# Combating WMD JOURNAL

U. S. Army Nuclear and CWMD Agency

Issue 2

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JTF-Elimination Integration and Combined Elimination Team Training in the Republic of Korea

Nuclear Science and Engineering Research Center (NSERC)

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## COLUMNS



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# USANCA Update

Mr. Peter Bechtel, Director
United States Army Nuclear and CWMD Agency

Mr. Peter Bechtel
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The Army continues to sustain, prepare, reset, and transform to meet requirements in a complex and dynamic environment. Key to this effort is integration of Combating WMD strategy into our Army both operationally and institutionally. Concurrently, the Army must ensure these activities are synchronized with those of our joint partners and across the interagency. The US Army CBRN School is an example of not only recognition of the environment, but a necessary step in transforming to meet new challenges. Activities such as adding CWMD instruction in the US Army War College distance learning curriculum, a continued capability increase in the 20th Support Command (CBRNE), and Army senior level participation in strategic steering groups all convey a consistent and comprehensive transition of Army CWMD capability in line with the Army transformation as a whole.

A significant event was the February 2008 ground breaking for the new USANCA facility. A simple action in its own, but one which marks continued transition and increased capability. Even though ground breaking ceremonies are usually low key, participation by Army Deputy Chief of Staff for Operations LTG James Thurman, USSTRATCOM Center for CWMD Deputy Director RADM William P. Loeffler, and Los Alamos National Laboratory National Security Office Dr. Patrice Stevens demonstrated the importance of continued capability improvement marked by joint teaming. It also demonstrated the crucial marriage between the technical and the operational with CWMD in the persistent conflict. Fort Belvoir estimates Spring 2009 as the occupation date for the renovated facility which will include conferencing support, enhanced IT connectivity, and the security and support which comes with a Fort Belvoir location.

**Current Activities**

Our Army participation in delegations to the NATO Joint Capability Group on Chemical, Biological, Radiological and Nuclear Defence (JCGCBRN) and the CBRN Defence Operations Working Group (CBRNWG) are heavily influencing (by emphasizing a US DOTMLPF approach to capabilities development) both groups' transition to capability-based business practices from their respective historic material-based and doctrine-based approaches. This transition will enhance the operational relevance of JCGCBRN's and CBRNWG's program of work leading to improved CBRN defense capability during coalition operations.

We are leading the JCGCBRN Scenario Team of Experts (ToE) charged with establishing a base-line set of operational CBRN scenarios to support capability development studies conducted across NATO and Australian, British, Canadian, American (ABCA) Armies forums. The ToE is currently collecting existing NATO and national-level CBRN scenarios for consideration for inclusion in a recommended scenario set that the ToE will present to the JCGCBRN in September 2008.

The nuclear Weapons Effects Strategic Collaborations (WESC), most recently hosted by USANCA Analysis Branch in February 2008, is identifying user capabilities and prioritizing requirements for nuclear weapons effects research and development. The WESC is the forum through which US/UK national requirements in nuclear weapons effects can be discussed and the potential for collaborative programs of mutual benefit explored. The WESC assembles the community of nuclear weapons effects managers, users and developers to share information on technologies, gaps and plans. The Principals consists of representatives from STRATCOM, DTRA, NNSA, and UK.

Internal to the Army, the TRADOC development of the Army Combating WMD Concept Capability Plan in parallel with USSTRATCOM development of the Combating WMD Joint Capability Document will serve to operationalize CWMD strategy and inform future capability development. We continue to assist the Assistant to the Secretary of Defense for Nuclear, Chemical, and Biological Programs in the development of DoDI 3150.aa – CBRN Survivability Program and supporting the Electromagnetic Environmental Effects (E3) community in developing DoDI 3222.cc – E3 Program while coordinating drafting efforts between the CBRN and E3 communities to ensure EMP Survivability is adequately addressed in both DoDI 3150.aa and DoDI 3222.cc.

From a planning and operations perspective, Army efforts to integrate CWMD strategy continue to realize success. Coordinated efforts on the part of planners in ARNORTH and AMC will result in a full integration of Chemical Accident Incident Response Assistance (CAIRA) procedures with response to national emergency under the USNORTHCOM framework which is not only a reflection of operational integration but also marks continued maturation of USNORTHCOM in a post 9-11 environment. As the Department of Defense refines strategic guidance coupling security cooperation priorities with contingency guidance we must take advantage of opportunities for coordination between current operations and future operations as well as theater cooperation and contingency plans. This coupling effect is already well known with the CWMD community. The linkages between the pillars, as described in the National Strategy, tie together all interagency activities from nonproliferation to counterproliferation to consequence management. CBRN planners must seek opportunities to accomplish CWMD strategy in all operations recognizing what effects are created by a given action be it in a 'build partner capacity' or 'deter/dissuade' setting.

Our Army must continue to integrate CWMD Strategy into its operational activities. Identification of Army Component requirements and incorporation of those requirements into strategic fora is the method by which we sustain and improve current activity and inform future capability development.

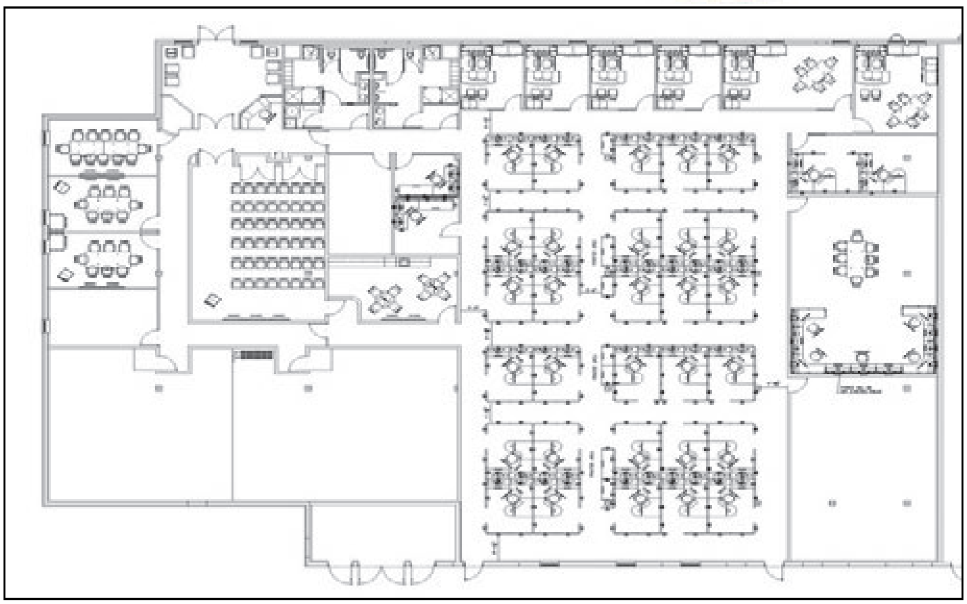
Thanks to all of you for your continued efforts toward this end.

U.S. ARMY NUCLEAR AND CWMD AGENCY
Fort Belvoir, Virginia

# USANCA Breaks Ground on New Facility at Fort Belvoir

LTC Dirk Plante, USANCA
LTC Andrae Brooks, USANCA
CW5 Stephen A. Gomes, USANCA (Photographer)

Work on the future home of the United States Army Nuclear & Combating WMD Agency (USANCA) officially kicked off with the Ground Breaking Ceremony on 21 February 2008. The ceremony was held at Building 238, Fort Belvoir, Virginia. Over the years the building had been home to the installation's Thrift Shop, Commissary and Class VI store. In less than one year Building 238 will re-open for business as the new home of the Army's Combating WMD Field Operating Agency.



Blueprint of USANCA's nearly 15,500 square foot state of-the-art facility.

The official party for the ceremony consisted of Lieutenant General James D. Thurman, the Army Deputy Chief of Staff, G-3/5/7; Mr. Peter Bechtel, Director USANCA; and Colonel Brian Groft, Deputy Director, USANCA. Of extreme importance, LTG Thurman echoed the threats from chemical, biological, radiological and nuclear devices, materials, and explosives that could cause immense danger to facilities, Soldiers, sailors, airman, and marines. "Today, more than ever, we must be on point. The world is watching us, and we must get the job done."

Several VIPs from the Combating WMD community and the Fort Belvoir Garrison attended the ceremony, including Rear Admiral William Loeffler (STRACOM Center for Combating WMD), Dr. Patrice Stevens (Los Alamos National Laboratory), and Command Sergeant Major Tracey Anbiya (Fort Belvoir Garrison Command Sergeant Major).

As this is a renovation of an existing building, the actual "ground breaking" involved a sledgehammer to begin the demolition of the interior of the building. As guests looked on, many envious, the official party donned hard hats and eye protection before taking their turn at the wall. LTG Thurman, Mr. Bechtel, and COL Groft each took turns swinging the "ceremonial" five-pound sledgehammer into the drywall of one of the rooms.

After the ceremony, guests were invited to stay for refreshments, and review the display boards depicting the layout for the new facility, USANCA's historical lineage, and the capabilities of our reorganized agency.

**New Facility**

Building 238 is located on 16th Street, on the South Post of Fort Belvoir. It will undergo an extensive renovation program to prepare a 15,500 square foot state-of-the-art facility as the future home of USANCA. Plans call for the renovation to be completed in early 2009, with a projected move-in occurring in March 2009. The new office will include conferencing areas, classified storage and computing rooms, a workshop and exercise support facility, and executive suites, all furnished with modern furniture and information technology equipment. USANCA will occupy most of the building, and our neighbor will be the United States Army Manpower Analysis Agency (USAMAA), currently located elsewhere on Fort Belvoir.

**History**

Since 1977, USANCA has been headquartered on the Engineer Proving Ground area of Fort Belvoir in

LTG Thurman, Mr. Bechtel and COL Groft prepare to make history.

Mr. Bechtel describes new features of the building to LTG Thurman.

Springfield, Virginia. The agency traces its lineage to the Office of Special Weapons Development (OSWD), established at Fort Bliss, Texas in 1952. Over the years OSWD went through many transformations to become the U.S Army Nuclear Group, then the Combat Developments Command Nuclear Agency, and finally the United States Army Nuclear Agency (USANA). In 1975, USANA moved to Fort Belvoir. Following a merger with the Nuclear Weapon System Safety Committee, and the U.S. Army Chemical and Nuclear Surety Group, the agency became the U.S. Army Nuclear and Chemical Agency (USANCA) in 1977.

**Capabilities**

On 1 October 2006, USANCA became the Combating WMD Field Operating Agency of the Army G-3/5/7, with the mission to provide nuclear and Combating WMD planning and execution expertise for the implementation of Army CWMD strategy and policy at the corps level and above in order that the Army meet joint operational requirements in achieving national objectives to combat WMD. Operational capabilities of the agency include modeling and simulation support to the Army, CWMD Planning Assistance Teams to the Army Service Component Commands, augmentation of Army units with specialized missions, international and treaty support, and analysis capabilities in support of the Joint Capabilities Integration and Development System. The completion of the state-of-the-art facility will increase the agency's operational capabilities, and allow the agency to provide world-class support during exercises and contingencies of the Army Staff and commands.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# JTF-Elimination Integration and Combined Elimination Team Training in the Republic of Korea

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During Exercise Ulchi Focus Lens (UFL) '07, the Army's 20th Support Command Headquarters and USSTRATCOM's Joint Elimination Coordination Element (JECE) strategically deployed to the Republic of Korea (ROK) and formed a Joint Task Force for Weapons of Mass Destruction (WMD) elimination operations (JTF-E) in support of Combined Forces Command (CFC). During this same period (Aug 2007), two WMD Joint Response Teams from the 110th Technical Escort Battalion deployed to the ROK and led two weeks of combined sensitive site exploitation training with teams from the ROK Chemical Special Forces Battalion, ROK NBC Defense Command.

The National Military Strategy to Combat WMD (NMS-CWMD) defines WMD Elimination as "military operations to systematically locate, characterize, secure, disable, and/or destroy a state or non-state actor's WMD programs and related capabilities in hostile or uncertain environments." More specifically, elimination operations will:

- Prevent the looting or capture of WMD and related materials.
- Render harmless or destroy weapons, material, agents, and delivery systems that pose an immediate or direct threat
- For intelligence purposes, exploit program experts, documents, and other media to prevent further WMD proliferation or regeneration.

Beginning in 2005, CFC and United States Forces Korea (USFK) addressed the need to train with a WMD Elimination Task Force in ST 9.0 in both its CMETL and JMETL. Based on the potentially large number of WMD sites in North Korea, CFC ground components lack the specialized teams, equipment, and expertise to exploit these sites. In order to fully achieve the standards, CFC needed to successfully integrate a JTF for WMD Elimination during an annual exercise, develop a concept of operations (CONOPS), and incorporate the JTF-E into its plans.

The February, 2006 Quadrennial Defense Review (QDR)directed the following: "Expand the Army's 20th Support Command (CBRNE) capabilities to enable it to serve as a Joint Task Force capable of rapid deployment to command and control WMD Elimination and site exploitation missions by September 2007". The JTF Elimination is not a standing JTF. Upon receipt of a Combatant Command (COCOM) Request for Forces (RFF) at USJFCOM, elements of the 20th SUPCOM and the Joint Elimination Coordination Element (JECE) – an element from USSTRATCOM, as well as other joint and interagency "plugs" come together to form the JTF Elimination headquarters. Although the subordinate units of the JTF Elimination are predominantly Army, some come from specialized assets across the services and the interagency.

***GEN Bell (CDR, UNC/CFC/USFK): "We all learned enormously together, and I can clearly endorse an Initial Operational Capability of this outfit"***

During the plenary session of the Counterproliferation Working Group (CPWG) in February 2006, the ROK Ministry of National Defense and United States Office of the Secretary of Defense for Counterproliferation Policy began discussing the need for not only the integration of a JTF-E

Breaching Operations- A Soldier from the 110th Chemical Battalion (Technical Escort) breaches the entrance to a suspected chemical weapons storage facility.

into CFC, but also the need for the ROK to develop their own capabilities to command and control elimination operations as well as specialized teams to conduct sensitive site exploitation (SSE). As a direct result of the CPWG, CFC initiated plans to begin two major partnership building activities between the US and the ROK. The first initiative involved annual Combined WMD sensitive site exploitation (SSE) team training, and the second involved the integration of the JTF-E into CFC during UFL 07.

**Combined WMD Sensitive Site Exploitation (SSE) Team Training**

For the team training, the Defense Threat Reduction Agency provided funding to send 15 ROK Soldiers from ROK NBC Defense Command's Chemical Special Forces Battalion to Aberdeen Proving Ground (APG), Maryland to train with the 22d Chemical Battalion (Technical Escort). In September 06, the ROK Soldiers accompanied by the CFC CWMD Plans Branch traveled to APG and trained with the 22d CM BN for two weeks. This training marked the beginning of an ongoing effort between the US and ROK to build ROK capabilities to conduct highly technical SSE missions.

The second iteration of combined SSE training occurred in August 2007 in conjunction with exercise UFL '07. For this iteration, two US Joint Response Teams from the $110^{th}$ Chemical Battalion (Technical Escort) deployed from Fort Lewis, WA to the ROK to train with the ROK Chemical Special Forces Battalion. In coordination with the $50^{th}$ ROK Infantry Division, ROK NBC Defense Command hosted the training at an urban warfare training site, which replicated a small North Korean village. After a week of classes and hands on training, the ROK and US Soldiers formed combined SSE teams for the second week. During the second week, a typical scenario included: the use of cutting torches and saws to enter a facility; the use of the (PINS) to conduct non intrusive chemical ordnance assessment to characterize unexploded chemical munitions; and a detailed personnel decontamination following each mission.

The ROK and the US plan to continue this annual training alternating the location between the ROK and the US. The goal is to build 12 ROK Joint Response Teams with capabilities similar to those found in the US technical escort battalions, and capable of conducting SSE missions.

**JTF-Elimination Integration into CFC during UFL '07**

Immediately following the QDR in February 2006, planners from CFC and the $20^{th}$ SC (CBRNE) began discussing the possibility of using UFL '07 to conduct the JTF-E Initial Operational Capability (IOC) validation exercise. In December 2006, planners from the $20^{th}$ SC (CBRNE) attended CFC's initial planning conference for UFL '07 and validated that the UFL scenario was the perfect venue for their upcoming validation exercise.

During the UFL '07 mid planning conference in February 2007, the


LTG Peterson, Deputy Commander, USFORSCOM, speaks to BG Wendel, Commander, 20th Support Command (CBRNE), and Soldiers from the NBC Defense Command and the 110th Chemical Battalion (Technical Escort) following a combined ROK/US sensitive site exploitation mission.

CFC CWMD Plans Branch and six planners from the 20th SC (CBRNE) hosted a JTF-E workshop to begin detailed planning and coordination across the CFC staff. The primary objectives were to develop the following: a concept of operations, C2 architecture, command relationships, scenario event lists, and intelligence summaries for North Korean WMD sites. In addition, they began planning all of the logistical support to include: strategic lift, transportation, work space for the operational Command Post (60 personnel) with appropriate communications, and operational work spaces within the CFC command post for 20th SC (CBRNE) Coordination Elements (12-15 personnel).

As action officer level planning and coordination continued throughout the spring, the plenary session of the ROK/US Counterproliferation Working Group (CPWG) met in Washington DC in May 2007. During this session, senior policy officials on both sides agreed to support JTF-E participation in UFL '07. They also agreed to continue the combined SSE training as well as building a ROK capability to command and control elimination operations. With the assurance that CFC was not out in front of US OSD or ROK MND policy, the UNC/CFC Commander approved the JTF-E's participation in UFL '07 based partly on the progress achieved through the CPWG.

In final preparation for participation in UFL '07, LTG(R) Ayres (UFL Senior Observer) and BG Wendel (Commander, 20th SC) came to Korea in June and facilitated a week long workshop with the CFC staff, USJFCOM, 20th SC (CBRNE), and the Joint Elimination Coordination Element (JECE) from the USSTRATCOM Center for Combating WMD (SCC). The primary objectives of the seminar were to inform the CFC staff of the JTF-E capabilities, agree upon the command relationship, develop a concept for integrating the coordination elements into the CFC staff as well as subordinate components, and develop a concept of operations for supporting ground components in SSE operations.

Soldiers from the Republic of Korea's NBC Defense Command and the US 110th Chemical Battalion (Technical Escort) take a group photo following two weeks of combined sensitive site exploitation training in the Republic of Korea.

