Combating WMD JOURNAL

U. S. Army Nuclear and CWMD Agency

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"Peace Is Our Profession"
The U.S. Air Force during the Cold War

Countering Weapons of Mass Destruction:
Aligning Capabilities with National Strategy

Towards a New Deterrence

A History of Chemical Warfare Part II

The Zero Hour
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Inside the Journal

Combating WMD

3 Countering Weapons of Mass Destruction: Aligning Capabilities with National Strategy

By Mr. Al Mauroni

9 Just When We Thought the Hard Part Was Over

By LTC Andrae Brooks
Lawrence E. Boeing

11 Toward a New Deterrent Analysis and Recommendations for the Commission on the Strategic Posture of the United States

By The New Deterrent Working Group,
Introduction by VADM Robert R. Monroe

Science and Technology

18 The Zero Hour - Silver Bullets for Peace in the Middle East

By MAJ Todd Hathaway

22 Opportunities for Higher Education in Nuclear Engineering at the University of Maryland

By MAJ Todd Hathaway

History

24 Peace is Our Profession, The U.S. Air Force during the Cold War

By CW5 Stephen A. Gomes

30 Chemical Warfare: Part II

By Mr. A. Mark Diglio

37 USANCA Officially Opens New Headquarters

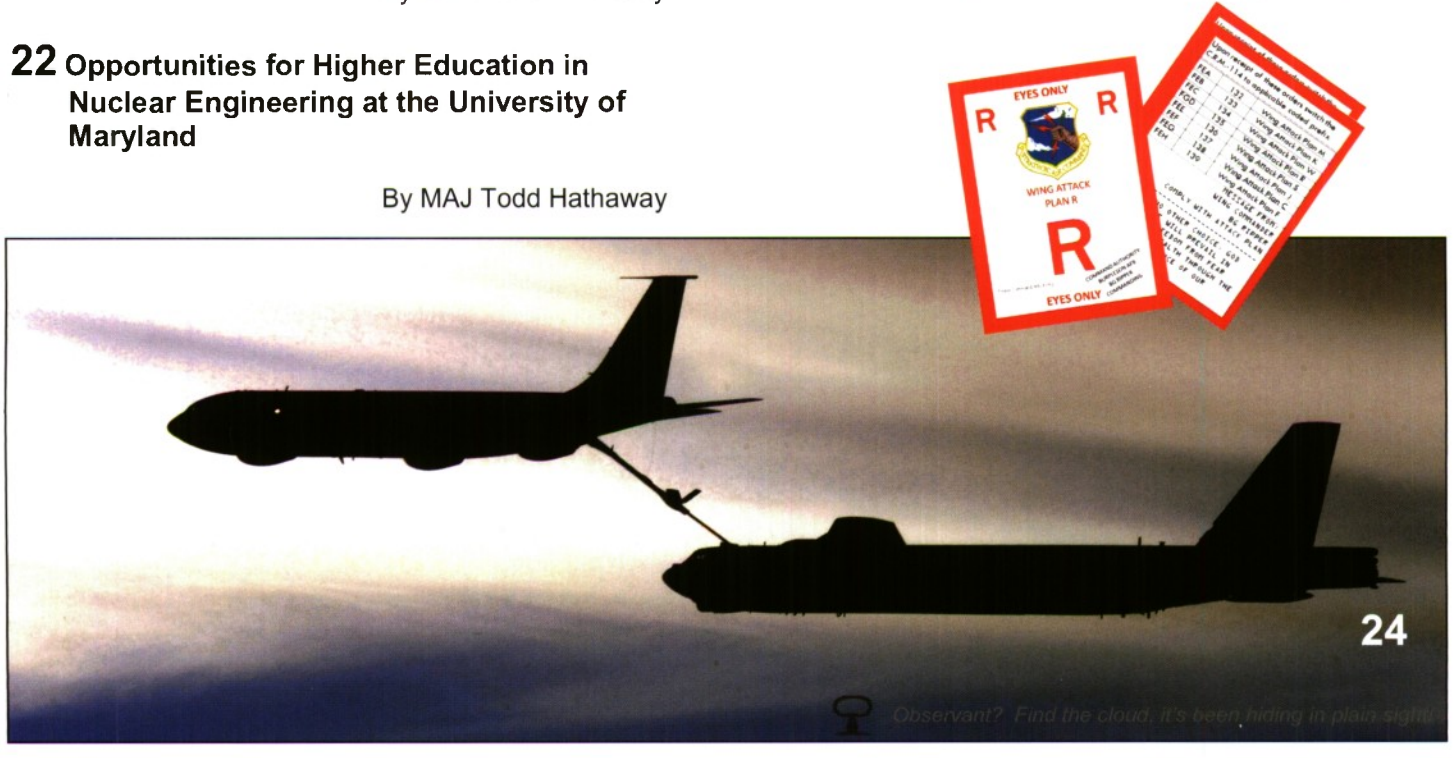
By Mr. Paul Bello, Fort Belvoir Eagle Staff Writer,
Ms. Marny Malin, Fort Belvoir Eagle Staff Photographer

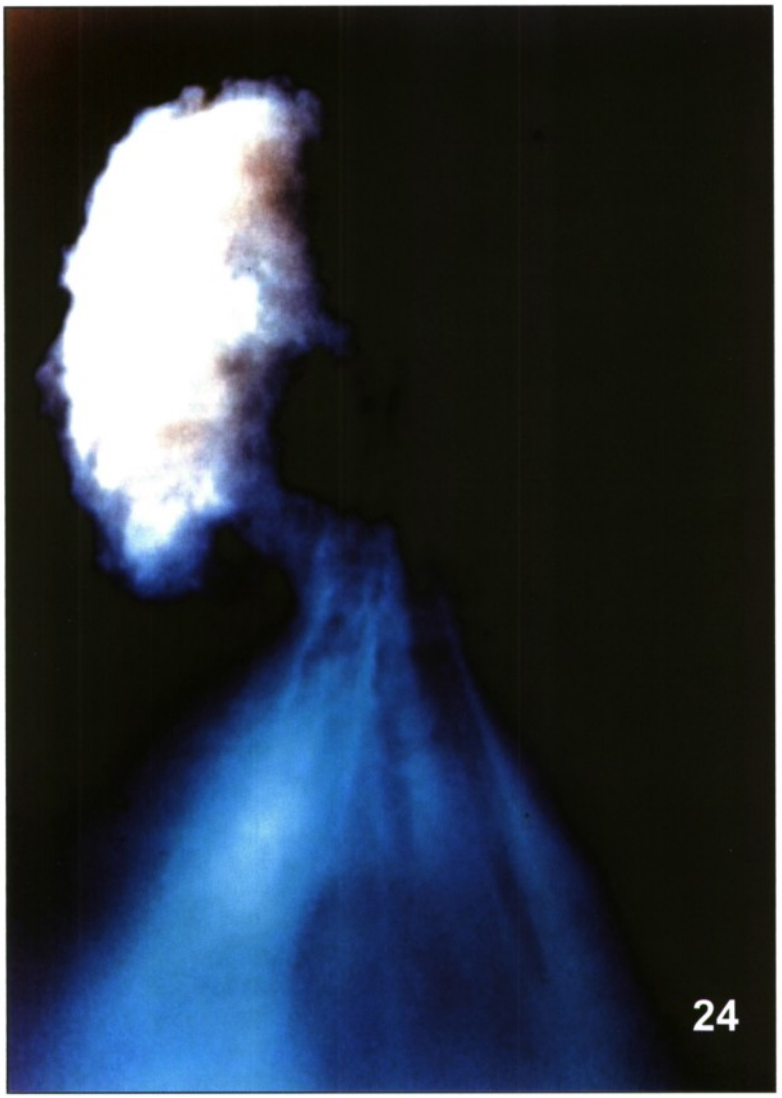
Book Review

38 Code Name: Downfall

By Lt Vern Conaway, USAF

Wing Attack Plan R cover sheet idea courtesy of Stanly Kubrick's movie, "Dr. Strangelove; or, How I learned to stop worrying and love the bomb"





COLUMNS

From The Director

1 CWMD Planning

By Mr. Peter Bechtel

36 International

CBRN Standardization in NATO (Non-Medical)
By Mr. Frank R. Jordan

Do You Know...

16 Medical Microbots Are Nearer Than You Think?

By Mr. Robert Pfeffer

40 Combating WMD Resources

Combating WMD Resource Page

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CWMD Planning

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Geographic Combatant Commands (GCCs) recently completed the Joint Planning and Execution Community (JPEC) review process for their respective Combating WMD (CWMD) campaign plans. This process sought to align the aforementioned plans with various national-level strategies and strategic guidance documents (e.g., Guidance for the Employment of the Force). As a result, each GCC CWMD campaign plan embraces an operational design that provides a common planning framework for CWMD across geographic boundaries and global commons. However, the rather broad end states and strategic objectives found within theater-level campaign plans often presents challenges for the Army when viewed through the lens of full spectrum operations (FSO) and when implemented through the elements of ground combat power (e.g., movement and maneuver, intelligence, fires, etc.). Operational granularity remains paramount to Land Component Commanders (LCCs) as they will bear the brunt of CWMD execution. Therefore, it is imperative that CWMD planning at the Army Service Component Command (ASCC) enlist the operational tenets of land warfare.

