out for Army-wide staffing and should be published by the Fall of 2016. None of the primary functions delineated in AR 10-16 required significant adjustment as a result of the of the USANCA re-organization. AR 10-16 will also contain an updated USANCA mission statement:

> USANCA supports Army strategic and operational requirements with nuclear and countering weapons of mass destruction (CWMD) expertise and analysis. On order, deploys Nuclear Employment Augmentation Teams (NEAT) to support Army and/or Joint Force Commanders.

**USANCA supports Army strategic and operational requirements with nuclear and countering weapons of mass destruction (CWMD) expertise and analysis.**

The "new" USANCA (figure 2) is slightly leaner as the Agency lost two civilian positions, but has gone from a three "operational" division structure to four, a design which allows a more focused effort on the Agency's nuclear mission as well as retaining dedicated manpower to the CWMD mission areas.

The major changes of the re-organization:

- All Agency administration functions are now consolidated under the Chief of Staff
- Plans and Operations functions reside in separate Nuclear and CWMD divisions
- CWMD Divisions now contain resident biological and chemical civilian subject matter experts
- Additional manpower was allocated to the Agency's Proponent function for Functional Area 52 and the Additional Skill Identifier, 5H, Nuclear Effects Analyst

Losing two civilian positions may seem inconsequential, but the Agency now only has 38 total military and civilian authorizations – requiring a true "do more with less" mentality for the dedicated USANCA Soldiers and civilian employees. Of the 38, 19 positions are military across four military occupational specialties: FA52 (Nuclear & Counterproliferation), 74A



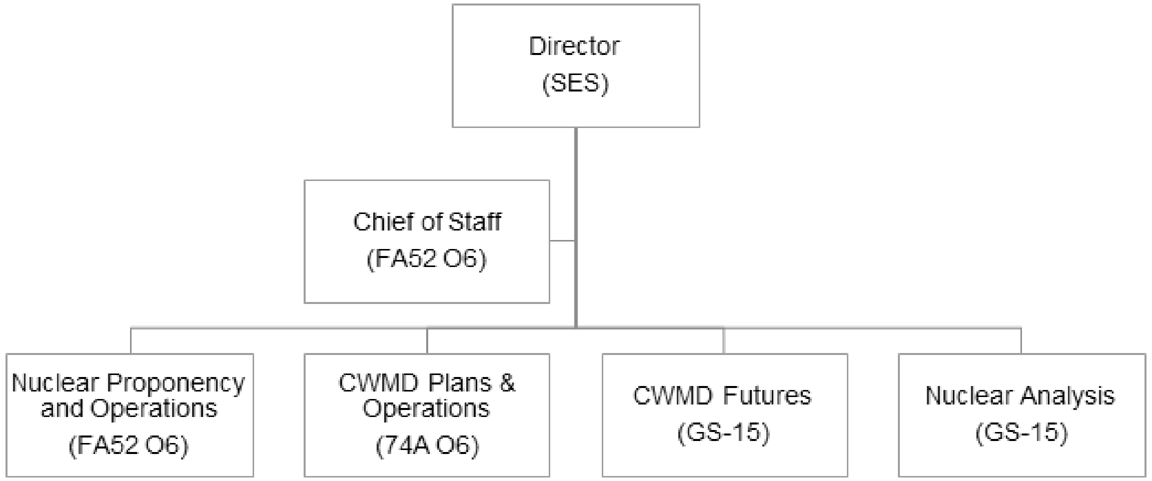


Figure 2 – USANCA's current organization chart

(Chemical), 72A (Health Physics), and 131A (Field Artillery Warrant). The 19 Department of the Army civilian positions include engineers, scientists, and program managers in addition to the administrative functions found in the headquarters element. Where each specifically resides can be found in the detailed organization chart (figure 3). USANCA has four Drilling Individual Mobilization Augmentee (DIMA) positions, each one currently designated to support each of the four divisions.

The Director of USANCA is dual-hatted, that is, in addition to his Director roles and responsibilities, he also serves as the Deputy G-35, Strategy and Policy, HQDA. In addition to leading the Agency, the Director is required to serve in the following roles:

- Chairman, Army Nuclear Reactor Council.
- Army Representative on the Nuclear Weapons Council Standing and Safety Committee.
- Army Representative to the DoD CBRN