In August 2007, the 135 personnel from the 20th SC (CBRNE) along with 30 personnel from the JECE deployed to the ROK and established a JTF-E under the operational control of CFC for exercise UFL '07. The JTF-E headquarters plugged into CFC using the CENTRIXS-K network and monitored updates to the CFC Commander via the click-to-meet features on the network. Coordination Elements (CE) from the JTF-E were located with the CFC C35 Future Operations Division, C35 CWMD Plans, C2, and Combined Unconventional Warfare Task Force (CUWTF). The click-to-meet capabilities allowed the JTF-E to conduct collaborative planning with these section/components throughout the exercise. Throughout the exercise, the JTF-E conducted deliberate planning for several chemical/biological WMD sites in North Korea. In addition, they worked with the C35 CWMD planners to develop a draft "Elimination Operations" tab for inclusion into the CWMD appendix to the CFC OPLAN.

With respect to security cooperation and partnership building, the JTF-E headquarters hosted several observers from the ROK Ministry of National Defense, Joint Chiefs of Staff, Korean Arms Verification Agency, and NBC Defense Command in order to help the ROK develop their own capability to command and control elimination operations. This effort was highlighted by BG Wendel's invitation to BG Lee (Commander, ROK NBC Defense Command) and his staff to attend the JTF-E's final draft presentation on the concept of operations for JTF-E support to CFC's Ground Component Command.

**Conclusion**

There is a conclusion from three separate perspectives: CFC/USFK, ROK, and 20th SC (CBRNE)/JECE (which come together to for the JTF-E). From the CFC perspective, UFL '07 provided the opportunity to train to standard IAW our CMETL/JMETL ST 9.0, thus integrating a capability to command and control elimination operations and provide highly skilled SSE teams to the ground components to exploit North Korean WMD sites.

***LTG(R) Ayres: "I consider their participation in UFL to have been a complete success. JTF-E has developed an operational focus that is suitable for a command that is OPCON to a COCOM"***

Soldiers from the Republic of Korea's NBC Defense Command and the US 110th Chemical Battalion (Technical Escort) conduct decontamination operations following the exploitation of a chemical storage facility.

From the ROK perspective, both UFL '07 and the combined team training greatly enhanced their effort to develop their own elimination operations capabilities. And finally, from the JTF-E perspective, the exercise provided the 20th SC (CBRNE) with the opportunity to complete its IOC validation IAW the QDR, which directed IOC by September 2007. In closing, the following are significant quotes with respect to the JTF-E integration into CFC during UFL '07.

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# A Call for a National WMD JIPOE Process: Getting Back to Fundamentals

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This article serves to rekindle the lost art of conducting Intelligence Preparation of the Battlespace (IPB) – now called Joint Intelligence Preparation of the Operational Environment (JIPOE) in current doctrine. While most of us can recall experiences with IPB from national training centers, in the age of concepts like capabilities-based planning, the adaptive planning cycle, and effects-based operations the applying the IPB process to the combating WMD (CWMD) problem set seemingly requires a leap of faith.[1]

The fact remains that no national–level, predictive, IPB-like analytical process exists that addresses the CWMD problem set. The absence of a reasoned IPB process and the predictive threat courses of action (COA) it would produce has caused strategic decision makers to make decisions based on "scenarios." The scenarios presented for strategic-level decision making, devoid of the analysis of all available data, discipline, and reasoned consideration of the facts and assumptions, highlight the difference between a scenario and a finished, predictive, threat COA. In the face of the multitude of WMD scenarios that span the spectrum of potentiality and likelihood, in venues ranging from public perception and the media to the inner circles of the Department of Defense, the Executive Branch, and the senior leaders on Capitol Hill, the fundamental question remains – how likely are these scenarios? How well does our current scenario development process regarding WMD depict what we know, what we don't know, and what we think about current and future threats? Further, without consensus throughout the IC on key WMD facts and assumptions, the proffered scenarios often serve as the opinion of a few, carry no weight, and fail to galvanize synchronized IA/DoD responses.

As the military's CWMD planning efforts mature across the combatant command and geographic combatant command (here, abbreviated as COCOM and GCC, respectively) staff structures, one of the greatest challenges we face stems from our lack of understanding of the operational environment. In order to actively prosecute our CWMD campaigns, we must know where and how to apply strategic military activities and planning

**IPB Vignette**

Situation: A battalion-sized Task Force is preparing a defense. An Orangeland armored regiment is expected to attack within 48 hours. The TF CDR, S-2, and S-3 are standing in front a map in the TOC.

TF CDR: "Ok 2, what do you think the enemy is going to do?"

S-2: "Sir, based on current reporting, our IPB, and the enemy's most likely COA, I believe that he is going to exploit the favorable terrain along avenue of approach 1 and attack from the north. Based on his templated position, we should begin to see his regimental recon assets this evening. We currently have NAIs 3, 8, 9, and 12 active. Over the next 12 hours, reporting from either our NAIs or our counter-recon CO/TM should confirm this assessment.

S-3: "Sir, I concur. Based on how this guy likes to fight, he will look to get maximum use from terrain that allows him to exploit any penetration in our defenses. Our counter-recon screen is set and our main effort is approaching 75% completion in their defensive preparations. No issues at this point.

efforts in the current and predicted operational environments. The arguments presented in this article demonstrate how to apply the IPB process to address this challenge. Further, this article provides the framework for recognizing the scope of the WMD problem set demands execution of the IPB process at the national level – with DOD and interagency (IA) partners working collaboratively and dynamically.

To help the CWMD community make this leap of faith, this article reviews the JIPOE concept, assesses the status of the CWMD community's ability to synchronize efforts, addresses current shortfalls in the CWMD community, and presents a recommended solution based on IPB as the corner stone of a synchronized, national-level CWMD JIPOE process.

**What is JIPOE?**

Stated most succinctly in JP 2-01.3, "Joint intelligence preparation of the [Operational Environment (JIPOE)] is the analytical process used by joint intelligence organizations to produce intelligence assessments, estimates, and other intelligence products in support of the joint force commander's (JFC's) decision making process." [2] JP 2-01.3 further declares that the JIPOE doctrine applies except when the commander has determined that exceptional circumstances exist. [3] This begs the question – which commander has determined (and explicitly stated) such exceptional circumstances apply to the WMD problem set and that the JIPOE process does not apply? More on the application of the JIPOE process to the WMD problem set follows, but first, a quick review of the process is in order.

Fundamental to understanding JIPOE process is the fact it is an evolutionary process and not a product. While the products that fall out of a JIPOE reflect the analysis at a singular point in time, the design of the process itself allows for continuous updates as the operational environment changes or additional information becomes available. The provision of predictive intelligence aimed at determining the adversary's probable intent and most likely future COAs serves as the primary focus of the JIPOE process. In addition, JIPOE assists "JFCs and their staffs in achieving information superiority by identifying adversary centers of gravity (COGs), focusing intelligence collection at the right time and place, and assessing the effects of the battlespace environment on military operations." [4] The JIPOE process consists of the following four steps:

- Step 1: Define the total battlespace environment
- Step 2: Describe the battlespace effects
- Step 3: Evaluate the enemy
- Step 4: Determine and describe probable adversary courses of action

Although the responsibility for managing the JIPOE process falls on the Joint force intelligence directorate (J-2), "a full understanding of the operational environment typically will require cross-functional participation by other joint force staff elements and collaboration with various intelligence organizations, [other government agencies], and nongovernmental centers of excellence." [5]

As staff officers engaged in the "Long War," we must not view the JIPOE process as outlined above as a cold-war relic; rather, it requires us to seek modern methods of applying traditional doctrine. As staff officers, we must question the sources of information that are feeding current military decision making processes. No commander or staff officer could argue against the importance of understanding the threat's decision cycle. "Identifying, assessing, and estimating the adversary's centers of gravity, critical vulnerabilities, capabilities, limitations, intentions, most likely COA, and COA most dangerous to friendly forces and mission accomplishment" [6] serve as keys to the threat mind set. The current problem, as it relates to CWMD, is that no JIPOE process exists and no DoD organization is willing and capable of accomplishing the task.

**How Does JIPOE Relate to the CWMD Problem Set?**

The JIPOE process relates directly to the CWMD problem set. Doctrine currently describes how to translate the conventional JIPOE process and adapt it for stability operations "the intelligence operation must help to collect - then fuse - political, criminal, economic, linguistic, demographic, ethnic, psychological, and other information regarding conditions and forces that influence the society." [7] JIPOE applies to CWMD planning efforts in the identification of potential threat streams, resource allocation, and the development of friendly and threat COAs. Further, application of the JIPOE process reveals an additional paradigm shift required by the CWMD community that recognizes the counterterrorism and CWMD are not two distinct problem sets. We must view the CWMD problem as being network-based and approach it using a holistic methodology – identifying state and non-state actors (individuals, terrorist groups, and non-governmental entities) in a comprehensive fashion, not as singular entities operating independent from one another. Only a limited set of pathways to a WMD capability (state or non-state) begin and end without some form of outside assistance (either witting or unwitting). The employment of a system-of-systems approach thru the JIPOE process is also grounded in doctrine: "Developing a systems view can promote a commonly shared understanding of the operational environment among members of the joint, interagency, and multinational team, thereby facilitating unified action." [8]

Acknowledgement of the preceding arguments leads to the third, and equally important paradigm shift – WMD are weapon systems, not an amorphous or intangible means of prosecuting war. As tangible weapon systems, WMD have predictable templates for program development, materiel acquisition, weapons development, production, assembly, and employment. These templates for WMD

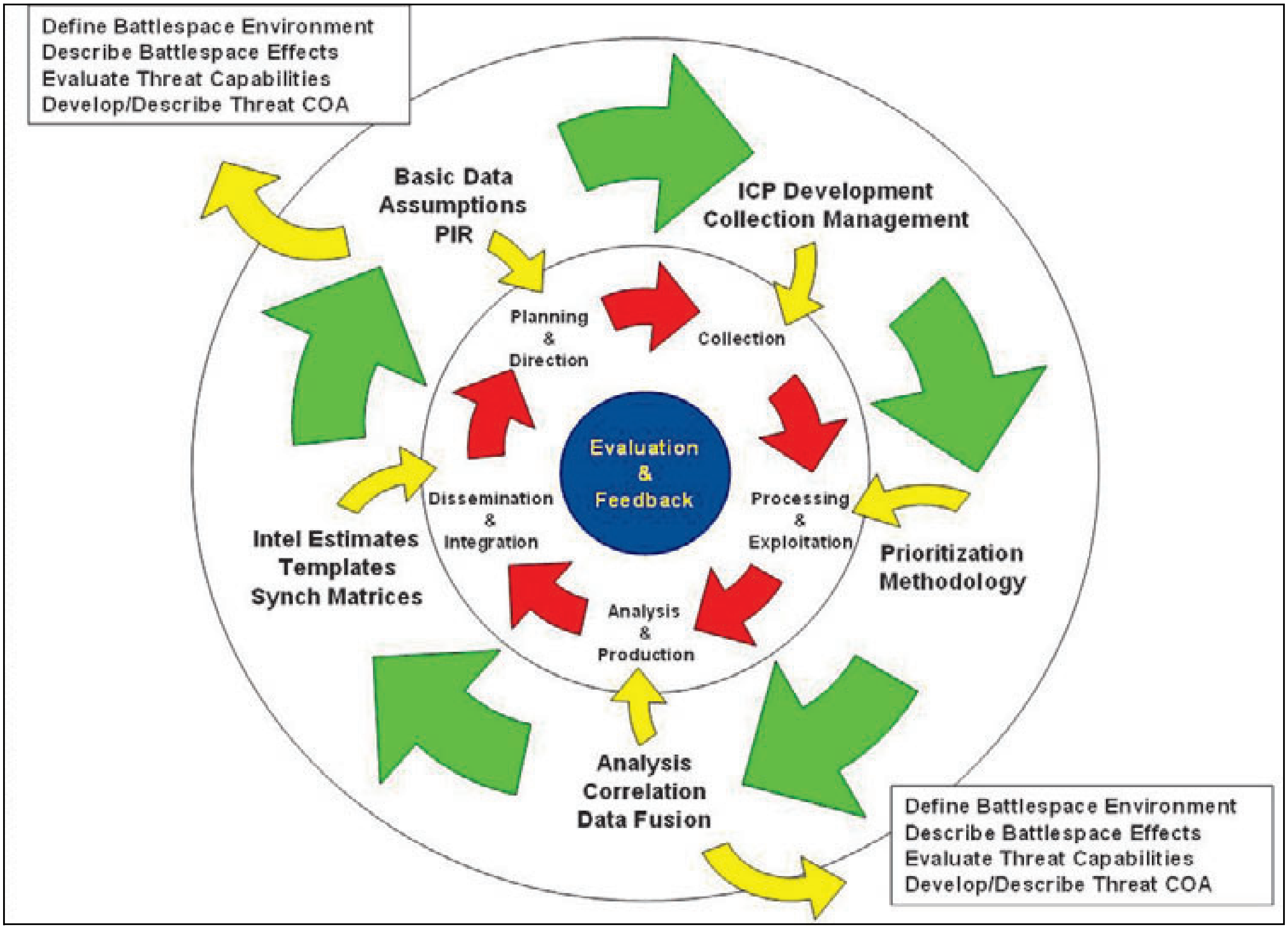


**Figure 1. JIPOE Interaction with the Intelligence Cycle.**

pathways serve the same purpose as the doctrinal templates in a traditional IPB. By themselves, these templates offer little insight into possible enemy intent. However, when tuned to the operational environment, they can serve as a powerful tool for predicting enemy intentions and capability. In this sense, the JIPOE process applies directly to CWMD operational and planning efforts.

Intelligence analysis drives our current operations and future planning efforts. JP 2.0 describes the intelligence cycle as having the following six elements: planning and direction, collection, processing and exploitation, analysis and production, dissemination and integration, with evaluation and feedback occurring continuously. [9] JIPOE "supports and is supported by each phase of the intelligence cycle," [10] as shown in the figure above.

Under the current dynamics operating within the CWMD community, the JIPOE process does not exist. Therefore, drawing from Figure 1, we essentially have a five-cylinder engine attempting to operate with one of the cylinders mis-firing – the JIPOE initial feeds into the ***Planning & Direction*** phase of the intelligence cycle. In the current operating condition, execution of the ***ICP Development*** and ***Collection Management*** functions relies on woefully scarce "confirmed reporting" without reasoned, predictive analysis injects from a JIPOE process. As a result, both the ICP and CM functions tend to provide either overly specific guidance (applicable to minute aspects of the problem set) or non-specific guidance (that fails to map to any portion of the problem set). The resulting collection and analysis effort is not focused against prioritized and target-able intelligence gaps.

It is worth noting that JP 2.0 describes JIPOE as "a systematic approach used by intelligence personnel to analyze information about the battlespace environment and the adversary." [11] Currently, the CWMD community does not apply the JIPOE methodology to the CWMD problem set. This leaves a host of questions unanswered: how do we determine the relative importance of and provide decision makers with perspective for WMD threat streams? – develop nonproliferation or counterproliferation options? – identify capability gaps and appropriate solutions? – develop adversary COA used to drive wargaming scenarios? – allocate our scarce CWMD resources? And all in the absence of strategic and operational understanding of the battlespace, what the threat is capable of doing, or how he might do it.

### WMD JIPOE Vignette – Part 1

Situation: Reporting suggests that members of a terrorist group, the Religious Liberation Front, operating from a safehaven in Orangeland appear to be assembling the requisite materials for production of agent blue. While traditionally employed using aerial bombs, agent blue could also be disseminated in improvised means by modifying conventional mortars, chemical IEDs, or even manual dispersion.

JIPOE analysis: Analysis indicates the most likely area in which the RLF could be establishing an agent blue production facility is in the northwestern provinces of Orangeland. Limited reporting on RLF personalities suggests that the group is capable of producing viable agent blue using non-traditional methods. The most likely sources of materiel support originate in Redland via commercial shipments to a local university. The signatures of agent blue production are known, however, we currently have no fielded means to detect them.

**Why Do We Need the WMD JIPOE Process?**

To apply our strategic guidance and execute operational plans, COCOMs, their staff, and subordinate commanders must understand and visualize the who, what, when, where, and how an adversary might seek to achieve or deploy a WMD capability. It does not suffice to tell a COCOM a particular named terrorist group could employ Anthrax or that a homemade recipe for an agent will not work because they don't have the western-centric expertise or equipment. A list of WMD-related questions requiring answers to illuminate the problem set might include: who (individual names, cell, groups) is involved? – what type of agent is being prepared? – where is the materiel support coming from? – where is the agent being produced? – where will it be employed? – how is the agent being produced? – how will it be employed? The answers to these questions accomplish more in terms of arraying strategic assets to confirm/deny what we believe is occurring in the operational environment than generic statements about threat actors and WMD capabilities.

### WMD JIPOE Vignette – Part 2

Situation: Based on the military mission areas identified in the NMS-CWMD, viable interdiction options exist, once the location of agent blue production facility has been identified. The COCOM planners have identified the lack of ability to detect agent blue production as a capability gap.

Actions required:
- Identify PIR, IR, and intelligence gaps
- Allocate/request intelligence collection assets
- Assess host nation capabilities (detection, interdiction, etc)
- Establish NAIs/TAIs; assign coverage to intelligence collection assets
- The COCOM/J8 initiates the means to resolve the identified capability gap (detection of the agent blue production process)

Current planning and organizational constructs do not establish the conditions for successful CWMD campaigns, let alone the synchronization of multiple campaigns. While some planners argue that the Adaptive Planning Cycle is too short, intelligence doctrine and guidance has replaced the traditional Intelligence Estimate with a Dynamic Threat Assessment (DTA). Further, the DTA and STRATCOM's variant of the DTA fail to predict threat WMD COAs in a meaningful way. Compounding the issue, our capstone document for all things CWMD, JP 3-40, Joint Doctrine for Combating Weapons of Mass Destruction, explains a host of non-proliferation, counterproliferation, and consequence management concepts but fails to mention any aspect of JIPOE or how to apply the CWMD concepts to predicted threat WMD COAs.[12]

The Adaptive Planning Cycle begs for a continuous WMD JIPOE process. The aggressive timeline for plan development, approval, and review requires that the DTA or STRATCOM's variant must adopt a comprehensive view of the problem set and offer predictive analysis to guide COCOM actions and decisions. Further, future versions of JP 3-40 must address WMD JIPOE process. CBRN subject matter expertise is scarce among COCOM/GCC staff and planning elements. This amounts to a severe capability gap. Appropriate resources and tools are required. We cannot expect COCOM and GCC staff members to tackle this global problem set on their own.

Within military channels, the WMD JIPOE process directly supports COCOM/GCC operational planning. WMD JIPOE products support the synchronization of intelligence collection and analysis efforts; provide the framework for a common, global picture of potential threat streams; and provide the context needed to identify and/or distinguish potential adversary COAs.