This is where USANCA excels as a Field Operating Agency (FOA); we have explored several planning models with the ASCCs and standing US Field Armies in an endeavor to develop tailored, well coordinated, and executable CWMD campaign support plans. There are several key areas where USANCA influences or directly supports ASCC activities as illustrated by figure 1. Under AR 10-16, USANCA is able to field two unique capabilities to accomplish the nuclear and CWMD mission. The first such capability is the CWMD Planning Assistance Team (CPAT); the second is the Nuclear Employment Assistance Team (NEAT). As the CPAT name implies, it is designed to provide technical expertise across the operational and tactical spectrum of CWMD to ASCC staffs. We have already experienced a great deal of success participating in the USFK and USARCENT planning efforts. At present, USANCA teams are poised to assist 8th US Army, USARPAC, and USARAF. In the next twelve to eighteen months, the weight of USANCA will lend doctrinal fidelity and operational depth to all ASCC planning efforts.

Culminating our engagement activities for fiscal-year 2009 was the 4th Annual Army Combating Weapons of Mass Destruction Conference held at our new facility on Fort Belvoir from 15-17 September 2009. The purpose of the Army CWMD conference was to provide a forum for dialogue across the Army CWMD community to address key Army CWMD issues. There were 78 attendees at the conference including representatives from all of the Army Service Component Commands (ASCCs), the Joint Staff, the Army Staff, Defense Threat Reduction Agency (DTRA), 20th SUPCOM, TRADOC, FORSCOM, Army Material Command (AMC), Office of the Secretary of Defense (OSD), Office of the Surgeon General (OTSG), Edgewood Chemical Biological Center (ECBC), Defense Intelligence Agency (DIA), National Ground Intelligence Center (NGIC) and USANCA. ASCCs were the main focus of the conference. Our goal was to identify and address key CWMD planning issues and capability gaps affecting the Army's ability to support Geographic and Sub-Unified Command plans for CWMD. The high level of participation allowed us to identify a number of issues that have the potential to significantly improve the ASCCs' planning and support efforts.

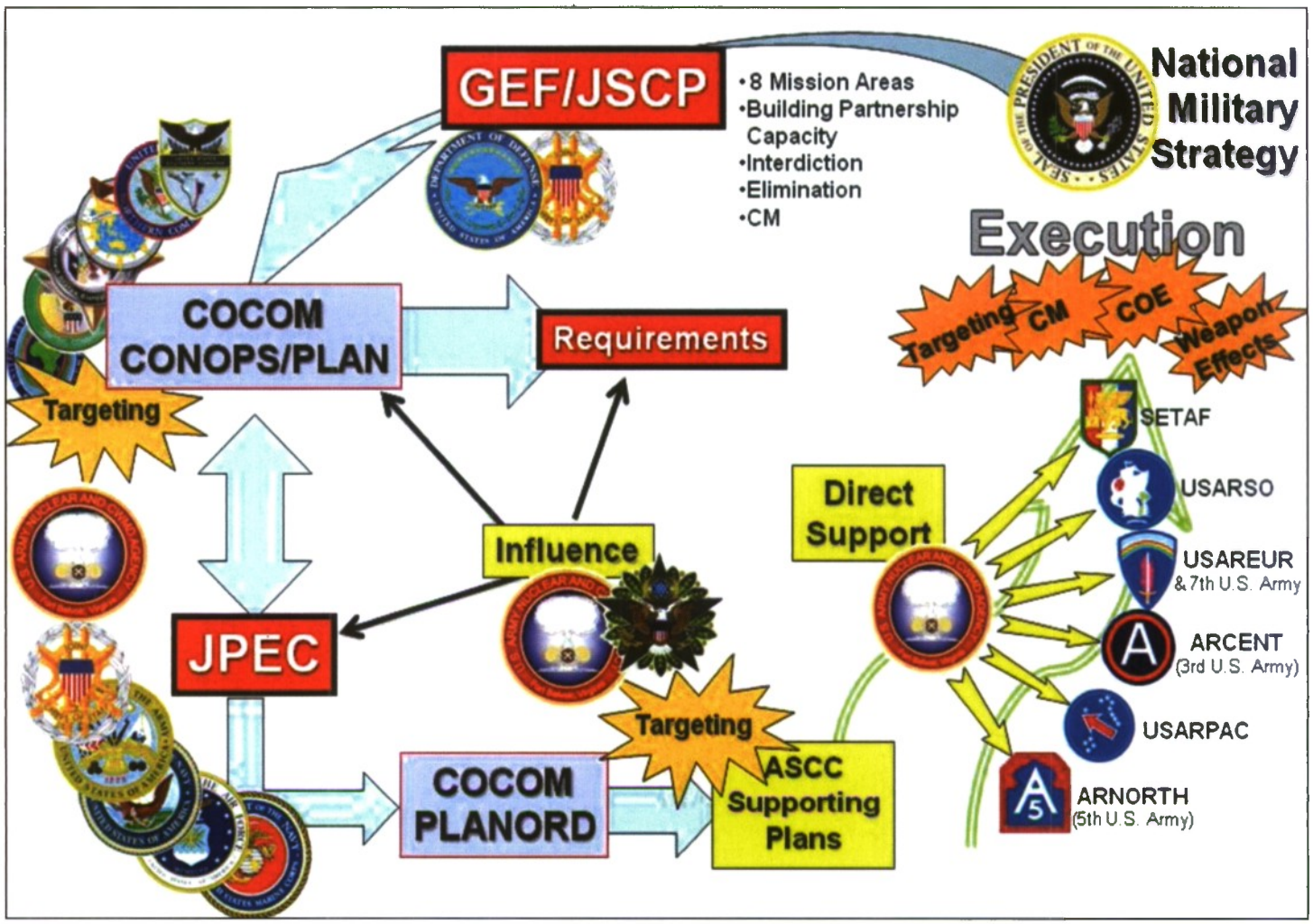

Figure 1. USANCA Planning Support.

This is only the start for the annual process. The Army Council for CWMD (ACCWMD) is the mechanism for continuing deliberations and consultations. The ACCWMD using three distinct working groups will cover Policy; Plans and Operations; and Capabilities, will meet on a regular basis as a mechanism for exchanging information and addressing issues. As the various ASCC CWMD plans garner fidelity, those mature plans should assist with informing nascent planning efforts. USANCA is postured to assist this linkage, and to advocate for resources within the Army Staff, TRADOC, and FORSCOM.

Finally, USANCA maintains the capability to employ Nuclear Employment Augmentation Teams (NEAT). NEAT provides offensive nuclear planning support to augment ASCC and LCC staffs in support of training, planning, exercises, and operations. This includes providing analysis of consequences of execution and, most importantly, the potential impact of planned nuclear strikes on maneuver operations. USANCA coordinates with and supports U.S. Strategic Command Center for combating WMD, DTRA and other Joint and Service staffs in maintaining an ability to compute, coordinate, nuclear weapons safety, effects, target coverage data, and target analysis procedures for all nuclear weapons of all U.S. Services and NATO. Because of these relationships and their understanding of nuclear weapons effects and nuclear targeting, NEAT personnel also provide support to the Defense Threat Reduction University in presenting the Theater Nuclear Operations Course.

Providing CWMD and nuclear targeting expertise and support to the Army is a mission essential task for USANCA. USANCA planners are engaged in the CWMD planning process; we have enjoyed the privilege of assisting in the development of GCC CWMD plans throughout the JPEC review process; taken requests for follow-on technical and planning support; stand ready to assist ASCCs and JFLCCs in planning, coordinating and executing their CWMD missions.

Countering Weapons of Mass Destruction: Aligning Capabilities with National Strategy

Mr. Al Mauroni
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At a past conference at the National Defense University, I made a comment about the nebulous nature of the term "weapons of mass destruction" or WMDs. I suggested that our ability to develop and evaluate distinct concepts and capabilities to counter WMD threats was impaired by the deliberate avoidance of using direct, clear terms that address homeland security requirements distinct from warfighter requirements. People use the term "WMD" when they are clearly only interested in addressing nuclear weapons, for instance. A member of the audience waved me off. "We know what we mean when we say 'WMD,'" he said. At the break, a man from the State Department approached me. "Definitional clarity is the beginning of all wisdom," he said. Currently, we lack that definitional clarity.

The U.S. Joint Forces Command released a document outlining the "Joint Operating Environment 2008" in December 2008. This document assures us that the "the threat of mass destruction – from nuclear, biological, and chemical weapons – will likely expand from stable nation-states to less stable states and even non-state networks."[1] The Department of Defense (DOD) "Capstone Concept on Joint Operations,"[2] released in January 2009, touches on the need to address the threat of WMDs in both conventional and irregular conflicts of the future. Two imperatives that require implementation to allow the success of this concept include the need to:

- Improve knowledge of and capabilities for nuclear warfare and operations in chemical, biological, radiological and nuclear environments.
- Renew emphasis on and understanding of strategic deterrence, including nuclear deterrence.