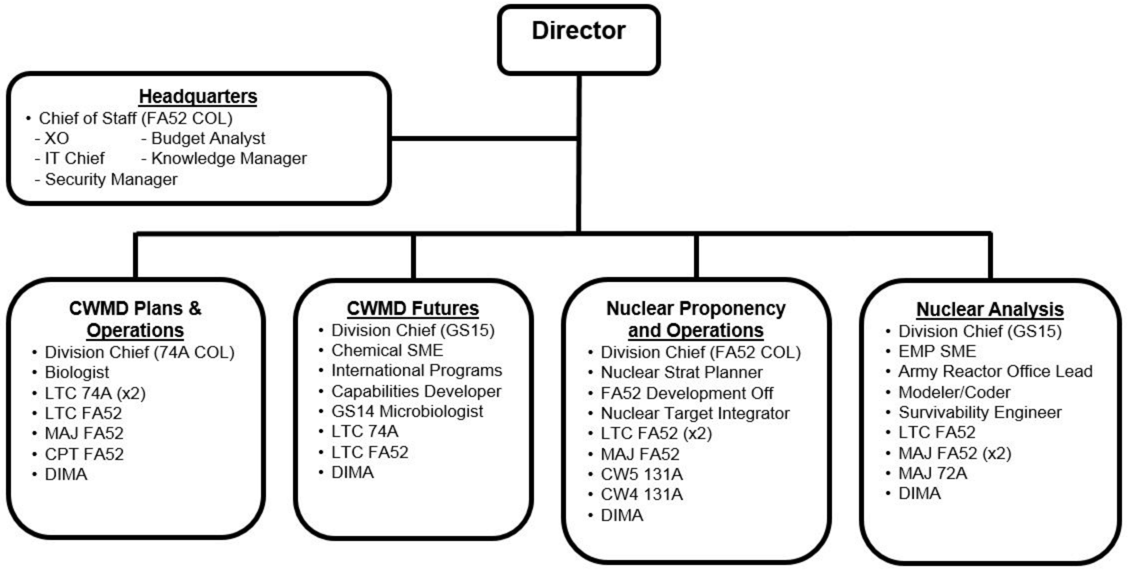


Figure 3 – USANCA detailed organization chart

Survivability Oversight Group – Nuclear (CSOG-N)

- In the absence of the DCS G-3/5/7, Army Representative to the DoD Nuclear Enterprise Review Team (NERT) Senior Advisory Group (SOG).
- Personnel and Force Modernization Proponent for Functional Area 52 (Nuclear and Counterproliferation) and Additional Skill Identifier (ASI) 5H (Nuclear Target Effects Analyst
- Represent the G-3/5/7 on the Chemical Biological Defense Program (CBDP) Executive Agent General Officer Steering Group to the CBDP Executive Steering Group.
- Chair, US NATO-Joint CBRN Defence Capabilities Development Group (CDG) Board of Directors overseeing the US Panel Heads of Delegation for the JSCBRN-CDG

One of the most frequently asked questions about USANCA is why isn't "nuclear" just part of CWMD. The Agency keeps the "N" separate to highlight the important role USANCA has in theater nuclear operations. What follows is a short description of the major roles and responsibilities of the four USANCA divisions.

**The Director of USANCA is the Army representative to the Nuclear Weapons Council Standing and Safety Committee and the Division represents the Army at the Action Officer working groups.**

The Nuclear Proponency and Operations Division is the Army Staff lead for all issues concerning the U.S. Nuclear Enterprise. The Director of USANCA is the Army representative to the Nuclear Weapons Council Standing and Safety Committee and the Division represents the Army at the Action Officer working groups. Members of this Division advise Joint Force and Army Service Component Commands on all aspects of nuclear weapon employment to include integration of weapon effects with conventional operations and have the on order mission to deploy as part of USANCA's Nuclear Employment Augmentation Teams in support of Joint Force Commanders and Staff.

This Division also serves as the single point of contact for personnel development and force modernization matters related to Functional Area 52, Nuclear & Counterproliferation and Additional Skill Identifier 5H, Nuclear Target Effects Analyst for the Army and executes these personnel development and force modernization functions (in accordance with ARs 600-3 and 5-22) relative to DOTMLPF for FA52 and the 5H ASI.

The CWMD Plans & Operations Division provides CWMD planning assistance to Army Service Component and Combined Land Force Component Commands and Staffs. The Division provides planning and operational subject matter expertise to the Army Staff on all CWMD matters to include WMD elimination, WMD pathway defeat, CWMD campaign, contingency and functional plans and other CWMD related strategic documents. This Division leads the Operations working Group for the Army Council on Countering WMD.

The CWMD Futures Division focuses on DOTMLPF development of future CWMD capabilities — from concept development through material development and fielding. The Division assesses current DOTMLPF gaps and emerging CBRN threats and operates in the nexus of and links CWMD Concepts, Capabilities and Strategies. In addition to providing the Army staff with subject matter experts in Chemical Science/Weapons and Biological Defense, this Division supports bilateral and multilateral engagement in support of interoperability and standardization.

The Nuclear Analysis Division provides the Army Staff and Army Service Component Commands with technical subject matter experts for nuclear weapon effects (NWE), radiological/nuclear (RN) hazards, and Soldier/equipment nuclear survivability. The Division provides nuclear weapon and CBRN hazard modeling in support of nuclear weapon preclusion oriented target analysis to minimize nuclear weapon collateral effects. The Division supports Army RDT&E efforts for all nuclear, radiological, and directed energy issues including nuclear weapon systems and manages the Army Reactor Office to ensure safe, secure, and reliable nuclear reactor operations and reactor decommissioning.

If you have any questions about USANCA's roles and responsibilities, or would like to know more about the Agency as a possible assignment option, please contact myself or any of the other points of contact listed on our website at http://www.belvoir.army.mil/usanca/.

## Submit an Article to Countering WMD Journal

*Countering WMD Journal* is published semi-annually by the United States Army Nuclear and Countering WMD Agency (USANCA). We welcome articles from all U.S. Government agencies and academia involved with CWMD matters. Articles are reviewed and must be approved by the Countering WMD Journal Editorial Board prior to publication. The journal provides a forum for exchanging information and ideas within the CWMD community. Writers may discuss training, current operations, and exercises, doctrine, equipment, history, personal viewpoints, or other areas of general interest to CWMD personnel. Articles may share good ideas and lessons learned or explore better ways of doing things. Shorter, after action type articles and reviews of books on CWMD topics are also welcome.

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

*Countering WMD Journal* is published two times a year: October (article deadline is 15 July) and April (article deadline is 15 January). Send submissions via email to usarmy.belvoir.hqda-dcs-g-3-5-7.mbx.usanca-proponency-division@mail.mil, or as a Microsoft Word document on a CD via mail, to: Editor, CWMD Journal, 5915 16th Street, Bldg 238, Fort Belvoir, VA 22060-5514.

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