To truly combat WMD, the WMD JIPOE process supports the holistic application of options from across the range of elements of national power (DIME – diplomatic, information, military, and economic). Many options for addressing potential WMD threats exist within diplomatic, information, and economic realms. Commanders and staff at all levels must understand and leverage these non-military CWMD options. Within the context of military options, WMD JIPOE products support the selection of the appropriate military mission (of the eight military mission areas) to address identified threats. Further, when executed correctly, the WMD JIPOE process could support the identification of capability gaps and the selection of appropriate solutions from across the DOTLMPF spectrum (doctrine, organization, training, leadership, materiel, personnel, and facilities).

WMD JIPOE products support increased IA synchronization such as identifying areas requiring greater diplomatic effort to deter/dissuade state transfer of materiel, technology, and expertise. In terms of information, WMD JIPOE supports the development of national and IA strategic communication plans that promote nonproliferation themes and the building of partnership capacity to combat WMD (e.g.: PSI). A comprehensive WMD JIPOE will identify opportunities for direct engagement by other government agencies (OGA, e.g.: DOS and DOE support for increasing border and port security capabilities) and the means for implementing financial incentives and disincentives (e.g.: U.S. financial support for partner capacity-building programs, application of export controls, freezing of financial assets). A WMD JIPOE process is not only required by DoD, all USG agencies can effectively use the process to develop, and when necessary, employ comprehensive and interlinked CONOPS to defend our homeland and interests abroad.

**WMD JIPOE Vignette – Part 3**

Situation: Given the situation from Part 1, the COCOM staff has prepared the following recommended actions with which to engage the IA:

Diplomatic:

- Request DOS issue a demarche to Redland for exporting agent blue production equipment that ended up in the hands of the RLF.
- Request embassy officials engage the Government of Orangeland on the issue of agent blue production by the RLF terrorists in their country.

Information:

- USG strategic communications should highlight the effects of agent blue against unprotected, civilian population centers.
- Alert the international and local news media to the increased threat the RLF poses to the local and international community.
- Military strategic communications should include the message that the USG will not sit by idly while a terrorist group develops the capability to produce and employ agent blue.

Economic:

- Seek the means to forbid U.S. businesses from conducting business with the Acme Co. in Redland, who is providing material support to the terrorist group.
- Seek the means to freeze the financial assets of personnel/institutions known to be supporting the RLF.

**A Proposed WMD JPOE Model**

The following elements serve as a general scheme for applying the JIPOE process to the CWMD problem set.

**Step 1: Define the battlespace environment.**

As depicted in the outer ring of Figure 1. (page 12), an initial WMD JIPOE begins with an assembly of available data and by ascertaining the required assumptions. The most significant failure in the current planning environment that effectively inhibits the use of the JIPOE process is that we assume either the data does not exist or too much data exists. The second greatest hurdle to executing a WMD-based JIPOE is that in the majority of the CWMD planning efforts, critical assumptions are made in the absence of a coherent analysis of the available data. Subsequently, planners and decision makers enter into COA development/acceptance without all of the relevant facts (or arbitrated assumptions).

During a traditional JIPB process, the typical data sets (facts and assumptions) include: terrain/weather data, mobility corridors, key terrain, observation and fields of fire, concealment and cover, weapon system specifications, avenues of approach, etc. In a similar manner, a WMD-based JIPOE seeks to follow a similar process in defining the battlespace environment.

Examples of pertinent data sets include the following: terrorist areas of operation and areas of influence; terrorists known to (or suspected of) developing WMD capability; regions lacking state resolve (or capability) to counter Islamic extremism; locations and security of WMD stockpiles; locations of WMD components, precursors, and seed stock materials (and their associated security); locations of restricted and dual-use materiel or equipment stockpiles and distributors; locations providing physical, financial, religious, educational, and intellectual safe haven; locations of smuggling networks capable of trafficking WMD-related materiel or finished weapons; the status of CBRN detection capabilities at land/sea/air points of entry (border crossing points, ports, and air hubs) worldwide; and the status of partner capacity to interdict WMD-related activity.

**Step 2: Describe the battlespace's effects (friendly and adversary operations).**

Based on the assembly of the data and assumptions made during Step 1, in a traditional JIPB, the description of the battlespace's effects begins with an analysis of the battlespace environment. Just as the traditional JIPB analysis supports the development of a modified combined obstacle overlay (MCOO), the WMD version of a MCOO will highlight risk areas associated with the acquisition, development, or activity surrounding WMD. These risk areas represent the convergence of: sources of WMD materiel, expertise, or finished weapons; routes suitable for trafficking materiel or expertise; networks capable of facilitating WMD development; safe havens that could facilitate the development of WMD; and information domains suitable for providing access to WMD-related materials or knowledge (or capable of supporting clandestine collaboration among groups or individuals).

**Step 3: Evaluate the adversary.**

In the WMD JIPOE, this step differs very little from the traditional JIPB**:** identify adversary COG; update or create adversary models; determine the current adversary situation; and identify adversary capabilities. Noted exceptions include the additional burden of identifying the critical vulnerabilities associated with the adversary's COG and the identification of the adversaries' networks the support their current (and projected) capabilities. Adversary models in the WMD JIPOE include "doctrinal templates" that depict pathways to a WMD capability in terms of agent/ weapon choice, materiel/precursor/ process requirements, and associated decision points or points of injection. The points of injection play a significant role in the WMD problem set as terrorists (and under some circumstances, state actors) are unlikely to follow a nation state proliferation pathway. For example, it is unlikely that a terrorist group would seek to develop uranium conversion and enrichment technologies in order to obtain enriched uranium from uranium ore. Far more likely, a terrorist group will seek a witting (or unwitting) state or NGE point of injection that can provide the materiel needed.

**Step 4: Determine adversary courses of action.**

As in Step 3 above, this step translates from the traditional JIPB to the WMD JIPOE without significant modifications (WMD merely serves as the focal point): identify the adversary's likely objectives and desired end state; identify the full set of COA available to the adversary; evaluate and prioritize each COA; develop each COA in the amount of detail time allows; and identify initial collection requirements. For the WMD JIPOE, we want suitable, feasible, acceptable, unique, and doctrinally consistent COA that describe the who, what, when, where and how an adversary will achieve (and possibly employ) WMD. In a generic sense, we define these as:

Who: State actor, terrorist group, NGE (or some combination thereof).

What: Chemical, biological, radiological or nuclear (by agent and production path).

How: This statement should geographically capture the network and activity that supports the materiel, technology and information acquisition, financial support, expertise required, and employment methods that support the agent and production pathway identified in the "what" above.

When: Each threat COA should be identifiable as either a current or future threat capability (with an estimate in terms of months/years for future capabilities).

Where: As expressed in the "how" statement, the "where" statement should include all identified and predicted aspects of the pathway development.

**WMD JIPOE Products**

Using JP 2-01.3 as a basis, the following list serves as an example of WMD JIPOE products that support CWMD decision making and operational planning:

- Common Operational Picture / Common Intelligence Picture
- Predictive analysis threat picture
- Intelligence synchronization matrix (synchronize/refine intelligence collection IOT answer PIRs and IRs
- Infrastructure overlay
- Lines of communication overlay
- Governance overlay
- Pattern analysis (violations of international/national protocols, agreements, and laws regarding CBRN materiel)
- Doctrinal template (pathways to CBRN capability, state and non-state)
- Threat event template/matrix
- Decision support template
- Set of prioritized threat COAs
- Activities matrix
- Situational Template

**WMD JIPOE Execution**

In its simplest form, WMD JIPOE execution stems from a notional commander posing the following questions: what does the WMD threat look like and what are we doing about it? Armed with WMD JIPOE products,

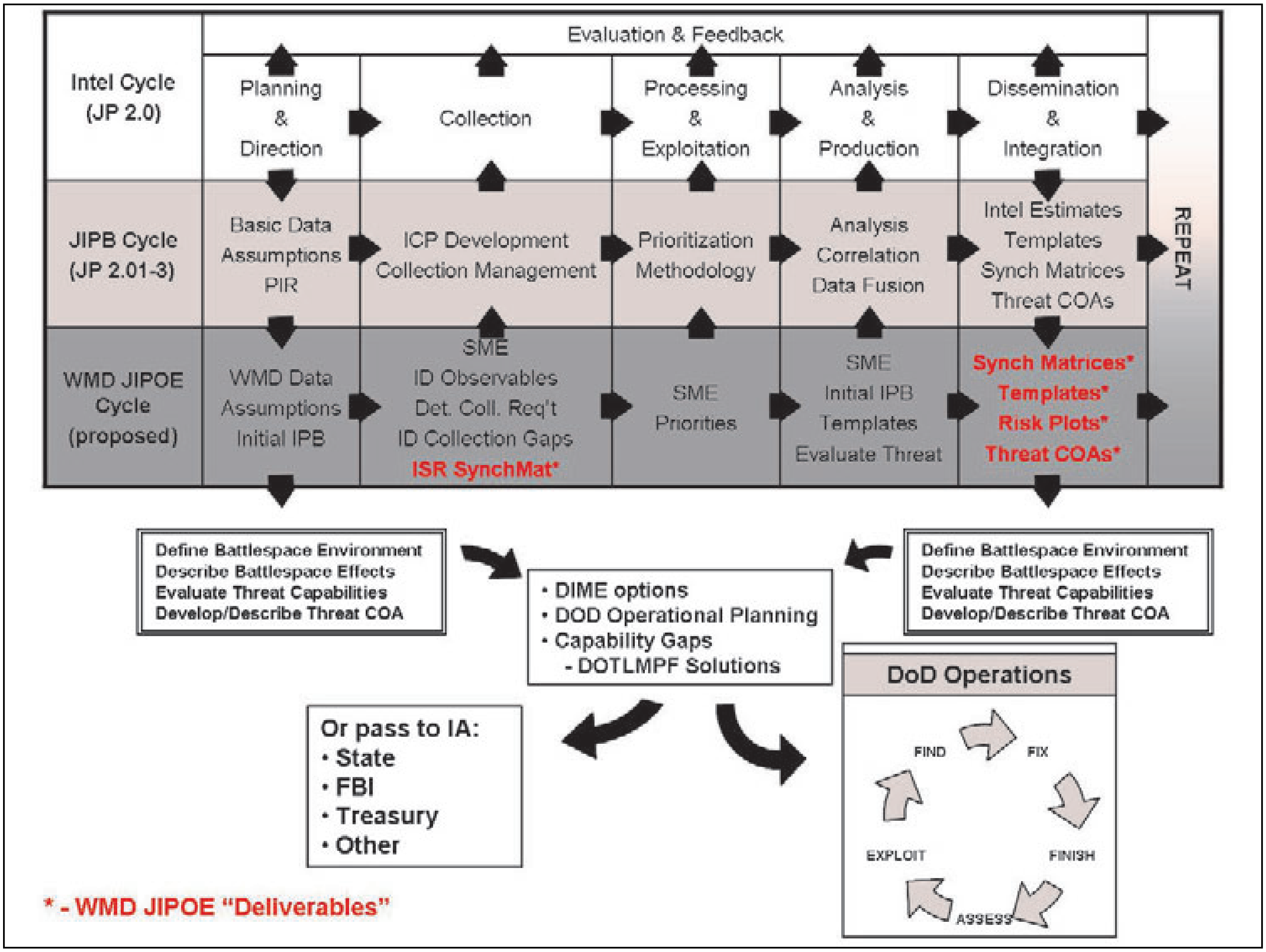


**Figure 2. Intelligence Cycle, JIPB Process, and WMD JIPOE Process Cross-walk.**

the staff could readily respond with the current enemy situational template, provide reasoned threat COAs, layout our current intelligence gaps and collection posture, focus collection against NAIs/TAIs, identify capability shortfalls, recommend friendly COAs, and address resource allocation and requirements concerns. Combating WMD, however, is not a DoD-centric problem. Therefore, we must consider how to effectively communicate a DoD-centric process such as JIPOE to the broader Interagency WMD community.

Combating WMD is a national problem that requires a DoD and Interagency integrated solution. Developing the necessary WMD IPB products most certainly requires non-DoD assets and capabilities. Within the DoD key partners include: OSD, Joint and Service staff members, COCOM/GCC staff members, the Defense Intelligence Agency, and elements from the respective Service intelligence production centers. Key partners outside of DoD include: Department of State, Department of Energy, Department of Homeland Security, the Department of Treasury, the Department of Justice and Federal Bureau of Investigation, the Office of the Director of National Intelligence, the Central Intelligence Agency, the National Counterterrorism Center, the National Counterproliferation Center, the National Security Agency, and the National Geospatial-Information Agency as depicted in Figure 2.

Proper execution of the national strategies for CWMD must couple strategic and operational planning efforts with the intelligence cycle. Commanders and staff must understand the current set of PIR and IR; the current intelligence collection posture; as well as where, how, and when to focus intelligence collection assets. The intelligence community (rife with its own list of organic issues) must develop and promote the growth of intelligence analysts with the skills, knowledge, and capacity to tackle this difficult problem set. The WMD Commission's Report refers to this group as a "virtual community of specialists." [13] In the rush to develop/enhance WMD intelligence analysis, the tendency throughout the IC has been to hire personnel as analysts first with the expectation that the technical understanding of CBRN technologies, weapons, and weapons effects would come from on the job training. While this process has filled billets on paper, in practice, it has not

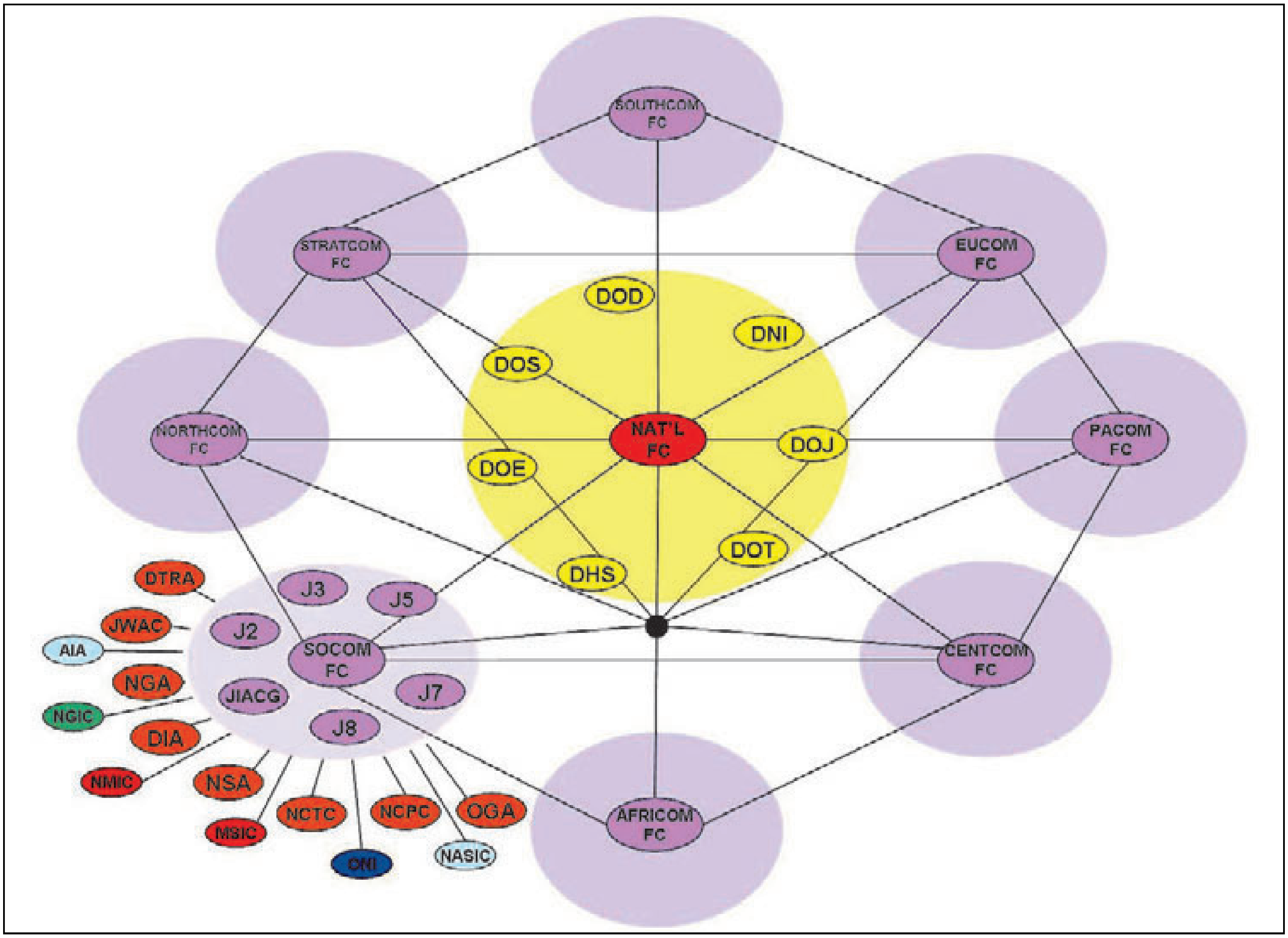


**Figure 3. Notional WMD Fusion Cell (FC) cross-talk, with SOCOM staff build-out (representative).**

adequately filled the intelligence community's ranks with personnel best suited to understand and articulate the CWMD threat. It might be more effective for the IC to hire CBRN SMEs and teach the tools needed for intelligence analysis.

The lack of CBRN subject matter experts across the DoD structure extends beyond intelligence organizations. There exists an inherent lack of CBRN capability and knowledge across the J2, J3, J5, J7, and J8 organizations at the COCOM/GCC level. The COCOM/GCC staffs rely on reach back to national assets to address CBRN issues. This limits the synchronization of CWMD initiatives across theater/AOR boundaries, not only within military channels, but also across the DIME construct; inhibits data sharing across organizational boundaries; and makes WMD JIPOE execution problematic.

In response to the current capability shortfall, as shown in Figure 3., above, we are advocating for the establishment of a national WMD JIPOE fusion center, coached and mentored by military professionals practiced in the art of JIPOE, counter terrorism, and schooled in the sciences and pathways of WMD. While the underlying reasons are manifold, critical factors include: the ability to balance and merge the efforts between state WMD and non-state/terrorist WMD collection efforts, change the state vs. non-state paradigm; responsiveness to mission focus vice routine intelligence production requirements; and the ability to leverage existing work. [14] The long-term strategy for combating WMD, however, must include a national-, interagency-level "fusion center" (potentially housed by the DNI at the NCTC/NCPC), as well as fusion cells at each COCOM/agency. The COCOM/agency-level cells provide the capability to leverage the national fusion center's work; the refinement required to meet the needs of a particular COCOM, agency, or area of responsibility; and promote analytic and data-sharing cross-talk across regional and organizational boundaries.