The *National Military Strategy to Combat WMD* parrots the *National Strategy to Combat WMD* in its concept and terms. Both purport to identify a "nexus" between international terrorist organizations and nation-state WMD programs, without clearly defining the differences between homeland security and warfighting concepts. The Deterrence Operations Joint Operational Concept (JOC) and the Combating WMD Joint Integrating Concept (JIC) discuss nuclear weapons and WMD issues (respectively), but these concepts are stove piped and not integrated into the mainstream of military operations and strategy. The few joint publications specifically addressing WMD issues are, sadly, a mulligan's stew of tactically-focused tasks and procedures from the four services, and are not focused at the strategic level. Throughout the Department, discussions of conventional or irregular warfare overinflate the threat of WMDs on the modern battlefield and treat the issue as a "special topic" – a threat that needs to be considered, but dealt with at the national strategy level. Meanwhile, those responsible to address this topic within the Office of the Secretary of Defense studiously ignore WMD issues in light of "other priorities."

There is no clearer example of this doctrinal dyslexia than how combating WMD is portrayed in the Universal Joint Task List. Consistently over the past seven years, there has been no visible, organized attempt to identify the WMD tasks associated with combating terrorism and homeland defense/civil support tasks as distinct from those faced by military forces facing a nation-state adversary. Instead, they are all consolidated under the topic of "combating WMD," which primarily addresses the protection of US military forces during conventional operations. Instead of recognizing that these are distinct concepts, it became easier to just move all WMD tasks into one basket. This threat-based approach to viewing complex, strategic unconventional warfare weakens our understanding of this important topic. As a result, the military community has struggled – and failed – to discuss and evaluate the capabilities of nuclear deterrence and combating WMD within defense policy, the defense budget, and overall modernization requirements.

The issues of employing nuclear weapons and protecting military forces from WMDs are complex, but this should not be an excuse to ignore them. In the "Report of the Secretary of Defense Task Force on DOD Nuclear Weapons Management," Dr. James Schlesinger observed that DOD has not addressed the capabilities required to execute nuclear deterrence within the evolving Joint Capability Area (JCA) structure.

The JCA framework is an ongoing attempt to functionally group DOD capabilities to support capability analysis, strategy development, and investment decision-making. Schlesinger believed that the absence of a "Strategic Deterrence JCA" at the top tier negatively impacts the Department's effectiveness in addressing modernization of nuclear weapons and associated delivery systems (specific aircraft and submarines).

Important national and DOD-level documents refer to nuclear deterrence with varying degrees of clarity. The 2006 Quadrennial Defense Review (QDR) states that the nuclear deterrent will remain robust as a keystone of U.S. national power. Other policy documents subsume nuclear weapons in the terminology of kinetic strike or WMD. All make reference to nuclear deterrence but stress developing additional, nonnuclear capabilities to increase the number of options available to the President. Most of the documents deal with the strategic aspects of force employment. This results in deterrence capabilities being taken for granted. Recent history has demonstrated that without adequate policy articulation and oversight by the DOD, the military services will not be motivated to sustain the nuclear deterrent—and will use the resources elsewhere.

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As opposed to force employment capabilities, in recent years the military has tended to discount the political and psychological element of deterrence and focus exclusively on whether there were sufficient weapons to threaten or attack a set of targets. Such a criterion, employed by some in the military for deciding whether a weapon system is "militarily cost-effective," misses the crucial point of whether the weapon system can contribute to overall deterrence. This concept is important for the deterrence umbrella, because different capabilities provide different levels of deterrence, assurance, or dissuasion depending on the potential adversary or ally and its individual psychology. The same principle also holds true for the dissuasion of adversaries and provides greater political maneuverability to control escalation. The creation of the recommended Portfolio/JCA for deterrence and fenced funding for nuclear capabilities would help address these shortfalls in the current process.[3]

There are nine Tier 1 JCAs, 35 Tier 2 JCAs, and 116 Tier 3 JCAs in the latest framework.[4] The Department's intent is to manage the top-level JCAs as vetting boards and "capability portfolios" during requirements development, budget reviews, and policy discussions. During past reviews of the JCA taxonomy and definitions, there was a discussion as to whether the capability to "combat WMD" ought to be identified as a discrete Tier 1 JCA. The combating WMD advocates not only lost their argument for a Tier 1 JCA, but also the following proposal to see it as a subordinate Tier 2 capability under the Protection JCA. Instead, the eight mission areas identified within the *National Military Strategy to Combat WMD* are addressed in three Tier 1 JCAs – offensive operations under "Force Application;" threat reduction cooperation and security cooperation and partner activities under "Building Partnerships;" and WMD interdiction, WMD elimination, active defense, passive defense, and consequence management under "Protection." [5] In addition, the capabilities of situational awareness of the presence and movement of WMD technology and material and WMD attribution are addressed under "Battlespace Awareness." [6]

Similarly, strategic deterrence is currently addressed by capabilities identified under Force Application, Building Partnerships, and Protection. It may be true that the Department has not actively addressed the elements of strategic deterrence under the JCA taxonomy or developed a modernization plan based upon the new JCA taxonomy. However, the Department has made the decision that both strategic deterrence and combating WMD, while important concepts, are executed through the application of particular capabilities that also address conventional warfare concepts, rather than as a distinct, parallel capability area.

This is not necessarily a bad thing; in fact, the decision ought to be applauded, from an academic point of view. The military capabilities required to execute strategic deterrence and combating WMD are not separate and unique from those currently required to execute combat functions during conventional and irregular operations. Whether the Joint Staff and Services actually view and manage strategic deterrence and combating WMD functions appropriately is another story. The Protection Functional Capability Board (FCB) – the groups that meet to review and vet issues for each Tier 1 JCA – reviews all combating WMD mission areas except for offensive operations, which is handled by the Force Applications FCB. The board does not distinguish homeland security capabilities or antiterrorism programs as distinct from those required for military combat operations. As Dr. Schlesinger notes, there is no clear pathway for strategic deterrence capabilities. The current JCA taxonomy does not allow the Department to make serious reviews as to aligning resources against required capabilities to counter WMD.

Assessing Capabilities to Counter WMD

Perhaps the greatest challenge in assessing DOD capabilities to combat WMD or to effect strategic deterrence is the poor development of these concepts in light of current operational and strategic concepts of warfare. It is difficult to clearly articulate what military capabilities are required for combating WMD when its "Joint Integrating Concept" is incoherent and too broadly based. Consider that document's stated end, ways and means to combat WMD:

- **End**: The United States, its Armed Forces, allies, partners, and interests are neither coerced nor attacked with WMD.

- **Ways**: The Joint Force Commander (JFC), in support of globally integrated Unified Action, will conduct a campaign to proactively and comprehensively dissuade, defeat, deter, or

mitigate the rogue behavior of multiple networks of state and non-state actors. The JFC focuses the military campaign against the decision-making calculus of the WMD actor. The JFC will influence this decision-making calculus through selective application of military capabilities against an expanded operational environment to impose costs or deny benefits or to influence the perception of costs, benefits, and value of restraint for any WMD-related course of action.

- **Means**: Fully integrated US Armed Forces capabilities linked across components, echelons of command, and elements of Unified Action and enabled by a common and collaborative information environment.

Classic Pentagonese, for those familiar with the language. One might summarize the "ways" section by stating that US military forces will seek to compel adversaries not to use WMDs by all available means. The Joint Integrating Concept elaborates upon the "ways" section by identifying four military strategic objectives, which in turn lead to the eight combating WMD mission areas. This construct allows the Department to then identify and analyze discrete tasks necessary to accomplish the missions, and correspondingly, the capability gaps that exist. But the major challenges with this concept remain:

- Equating nuclear, radiological, biological, and chemical weapons as equal threats under the term "WMD."
- Viewing general terrorist capabilities to use CBRN hazards in discrete, small-scale events as equivalent to those of nation-states with large WMD programs.
- No clear distinction between capabilities required to protect military forces during war and capabilities required to support anti-terrorism programs that protect noncombatants and military installations.

Faulty assumptions of the current and future WMD threat; to wit:

* That state pursuit of WMD will continue and the number of WMD-capable states opposed to US interests will grow (they have actually declined over the past three decades).

* That state support of terrorists' pursuit of WMDs will continue (no such activity by any distinct group has actually been noted or reported).

* That those terrorists "inclined towards rogue behavior" will be more capable of pursuing WMDs without state sponsorship (pursuit should not be equated to achieving a capability to cause mass casualties).

When the DOD Counterproliferation Initiative was developed in the mid-1990s, it was focused on the threat of adversarial nations lacking nuclear weapons but having an offensive CB weapons program. This concept, which evolved into the *National Strategy to Combat WMD*, was fundamentally altered in 2000-2001 to remove consequence management as a subordinate capability to counterproliferation and to become an equal "pillar" with nonproliferation and counterproliferation.[7] The strategy viewed nuclear weapons, either in the hands of terrorists or nation-states, as the most challenging threat, but used the term "WMD" as its default expression. This was a purposeful act, designed to develop a single national strategy that addressed both homeland security response to potential terrorist CBRN incidents and military operations against nation-state WMD programs. The *National Military Strategy* developed later, purported to address homeland security, but to a large extent, it remained a modification of Cold War proliferation theory for use against nation-states, rather than one designed to plan for and respond to domestic WMD terrorism.[8]

Because of this ambiguity in the *National Military Strategy*, material projects developed to address the armed forces' requirements are competing with those projects designed for homeland security functions (e.g., chemical and biological detectors designed for combat operations and the equipment used by the WMD Civil Support Teams). Proposed concepts for combating terrorist WMD efforts, such as improving information, surveillance, and reconnaissance capabilities to identify the flow of WMD materials and technologies, are confused with pandemic flu surveillance concepts. The deliberate ambiguity in the national strategy, with its focus on a specific *threat*, has weakened the Department's ability to develop focused *capabilities* to counter WMD threats.