## Outlook

As a professional body of CBRNE staff members, we must become more vocal in our efforts to attack the CWMD problem set. The published guidance and emerging operational concepts exist – again, produced in the absence of a reasoned WMD JIPOE process. As a result, terms such as "overly broad," "vague," "ineffective," and in some cases, "conflicting" often best describe the guidance and operational concepts. We must take action and get into the terrorist mindset. As senior DOD leaders and OGAs become more aware of the CWMD problem set, the WMD JIPOE process is gaining greater recognition. As a moderately successful predictor of train wrecks, it is merely a matter of time before the hard questions begin – either self-imposed or in response to a WMD event. I further predict that any reliance on the "lack of confirmed reporting" as an excuse for inaction will not sit well – with either the senior leadership or the American public. We must take the CWMD campaign on the offensive.

The following statements are important concepts for all of us to keep in mind as we educate ourselves, leaders, and peers alike. The CWMD problem set is tractable and finite – viable options do exist for us to deny, dissuade, deter, and defeat the spread of WMD – as long as we can understand and visualize the operational environment. Combating terrorism and counterproliferation are not distinct problem sets – CWMD demands a comprehensive and continuous approach that spans state, non-state actors, and non-governmental entities. Combating WMD is a national problem set that requires a DoD and IA integrated effort and solution. We must demand more predictive analysis from the IC – while confirmed reporting may succeed in tackling the 5-meter target, execution of the comprehensive strategy to CWMD requires predictive analysis that looks beyond today and gives us the vision on how best to expend resources and be prepared and equipped to engage the threats of the future.

Combat operations and test beds such as the National Training Centers have proven the strengths of the predictive analysis resulting from the JIPOE process. Why then are we not employing the JIPOE process to face and prepare for our nation's greatest threat?

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**ENDNOTES**

[1] The authors acknowledge the definition of WMD as provided in JP 1.02, but recognize that terrorist CBRN devices, by design or employment technique, may not result in "a high order of destruction" nor "destroy large numbers of people."

[2] Joint Staff, ***JP 2-01.3: Joint Tactics, Techniques, and Procedures for Joint Intelligence Preparation of the*** Battlespace, May 24, 2000, vii.

[3] JP 2-01.3, i.

[4] JP 2-01.3, I-1.

[5] Joint Staff, ***JP 3-0: Joint Operations***. September 17, 2006, IV-4.

[6] JP 2-01.3, viii.

[7] Joint Staff, ***JP 5-0: Joint Operational Planning***. December 26, 2006, IV-28.

[8] Joint Staff, ***JP 3-33: Joint Task Force Headquarters***. February 16, 2007.

[9] Joint Staff, ***JP 2.0: Doctrine for Intelligence Support to Joint Operations***, March 9, 2000.

[10] JP 2-01.3, I-8.

[11] JP 2-0, II-9.

[12] Joint Staff, ***JP3-40: Joint Doctrine for Combating Weapons of Mass Destruction***, July 8, 2004.

[13] Commission on the Intelligence Capabilities of the United States of America Regarding Weapons of Mass Destruction, ***Report to the President of the United States***, March 31, 2005. 443.

[14] ***SOF WMD Threat Assessment***, John Hopkins University/Applied Physics Laboratory: Laurel, MD, October, 2005.

# There Is No "E" in Combating WMD

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Over the past six years, there has been an increasing trend by military professionals to use the term "CBRNE" – chemical, biological, radiological, nuclear, and high-yield explosives – as the descriptor for weapons of mass destruction (WMD). Those counterproliferation analysts who actually address nation-state WMD programs have been overcome by the counterterrorism community. To a large degree, this has been driven by interpretation of the ***National Strategy to Combat Weapons of Mass Destruction***, which proposes that terrorists are actively seeking WMD material and technology from rogue nations who have state-run WMD programs.

The possibility of a terrorist CBRNE incident is often viewed as being more dangerous to the United States than a nation-state's WMD program. Whether this is a rational concern or not is another issue. Since the counterterrorism proponents use the term "CBRNE" to describe the range of weapons considered by terrorists, they encouraged the use of the term "CBRNE" weapons as another way to describe "WMD" materials. A review of past terrorist case issues does not support the finding of terrorist incidents matching the level of destruction caused by nuclear, biological or chemical (NBC) weapons, and yet the trend continues.[1]

The debate has become centered on whether "high-yield explosives" – as employed by terrorists in mass casualty events – ought to be included in the definition of "weapons of mass destruction." The Department of Justice, and specifically the Federal Bureau of Investigation, has a federal statute to address the criminal use of high-yield explosives as a WMD event, along with any amount – down to grams – of dangerous chemical, biological, or radiological material. It may be that the Bureau had intended mass casualty events, rather than WMD events, to be the target of its jurisdiction. However, given the DoD's role in combating terrorism, the military's counterproliferation and counterterrorism communities have clashed over the terminology.

The military began changing its language from nuclear, biological, and chemical (NBC) defense to chemical, biological, radiological, and nuclear (CBRN) defense around 2000-2001, formalizing the change in 2003. One reason for this change was the recognition that the defined threat by unconventional munitions had expanded from nation-state WMD programs, designed for large-scale battlefield use, to include terrorist use of CBRN hazards. To capture the broader defensive measures necessary against both threats, "CBRN defense" has become a generic term to address passive defense (counterproliferation), consequence management, and antiterrorism measures. So is it CBRN or CBRNE? Should there be two terms or one term? Who's right?

It's important to understand why the many changes in terminology occurred and what the impact on the development of policy, doctrine, and material has been. The purpose of this article is to examine the use of the terms "CBRN," "CBRNE," and "WMD" and to make the cause that the discussion of terrorist use of high-yield explosives is not appropriate in the context of "combating WMD." The basis of this argument lies not only in the appropriate use of defense terminology, but also has implications in executing arms control agreements, crafting defense policy, and developing military capabilities.

**Defining "Weapons of Mass Destruction"**

In April 1937, German pilots supporting General Franco's nationalist forces bombed the city of Guernica, then holding about 7,000 residents. Over a three-hour period, the German air force used high explosives and incendiary munitions to destroy the old town and kill about a third of the population in what can only be described as a deliberate terror attack. That December, an editorial in the ***London Times*** was still discussing the incident: "Who can think at this present time without a sickening of the heart of the appalling slaughter, the suffering, the manifold misery brought by war to Spain and to China? Who can think without horror of what another widespread war would mean, waged as it would be with all the new weapons of mass destruction?"[2] While this attack used high explosives and certainly caused both mass casualties and mass destruction, it paled in comparison to the strategic bombing campaigns that would occur later during World War II.

Modern development of chemical weapons had started in 1915, while biological weapons had a later formal development date of 1941 for the United States military. Throughout the years between 1918 and 1945, no government official or military leader ever referred to chemical or biological weapons as "weapons of mass destruction." They were unconventional weapons planned for employment at the operational and strategic level, but not WMDs. The formal use of that term to describe NBC weapons did not start until after the offensive use of atomic weapons against Japan in 1945. The United Nations Commission for Conventional Armaments defined WMDs as "atomic explosive weapons, radioactive material weapons, lethal chemical and biological weapons, and any weapons developed in the future which have characteristics comparable in destructive effect to those of the atomic bomb or other weapons mentioned above."[3] This is not to say that the United Nations has applied this definition uniformly since that date; only that the original definition was intended to evolve as weapon technologies evolved. The issue of whether conventional weapons with significant damage effects should be considered as WMDs has never been addressed.

Without exhaustively covering the same discussions that others have already documented, let me note a number of significant events related to the definition of WMDs:

- 1956, Soviet Marshall Zhukov identifies the threat of atomic, biological, and chemical weapons as "weapons of mass destruction."
- 1969, a UN report discusses the danger of chemical and biological weapons as being as significant as nuclear weapons, using a strategic bomber attack against a major city to compare the impact of 15 tons of BW agent (tularemia), 50 tons of nerve agent (VX), and a megaton atomic bomb.
- Between 1972 and 1990, the U.S. military discusses the implications of tactical and operational employment of nuclear, biological, and chemical (NBC) weapons. The term "WMD" is only used by arms control experts, not operational concept developers.
- 1991, the U.S. government acknowledges failures to address the adversarial use of chemical and biological weapons against its military forces. This leads to the development of a Defense Counterproliferation Initiative to develop offensive and defensive options against non-nuclear nation-states that have a CB weapons capability.
- 1992, Congress passes the WMD Control Act of 1992, referring to NBC weapons.
- 1994, the Joint Staff initiates an antiterrorism/force protection office (J34) to coordinate military doctrine and concepts, focusing on "conventional" weapons.
- 1994, Congress passes the Violent Crime Control and Law Enforcement Act, broadening the term "WMD" as "any destructive device" that includes poisonous chemicals, disease organisms, or radioactivity that could be dangerous to human life.
- 1995, Aum Shinrikyo uses sarin-filled pouches in the Tokyo subway to kill 12, injure hundreds, and panic thousands. Interest in CB terrorism sharply increases.
- 1995, Oklahoma City bombing (168 dead, more than 800 injured) causes discussion of terrorist use of high explosives as a "WMD" incident. The FBI and FEMA create a terrorist incident annex to the Federal Response Plan in 1997 to address federal responsibilities to support a response to terrorist WMD incidents.
- 1996, Congress defines WMD as weapons that disseminate chemicals, biologicals, or radiological material/radioactivity that could cause death or serious injury to "a significant number of people." This number is never quantified.
- 1996, Congress directs the DoD to conduct a "domestic preparedness program" where military instructors train emergency responders on how to respond to CB incidents. The training does not address responding to radiological/nuclear or explosives use.
- 1998, the Joint Staff releases Joint Publication 3-07.2, which addresses antiterrorism. The publication addresses terrorist WMD incidents, but there is no mention of "CBRNE."
- 1998, Congress directs the development of what are eventually called WMD Civil Support Teams to assist state and local emergency responders. The teams have no capabilities to address incidents involving explosives.
- 1999, the Gilmore Commission on Homeland Security uses the term "CBRN" in reference to terrorist incidents. The term "terrorist WMD" doesn't make sense to them.
- 1999-2001, the Joint Staff develops an overarching counterproliferation strategy to enable military execution of counterproliferation concepts. It does not address explosives.
- 2000, Defense Secretary Bill Cohen appoints an Assistant to the Secretary of Defense for Civil Support (ASTD[CS]), who is supposed to address domestic CBRNE incidents.
- 2001, the ATSD(CS) position is eliminated and ASD(SO/LIC) takes responsibility for coordinating terrorist CBRNE response policy.
- 2002, the White House releases National Security Presidential Directive-17 as the ***National Strategy to Combat WMD***, changing the Joint Staff's counterproliferation concept into a combating WMD/homeland security document.
- 2002, DTRA and JFCOM recommend changing "Manage Strategic Deterrence of Weapons of Mass Destruction" to "Manage Deterrence of ***CBRNE*** Weapons" in the Universal Joint Task List.
- 2002, the Joint Staff authorizes the stand-up of a Joint Requirements Office for CBRN Defense, which will address CBRN defense issues in passive defense, force protection, consequence management, and homeland defense. There is no mention of explosives.
- 2003, during Operation Iraqi Freedom, the 75th Exploitation Task Force searches for evidence of Iraq's WMD program. The task force ignores the huge piles of explosives, munitions, and conventional weapons stacked high in the warehouses.
- 2005, during the Mossauwi trial, the jury is instructed to consider the use of commercial airplanes in the 9/11 event as "weapons of mass destruction."

Dr. Seth Carus does a much better job discussing the various definitions of WMD and their sources, [4] to include the debate over the terms NBC, CBRN, and CBRNE, but that is not the point here. This list of events is meant to illustrate two important things. Between 1972 and 1990, the U.S. military talked about NBC weapons as an aspect of state-versus-state military operations. It didn't matter if one were discussing U.S. unconventional weapons or the adversary's unconventional weapons. Between 1992 and 2001, there was a shift where WMD became something that "other nations did" as a destabilizing function, while the U.S. nuclear weapons program was a stabilizing, good thing. Between 1995 and 2001, the combating terrorism moved toward the term "CBRNE," while counterproliferation was solely associated with proactive actions against a nation-state's WMD program(specifically the adversarial use of CB weapons). So what happened after 2001?

After the 9/11 event, the Bush administration changed national defense policy – as is its prerogative – to emphasize its concern over linkages between terrorist CBRNE incidents and nation-state WMD programs, in particular due to the concern that a terrorist might desire to use a nuclear or biological weapon in an attack on an American city with the intent of causing mass casualties. Whether one believes this scenario to be valid or not is irrelevant to the argument. It was the act of addressing terrorist WMD issues under combating WMD strategy that has caused the debate over whether "E" belonged in combating WMD or the combating terrorism community.

### The Arms Control Community Says "There Is No 'E' in Combating WMD"

The term "WMD" had its origins in arms control, and for half of the 20th century, was solely used by the arms control community. To them, the term included all "unconventional weapons," to include nuclear, biological, and chemical weapons developed by nation-states, with the intention of causing significant effects at the operational and strategic level. By controlling their development and potential use, the arms control community intended to establish a set of general norms for the international community, and in particular, to reduce the impact on noncombatants. Over the past seven years, the term "WMD" has been used more loosely by a larger community, including military and political leaders.

The arms control community is concerned about conventional weapons that use high-yield explosives, and has had numerous discussions on the appropriate use of land mines, particular classes of ammunition, and incendiary devices, for instance. But they also clearly relegated conventional explosives as outside the scope of weapons of mass destruction, once defined in 1948 as "comparable in destructive effect" of nuclear weapons. It is clear that many chemical and biological weapons, if used in small quantities in discrete scenarios, would fall outside this distinction. The arms control community has vigorously avoided that discussion, perhaps fearing that nations might try to develop and use small stocks of CB weapons in an effort to get around the potential international backlash over using "WMDs."

The arms control community has often debated over whether the military employment of riot control agents and similar non-lethal incapacitants might loosen restrictions on chemical warfare, merely because of their chemical composition and similar means of employment (as an aerosol or gas against unprotected personnel). The US Senate deliberately took riot control agents, herbicides, and incendiary devices out of the purview of the Chemical Weapons Convention, even though some of these were termed "chemical munitions" in World War II and Korean Conflict. With the recent insurgent use of chlorine in Iraq, the Director of the Organization for the Prohibition of Chemical Weapons has even suggested that the use of that common industrial chemical was an expansion of chemical warfare, no matter the very brief period that chemical was used as a munition fill during World War I. But no one has suggested that explosives ought to be considered a WMD merely because they have a chemical composition.

The State Department has reorganized its arms control offices, creating the Bureau of Verification, Compliance, and Implementation to replace its former Arms Control and Nonproliferation office. In addition to working all the WMD treaty issues – the Chemical Weapons Convention, Biological and Toxin Weapons Convention, the Strategic Arms Reduction Treaty, and others – the State Department approves all foreign government requests for U.S. assistance in responding to terrorist CBRN incidents. They do not consider high-yield explosives to be a "WMD" issue, although there are other arms control treaties, such as the Conventional Armed Forces in Europe treaty, which do address conventional munitions. It is generally understood that, unless specifically requested, overseas terrorist incidents involving conventional explosives will be addressed by the host nation.

### STRATCOM says "There Is No 'E' in Combating WMD"

Defense Secretary Donald Rumsfeld assigned the responsibility of "integrating and synchronizing" DoD combating WMD operations to U.S. Strategic Command (STRATCOM) in 2005. That command led the development of the ***National Military Strategy to Combat WMD*** (released in 2006), which largely built upon the counterproliferation strategy developed by the Joint Chiefs of Staff J-5 directorate (Nuclear and Counterproliferation Division) between 1998 and 2001. This document takes a very clear stand that "WMD" means nuclear, biological, and chemical weapons, and deliberately excludes explosives from the discussion.

At the 2007 National Defense University's "Combating WMD" conference, two renowned defense experts basically stated that nuclear weapons were the only true WMD, and with the exception of a few biological weapons, there really were no other types of weapons worth discussing. This is

Table 1. Executing Passive Defense, Antiterrorism, and Consequence Management missions in regards to a CBRN hazard.

| | Passive Defense | Antiterrorism | Consequence Management |
|---|---|---|---|
| Who is in charge of developing defense policy and defense concepts? | Spec. Asst. for Chemical and Biological Defense and Chemical Demilitarization Programs; Asst. Sec. of Def. for Global Security Affairs; STRATCOM | Asst. Sec. of Def. for Special Operations/Low-Intensity Conflict; Asst. Sec. of Def. for Homeland Defense; SOCOM | Asst. Sec. of Def. for Special Operations/Low-Intensity Conflict; Asst. Sec. of Def. for Homeland Defense; NORTHCOM |
| What is the threat? | NBC weapons affecting a large area of the battlefield | Improvised CBRN hazards affecting a small area within a military base or facility | Improvised CBRN hazards affecting a small area within an urban center |
| Who is the target? | Service members during combat | Service members and untrained civilians | Civilians and emergency responders |
| What is the mission? | Ensure that military personnel survive and sustain combat operations in a hazardous environment | Reduce the vulnerability of individuals and critical infrastructure under the commander's scope | Protect public health and safety, restore essential government services, and provide emergency relief |
| When and where is the attack? | On a battlefield in all conditions, during military combat operations | At military bases throughout the world | In cities across the Nation and in support of allied nations |
| What is the allowable risk for CBRN exposure? | High risk; emphasis on mission over long-term health and safety | Moderate risk to noncombatants, very low risk for very important persons | Very low to emergency responders |
| What equipment is used by the responders? | Military equipment designed for acute exposure | Mix of specialized military equipment and standard equipment | National Institute for Occupational Safety and Health specification, protects against long-term chronic exposure |
| Who funds the purchase of equipment? | Office of the Secretary of Defense through the DOD CB Defense Program | Services and installation commanders | Office of the Secretary of Defense, National Guard Bureau, and Services (depending on the particular response) |

not an uncommon discussion today, especially as the nation struggles to address the proliferation of nuclear weapons technology by Iran and North Korea. If the majority of biological weapons and all chemical weapons can be so casually disregarded, what does that say about the idea that high-yield explosives are a "WMD" of concern?

Guidance at the top levels of DoD is unclear. The Joint Staff's Capstone Concept for Joint Operations (dated August 2005) [5] does include "E" in the term WMD, and even adds a related term "weapons of mass effects" to further confuse the issue. Within the office of the Undersecretary of Defense for Policy, there is clear direction that DoD support to foreign consequence management missions will not include responding to terrorist explosive incidents. DoD response to domestic consequence management does, however, include supporting terrorist high-yield explosive incidents. In fact, the US Army's 20th Support Command (CBRNE) has responsibilities for both responding to requests for supporting domestic and foreign consequence management and executing combating WMD mission areas, in addition to its legacy mission of supporting the Army's CB weapons stockpile/nonstockpile responsibilities. When OSD had the opportunity to update its instruction on its combating WMD responsibilities (DoDI 2060.02), [6] the final decision was to avoid defining WMD at all!