To correct this ambiguity, the Department should immediately pull references to "non-state actor pursuit of WMDs" and "enabling WMD networks" from its strategy and concepts and make it clear that the current *National Military Strategy* addresses the protection of its armed forces from nation-state unconventional weapon programs. There is no evidence of the collaboration of terrorist groups and "rogue nations" to exploit WMD capabilities, and it is unclear whether there are "networks" to attack as the means to defeat them. The counter-terrorist community needs to address the threat of terrorists seeking CBRN hazards, just as it addresses the general threat of all terrorist activities. The Department needs capability-based concepts and tools, not strategies that address specific tactics and weapons.

Similarly, the Department's efforts to address WMD threats within the scope of homeland defense and civil support ought to be clearly segregated as a distinct threat from nation-state forces poised to attack military forces. While the technical aspects of CBRN hazards and WMDs are similar, the targeted audiences are different, the desired level of risk to the responders is far different, and DOD forces are acting in support to other federal agencies or governments rather than as lead agents. The De-

Table 1. Capability Framework for Protection Addressing Conventional Threats, WMD Threats and Homeland Security Missions.

Tier 2	Tier 3	Counter-proliferation	Combating Terrorism	Homeland Security (DOD Aspects)
Prevent and Defeat Significant Threats		WMD Interdiction	Antiterrorism – Physical Security	Homeland Defense – Threat Awareness
	Detect Threats Prior to Employment			
	Control Access to Critical Areas			
	Investigate and Intercept Threats			
	Seize Materials and Defeat Weapons			
Protect Individuals, Systems, and Facilities		Active & Passive Defense	Antiterrorism – Resource Application	Critical Infrastructure Protection (DOD)
	Assess Infrastructure & Assets			
	Implement Protective Measures for Critical Facilities			
	Mitigate Risk to Individuals and Systems			
	Provide Threat Information to Leaders			
	Provide Force Health Protection			
Respond to the Incident/Accident		Battlefield Consequence Management	Domestic/Foreign Consequence Management	Civil Support
	Assess the Hazard and Understand the Consequences			
	Provide Hazard Info to Leaders			
	Minimize Hazard to Individuals			
	Manage Casualties			
	Support Initial Federal Response to the Incident/Accident			
Recover Fully from the Incident/Accident		WMD Elimination	Humanitarian Assistance/ Disaster Relief	Emergency Preparedness
	Provide Impact Analysis			
	Reconstitute the Infrastructure			
	Restore the Environment			
	Dispose of Hazardous Materials			

partment should not confuse the need to protect military personnel from WMD effects during high-risk combat operations with the much more challenging requirement of responding to a terrorist CBRN incident to protect noncombatants within the United States.

The Problem with Protection

The JCA taxonomy is not the easiest thing to understand. Basic military capabilities for the Army used to be as simple as "shoot, move, and communicate." Because the JCA taxonomy is designed to link common capability requirements, defense policy, and budget strategies together, it has gotten more complicated. "Force Application," while retaining two simple subtasks – move and engage – is detailed down to more than 80 subtier capabilities. That may be due to the parochial concerns of the four services when it comes to the understandably important area of offensive capabilities designed for a future battlefield. Various communication capabilities can be found in "Battlespace Awareness," "Net-Centric" operations, and "Command and Control." Combat support services can be found in "Logistics" and "Force Support" capability areas. The goals of "Building Partnerships" and "Corporate Management" are not hard combat capabilities, but reflect desired DOD capabilities necessary to execute the Department's missions. And then there is "Protection."

The Protection JCA is broken into two aspects – preventing attacks and mitigating effects.[9] Under the prevention capability, the goal is to defeat kinetic and non-kinetic[10] weapons that are delivered from the air and space, from the earth's surface (ground or sea), and from below the surface (underground or under the

Marines don chemical gear at a range in the Middle East.
USMC Photo by Cpl. Jeremy Ross [12]

sea). Under the mitigate capability, the goal is to minimize the impact of lethal and non-lethal threats, to include chemical, biological, radiological, nuclear, electromagnetic pulse (distinct from nuclear weapons effects), explosives, projectiles, directed energy, and natural hazards. This is the only JCA in which the underlying tiers are threat-based rather than capability-based actions. That bears repeating – directly contrary to the original philosophy of the JCA framework, the underlying concept of the Department's Protection JCA is threat-based.

In addition to articulating threat-based requirements, the Protection JCA is poorly designed to address the gamut of capabilities required for force protection (anti-terrorism) and homeland security. Certainly there is more to homeland defense and civil support than "preventing" and "mitigating." This framework is entirely too simplistic and focused on traditional combat operations, and does not address the full spectrum of DOD force protection requirements. For instance, the JCA does not include force health protection, the capability to "sustain and protect the health" of military service members. Force health protection is included under "Force Support" with other medical capabilities. Similarly, general engineering, required to "modify, maintain, or protect the physical environment" is under the Logistics JCA instead of Protection. Combat engineering, required to *support* land combat maneuvers by defeating hazards and enhancing survivability, is not under Force Support or Protection, but is also in Logistics. One sees here a selective application of individual agendas by specific communities for convenience rather than by derived logic.

The Joint Staff and Services have been intellectually lazy in this area. There is another model for Protection, readily available, found in the Department of Homeland Security's mission area analysis. The overall mission of "Secure the Homeland" is supported by four missions: Prevent, Protect, Respond, and Recover. [11] Using the framework within this document, and ignoring the Joint Staff's rule that a sub-tier cannot use the same words as in the Tier 1 title, one can develop a capability-based framework for Protection that addresses conventional threats, WMD threats, and homeland security missions (see table 1).

This is by no means an exhaustive list, but it is an illustrative example of how the Protection JCA could be modified to become a capability-based framework that accurately addresses the mission areas within counterproliferation, combating terrorism, and homeland security. At the same time, the Building Partnerships JCA must take on the burden of identifying and assessing nonproliferation activities, to include security cooperative agreements and threat reduction programs. These activities are in line with the responsibilities of that JCA, and they should not be abrogated to the Protection JCA merely out of convenience or attempts to bundle all combating WMD mission areas under one umbrella.

Fundamentally, the Department needs to reassess how it has developed the concepts of strategic nuclear deterrence, combating WMD, and combating terrorist WMD. The 2002 *National Strategy to Combat WMD* is not a valid approach for today's WMD challenges, as it was based on faulty assumptions to begin with. The Department needs a grand strategy that addresses how the armed forces, in coordination with other federal agencies, *counter* WMD activities to ensure the ability of its military forces to move, shoot, and communicate unhindered by nation-state use of WMDs. This counter WMD strategy should be viewed as a three-legged stool, requiring strategic deterrence, nonproliferation, and counterproliferation for optimal stability. Another key aspect is the return of consequence management (specifically addressing military installations and facilities attacked by nation-states with WMD capabilities) as a subordinate element to counterproliferation. Similarly, we should use the term "defense support to civil authorities" or civil support when referring to the DOD support to the overall federal response to domestic catastrophic disasters and incidents. Continuing to define "WMD" or "CBRNE" consequence management as if it were distinct from all other incident management is ridiculous and self-defeating.

The homeland security and combating terrorism communities should address the possibility of terrorist CBRN incidents under an all-hazards approach, integrating all federal activities addressing the response to a terrorist CBRN incident under the

National Response Framework. Even given the unlikely (and unproven) scenario of a terrorist organization accepting WMD materials or technology from a nation-state, it is unlikely that the resulting incident will even come close to the descriptions of mass casualty events so clearly illustrated in the worst-case scenarios. The key to successfully implementing these strategies is the ability to develop accurate and timely threat assessments that both identify terrorist capabilities and motivations and the location and activities of nation-state experts and production facilities associated with WMD programs.

The Department needs to consider how strategic deterrence will be incorporated into the JCA framework. Given the past series of events in regards to Air Force nuclear security and operations, this review is urgently needed. As a starting point, it might be suggested that capabilities under Force Support, Battlespace Awareness, Force Application, and Building Partnerships be examined as fundamental components of strategic deterrence.

Conclusions

Current and past documents throughout DOD assure us that WMDs remain one of the gravest threats to our armed forces and to American civilians in the homeland. And yet it cannot be said that those responsible for developing defense strategies and concepts for strategic deterrence have been very successful in maintaining that very critical capability. The Department has not designed a strategic deterrence concept for the post-Cold War.

We do have distinct concepts and cost-effective capabilities for protecting military forces on the battlefield, but they are not interchangeable with the mission of protecting noncombatants. The antiterrorism programs for US military installations and facilities still lack sustainable and effective CBRN defense equipment, despite the development of a specific concept of operations for that capability in 2004. Our homeland defense and civil support programs addressing the terrorist WMD threat have been developed in an ad hoc and stove piped fashion. The common thread among these challenges is the inability to conceptualize the capabilities required for countering WMD.