Within DoD, there are clear boundaries between counterterrorism and counterproliferation, not merely in policy direction, but in doctrine, concepts, funding, and execution. It is only when one discusses the possibility of terrorist use of "WMD" material that it becomes contentious. Table 1 represents the differences in executing passive defense, antiterrorism, and consequence management missions in regards to a CBRN hazard are very distinct. This is where the clarification is desperately required. Although the threat is technically the same in every instance, the response – and who addresses the response – is very different.

### The Services and Antiterrorism Community say "We Really Only Care About 'E'."

Military installation commanders have a responsibility to protect those individuals working at and living on their bases and in their facilities. In developing a force protection plan, these commanders assess the local threats and their vulnerabilities, and based upon their available resources, prioritize their actions and execute a plan to meet that responsibility. During the twentieth century, their concern was nearly completely focused on conventional threats – criminals, espionage, sabotage, car bombs, pipe bombs, firearms, and the like. Terrorist WMD incidents were addressed in an appendix basically noting that there were defensive military capabilities, but in general, there are none employed at domestic military installations.

Following the 9/11 incident, OSD Policy inserted language into the Defense Planning Guidance for 2004 to direct the development and execution of a CB defense installation protection program. The basic approach was to take existing military CB defense sensors (designed for the battlefield), employ them at particular fixed locations on the base, and tie those into the base's command post. This concept was expanded, beyond reasonable cost/schedule expectations, to an unconstrained effort to protect the entire base's population and to tie the protected bases into the Department of Homeland Security's efforts to address terrorist CBRN incidents. Despite the transfer of nearly $1.5 billion from service antiterrorism programs into a special project run by the DoD CB Defense Program, [7] this effort has failed to accomplish much more than equipping hazmat response teams and providing limited training. It failed for a number of reasons.

First, military CB defense equipment was never designed to operate 24/7 throughout the year on a fixed site. Given the quantities required to adequately address an installation's critical areas, no installation – other than the Pentagon – could afford to man, operate, or sustain such a system on its own. Second, the approved concept was never designed to protect every person on the installation – it was designed to ensure the installation could continue essential operations while evacuating non-essential personnel and awaiting the arrival of federal response elements to support local and installation responders. The acquisition office executing the program ignored both of these points. Third, the antiterrorism community, from OSD down to the installation commanders, refused to integrate CBRN defense into their force protection directives, concepts, and force protection conditions (FPCONs). They didn't want to complicate the installation commander's challenges with a threat that had such a low probability of occurring.

There was a challenge for many to believe that there were fundamental differences between facing a military-generated CB warfare attack on a battlefield as opposed to a terrorist CBRN hazard created within an installation's boundaries. The hazard is the threat, right? Perhaps the hazard's physical properties are the same, but certainly the responses to the threat are distinct. Some people could not get past the point that military CB defense equipment and concepts were designed to provide a full protective capability for a limited time against a robust threat, while the installations could accept a much more limited protective capability based on a smaller, limited threat, risk management practices, and vulnerability assessments. The Deputy Secretary of Defense signed out a concept of operations basically outlining a more flexible "CBRNE" installation protection concept in 2006, but this concept was (and continues to be) ignored.

Although the services and combatant commands receive jointly developed (and OSD-funded) CBRN defense equipment and concepts for military operations on the battlefield, their capability for protection against conventional explosives and terrorist incidents is funded and executed by the individual services and combatant commands. Because there is no "joint" explosives concept or R&D program, each service – indeed, each installation commander – can and does develop unique approaches to addressing terrorism incidents, based on the particular installation's threat and vulnerability assessment. And in these approaches, terrorist CBRN incidents rank very low on probability, which is reflected in their annual funding requests.

### A Path Forward

The intent to use the term CBRNE for combating terrorism efforts was made in good faith. The concept of addressing terrorist incidents under an "all-hazards" approach is sound, and certainly any response to terrorist CBRN incidents ought to be structured along the same lines as how conventional incidents are currently managed. First, the overwhelming majority of terrorist incidents will be conventional, and any terrorist CBRN incident is going to be small and limited in its effects (compared to any military combat scenario). Second, the Department of Homeland Security's National Response Plan has clearly indicated the value of a single "all-hazards" approach that allows for the development of common protocols and plans to address natural disasters and man-made accidents/ incidents. It makes sense to integrate CBRN response into the current response protocol – the difficulty has been getting the antiterrorism community to do the integration, which they have fiercely resisted to date. It makes sense to capitalize on technologies developed to counter CBRN hazards faced on the battlefield and apply those concepts and technologies to the requirements of military installations and homeland security missions.

It does NOT make sense to believe that counterproliferation experts (and in particular, those military specialists trained in passive defense) ought to also develop capabilities and response to high-yield explosive threats on the battlefield. Besides the fact that there are practically no explosive munitions that even approach tactical nuclear weapons effects, each service already addresses the threat of conventional explosives on the battlefield – it's the bread and butter of the business. Even the threat of short- and medium-range ballistic missiles, once closely associated with NBC capabilities, has been handled separately from the combating WMD strategy. So why use the term "CBRNE" as if it were a jointly-accepted concept when discussing the challenge of addressing nation-state WMD programs? It simply does not follow logic. Yet the failure to accept these basic truths is not limited to the general defense community but also to the counterproliferation specialists.

Recently, the Army Chemical Corps changed the name of their corps chemical officer position to "CBRNE Officer." On the plus side, the corps staff gained a major from the Ordnance Corps to address antiterrorism efforts. On the negative side, this name change could provide the justification for the Ordnance Corps to take over the responsibility, since the majority of terrorism threats are (and will continue to be) conventional explosives. The result will be a decrease in emphasis on counterproliferation issues. Look at the constant attention gained by the use of improvised explosive devices in Iraq, given the Joint IED Defeat Organization and the Mine Resistant Ambush Protected (MRAP) vehicles, as opposed to the past hunt for Iraq's WMD program. Who is DoD going to put in charge of "CBRNE" issues? Which profession will address its issues, the CBRN defense specialist or the antiterrorism specialist?

Nor does the Air Force's "Counter-CBRNE" concept make sense, given the very well-defined combating WMD strategy against which their concept proffers to address. Its "counter-CW" concept appears to be a combination of offensive operations and passive defense, while its "counter-BW" concept is more of a combination of force health protection and passive defense. Although it appears that the Air Force has abandoned a "counter-NW" and "counter-E" concept, the term "counter-CBRNE" is still used frequently. It is understandable that, given the "global war on terror" that dominates discussions of national strategy, people want to use the term that attracts the most attention. But this overlap of combating WMD and combating terrorism responsibilities and concepts of operation is causing more confusion and discourse than is healthy. DoD needs to make a stand on this issue, to enforce its joint strategy on combating WMD and to successfully integrate CBRN defense into antiterrorism practices.

The Bush administration has, for better or for worse, used the term "WMD" in its case supporting the preventive invasion of Iraq and emphasized the potential threat of terrorist use of WMD materials and technologies. As a result, the defense community has lost the ability to coherently discuss what ought to be done in terms of combating the WMD programs of nation states vice combating terrorist intentions to use CBRN hazards against non-combatants. One solution is to restrict the use of the term "WMD" to official arms control documents and to stop using the term in public discussions of military doctrine and strategy. One ought to use the term "unconventional weapons" or NBC weapons if discussing the ambitions of nation states, and save the term "CBRNE" for discussions of terrorist groups. If a defense conference is titled "Combating WMD" but only focuses on nuclear weapons, is that really benefiting the quality of academic discussion in this area?

From a practical point of view, this is a win-win for organizations such as the Defense Threat Reduction Agency, the DoD CB Defense Program, and other agencies developing similar capabilities for combating WMD and combating terrorism. Instead of stating that the Defense Department requires a single set of generic CBRNE defense capabilities for counterproliferation, antiterrorism, and consequence management, we ought to be stressing that there are three very distinct customers requiring similar CBRN defense technologies but different solutions. This approach emphasizes that the defense agencies understand and appreciate the fact that there is a difference in the policies, funding, and requirements between CBRN defense and CBRNE response. The result would be a much closer fit of affordable and sustainable solutions against current warfighter challenges, addressing specific policy concerns as well as funding constraints.

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**ENDNOTES**

[1] Jonathan Tucker, "Toxic Terror" (Cambridge: MIT Press, 2000).

[2] London ***Times Online***, http://www.timesonline.co.uk/tol/system/topicRoot/Guernica/, and ***Wikipedia*** website (http://en.wikipedia.org/wiki/Weapons_of_mass_destruction#_ref-0) accessed May 25, 2007.

[3] SIPRI, ***The Problem of Chemical and Biological Warfare*** (New York: Humanities Press, 1971), 4:193.

[4] Carus, Seth. ***Defining Weapons of Mass Destruction*** (Washington, DC: NDU Press, 2006). Iv Available at http://www.ndu.edu/WMDCenter/docUploaded//OP4Carus.pdf.

[5] Available at http://www.dtic.mil/futurejointwarfare/concepts/approved_ccjov2.pdf.

[6] Available at http://www.dtic.mil/whs/directives/corres/pdf/206002p.pdf.

[7] Since its inception in 2004, the funding for Joint Program Guardian's CB Installation Protection Program was slashed in half in 2006 after fully fielding equipment to only one installation. A special OSD working group developed a new implementation plan with much more modest goals, which is in the process of being executed.

# DARPA Urban Grand Challenge 2007 has a Winner!

Robert A. Pfeffer, Physical Scientist

For the second time in a row there is a winner of a DARPA-sponsored Grand Challenge. The previous Grand Challenge was held 2005. It required an autonomous vehicle to traverse a 132-mile rural California environment within 10 hours. A total of four vehicles completed the course in less than the required time. The fastest time was recorded by "Stanley" of the Stanford Racing Team (Stanford, CA).


First Place Winner – Tartan Racing, Pittsburgh, PA.

This time, vehicles had to maneuver through a mock city urban environment. The winner, Tartan Racing (Pittsburgh, PA) won $2 million for finishing the course in the fastest time. The second place winner, the Stanford Racing Team (Stanford, CA) won $1 million, while the $500 thousand third place award went to Victor Tango (Blacksburg, VA). All three finished the race under the specified time limit.

Now what does this mean to the military? Quite simply, it means autonomous vehicle technology will reach the battlefield much faster. A new generation of unmanned sensors, C4I, and weapons delivery systems can now become an integral part of the future battlefield. The Future Combat System and/or the Heavy Brigade Combat Team are possible applications of this technology. There, unmanned ground-based vehicles could "drive-by-wire" in much the same way as some of the first generation "fly-by-wire" UAVs .

Further Reading:
Spring/Summer 2006 NBC Report, and the previous issue of Combating WMD Journal Issue 1.

The official DARPA Grand Challenge web site
http://www.grandchallenge.org. or
Google search on DARPA Grand Challenge

# The Nuclear Science and Engineering Research Center

## A Research Partnership Between the Defense Threat Reduction Agency and the United States Military Academy

LTC Jeffrey H. Musk, Ph.D. and MAJ Robert F. Schlicht
Defense Threat Reduction Agency

COL(R) Brian E. Moretti, Ph.D.
United States Military Academy

Logo for the newly established Nuclear Science and Engineering Research Center, a Defense Threat Reduction Agency (DTRA) field element located at the United States Military Academy (USMA), West Point, New York.

The Nuclear Science and Engineering Research Center (NSERC) is a Defense Threat Reduction Agency (DTRA) field element located at the United States Military Academy (USMA), West Point, New York. Established by mutual agreement between USMA and DTRA in May 2007, the NSERC leverages USMA faculty and cadet expertise in the solution of problems of interest to DTRA and the Department of Defense (DoD). The NSERC is hosted by the USMA Department of Physics and manned by DTRA personnel with USMA faculty experience. Within DTRA, the NSERC falls under the Nuclear Technologies (NT) Directorate in the Research and Development (RD) Enterprise. This article chronicles the establishment of the NSERC, how the NSERC supports the missions of DTRA and USMA, the NSERC's role in developing Functional Area 52 (FA52), Nuclear and Counterproliferation Officers, and the NSERC faculty and cadet research models. The article concludes with how the NSERC can work with you and your organization to leverage USMA faculty and cadet expertise to help meet your research needs.

### A Brief History of the NSERC

After the attack on September 11, 2001, USMA and the Department of Physics foresaw the Army's increased need for officers with nuclear and weapons of mass destruction (WMD) skills. To help fill this need, the nuclear engineering major in the USMA Department of Physics was established in August 2003.[1] The Department of Physics recognized that an active nuclear engineering research program was a key element in creating and maintaining a vibrant academic major, and so the Nuclear

BG Patrick Finnegan, Dean of the Academic Board, signing the memorandum of agreement to establish the NSERC on 2 May 2007. From left to right: LTC Jeffrey Musk, COL Raymond Winkel, Jr., Head of the Department of Physics, BG Patrick Finnegan, COL Edward Naessens, Deputy Head of the Department of Physics, and Dr. Brian Moretti.

Engineering Research Group (NERG) was founded in August 2004.[2]

The NERG's mission was "… to conduct quality, rigorous research in nuclear engineering and the nuclear sciences to support the United States Army, and to enhance the nuclear engineering academic program, the Department of Physics, and USMA." [3] The NERG, composed of volunteers from the Department of Physics faculty interested in conducting research, began to meet regularly in the fall of 2004. The NERG served several important functions. It brought together information about ongoing research efforts in the DoD, became a forum for the exchange of ideas, placed an increased emphasis on faculty research, and established the structure required to coordinate ongoing research efforts. The result was a dramatic increase in the quantity of faculty research, and a faculty more in tune with current research efforts. The NERG demonstrated the desire of the faculty and the cadets to conduct research and emphasized the synergy created by a collaborative group. The NERG also demonstrated to the department leadership that the faculty and cadets were a resource that could substantially contribute to the greater research effort in the DoD, but to most effectively harness this potential, there must be full-time researchers. Such full-time investigators would allow the faculty to concentrate on research and not the administrative requirements inherent in running a research program.

At this point, the concept of the NSERC was born.[4] To most effectively use the research talents of the faculty and cadets, USMA sought to invite the DoD to establish a nuclear science and engineering research center at USMA. Like the NERG, the NSERC would promote and support nuclear engineering research within the Department of Physics. However, instead of being created by USMA and manned internally from faculty within the Department of Physics, the NSERC would instead be created and manned by DoD assets. With the support of the Head of the Department of Physics and the Dean of the Academic Board, COL Edward Naessens, the Nuclear Engineering Program Director, Dr. Brian Moretti, and CPT Michael Shannon briefed the NSERC concept to Dr. Dale Klein, Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs (ATSD (NBC)) and Dr. James Tegnelia, Director of DTRA, in May 2005. Dr. Klein and Dr. Tegnelia were supportive of the NSERC concept and gave approval for establishment of the NSERC as a field office of DTRA to be located at USMA.

Staffing the NSERC plan and writing the Memorandum of Agreement (MOA) between DTRA and USMA to establish and operate the NSERC consumed much of the next two years and was led by Dr. Brian Moretti and LTC Jeffrey Musk at USMA, and Mr. Todd Hann and LTC Steve Creighton at DTRA. Dr. Tegnelia signed the MOA to establish the NSERC on 10 April 2007 for DTRA and BG Patrick Finnegan signed the MOA on 2 May 2007 for USMA, making the NSERC a reality. The NSERC received its initial operating budget on 18 June 2007 and the NSERC achieved initial operational capability on 20 August 2007.

**Why a NSERC? Why at USMA?**

Normally, there are fifteen to twenty FA52 officers assigned to the USMA faculty, most serving in the Department of Physics. Outside of DTRA, USMA has one of the largest populations of FA52 officers. All of the FA52 officers in the Department of Physics have a master's degree or a doctorate in nuclear engineering or physics, graduate school research experience, and a proven record of success in the Army. Historically, most of these officers have not continued their graduate school research once assigned to the USMA faculty, making them an under-utilized resource for both USMA and the Army. Many of these officers have a desire to engage in research, but research time directly competes with other demands on their out-of-class discretionary time, such as involvement in leading cadet sports, cadet clubs, and cadet military training. By making new, real-world research opportunities, facilities, and direct support from DTRA available to these officers, the NSERC is able to tap into this wealth of talent for the benefit of DTRA, USMA, and the Nation.

## DTRA Mission

**The Defense Threat Reduction Agency safeguards America and its allies from Weapons of Mass Destruction (chemical, biological, radiological, nuclear, and high explosives) by providing capabilities to reduce, eliminate, and counter the threat, and mitigate its effects.**

## USMA Mission

**To educate, train and inspire the Corps of Cadets so that each graduate is a commissioned leader of character committed to the values of Duty, Honor, Country and prepared for a career of a professional excellence and service to the Nation as an officer in the United States Army.**

## NSERC Mission

**To increase the output of USMA faculty and cadet research in support of DTRA objectives; enhance the professional development of USMA faculty; and contribute to the education of cadets, especially those majoring in nuclear engineering of physics - the next generation of Army leaders.**

The missions of DTRA, USMA, and the NSERC.

USMA is the only Service Academy with a nuclear engineering major. On average, twelve cadets per graduating class major in nuclear engineering, with an additional twelve or so majoring in physics. These cadets are available to work on NSERC-sponsored projects through a client-based capstone design project, integrative experience, in-class projects, and independent study.

Cadets also become involved in NSERC research through Academic Individual Advanced Development (AIAD) experiences at DTRA, NNSA, the National Laboratories, and elsewhere. AIADs are the USMA equivalent of summer research internships at civilian universities. They typically last four weeks and are voluntary for the cadets since they give up either leave time or additional military training to participate. Nuclear engineering cadets participating in NSERC-coordinated AIADs can continue their AIAD research in their capstone design project.

The NSERC's location at USMA enhances its ability to collaborate with the Academy's centers of excellence[5], such as the Combating Terrorism Center (CTC)[6] and the Photonics Research Center (PRC).[7] Through the CTC, the NSERC involves cadets in policy-related research in the areas of nuclear terrorism and homeland defense. In return, the NSERC provides technical WMD expertise and advice to the CTC from both DTRA and the Department of Physics. In the area of high-energy lasers, as related to the National Ignition Facility (NIF) for example, the NSERC can leverage the expertise of the PRC, which is manned by members of the Department of Physics, the Department of Electrical Engineering and Computer Science, and the Department of Chemistry and Life Science.