The DHS mission areas of Prevent, Protect, Respond, and Recover, with some minor modifications in the sub-tiers of those missions, offer a potential avenue for relief. By developing a construct of tiered capabilities under the Protection JCA that equally address counterproliferation, combating terrorism, and homeland security, the Department can – for the first time – have a distinct set of tools to examine common needs for protection against WMD threats while retaining necessary characteristics unique to each concept. However, the Department must also take the additional step of directing the Building Partnerships JCA to take charge of the nonproliferation mission areas, and perhaps aspects of consequence management and WMD interdiction, since those mission areas also require partnerships to succeed.

Al Mauroni is a senior defense consultant working in the Washington DC metro area. A former Chemical Corps officer, he has more than twenty years experience in DOD chemical-biological defense programs and policy issues. He has published numerous articles and six books on the topic, the latest of which is "Where Are the WMDs?" by Naval Institute Press, 2006.

ENDNOTES

1 JFCOM, "Joint Operating Environment 2008", December 2008, available at http://www.jfcom.mil/newslink/storyarchive/2008/JOE2008.pdf.

2 DOD, "Capstone Concept for Joint Operations, Version 3.0," January 2009, available at http://www.jcs.mil/090115CAPSTONEConceptJointOps.pdf.

3 DOD, "Report of the Secretary of Defense Task Force on DOD Nuclear Weapons Management," December 2008, pp. 25-28. Available at http://www.defenselink.mil/pubs/pdfs/PhaseIIReportFinal.pdf.

4 Based on the JCA Framework dated January 12, 2009, available at http://www.dtic.mil/futurejointwarfare/strategic/jca_framework.xls

5 The breakout of combating WMD mission areas among respective JCAs was based upon an independent review of the defense issues identified within the 2008 Guidance for the Development of the Force document.

6 Situational awareness and WMD attribution are not mission areas but are identified capabilities under the combating WMD concept.

7 Author's personal observation while working in the J5 Strategy and Policy directorate, Joint Chiefs of Staff.

8 This statement was made at a briefing by a Defense Science Board member at a U.S. Strategic Command conference in November 2005 in reference to its 2005 Summer Study on Reducing Vulnerabilities to Weapons of Mass Destruction, which was released in 2007.

9 OSD made the decision to place the Tier 2 area "Research and Development" in Protection, not because it belonged there, but because it didn't want that area to be under Corporate Management. For the sake of this argument, this paper ignores this recent and hopefully reversible decision.

10 Interestingly, the JCA definitions describe chemical, biological, and radiological hazards as "non-kinetic weapons," although they are often delivered by kinetically-based weapon systems.

11 Homeland Security Institute, "Homeland Security Strategic Planning: Mission Area Analysis," Arlington, VA, March 28, 2007. Available at http://www.homelandsecurity.org/hsireports/MAAReportFinal28Mar07public.pdf.

12. www.defendamerica.mil/photoessays

Just When We Thought the Hard Part Was Over

LTC Andrae Brooks
U.S. Army Nuclear and CWMD Agency

Lawrence E. Boing
Special Projects Manager,
Nuclear Engineering Division, Argonne National Laboratory

Having recently become a FA52 at the ripe old age of 41 and the rank of LTC, I find the list of potential CBRN related issues and functional work to be somewhat overwhelming, yet fascinating. I agree that the crossover or "nexus" of CBRN and radicalism is in fact a daunting task to imagine, prepare for, and ultimately prevent. However, what I find as equally critical, the vast FA52 job opportunities that require an experienced officer that is well versed and yet understands the full breadth of what exactly "CBRN" really entails these days.

In addition to the core engineering science and fundamentals of the nuclear genre, the abstract CBRN related issues such as radiation and health physics, safety, environmental regulation, national defense, energy, capability design and survivability, intelligence interpretation, biological and chemical surety, international treaties such as the Chemical Weapons Conventions, NATO and ABCA, and even CBRN modeling and simulation (just to name a few) are all potential FA52 minefields that must be negotiated. We'll save the equally daunting laundry list of supporting CBRN agencies, organizations, departments, and centers for a follow-on article.

The point is: Combating Weapons of Mass Destruction and FA52 requirements are changing rapidly. Now, more than ever, FA52s must grasp the concept that CBRN includes so much more than the Cold War, Air Land Battle, and nuclear Mutual Assured Destruction. Ironically, these were the good old days. As such, it is now truly essential that all FA52s seize every training opportunity that will enhance the CBRN tool bag of experience and broaden the subject matter expertise of the officer in terms of CBRN.

As just one example of some new experienced based training that is available and an excellent educational opportunity for FA52s, Argonne National Laboratory (ANL) has developed a new training course for facility Decontamination and Decommissioning, or D&D. As a chemical officer I didn't even know there was a reactor in the DoD, yet alone on Aberdeen Proving Ground, Maryland. Now I find myself involved in and supporting the D&D project as a member of the technical support working group that will coordinate the shipment and disposal of low level radioactive waste! The Aberdeen Pulse Radiation Facility (APRF) research and test reactor was built in 1967 to serve the needs of the DoD, other U.S. Government agencies, and NATO in order to evaluate nuclear effects of both neutron and gamma radiation and permanently ceased all reactor operation in December of 2003 (Decommissioning Plan, Army Pulse Radiation Facility, Aberdeen Test Center, Revision 2, March 2008). The D&D for the APRF commenced in early summer 2009 with an estimated completion date of December 2009. Planning is underway and I am excited about learning the process, and providing some environmental assistance to the project leadership.

Removing a Heat a Exchanger

Initially, I attended the ANL D&D Training Course as a preparation activity and I found it to be well worth the time and cost. The lecturers were very knowledgeable and willing to answer questions openly and address attendee issues individually. Topics such as excavation tactics, techniques, and procedures, soil sampling (both environmental and radiation sampling and monitoring), D&D steps and procedures, historical (experience based) lessons learned, planning, safety, and overall project management were invaluable.

ANL has now (effective officially 1 April 2009) teamed up with ORAU (Oak Ridge Associated Universities) and established a Decommissioning Certification Program (DCP). Addi-

Cleaning up contaminated facilities at the Laboratory that are surplus to operational needs.

tional information and requirements on the DCP include:

DCP General Requirements:

- Program opens for Registration Annually.
- Participants are required to attend two core/requisite training courses with one additional elective preferably within a 24 month period (not mandatory to the timeframe, but suggested)
- Upon completion of the 3 training courses and verification by the ORAU program coordinators, the individual will be issued the Decommissioning Certificate.

ORAU will maintain a database of the Database of Certificate issued for the record.
Important Note: Any of the training courses can be taken separately outside of the DCP if desired by the participant.

DCP Participation:

- Open to any interested participant – foreign or domestic.
- Technical background or other degrees or educational background is highly encouraged, useful, and recommended.
- Fees are inclusive for the training course with any additional administrative expenses.

DCP Requisite Courses:

- Facility Decommissioning (ANL) http:www.dd.anl.gov/ddtraining/index.html
- MARSSIM (Multi-Agency Radiation Survey and Site Investigation Manual) http://www.orau.org/busops/ivhp/health-physics/marssim-course.htm

DCP Elective Training Courses:

- Any of the RESRAD Workshops (ANL)
- Site Characterization Course (ORAU)
- Gamma Spectroscopy Course (ORAU)

Note: Additional Information on the Program, Upcoming Events, and Points of Contact can be found at:
http://www.dd.anl.gov/ddtraining/certificate_program.html
http://www.dd.anl.gov/ddtraining/certificate_program.html

In closing, this article is in no way meant to be an advertisement for Argonne or ORAU, rather as information to be used for the FA52 community. The new Decommissioning Certification Program is an excellent additional "spanner" in the CBRN tool bag and serve as a reminder of just how broad and diverse the CBRN challenge can be for a junior FA52 Officer.

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His email address is andrae.brooks@us.army.mil.

Lawrence E. Boing is a graduate of Purdue University . He manages the Special Projects within the Nuclear Engineering Division of Argonne National Laboratory. Manages various decommissioning areas focusing on: international decommissioning activities, technical assistance/oversight in niche areas of decommissioning, supporting technical information exchange and training courses on various decommissioning and related technical topics for the past 29 years.

Toward a New Deterrent
Analysis and Recommendations for the Commission on the Strategic Posture of the United States

By the New Deterrent Working Group
Introduction by VADM Robert R. Monroe, USN, Retired

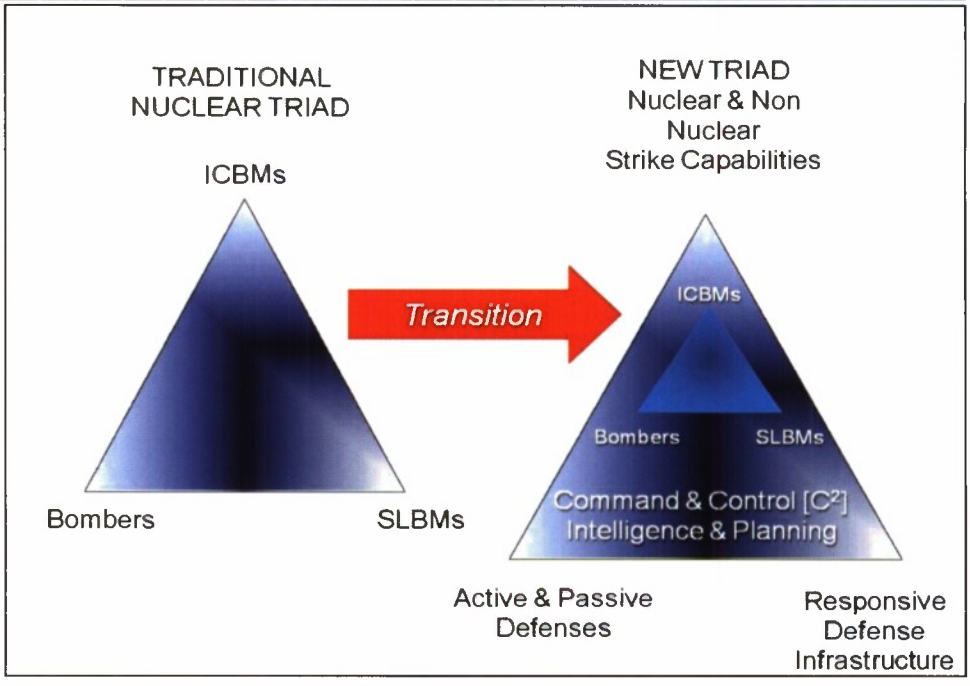
AIR & SPACE POWER JOURNAL The Professional Journal of the United States Air Force

Introduction

America's nuclear deterrent, which has kept us safe for over 60 years, is in grave danger of failing. Our nuclear strategy-still that of the Cold War-has little relevance to today's principal adversaries and threats. The nuclear weapons that make up our stockpile are also virtually irrelevant and well beyond the end of their design life. Our experienced personnel are retiring, and our nuclear facilities are antique and deteriorated.

Secretary of Defense Robert Gates recently stated that "no one has designed a new nuclear weapon in the United States since the 1980s, and no one has built a new one since the early 1990s. . . . The United States is the only declared nuclear power that is neither modernizing its nuclear arsenal nor has the capability to produce a new nuclear warhead."[1] To make matters worse, if we start a modernization program immediately, pursue it vigorously, and resume essential underground testing, it will still take about two decades before we could begin replacing our stockpile. Thus, the relevant issue is not whether our nuclear deterrent is safe, secure, and reliable today, but what actions we must take today to ensure its effectiveness in 20 years, in an uncertain and dangerous world.

After years of denying funding for nuclear initiatives, Congress last year created a 12-person Congressional Commission on the Strategic Posture of the United States, chaired by Bill Perry, former secretary of defense, and co chaired by Jim Schlesinger, former secretary of defense, secretary of energy, and director of central intelligence. The commission started work in summer 2008, delivered an interim report in December 2008, and will submit a final report in spring 2009.



Transition of the Traditional Nuclear TRIAD to New Triad.

Quite separately, in early 2008 the New Deterrent Working Group, an informal coalition of experts in national security and nuclear weapons, sponsored by the Center for Security Policy, became concerned that the commission would have only two "nuclear programs" to consider: one the unannounced "nuclear freeze" the United States has followed during the 18 years since the Cold War ended, and the other the "world without nuclear weapons" initiative recommended by Perry, George Shultz, Henry Kissinger, and Sam Nunn for the past two years. Both programs would lead to unilateral nuclear disarmament by the United States-the first unintentionally, the second intentionally. To outline a third program, that of a strong nuclear deterrent, the working group prepared the following remarks and provided them to the commission in the summer of 2008.

America's Failing Nuclear Deterrent

The United States is at a critical moment in its history. To an extent largely unknown to the American people and even to many US policy makers, the nuclear deterrent that has served as the backbone of our defense posture for 50 years is becoming obsolete, unreliable, and poten-

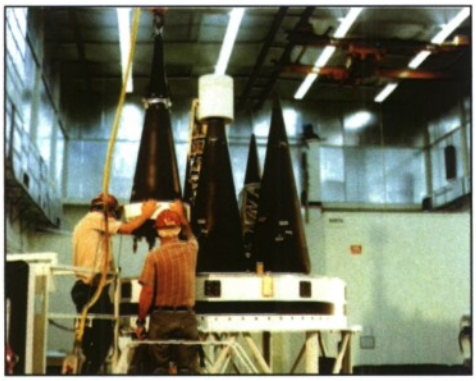


Photo: Department of Defense

tially ineffective. This is the direct and predictable result of the practice of essentially "freezing" our nuclear-weapons strategy and stockpile over the past 18 years since the end of the Cold War.

Unfortunately, we may freeze weapons policies and modernization programs, but our doing so does not preclude changes to the arsenal itself. To the contrary, such a nuclear freeze serves to ensure that the combined effects of aging and changing strategic circumstances go unaddressed, resulting in an inexorable reduction in capability and relevance to the nation's deterrent requirements. We have even refrained from making much-needed improvements to the stockpile's safety, security, and control rather than undertaking new designs that we could validate only by underground testing.

The problem is not confined to the weapons themselves. At the nuclear labs and plants operated by the National Nuclear Security Administration, the human and physical infrastructure essential to our deterrent is in real jeopardy. There is virtually no one left in that once-great industrial enterprise who has ever designed, tested, or produced a nuclear weapon.

Meanwhile, the Defense Department has downgraded the importance and value of nuclear weapons across the board. The investigation that followed a recent, unauthorized B-52 flight with six full-up nuclear weapons revealed a widespread lack of focused military attention to nuclear procedures and policy.[2] In short, America is years late in transforming its nuclear strategy and stockpile from a Cold War orientation to one focused on today's adversaries-as well as tomorrow's-and to the different and far more distributed threats they represent.

The Nuclear Threats We Face

While America has largely neglected its nuclear arsenal and associated weapons complex for nearly two decades, others have taken a very different approach. Notably, Russia and China are making significant investments in the modernization of their nuclear forces. We have reason to believe that some of these will involve highly advanced, specialized-effects nuclear weapons (known as "fourth generation" weapons).

In addition, nuclear-weapons technology has proliferated of late to a number of rogue states. There is reason to fear that one or more of these nations may be willing to help terrorist organizations acquire nuclear weapons-and perhaps use them. In short, more states today have active (if, in some cases, still-covert) nuclear-weapons programs than ever before. Apart from the United States, virtually all of these countries-comprising roughly half the world's population-are working to enhance their nuclear capabilities.

Like it or not, tens of thousands of nuclear arms exist around the world, and neither they nor the know-how and capability to make them are going to disappear. Knowledge, once gained, cannot be washed away by treaties-let alone by unilateral US nuclear disarmament. For generations to come, our lives and civilization will depend on effectively countering these threats.

The Failure of Nonproliferation

The accelerating proliferation of nuclear-weapons technology in places like Pakistan, North Korea, Iran, and Syria represents an indictment of the effort to prevent such a danger via arms control. The global nonproliferation regime has been steadily declining for many years, and it has now reached the point of impotence. The last Nonproliferation Treaty Review Conference, five years in preparation, achieved nothing. Non-nuclear-weapon states that have signed the treaty increasingly flout their international obligations by pursuing clandestine weapons programs under the guise of civilian power activities.

The success of such rogue states threatens to trigger regional proliferation cascades, which could soon become global. Some of our allies and friends who formerly relied on the US "nuclear umbrella" for protection could feel constrained to join these proliferators, in part as a result of their loss of confidence in our outdated arsenal and our ability and will to use it. This cascade might well lead to a world characterized by frequent use of nuclear weapons, from which there is no return.

To avoid such a frightening prospect, the United States must both eliminate questions about the credibility of its deterrent and adopt a more effective approach to nonproliferation. If we are to have any chance of fulfilling these two roles and averting an unimaginably dangerous world, we must change our policies and programs significantly.