The synergy created by USMA's unique combination of FA52 officers, the nuclear engineering major, centers of excellence, and cadets in need of militarily-relevant projects makes USMA an excellent location for the NSERC.

### The NSERC Researchers' Role at USMA

The NSERC full-time researchers' role at USMA is to serve as a conduit through which DTRA expertise, research, and projects can be brought into USMA to enhance the educational experience of cadets and to provide cutting-edge research opportunities for USMA faculty and cadets in support of DTRA objectives. We coordinate with DTRA HQ, NNSA, and the National Laboratories to find projects suitable for cadet and faculty research. Often, these organizations have research needs but do not necessarily know if they are appropriate for USMA cadet and faculty work. Most have projects that are not immediately suitable in scope or content for cadet (undergraduate) research but instead have general "mission areas" or "research areas" of interest. This is where the NSERC researchers can help. It is our mission to work with these client organizations to translate their areas of interest into appropriate cadet and faculty research and design projects. Once work begins on a NSERC-supported project, NSERC personnel mentor, guide, and assist the faculty and cadets. Our assistance may include providing work space, procuring needed equipment and software, or the funding of faculty and cadet travel to conferences or to meet with project sponsors.

### Faculty Research Model

Involving faculty in research is one of the NSERC's core missions, and also one of its greatest challenges. After spending a year teaching introductory physics (i.e., "the core course"), faculty serve either as a course director for an elective course in nuclear engineering or advanced physics, or in a leadership position in the core course. After two years of teaching, faculty can seek academic promotion to the rank of assistant professor. Academic promotion requires scholarly research and publication in a refereed journal. NSERC-supported research keeps faculty up-to-date on both the research needs of

LTC Mark Visosky, Nuclear Engineering Program Director, and LTC Jeffrey Musk, NSERC Director, mentoring Cadets James Johnson, Brian Czarnecki, and Korey Cook on their NE496 capstone design project.

DTRA and on current events in the research community and can help faculty achieve academic promotion. Besides benefiting the researcher and DTRA, faculty research also benefits the USMA classroom by enhancing the educational experience of cadets. Faculty research is further expected to inspire more cadets to consider majoring in nuclear engineering or physics.

The NSERC researchers facilitate faculty research by providing projects that faculty can get involved in and quickly become productive. We provide well-defined research topics to interested faculty and give them the resources, support, and necessary guidance. Under the NSERC model, any faculty member willing to devote time to research will be able to make a valuable contribution and so we expect that there will be multiple officers and cadets working on many of the NSERC research areas.

Often, graduate school research, particularly experimental research, cannot be easily continued at USMA due to lack of research-specific equipment, software, and on-site collaborators. The NSERC helps here by providing faculty with research topics and needed resources. For officers about to attend graduate school en route to USMA, we provide them a list of research topics of interest to DTRA (high-altitude nuclear effects, for example) that they can continue upon arrival at USMA. USMA officers reassigned to DTRA are linked with research topics of interest to their future DTRA directorate, facilitating their transition into new assignments.

**Cadet Research Model**

The ideal cadet-research model begins with a cadet AIAD experience between the sophomore and junior years. The AIAD introduces cadets to a real-world project supervised by a project sponsor. The following summer, after their first full year in the nuclear engineering major (junior year), these cadets can return for a second AIAD at the same location. Returning to USMA, the cadets continue their research under the supervision of NSERC personnel in a year-long capstone engineering design project. In the capstone design project, research is conducted in teams of three to four cadets with an assigned faculty mentor. NSERC personnel serve as the primary project mentors for all DTRA projects. For many cadets, following this model is a challenge since summer scheduling conflicts prevents some cadets from participating in the AIAD of their choice. But for those who do follow the model, they gain invaluable experience and insight into challenges facing the DoD nuclear community.

**NSERC Research Topics for Academic Year 2008**

During Academic Year 2008 (August 2007 to May 2008), the NSERC mentored cadet and faculty research in the following areas:

- Modeling the dispersion of contaminants from a dirty bomb in an urban area using the 3-D high-fidelity simulation code Aeolus+.

- Designing experiments to compare model results among the SCENARIO, GSCENARIO, and NORSE high-altitude nuclear effects (HANE) codes.

- Designing radiation hardening experiments and targets needed to produce needed radiation environments for the National Ignition Facility (NIF).

- Designing a nuclear facility from unclassified sources and studying its vulnerability to conventional and unconventional attacks.

• Using the Sandia National Laboratories ALEGRA code to design an experiment for measuring the properties of materials under high pressure.

**Long-Term Vision**

Some of the USMA nuclear engineering and physics majors of today will be the FA52 officers of tomorrow. Involving these cadets in DTRA and NNSA research now through the NSERC will give them valuable experience and insight into the nuclear weapons and FA52 communities. Officers who worked with the NSERC as cadets will enter the FA52 community with real DTRA experience - a definite benefit to both the officer and their organization.

Currently, the NSERC is concentrating its efforts on involving nuclear engineering and physics majors in research but it already involves cadets from other academic majors across USMA. Experiencing the kind of research and missions performed by DTRA, NNSA, and the FA52 community may lead some of these cadets to consider future careers in FA52 bringing even more high-quality officers into the growing FA52 community. Ultimately, it is envisioned that the NSERC will serve as the conduit through which DTRA research projects are funneled to all academic departments at USMA, and through which USMA faculty from any department can reach back to DTRA to incorporate DTRA materials, expertise, and information into their classrooms.

In the fall 2007 semester, we taught lessons on nuclear terrorism for the Seminar on Weapons of Mass Destruction and Terrorism, a course taught in the Department of Social Sciences by the Combating Terrorism Center. In November, LTC Musk served as a co-chair for the Proliferation of Weapons and Materials table at the 59th Annual Student Conference on United States Affairs (SCUSA) hosted by the Department of Social Sciences.

The immediate NSERC benefit to DTRA is the research conducted by USMA cadets and faculty on projects of interest to DTRA. However, the NSERC's role in introducing cadets to DTRA, NNSA, and the FA52 community, "growing" future FA52s, and developing current FA52 officers may turn out to be its most important and lasting contributions.

**Working with the NSERC**

The NSERC is seeking research topics related to DTRA mission areas, and welcomes project ideas both from within and outside the DoD. Working through the NSERC gives the client access to USMA faculty expertise, outstanding cadet researchers, and the capabilities of DTRA. In return, clients can expect high-quality undergraduate-level research from the cadets, and professional-quality faculty research. In addition to providing results to the client, it is also expected that NSERC researchers will publish their results in a suitable venue.

What types of projects are suitable for the NSERC? Currently, the NSERC is best equipped to do computational and theoretical research. Within the NSERC and the Department of Physics, expertise exists in the areas of infrastructure characterization, MCNP modeling, exploding-wire physics, plasma physics, space physics, high-altitude nuclear effects, nuclear weapons effects, the nuclear fuel cycle, and nuclear reactor theory. The NSERC plans to expand its research scope to encompass experimental topics, particularly in the area of radiation detection.

**Contact Us**

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**ENDNOTES**

1 For more information on the nuclear engineering major at USMA, see ***NBC Report***, ***Fall/Winter 2002***, pp.29-31.
2 For more information on the NERG, see ***NBC Report***, Fall/Winter 2005, pp. 7-9.
3 ***NBC Report***, Fall/Winter 2005, p. 7.
4 The Nuclear Engineering Research Center (NERC) was the original name of the organization that was later to become the Nuclear Science and Engineering Research Center (NSERC). The original concept for the NERC was discussed in ***NBC Report, Fall/Winter 2005***, p. 9. At the time of the Fall/Winter 2005 article, it was believed that the NERC could be staffed internally within USMA, as the Photonics Research Center is.
5 In addition to the NSERC, USMA is home to fourteen other centers of excellence. These range from the technical, such as the Photonics Research Center, to the educationally-oriented, such as the Center for Teaching Excellence, to those focusing on analysis, such as the Operations Research Center (ORCEN). Each center directly contributes to the USMA mission and conducts independent research and analysis.
6 The Combating Terrorism Center (CTC) at West Point contributes relevant scholarly perspectives through education, research and policy analysis to combat terrorist threats to the United States. It maintains expertise in four primary areas: terrorism, counterterrorism, homeland security, and weapons of mass destruction. By developing a curriculum of the highest quality, producing theoretically informed studies, and crafting relevant policy recommendations, it has become an internationally recognized center of excellence dedicated to the advancement of terrorism knowledge and expertise.
7 The Photonics Research Center's three principle missions focus on education of both cadets and officers, the conduct of basic and applied research, and support to the Army and Department of Defense in the area of lasers and photonics.

# Chemical Weapons Production in Russia is Closer to Being a ‘Cold’ Idea

MAJ Adam S. Talkington

Recently, the United States and Russia scored an important, albeit quiet victory toward ending the production capability for weapons of mass destruction.

In July 2007, the last piece of processing equipment in the former chemical weapon production facility located in Novocheboksarsk, Russia, was destroyed. Along with the Volgograd, Russia, facility, which was destroyed in 2005, these complexes were responsible for the production of the majority of Russia’s deadly nerve agents: sarin, soman and VX.

The project began 10 years ago, when the leadership in the Republic of Chuvashia, where Novocheboksarsk is located, expressed the desire to eradicate their legacy of past chemical weapons production.

The government in Cheboksary (capital of Chuvashia) sought assistance from the Russian Federation and the United States. As a result, the Department of Defense directed the Defense Threat Reduction Agency (DTRA) to assemble a project team for this demilitarization project from within the Cooperative Threat Reduction (CTR) directorate in the Operations enterprise.

Building 350 at Novocheboksarsk, was a VX production and filling facility. Photograph courtesy of the Cooperative Threat Reduction Program.

The DTRA team was formed and repeatedly visited the plant site between 1997 and 2007. The team's task was to complete the work designed to bring an end to the capability of producing deadly chemical weapons, and help to dismantle and destroy the facility under provisions of the Nunn-Lugar Cooperative Threat Reduction (CTR) program.

The Novocheboksarsk complex included Building 350, a seven-story structure where deadly chemical weapons and materials were created for use in the battle plans of the old Soviet Empire during the 1960-1980s. Agent production and munitions filling operations finished in the mid-1980s, and the building sat vacant for over a decade. It was determined to be unacceptable to leave as it was, and assistance was requested to dismantle and destroy the facility.

The project cost more than $45 million, and was headed by DTRA with support from the Tennessee Valley Authority (TVA) and Parsons Delaware, Inc. For over five years, Parsons, TVA, DTRA, and the Russian Federation's Khimprom Joint Stock Company at Novocheboksarsk worked to design and build three thermal treatment units (furnaces) to thermally decontaminate scraps and waste.

Two years ago, the DTRA/TVA and Khimprom team completed the installation of the thermal treatment units within the building, and the processing of equipment and building materials began. The final destruction of the processing equipment was completed in July 2007, and now only scrap metal remains for thermal decontamination. It was jointly agreed that the Novocheboksarsk facility no longer possessed the capability to produce deadly chemical weapons because the last piece of former production equipment was destroyed. The formal announcement that Russia officially has one less production facility is left to the Russian Federation in coordination with the Organization for the Prohibition of Chemicals Weapons, the executive agency of the Chemical Weapons Convention.

Support for project completion came from interpreter Emily Durakovsky, project support staff Cedric Adams, Kevin Turner and Yvonne Pool-Poe, and David Stephenson from TVA. Ben Moberley, Science Application International Corporation, provided technical assistance.

In support of Department of Defense and DTRA's goal, the world has been made safer by the elimination of this production facility.

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# Dosimetry Needs and Challenges for Active Interrogation Systems

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The purpose of this article is to address some of the challenges and questions associated with active interrogation nuclear detection systems. Deployment of these types of systems is fundamental to meeting the challenges presented by the counterproliferation mission space. The execution of the counterproliferation mission on the future battlefield requires the use of sophisticated technologies coupled with the intellectual and physical capabilities of the modern soldier to dissuade, deter and defeat the enemy's use of weapons of mass destruction (WMD). [1] A key component of this mission space is the ability to effectively detect the movement of illicit nuclear materials and systems across the entire spectrum of the battlefield. Several efforts are underway to develop systems and technologies which support this detection mission. These efforts can be broken into two key areas, active nuclear detection systems and passive nuclear detection systems. While both modalities are important to the overall mission space, this discussion will focus on the challenges and needs for active nuclear detection systems.

Active "interrogation" nuclear detection systems operate on the premise of using radiation (historically neutron or photon) from a radiation source to stimulate the emission of characteristic radiation within the suspect target. In general, the radiation source is a radiation generating device such as an accelerator or a neutron generator. Scientists in both academia and at the Department of Energy (DOE) national laboratories have conducted a great deal of research over the past 20 years, exploring these systems from source to related detector technology development. This methodology is attractive since special nuclear material provides several key signatures when stimulated with incident radiation. In this case, physics is on our side and can be exploited to solve difficult detection problems, which is the reason many federal agencies are interested in the employment of active interrogation technology.

The Defense Threat Reduction Agency (DTRA) is pursuing several active interrogation technologies [2] including electron accelerator-based systems which utilize bremsstrahlung induced photonuclear detection. [3] A key concern of DTRA and the user community is properly accounting for the dose received by the interrogated object (e.g. a vehicle, container, etc.) as well as both soldiers and civilians which are within the immediate vicinity of such a device. Accelerator-based systems operate in a pulsed mode in which the charged particles are delivered in pulses within 1 ns to 1 µs and are spaced a few milliseconds apart. When used in a standoff mode-of-operation in an outdoor environment, such systems utilize both collimated and uncollimated beams to control the spatial behavior of the radiation emissions. The accelerator nominal operating parameters (e.g. beam current, repetition rate, beam energy, etc.) used in interrogating a suspect object can be varied which complicates dose measurement. Furthermore, the pulsed nature of an accelerator radiation field presents a litany of challenges in terms of dose determination. This paper will provide an overview of research being performed at the Georgia Institute of Technology to study the dosimetry needs for active interrogation systems as well as some other institutional questions such as dose limits, system deployment and regulatory implications. The model used to present this research is the bremsstrahlung-based system being developed by the Idaho National Laboratory (INL) for DTRA.

## Active Interrogation Dosimetry Challenges

Several challenges exist for performing dosimetry in active interrogation environments. In general, active interrogation devices are accelerator-based systems which operate in a pulsed mode. Steady-state radiation fields, such as those emanating from an isotopic source, are fairly straight forward in terms of dose measurement whereas the pulsed environment provides a unique set of challenges in terms of measuring dose. The following are a discussion of some of those challenges.

### 1. Charged Particle Equilibrium (Build-up)

Charged particle equilibrium (CPE) is a condition that is fundamental to radiation dosimetry.[4] Since the dose in a photon field stems from the ionization and excitation of the secondary charged particles which are generated via the photoelectric effect, Compton scattering and pair production, achieving CPE in a dose measuring device is required to obtain a reasonable estimate of the dose. The challenge in high-energy bremsstrahlung fields is that current (standard) dosimeters do not provide for CPE above a few MeV. CPE can be obtained by placing tissue-equivalent material (such as a build-up cap) around the dosimeter. This material is generally tissue equivalent plastic or polymethyl mythacrylate (PMMA). The challenge with using a build-up cap is ensuring that the low-energy portion of the photon spectrum is not overly attenuated. This attenuation will cause an underestimate in the total dose measured by the dosimeter.

**2. Detector Partial Volume Effect**

The measurement of dose in the primary beam of a bremsstrahlung-based system is based on the premise that the dosimeter/detector is uniformly irradiated. In general, ionization chambers are the instrument of choice for pulsed-field exposure measurements. Air-filled chambers are the best ionization chambers for measuring exposure since exposure is defined by the amount of ionization charge created in air. [5] Electric fields are applied within the ion chamber to collect the radiation-induced charge. This collected charge is then converted into dose. The response of an ionization chamber irradiated non-uniformly (partially) can vary significantly and thus underestimate the dose. The beam size can contribute to this phenomenon. The actual dose within the primary beam will be higher than the instrument reading based on the ratio of the detector's actual volume to the beam volume within the detector. [6] Moreover, corrections must be made for ion recombination, to be discussed in the next section. In general, a large volume detector with an appropriate build-up cap is needed to ensure uniform irradiation and thus an accurate dose measurement.

**3. Pulsed Field Effects**

Bremsstrahlung-based active interrogation systems, which generally operate at a low duty cycle, often suffer from pulsed field effects. During a pulse, which typically lasts for 1 ns to 1 µs and occur every few milliseconds, the maximum dose rate for an ionization chamber may be exceeded. This effect can result in a non-linear response of the ionization chamber. The incomplete collection of charge is known as ion recombination and results in dose measurements which are lower than the actual dose. This is due to the fact that some positive and negative ions combine (due to the large ion densities within the pulse) before they can be separated by the chamber's electric field. This phenomenon can be corrected for by taking measurements at various bias voltages and applying a correction factor.

**4. Neutron Production**

The high-energy photon fields used in active interrogation produce a secondary neutron field. The challenge with measuring this secondary neutron dose is the fact that the response of neutron dosimeters is strongly dependent on the neutron energy spectrum. In general, the reference radiations used for dosimeter calibration have spectra that differ from that measured near the active interrogation system. Typically, the effective dose due to neutrons from the primary beam of an active interrogation system is much less than the photon dose. However, the neutron dose in the surrounding area is a function of shielding materials and system design. This dose can be a concern if not correctly measured.

**5. Skyshine**

The primary beam of an active interrogation system will scatter both in the air and off the interrogated object. This scatter term can create dose via skyshine at distances away from the area of operation. This effect must be taken into account when determining the total dose from an active interrogation system.

**Current Research**

The thrust of current research is to develop the ability to measure, in real-time, photon doses in the bremsstrahlung-based active interrogation radiation environment. Work is underway at Georgia Tech to develop a photon dosimeter/detector which provides near real-time dose estimates while accounting for the issues mentioned above. In order to develop a detection system, one must know and understand the radiation field surrounding the system. The characterization and assessment of dose for an active system deployed in an outdoor environment, has never been conducted. The technical literature contains a great deal of work in the area of accelerator health physics; however, most of this work is based on shielded facilities. The idea of operating an accelerator outdoors in a potentially populated area for the purposes of detecting illicit nuclear material is truly cutting edge.

Although the interrogation technique is new, the challenges associated with dosimetry can be addressed and solved with research. The photon dose surrounding the system can be estimated using Monte Carlo codes such as MCNP. Such numerical simulations are very useful in providing insight into the radiation field behavior and a predictive capability to assist in the design of dose measuring instruments. The validation of such simulated data is accomplished through actual dose measurements. Dose measurements can be conducted utilizing passive detectors such as thermoluminescent dosimeters (TLDs) or optically stimulated luminescent (OSL) dosimeters. Both types of dosimeters are effective in estimating dose; however, lack the ability to provide real-time data since they are passive devices which must be read after the measurement is completed. Active dosimeters/detectors, such as ionization chambers or proportional counters, can provide accurate dose estimates; however, they suffer many of the effects described above when operated in a pulsed field so appropriate technical precautions must be taken.

The implications of deploying an active interrogation system present a unique set of questions in terms of dose limits and regulatory considerations. The National Council on Radiation Protection and Measurements (NCRP) recommends that an inadvertently exposed person should receive an effective dose of less than 1 mSv [7] (where 10 mSv is equal to 1 rem) for a single inadvertent exposure. The NCRP further recommended that that this limit can be raised to 5 mSv, if necessary, to achieve national security objectives. [8] These recommendations are consistent with 10 CFR 20 [9] limits as well as those used in current Army systems. There are questions to be addressed in terms of dose limits: Do these limits make sense for active interrogation systems? What are the drivers that would lead to a change in these limits? Is there a technical basis? These questions must be answered before an active interrogation system is deployed.

## Conclusion

Research is underway to scientifically study the dose implications of active interrogation systems. The thrust of this work is to provide a sound technical basis for answering dose-related questions as well as overcoming the obstacles associated with deploying these technologies.

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# Last Call for Professional Engineering Licensure?

LTC Nik Putnam, Professional Geologist

Some FA 52 Officers do not have Accreditation Board for Engineering and Technology (ABET) accredited undergraduate degrees but later received MS and PhDs in Engineering and Science from those same institutions. Professional Engineering licensure is a qualification that carries legitimacy and credence within authoritative science and engineering circles often traveled by FA 52 Officers. As one of these "late bloomers" I felt it appropriate to share one way of availing oneself to this professional development opportunity.

When scoping State PE Licensure information found at http://www.ncees.org/licensure/licensing_boards/, I noted that many States are in the process of closing the door on exceptions to policy regarding applicant requirements for ABET accredited undergraduate engineering degrees. I have found that the State of Virginia offers a PE through an Engineering and Technology Program option for use by those applicants with degree in fields other than engineering or a related science, or with no degree. For this option you may visit http://www.dpor.virginia.gov/dporweb/eit_form.cfm for more information. In essence, the applicant must have taken a combination of 128 semester hours in mathematics, science, & technology courses.

This may seem daunting for those of us that have been out of the undergraduate school environment, for some 15 years or more. The endeavor to pass the fundamental and PE exams that result in licensure is a serious undertaking. Indeed, there is no indication that a 'last call' for those without ABET undergraduate engineering degrees: The opportunity for those of us determined to strive for professional engineering excellence still exists.

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# Fleeing the NEST

**Andy Oppenheimer looks at the work of the US Nuclear Emergency Search Teams**

Recovered looted yellowcake barrels at the abandoned al-Tuaitha nuclear facility in Iraq after a team scoured the surrounding villages and recovered them.

Possibly the first time the general public heard anything about the United States' Nuclear Emergency Search Teams (NEST) was from seeing the feature film, ***The Peacemaker***, which depicted a terrorist carting a small nuclear primary in a backpack through the streets of New York intent on destroying the United Nations (and most of the city). The heroes of the movie are joined by NEST team members in helicopters scanning the streets a few metres above the tops of skyscrapers -- their goal to detect and track the man-carried bomb as it moves closer to its target, then for Nicole Kidman to dismantle it single-handed.

NEST was set up in 1975, a year after a Boston hoaxer threatened to detonate a nuclear device unless paid $200,000. Scientists with the Atomic Energy Commission were flown to one airport. Their radiation detection equipment went to another. No one was sure what to look for or how to find it or exactly what to do if they did. As it turned out, the government's bewilderment really didn't matter. The extortionist never picked up the money the FBI left at a prearranged spot. Fortunately for Boston, there was no bomb. Since then there have been over 125 incidents, which have all officially been hoaxes.

**Team response**

The NEST is a volunteer response group of more than 900 personnel on call who have highly specialised expertise and equipment. They are managed and directed as part of an emergency response branch of the National Nuclear Security Administration (NNSA) within the US Department of Energy (DOE), on a small annual budget of roughly $40 million. Their mission: to boldly search for, defuse or as safely as possible destroy, nuclear material or weapons, perform diagnostics and assessment of suspected nuclear devices, carry out technical operations in support of render safe procedures, and package devices for transport to final disposition. The teams also assist the FBI in investigating a crime involving nuclear theft, and increasingly relevant in terms of the terrorist threat, improvised nuclear devices (INDs) and radiological dispersal devices (RDDs).

Out of the 900+ specialists, ***ad hoc*** response groups can range from five advisory members to operational teams of 45 physicists, chemists, mathematicians, communications specialists, security experts, meteorologists, and other technical specialists from the national nuclear laboratories and facilities, some of whom have designed nuclear weapons. As terrorist incidents can arise with no warning, the teams must be prepared for rapid deployment at any time; otherwise, they may be drafted in for pre-deployment planning. They must also co-ordinate between agencies, including State Department, FBI, state and local officials, and possibly foreign governments.

The NEST teams are usually accompanied by special-operations commandos from the FBI'S domestic counterterrorism office, but the DOE has authority to call in counterterrorist special mission units (SMUs), comprising élite members of the Army's Delta Force and the Navy's SEAL Team 6. NNSA also works with the Customs Service to detect and analyse incidents involving smuggling of radiological materials into the US.

Within NEST the Accident Response Group (ARG) deals with accidentally damaged nuclear weapons ('Broken Arrows'); the Joint Technical Operations Team (JTOT), responds to the threat of a terrorist device. The heart of the search operation is the Search Response Team, consisting of seven full-time emergency response personnel who are on a four-hour standby to be transported immediately by military or civil aircraft to the area being searched. Once deployed, their task is to instruct and equip local first-responders. This will include training of 'novice' searchers who have local knowledge and may help the primary team to trace the source, although security would be of paramount importance where local searchers could compromise an operation.

The Radiological Assistance Program (RAP) is usually the first-responding resource in assessing a radiological emergency, and advises on what further steps should be taken to minimise hazards. RAP teams arrive at the scene within four to six hours after notification of an emergency to conduct the initial radiological assessment of an affected area and determine what actions to take.

As an ongoing process NEST and RAP specialists track all the examples of information on nuclear bomb-building on the Internet and elsewhere, a problem that did not exist when the teams were set up – although in 1979, the US government fought to stop a radical magazine from publishing details and diagrams on how to build a hydrogen bomb. The information was eventually published by other sources, but open sources do not include the vital steps necessary to construct the most complex explosive devices ever made.


US Fire Service personnel using GR135 Plus, which is hand-held Radioactivity Characterization Equipment for searching, measuring and identifying HEU, plutonium and other radioactive sources.

**Past NEST 'call-outs'**

NEST crews have officially never found a nuclear bomb, but there have been several scares and at least one actual threat. Since 1978, of these 60 have been nuclear extortion (mostly by nuclear industry employees), 25 nuclear reactor hoaxes, 20 non-nuclear extortion; and 650 cases involving reported or attempted illicit sale of nuclear materials.

Details of past cases are not available, although some stories have done the rounds – one such being a call the FBI received on in February 1999, saying that radioactive material was aboard an Amtrak train bound from Chicago to Seattle and that its passengers were in danger. This and an eastbound passenger train were diverted to a remote stretch of track in Montana. NEST teams were flown to the site; after searching both trains they found no device.

In 1976 NEST vans monitored radiation in the streets of Washington, D.C. following a tip-off that a terrorist

Low-Level radium and palladium are spread to simulate a nuclear accident to test search response.

group could mark the Bicentennial celebrations with a bang. In August 1980 a sophisticated IED was detonated in Harvey's Casino in State Line, Nevada. The device was exploded by a failed attempt to render it safe. While not nuclear, the IED presented the kind of challenges that could be encountered in an IND and became a benchmark for the development of new equipment and techniques to render safe similar devices.

Surface contamination detector.

In the immediate aftermath of 9/11, NEST has been deployed twice a year. Teams were tasked in January 2002 with searching major US cities for a possible terrorist-deployed RDD. In February 2002 teams also quietly provided support to security efforts at the Salt Lake City Winter Olympics. That same year, NNSA administrator John Gordon testified at a hearing of the House Armed Services Committee that the NEST could respond to a potential incident within four hours, but that they would in future need to act even more quickly.

More recently, in October 2005 a radiation sensor at Colombo, Sri Lanka signaled that the contents of an outbound shipping container included radioactive material. After American and Sri Lankan inspectors hurriedly checked camera images at the port, they concluded that the suspect crate might be on any one of five ships - two of which were steaming toward New York. One NEST team flew to Canada and a second intercepted one of the ships before it could reach Hamburg. Nothing was found. When the United States Coast Guard stopped the two New York-bound ships in territorial waters, scientists boarded the vessels and, using diagnostic equipment, found nothing. The offending vessel was on an Asian route, and its cargo was scrap metal mixed with radioactive materials that had been dumped improperly.

Searching for looted material in Iraq

**NEST equipment**

Precise details of operational search procedures remain classified to deny any potential threat from the defeat of developing countermeasures response plans. The specialised equipment first available to the NEST was the early Surveillance Accident Nuclear Detection System (SANDS) which continues to evolve. It includes a range of nuclear radiation detection systems for surveying an area for lost or diverted nuclear weapons and SNM (special nuclear materials: weapons-grade uranium and plutonium) and also for delineating the distribution of radioactive material resulting from a nuclear accident. A DoD programme is under way to upgrade NEST'S detection capabilities and counterterrorism intelligence to counter the rising threat of nuclear terrorism.

Equipment is both vehicle-carried and hand-held. The teams have four helicopters and three planes at their disposal and the exteriors of vans carrying teams with their equipment are disguised by fake commercial artwork prepared by a dedicated graphics agency. The Aerial Measuring System (AMS) is deployed on board the aircraft and helicopters to detect and measure radioactive material deposited on the ground, including at extremely low radiation levels, and can conduct real-time air sampling and tracking of airborne radiation. This information helps determine how fast contaminants are moving and in what direction.

Detection of devices is carried out using neutron and gamma detectors. Material emitting neutrons and gamma rays, which can shoot out hundreds of metres, can be most easily detected while a team is driving up a street, walking through a building, or flying low over a town. Sensitive passive heat detectors are used, as decaying nuclear material gives off more heat than detectable high-energy particles. As would be expected, much depends greatly on the nuclear material used – whether it emits alpha radiation, which can be shielded by a single sheet of paper, while beta rays cannot penetrate wood or a dry wall.

The kit also includes Portac, a portable x-ray source that can quickly provide high-quality images of a weapon's interior; a high-pressure non-magnetic water cutting tool; robots with video cameras; and disablement and damage-limitation devices. The teams have to be unobtrusive: hand-held detectors are carried in toolboxes, briefcases and beer coolers. They have a fleet of nondescript vans and trucks at their disposal to carry, along with the detectors, tons of kit for satellite information-gathering, lathes to machine their own equipment at the scene, cameras, scuba and climbing gear, tents, special foam and freezing chemicals.

The teams carry an armoury of laptops and disk drives - such as those which went missing in May 2000 at Los Alamos Nuclear Weapons Laboratory (LANL). The disks

## Examples of NEST call-outs since 1975

| Reason for Call-out | Result | Date | Location |
|---|---|---|---|
| A threat, including the drawing of a one-megaton hydrogen bomb, supposedly from the radical group Weather Underground. Nuclear bombs said to be placed in three buildings. | unknown | 31 Jan 1975 | Los Angeles, CA. |
| Police receive a message threatening 10 explosions, each dispersing 10 pounds of radioactive waste. Message demands $500,000. | unknown | 23 Nov 1976 | Spokane, WA. |
| Former employee at a nuclear fuel processing plant leaves a radioactive sample and a note at the door of the plant manager. He demands $100,000 or threatens to scatter uranium in a city. | Suspect arrested, convicted | 30 Jan 1979 | Wilmington, N.C. |
| Postcard sent to the governor of California claims small amount of plutonium has been released in the Capital building to demonstrate the folly of nuclear energy and toxic substances. | unknown | 9 April 1979 | Sacramento, CA |
| Telephone caller claiming to represent a Cuban political movement says a nuclear device he has invented would go off that night in a bank building. | unknown | 27 Nov 1987 | Indianapolis, Indiana |
| Caller to the mayor's office saying nuclear explosive built with uranium would blow up a 3 sq m area. | unknown | 13 April1990 | El Paso, Texas |

contain information about materials, design, and other physical parameters of both domestic and foreign nuclear weapons. Results from detection sensors along with other physical measurements and observations are fed into the NEST laptops. Advanced software is then used to make a best attempt to generate procedures and advice on disarming the devices. The best way, though, to work out how to dismantle an IND (or any bomb) is to build one yourself. So NEST scientists spend a lot of time trying to dream up how a nuclear device would be assembled.

**Render safe**

Once an unexplainable radioactive emission is located, a plain-clothes NEST deactivation squad takes off in tandem with the FBI'S commandos. They are guided from a NEST command post inside an ordinary-looking recreation vehicle. Faced with an unknown design, JTOT volunteers would evaluate the device without disturbing or destroying it, and determine how it was constructed and how to determine the source of the weapon from its design or materials. A Home Team provides JTOT with rapid access to expanded expertise and a vital computing link. At the site, scientists can weigh what their diagnostic tools told them against data from more than 1,000 US nuclear tests. Those data are available to them on the laptops, which run simulations of a device's destructive potential. But it is most likely that a nuclear or radiological deployment is likely to be of an improvised nature.

The mission is 'render safe' - disable the device then move it to a safe spot for disassembly. The device must be rendered inert, which involves making safe the high explosives (HE) that surround the nuclear core. HE are very difficult to render 100% inert. If Portac radiography reveals the HE is cracked, it must be stabilised with injections of a vulcanising rubber before the weapon is moved. The device would be surrounded by a tent enclosure several tens of metres in height and width, then filled with special foam to contain the radioactive material if the bomb exploded during defusing.

The Percussion-Actuated Nonelectric (PAN) Disrupter is a disablement tool used to dismantle suspected RDDs and also preserve forensic evidence. Other equipment is for containment of particulates released in an RDD explosion.

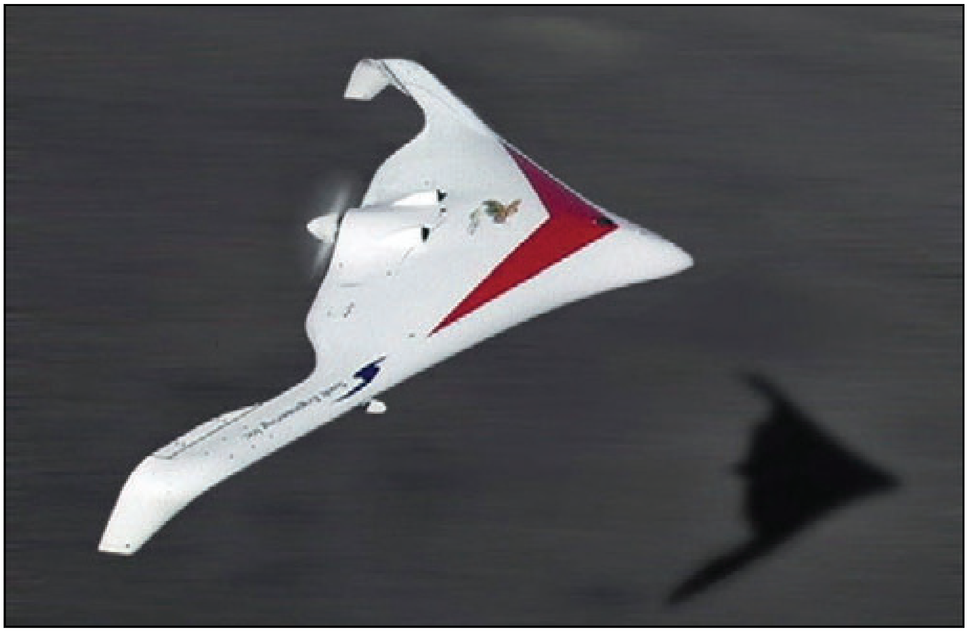
Almost every week the FBI randomly selects several cities for visits by NEST. Agencies in larger metropolitan areas such as San Francisco, Los Angeles, Chicago, New York and others have worked alongside NEST in training exercises, which involve the hiding of fake nuclear weapons containing radioactive materials sufficient to represent emissions that would be given off by an actual nuclear bomb. In the words of one NEST operative: "You have to have the knowledge of a Nobel scientist, nerves of steel and loud noises can't make you jumpy."

***Reprinted with kind permission from NBC International, Autumn 2007***

# Chemical Brothers

John Eldridge examines chemical threats to troops during military operations around the world

Chlorine gas is now being used by sectarian terrorists against civilians in Iraq. Heavier than air, it clings to the ground and spreads quickly in a light wind. Eventually lethal in large quantities, it chokes the victim to death. The terrorists have found that it increases the death toll for two reasons. Firstly, without individual personal equipment (IPE) the emergency services get delayed in reacting to an event and secondly those close to the blast, immobilised by their injuries, die through asphyxiation. The injury toll is vastly increased (by over 150 in the 21 February 2007 Baghdad event).



The Swift Engineering KillerBee UAS allows a payload between 14 and 30 kg and can stay airborne for up to 15 hours a useful vehicle for CW detection.

### Awash with chlorine

Experts accept that the terrorists clearly understand the risks inherent in trying to synthesise, store and then deliver one of the 'classic' agents such as sarin. Why bother, when a common-range toxic chemical can be used? Sadly, history repeats itself. In 1915, the Germans used gas for the first time - as a means of breaking the tactical stalemate that had descended on the western front. The gas they used was chlorine. It was available. Health spas were big business in pre-war Germany and the average resort used thousands of kilograms of chlorine gas to purify the water. They were producing 40 tons a day by the outbreak of war. In Iraq today and especially in neighbouring wealthy Gulf states, there are swimming pools in every hotel and many thousands of private homes. Chlorine is readily available.

Fortunately, modern individual protective equipment (IPE) and collective protection (COLPRO) is effective against chlorine and other traditional gases. Armed forces are well protected but the civil emergency services, less so.

### Dawn of the superterrorist

Military personnel today face an unfamiliar and uncomfortable challenge. Compared with 30 years ago, the character of warfare has changed beyond recognition. Then, both NATO and Warsaw Pact forces planned for the massive use of chemical weapons (CW) on the battlefield, both in the area denial role to foil amphibious assault and, offensively, to gain ground. Armoured units and infantry trained hard to fight a lengthy, dirty war.