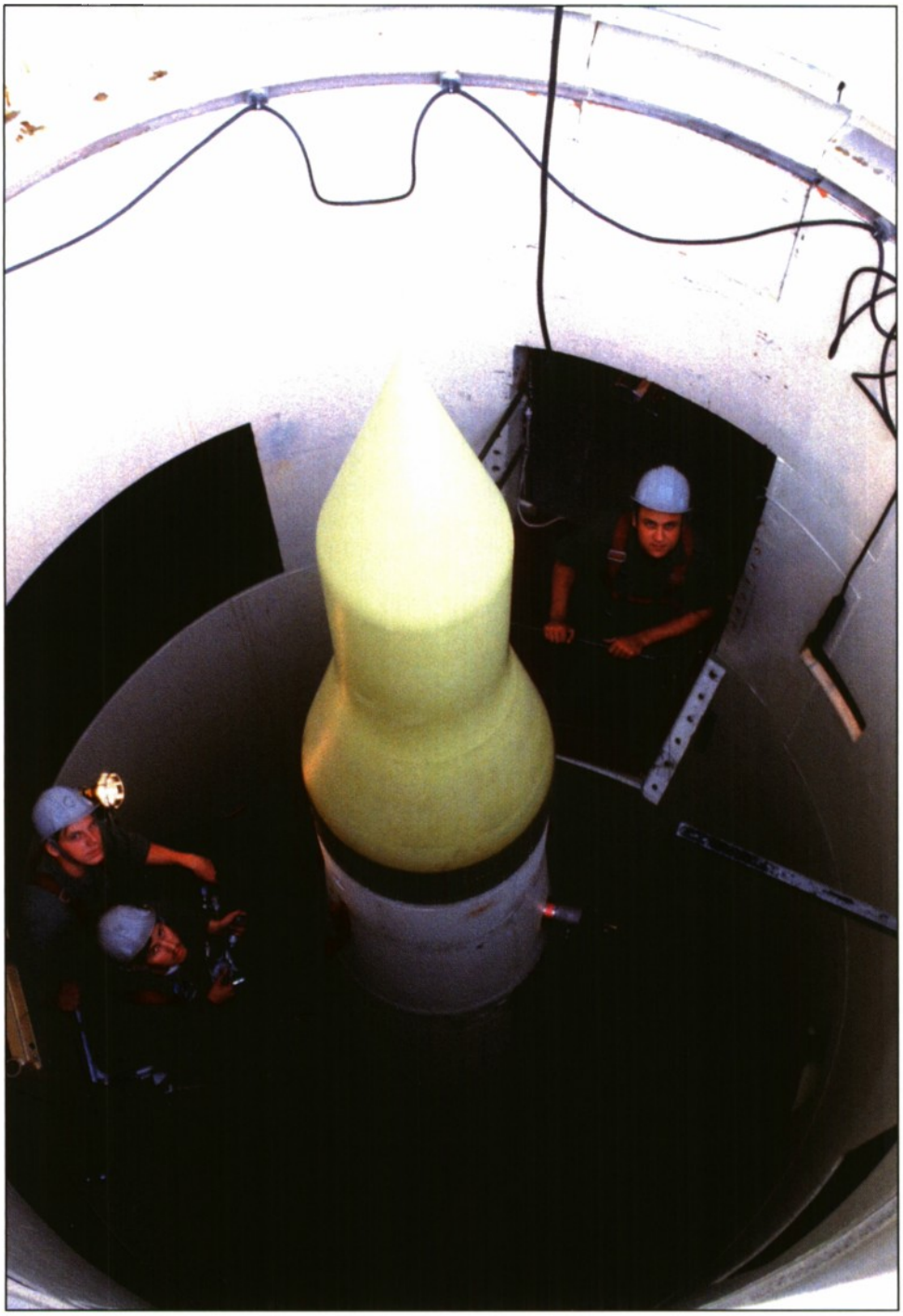
A Program for Recovery

America must reestablish the posture of nuclear strength that saved the West-and the world-during the half-century-long Cold War. During those decades, our nuclear posture was also the key factor in preventing renewed outbreaks of global conventional wars and the terrible costs they entail. To provide a similar insurance policy for the future, we must undertake at a minimum the following eight critical steps:

- **Immediate Actions**

As a matter of great urgency, two initiatives are in order: First, the president must issue a clear, firm statement to the effect that a credible, safe, secure, and reliable nuclear deterrent is essential to America's security and that we will maintain it with highest priority.

Second, we must reestablish the



U.S. Air Force ICBM undergoing routine maintenance.
Photo: Tech. Sgt. Bob Wickley

Reliable Replacement Warhead as a vital program in order to prevent the loss of core nuclear-weapon capabilities in the National Nuclear Security Administration's labs and plants, and to provide the optimum replacement approach for those overage weapons in our stockpile that we will need for decades to come. This warhead provides our only current opportunity to recapture the experienced, integrated management expertise necessary to guide new nuclear weapons from concept definition to service introduction. Without it, this invaluable capability, for all intents and purposes, will be lost.

- **National Debate**

The issue of deterring nuclear attack, despite its potentially existential importance to millions of Americans, has scarcely-if ever-been rigorously discussed in a highly visible way since the Cold War ended. If the United States wishes to maintain an effective nuclear deterrent, it will need a strong consensus, reflected in solid bipartisan majorities, sustainable over the decades required to implement that program. We can assure such majorities only by informing the American people and enlisting their support.

Toward that end, we must initiate a thoughtful national debate on (1) the nature of deterrence in this new age, (2) its role in US foreign policy and national security strategy, (3) the role of nuclear weapons in this strategy, and (4) the characteristics and approximate numbers of nuclear weapons needed to provide effective deterrence today and in the future.

- **Advanced Technology**

We must reestablish a continuing, robust research, development, test, and evaluation program. Currently, we should focus on cutting-edge technology in research, exploratory development, and accelerated development across dozens of fields relevant to advanced designs for nuclear weapons.

This scientific approach is absolutely essential if the United States desires to understand the possibilities -for us and for potential adversaries- in physics, weapons effects, materials, explosives, diagnostics, and so forth. Verifiable evidence indicates that our peer adversaries are working very hard to develop new and more usable systems in order to exert leverage over the United States and further their strategic interests. If we allow them to continue unchallenged, we may lose our world leadership position. At the very least, without a corresponding US research and development effort, America's deterrent cannot possibly remain commensurate with the emerging nuclear threat.

- **Military Preparedness**

The Defense Department must recommit to the need to maintain, for the foreseeable future, both an appropriate nuclear arsenal and the com-

petencies necessary to field and exercise it. Doing so will entail preserving America's existing nuclear-weapons platforms and capabilities as well as planning, budgeting, and performing the long-range actions needed to contend with an uncertain nuclear future.

Specifically, the armed services must take the following steps:

1. Establish military requirements for new nuclear weapons that will credibly deter current and future adversaries and threats. These counter-proliferation weapons should have low yield, great accuracy, and intrinsic security features to prevent unauthorized use. They must also produce reduced collateral damage and minimal residual radiation yet destroy deep underground bunkers as well as neutralize biological and chemical agents.

2. Plan, program, and budget for follow-on strategic submarines, sea- and land-based intercontinental-range ballistic missiles, bombers, cruise missiles, and so forth.

3. Increase emphasis on nuclear-specialist personnel, nuclear strategy and tactics, and nuclear exercises.

4. Work as a closely integrated team with the Department of Energy and the National Nuclear Security Administration to revitalize and transform our nuclear-weapons infrastructure. In addition, the military's insights and expertise will prove vital to informing the aforementioned national debate.

- **New Nuclear Weapons**

We must adopt anew a national commitment to design, test, and produce, on a continuing basis, new nuclear weapons. We can maintain expertise in these "performance arts" only by engaging in them. Simply put, the extreme complexity and hazards of the work are such that there is no substitute for competent, integrated management, which, in turn, requires continuing, hands-on experience. Although the throughput in terms of numbers of weapons may amount to tens per year (rather than the hundreds routinely in the pipeline at the height of the Cold War years), we can realize no credible deterrent over time without an active pipeline that includes a "hot" production line.

- **Nuclear Infrastructure**

The United States must immediately commence the comprehensive modernization of its nuclear-weapons infrastructure. We have debated the measures necessary to do so for years and have proposed plan after plan. We have done little, however. Meanwhile, our facilities become ever -more antiquated, dilapidated, and unsafe. We most urgently need a modern fabrication facility for the "pits," the heart of a warhead, with adequate flexibility to produce several designs simultaneously and a throughput capacity sufficient to permit replacement of the stockpile's obsolescent weapons at an acceptable rate.

- **Effects of Nuclear Weapons**

We must revitalize the Pentagon's national research and development program for examining the effects of nuclear weapons. The survivability of American weapons systems (conventional and nuclear); our command, control, communications, and computer systems; and our intelligence, surveillance, and reconnaissance systems against a wide range of nuclear-weapons effects depends on our successfully hardening and testing these systems. Good design and simulator testing can help, but actual underground nuclear testing is essential in order to assure survivability. Such test and evaluation is also indispensable for assessing and correcting the vulnerabilities of critical parts of the country's civil infrastructure against such threats as electromagnetic pulse.

- **Prevention of Proliferation**

Finally, America must undertake a sweeping course correction with respect to countering nuclear proliferation. Full effectiveness, of course, demands changes in the world's approach to nonproliferation-not just this country's. Still, any improvement in the utility of global efforts to prevent the spread of nuclear-weapons technology and capabilities remains unlikely unless and until the United States adopts a more practical strategy for contending with this threat.

Over the last several decades, the Nonproliferation Treaty has been distorted by the preoccupation of its stewards with promoting nuclear disarmament rather than with preventing proliferation. Apart from the steady erosion of the US arsenal, this fixation has neither resulted in the appreciable diminution of existing inventories of nuclear weapons around the world nor prevented a mushrooming of proliferation to other states.

With some 188 signatories (out of about 193 nations in the world), the 40-year-old Nonproliferation Treaty, the accepted cornerstone of the global nonproliferation regime, provides the basis for our efforts. If we wish the treaty actually to prove helpful, however, we must refocus attention and effort on its actual language and intent.

The Nuclear Nonproliferation Treaty's purpose is to prevent proliferation, codifying the right of five nations-the permanent members of the United Nations Security Council-to be nuclear-weapons states and requiring all other signatories to remain non-nuclear-weapons states. Each of the 188 signatory states has voluntarily accepted this inequality and endorsed a treaty that places no restrictions whatsoever on the five nuclear-weapons states as regards designing, testing, producing, and deploying nuclear weapons.

Given the aforementioned hard strategic realities, the United States should redirect its nonproliferation policy along the following lines: (1) emphasize that nonproliferation requires enforcement; (2) urge that the five nuclear-weapons states accept this implicit responsibility; (3) until all five agree, be willing to act unilaterally, or in coalition, as a default action to prevent proliferation; and (4) regularly modernize our stockpile to keep it effective, safe, secure, reliable, and

Without these actions, the remnants of global nonproliferation will inevitably become ever-more irrelevant and ineffectual.