Armed forces today operating in the Middle East, Africa, Sri Lanka and Afghanistan find themselves in hostile territory, mounting fast tactical operations out of heavily defended garrisons. They face a much more challenging threat. The enemy is highly trained, dedicated, motivated, mobile and armed with sophisticated weaponry supplied by sponsoring states. These are superterrorists with a resourceful insight into the use of CW.

At an individual level, they have studied the Internet as well as the written notes on chemical, biological, radiological, nuclear (CBRN) circulated within the Al Qaeda network. It has become a local idea, using the resources available at the time. Even the LTTE (Liberation Tigers of Tamil Eelam - 'Tamil Tigers') have used chlorine gas - in a 1990 attack against a military camp in East Kiran. Looking at events like these, targeted against sophisticated, disciplined military forces, most recently in Iraq, experts see a grave danger, as happened in 1915, that the insurgents may re-learn an ancient lesson and see chlorine as a significant force-multiplier. They will have analysed the results and may be persuaded to move on to other things.

### TICs on the battlefield

Western intelligence has produced a long list of inherently toxic industrial chemicals (TICs) whose extraction or synthesis, storage, distribution and utilisation still remains largely unprotected, because government cannot agree with industry - which should bear the cost. NATO's International Task Force 25 (ITF-25) defines a TIC as a chemical compound with an inhalation LCt50 of less than 100,000 mg per min $m^3$ (where LC50 equals

The Avon Protection M50 mask, shown here with twin conformal filters forms the next generation of respiratory protection for the US armed forces as part of the Joint Service General Purpose Mask Program.

the separate effective concentrations for lethality in 50% of the exposed population and t = time of exposure) and an 'appreciable' (undefined) vapour pressure at 200°C.

There has been an undercurrent of anxiety that many of these materials would start to appear on the battlefield. The recent use of chlorine is therefore extremely significant, although it has received little ongoing media attention. Industry uses many compounds with utility as CW agents. In the Middle East, for example, there is an extremely large requirement for robust pest control. Some of the latter are close to the nerve agents (malathion is an example from the organophosphate group) and others include cyanide and ammonia.

The Russians used a fast-acting opioid analgesic (fentanyl) in trying to knock down Chechen rebel hostage-takers in 1992. The effects of fentanyl in this kind of situation were poorly understood and 127 of the 850 hostages (mainly the young) died. And CW is not the only thing in the terrorists' sights. Radioactive materials are more difficult to procure in any quantity but could be much more effective in a long-term area denial role. Although BW is seen as essentially a strategic weapon, the general desire to inflict massive casualties could be realised by the self-infected terrorist. However, in the tactical threat to troops, it is the use of CW which is the most pressing challenge.

**Instant reaction**

Mobility, a key factor in military operations, would be frustrated by the need to operate continuously protected, especially in the Gulf climate. Also, the requirement for close contact with local populations in order to win hearts and minds precludes such a method of operating. Continuously protected operation would be the only sure way of surviving the kind of no-notice threat posed in this type of environment but remains out of the question. The nature of the threat prevents any form of early warning but widely dispersed individual detector/warners can offer valuable alarm information to those downwind of the affected victim, allowing others time to mask up.

How, then, has the defence community and industry moved to meet the challenge? In this changed threat environment, individual protection assumes perhaps a greater significance than detection. A roadside bomb or suicide attack comes without warning. No time to look at screens, only time to mask up as a fast as possible. Clearly, the key element here in saving lives is speed (and therefore the ease) with which a mask can be donned. The quality of filtration comes a very close second and, here, there have been significant developments both in large scale filtration for COLPRO as well as at an individual level.

**Nanoprotection**

The insides of both types of filter were once similar. Not so today. Nanotechnology has been brought to bear on IPE filter design. Especially in face-mask canisters, both vibration and adsorption of water-vapour cause a decay in the adsorptive effectiveness of the carbon filter. Carbon-bonded carbon composites allow a more rigid structure, avoiding the settling effect and presenting a consistent face to the incoming challenge. Carbon nanotubes - highly rigid, long stranded, fullerene-type allotropes of carbon hold great promise in the improvement of shelf life and filter effectiveness. At molecular level, activated carbon can be placed precisely on microengineered lattice structures to give the most efficient labyrinth in which to trap the challenge material.

Different compounds are utilised to improve activation (ASC-TEDA charcoal) to render it more effective against high vapour pressure compounds such as the blood agents. In fact the USA moved away from ASC/TEDA charcoal some time ago, based on the perceived dangers from its chromium content. Its patented replacement, ASZM-TEDA, carbon uses a triethylenediamine compound containing copper, silver, zinc and molybdenum molecules for activation. Ion-exchange technology makes the impregnation process less hit-and-miss than at present. There are rivals to carbon as well. Zeolites (crystalline structures of oxygen, silicon and aluminium) are being examined as alternatives. MCM-41 (Mobile Crystalline Material) is a particularly interesting silicate structure which lends itself to molecular sieves and to filters. Unlike carbon, the white colour of silicates takes on the colours of activation compounds such as copper or chromium. These, in turn change when challenged with agent, giving a visual indication of the remaining capacity in a filter which is not available to carbon.

**Filtration and mobility**

An important factor in ensuring the effectiveness of mask filtration is the ability to monitor its quality. Mask testing has also moved ahead and products like Air Techniques International's TDA-99M allows a full range of parameters to be assessed and recorded including the integrity of the face seal, inlet and outlet valves and drinking devices, for a wide variety of masks.


A UK consortium comprising Smiths Detection, Siemens Power Generation and Bruhn Newtech recently delivered to the UK MoD an integrated detection system, designed for adaptable deployment in a variety of vehicles, such as the UK Spartan CRV(T).

COLPRO filtration, not concerned so much with portability and size, has focused on technologies like pressure or temperature swing (P/T Swing), whereby two adjacent filter beds are alternately challenged and purged, managed by a 'bootstrap' system. This cycle was found to have a detrimental effect on traditionally manufactured carbon filters for similar but larger-scale reasons to the IPE canister. Improving the stability and rigidity of the carbon structure increases the life and, using silicon-based filters, the high temperatures involved in the purging process actually improves the quality of filtration.

The traditional IPE suit has attracted some subtle changes in technology. The level and type of activation has been optimised to face the challenge of toxic industrial materials (TIMs). Non-woven polymers with better 'wicking' capability and less heat-stress impact have emerged. The bonding of the fibres at the seams and joints has also improved, reducing the possibility of leaks. Impermeable suits, essential for activities like remediation and thorough decon now offer better mobility, visibility and internal climate control.

**Forewarned is forearmed**

The first purpose of CW detection is to give enough warning to personnel to minimise injury. Whilst networked perimeter detection systems are a tried and tested solution, fast deployment of detection capability further afield is vital for force protection. A great deal of effort is being put into land-mobile CBRN reconnaissance. For example, a UK consortium comprising Smith's Detection, Siemens Power Generation and Bruhn Newtech has delivered a technical demonstrator to the UK MoD within a six-month timescale, designed to offer an adaptable, comprehensive, integrated system suitable for fitting to a variety of potential recce vehicles. It deploys an integrated suite of Radiation CW agent and, in the future, BW detectors. The first purpose-designed CBRN recce vehicle, the German Fuchs, carries a similar integrated suite from Bruker Daltonics. Developed for the first Gulf War, Fuchs has become popular and now equips a number of armed forces apart from the German armed forces, including the UK and USA. The CW agent detector here is based on the GC/MS system RAID-2.

**Detection takes off**

There are other methods on the horizon offering a quicker response to intelligence of a developing raid with a CBRN flavour. In fact, this is where aviation meets nanotechnology. Unmanned aircraft systems (UAS) such at Swift Engineering's KillerBee UAS could carry a CBRN detection payload. With an open architecture approach, the load bay accepts between 14 and 30 kg of payload, trading off against endurance (a healthy maximum of 15 hours). The vehicle itself could operate on-board sensors, surveying the suspected zone of contamination or could deploy stand-alone sensors upwind of vulnerable sites and formations.

The Defence Science Office (DSO) of the US Defence Advanced Research Project Agency (DARPA) is looking at remote agent detection for BW and some research is focusing on optical systems which, in future, could form a UAS payload. The DARPA Femtosecond Adaptive Spectroscopy Techniques for Remote Agent Detection (FASTREAD) programme aims to overcome the shortcomings of current LIDAR techniques (which provides temporal data but not discrimination) and spectral analysis (poor specificity), using anthrax spores as the trial challenge.

CW detection technology has moved on and although not instantaneous, the leading products offer extremely fast reaction times. In the past, detection has been dogged by high false alarm rates, the need for specialised maintenance and logistic support and poor ease of use. All that has changed. Three elements have come into play: nanotechnology, system integration and improved software. Not only has the basic design moved ahead in each approach but the convergence between the underpinning science and these three elements has accelerated the improvement to all-round capability.

For example, early detectors which relied on optical signals, such as photo ionisation devices (PID) and flame photometry detectors, were prone to fogging. Early IMS devices suffered from high false alarm rates and were unsuitable inside COLPRO. Modern IMS devices such as Smiths Detection's Lightweight Chemical Detector (LCD), an individual detector issued to UK and other armed forces, and Bruker Daltonics' RAID-M-100 both cover TICs in addition to the 'war gases'. Gas Chromatography and Mass Spectrometry (GC/MS) devices were cumbersome and only viable as vehicle-mounted systems. Synodys (France) produces the miniaturised DAXEL 2C GC/MS system. In addition to developments like these, 'lab-on-a-chip' has met microfluidics and future aviation has converged with nanotechnology.

In October last year, two US companies, NanoDynamics of Buffalo NY and ICx Agentase of Pittsburgh, joined forces to develop a nano-engineered biocatalytic air monitor capable of detecting nerve agents at extremely low concentrations. In the case of sarin, the first noticeable effect is miosis at concentrations between 0.5 and 2.0 mg min $m^3$ and the monitor will detect concentrations well below this level. Smart Dust (see 'Lab on a Chip: Promised Land of Detection - NBC International Winter edition) is an extremely promising piece of science which, at relatively low cost, can deploy a widespread array of such detectors, unseen and unfound by the enemy. Micro volume immunoabsorbant assays are emerging, offering near-real time detection. Technologies such as High Performance Liquid Chromatography-Inductively-Coupled Plasma-Mass Spectrometry (HPLC-ICP-MS) have been developed by companies like Agilent Technologies in the USA, with its 7500 series.

**Measuring up to new CW threats**

At unit level, a comprehensive detection capability still remains vital for the protection of fixed bases and vulnerable maritime platforms. Mobile formations, headquarters unit staff, locally employed workers and supporting units cannot possibly be expected to operate at the top level of CBRN preparedness indefinitely. Insurgent or terrorist attacks, whilst becoming increasingly sophisticated through the support of sponsoring states, lack the reach available to modern armed forces such as aircraft and unmanned aircraft systems (UASs).

Whilst rocket RPGs and mortars have sufficient range, the business of sourcing or manufacturing, storing, filling munitions, deploying and launching CBRN warheads is yet to be considered worth the risk compared with the ease and devastating effectiveness of conventional warheads. Nevertheless, the chlorine events in Iraq suggest that the time cannot be far away when these weapons will form a more central part of the terrorist inventory. Detecting launch sites is a key task for reconnaissance vehicles and aircraft, both conventional and unmanned. Low-tech release methods for CWA are readily available and toxic vapour from vehicle-mounted pressurised containers could be released well upwind of a protected base or airfield. The Aum Shinrikyo sect successfully used such an arrangement in 1994 at Matsumoto, with a nerve agent manufactured and stored in great secrecy under the noses of the Japanese police. The agent was released from a truck-mounted array of industrial sprayers connected to a heater. There were seven deaths and nearly 300 casualties.

In summary, the new threat to armed forces has caused both the defence community and industry to think again - to take the wider view in trying to combat the short-notice CBRN hazard in a very different operational environment than in the past. Technology has come to the rescue and begun to deliver the kind of warning and protection required by the new environment. The biggest gap is in the provision of countermeasures to first-responders and guidance to the civilian population, especially in Iraq.

***Cdr John Eldridge MBE FNI, former editor of Jane's Nuclear, Biological and Chemical Defence, was principal Royal Navy staff adviser on CBRN at the UK Ministry of Defence during the first Gulf War.***

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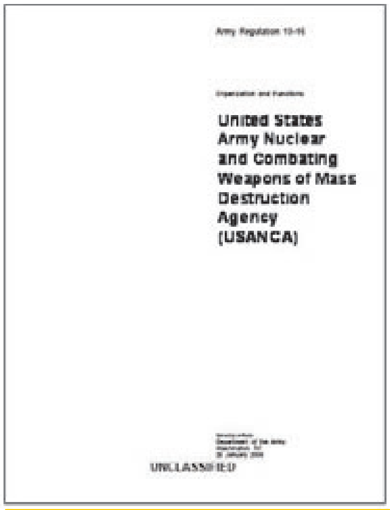
United States
Army Nuclear
and Combating
Weapons of Mass
Destruction
Agency
(USANCA)

UNCLASSIFIED

## Army Regulation 10-16

This regulation prescribes the mission and functions of the U.S. Army Nuclear and Combating Weapons of Mass Destruction Agency (USANCA). This newly revised AR is expected for release in May 2008.
Among the changes:
- Reflects the transfer of USANCA from TRADOC to HQDA.
- Establishes the responsibilities for development and maintenance of Army consequence assessment modeling programs and establishes a skill identifier for consequence assessment modelers.

## 2008 Technical Meetings

HEART Conference: 31 Mar-4 May, Colorado Springs, CO
DOD E3 Program Review: 7-11 APR, San Diego, CA
Nuclear and Space Radiation Effects Conference: 14-18 JUL, Tucson, AZ
POC is Mr. Robert Pfeffer @ 703-806-7862

## FA52 Courses of Interest

### Theater Nuclear Operations Course (TNOC)

TNOC is the only course offered by a Department of Defense (DOD) organization that provides training for planners, support staff, targeteers, and staff nuclear planners for joint operations and targeting. The course provides overview of nuclear weapon design, capabilities and effects as well as U.S. nuclear policy, and joint nuclear doctrine. TNOC meets U.S. Army qualification requirements for the additional skill identifier 5H. The course number is DNWS-R013 (TNOC). Call DNWS at (505) 846-5666 or DSN 246-5666 for quotas and registration information.

### Nuclear and Counterproliferation Officer Course (NCP52)

NCP52 is the Functional Area 52 qualifying course. Initial priority is given to officer TDY enroute to a FA52 assignment or currently serving in a FA52 position. For availability, call the FA52 Proponent Manager at (703) 806-7866.

### Hazard Prediction and Assessment Capability (HPAC)

HPAC provides the capability to accurately predict the effects of hazardous material releases into the atmosphere and the collateral effects of these releases on civilian and military populations. HPAC employs integrated source terms, high resolution weather and particulate transport algorithms to rapidly model hazard areas and human collateral effects.

Registration, Software Distribution and Training:
(703)-325-1276 Fax: (703) 325-0398 (DSN 221)

https://acecenter.cnttr.dtra.mil.acecenter@cnttr.dtra.mil

## Introduction to Combating WMD Course

This course introduces students to US Government and Department of Defense Combating WMD (CWMD) strategy, policy and operations.

8-10 Apr 2008 – NCR
7-9 Jul 2008 - DNWS

Locations:
National Capitol Region (NCR) and Defense Nuclear Weapons School (DNWS)
Albuquerque, New Mexico

## US Nuclear Policy

This course explains the US policy and it's history; reviews NATO policy, discusses nuclear deterrence: theory, principles, and implications; discusses instruments of national power and implications for nuclear weapons; review nuclear surety and intelligence; discuss nuclear treaties and arms control.

**21-23 Apr 2008**
**15-16 Jul 2008**

**This course is taught at DNWS.**

**Email: DNWS@abq.dtra.mil**
**Fax (505) 846-9168 or DSN 246-9168**

**Online Registration:**
https://dnws.abq.dtra.mil/StudentArea/Login.asp

**Pantex Plant Operations**

Participants will learn about nuclear weapon (programmatic) high explosive operations and tests, the US nuclear weapon complex, nuclear weapon design history, production operations, and US nuclear weapon dismantle issues. This training course will provide educational overviews and tours of actual facilities and equipment used in the US nuclear weapons production, transportation, and storage process. This course will also provide an overview of the CI threat to the nuclear weapons operations at the Pantex Plant.

There is no tuition charge, agencies are responsible for their trainee's travel and per diem expenses. This workshop consists of lecture sessions and Plant tours and demonstrations. All workshop sessions are conducted at the Pantex Plant, Amarillo, Texas. There are two scheduled workshops:

15-18 April 2008
17-20 June 2008

Registration Deadline: 60 days before course date; participants will receive reporting instructions 30 days before course start date.

For further information please contact the Training Coordinator at (865) 574-9226.

**WMD Terrorism**

This workshop provides a basic overview of the technical and terrorist threat aspects of nuclear, chemical, and biological weapons.

Participants will be introduced to the various Federal Response Elements and the role that each plays when responding to a WMD event as well as counterterrorism policy. The first day concluded with Trends in Terrorism Overview. Nuclear technology briefings on the infrastructure required to support a nuclear weapons effort will be provided. Production of materials useful for radiological threat devices will also be covered. Briefings on illicit nuclear materials and scams will lead to a threat analysis exercise (an analytical methodology useful for any WMD type threat). Technical briefings on the chemical, and biological terrorism threat, materials and methods, and agents and effects are followed by a demonstration of detection and personal protection equipment.

There is no tuition charge, agencies are responsible for their trainee's travel and per diem expenses. This workshop is conducted at Fort Story, Virginia, September 8-12 2008.

For further information please contact the Training Coordinator at (865) 574-9226.

***Army Knowledge Online (AKO) users: Electronic back issues available!***

Open up AKO and type in: **Nuclear and Counterproliferation** in the Search for… dialog box on the right side of the web page. Following that you will receive a page showing all unrestricted content in AKO.

Select: Nuclear and Counterproliferation

This will bring you to the Nuclear and Counterproliferation page. Scroll towards the bottom and you will see ***Combating WMD Journal***. There you can find back issues.

***Do you have information to share with the "CWMD Community?"***

Get it posted here. Send your input to dcsg3usanca2@conus.army.mil, in the Subject line: ATTN: Editor, CWMD Journal

Note: The editor retains the right to edit and select which submissions to print.

**Peacekeepers**
A time exposure of eight Peacekeeper (LGM-118A) intercontinental ballistic missile reentry vehicles passing through clouds while approaching an open-ocean impact zone during a flight test.

(U.S. Air Force photo)

U.S. ARMY NUCLEAR AND CWMD AGENCY

Fort Belvoir, Virginia