America's Choice:
Weakness or Strength?

In conclusion, the nation must decide between weakness and strength now. Adopting the former by continuing the 18-year-long post-Cold War status quo can only lead to dangerous, unilateral US nuclear disarmament. We would be ill advised to adopt the agenda for accelerated dismantling of our nuclear arsenal now promoted as a way to "reinvigorate" the moribund nonproliferation regime. Champions of the latter idea propose, among other things, that we (1) cut our nuclear stockpile below its already vastly reduced level, (2) commit irrevocably (by treaty) to forgo necessary testing, and (3) refrain from all essential nuclear modernization or replacement activities. They believe that doing so will cause our adversaries to reduce their arsenals and motivate the entire world eventually to abandon nuclear weapons.[3]

Regrettably, there is no basis in past experience or in logic for these lofty hopes. To the contrary, history has clearly shown that unilateral US reductions, far from causing a similar response, actually stimulate nuclear buildups by adversaries. Second, as a practical matter, it would be impossible to verify the elimination of all nuclear weapons. Third, reduced numbers encourage first strikes designed to disarm. Fourth, and most importantly, the ultimate goal of a world without nuclear arms is not only unachievable but also a utopian delusion. Nuclear weapons cannot be "uninvented." Pursuit of such a goal by the United States would constitute a formula for the further evisceration of America's deterrent and for a world in which only the most dangerous states and perhaps nonstate actors have these weapons-a world of unimaginable horror and chaos.

For these reasons, the United States has no real choice other than adopt a policy of peace through abiding nuclear strength. The foregoing eight measures will assure that such strength continues far into the future and, with it, will enhance the prospects for a world free of either nuclear war or global conventional conflagrations.

The New Deterrent Working Group -an informal coalition of experts in national security and nuclear weapons, sponsored by the Center for Security Policy-seeks to inform lawmakers and the public about the need for the United States to maintain a credible and an effective nuclear deterrent.

VADM Robert R. Monroe, USN, Retired (BS, US Naval Academy; MA, Stanford University), is a self-employed national security consultant. Admiral Monroe enlisted in the Navy during World War II, and in 1946 he entered the Naval Academy from the fleet. Commissioned in 1950, he served in destroyers, minesweepers, cruisers, and amphibious assault ships, including three commands at sea. He subsequently served in flag rank for 11 years, including (as vice admiral) positions as director of the Defense Nuclear Agency and director of Navy Research, Development, Test, and Evaluation. His Navy career spanned the Cold War as well as the Korean and Vietnam conflicts. Retiring from the Navy after 38 years, he joined Bechtel, a large, worldwide, high-technology engineering, construction, and management firm, serving successively as business line manager, vice president, senior vice president, partner, and senior counselor for 22 years. He currently serves or has recently served as a member of numerous advisory boards for the Department of Defense, Department of State, Department of Energy, National Aeronautics and Space Administration, and other government and private organizations. Admiral Monroe frequently authors papers on nuclear-weapons issues.

ENDNOTES

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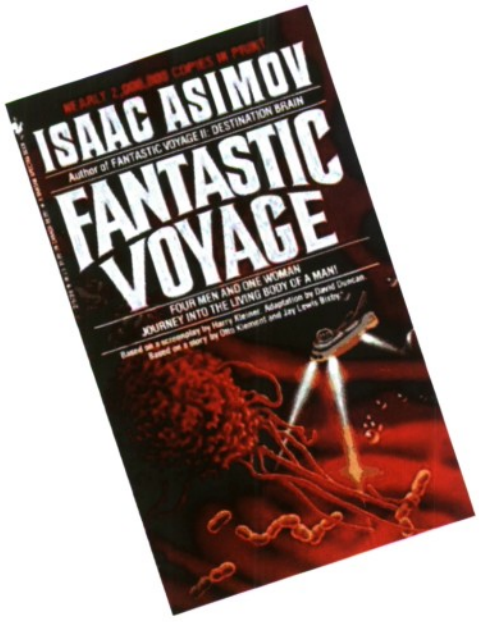
Medical Microbots Are Nearer Than You Think?

Robert A. Pfeffer
Physical Scientist, U.S. Army Nuclear and CWMD Agency

For those of us old enough to remember the 1966 Harry Kleiner movie Fantastic Voyage and the 1966 Isaac Asimov book (below) based on that screenplay we are beginning to see the reality of saving a human life by miniaturization, that is, shrinking medical tools (not doctors) so they travel through the bloodstream while viewing and fixing arterial problems along the way. In the film Raquel Welch, her four male companions (I already forgot their names), and their submarine were shrunk and then injected in the carotid artery of a comatose Soviet defector to remove a blood clot in the brain. While that is still a long way off, modern day nanotechnology has opened the door to the development and use of small micro-motors injected into the bloodstream that power their way upstream to problem areas. These micro-motors are also known as microbots.



Bantam Books Cover

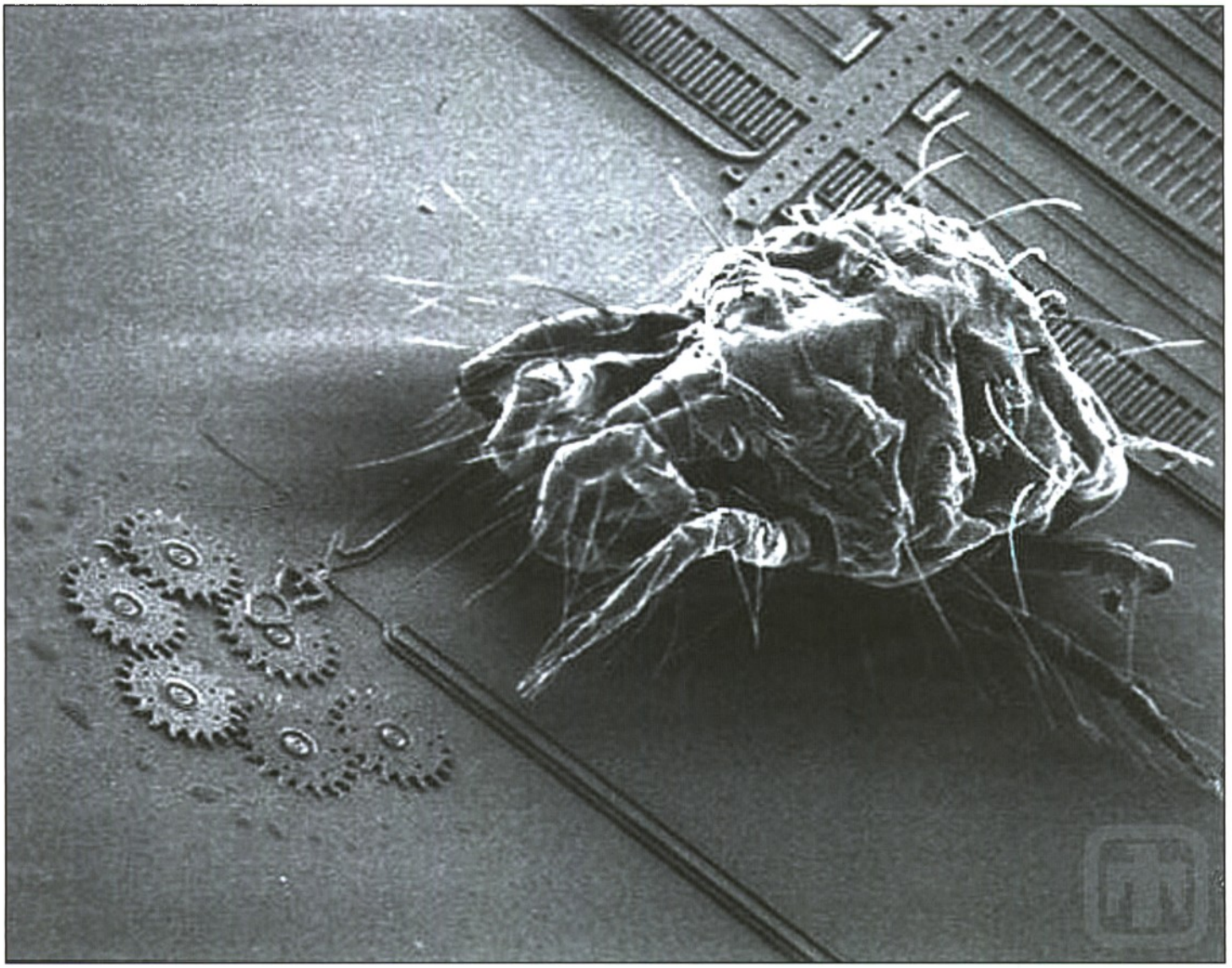
Just what is a microbot? Let's start with the Wikipedia definition of microbotics. *"**Microbotics** (or **microrobotics**) is the field of miniature robotics, in particular mobile robots with characteristic dimensions less than 1 mm."* The term can also be used for robots capable of handling micrometer size components. Recently, scientists have used piezoelectricity to power micro-motors 250 micrometers (one-fourth of a millimeter) in width. These microbots are small enough to be injected into the bloodstream via catheter in a less invasive technique than the more traditional "cut-and-sew" medical procedure. They are small and yet are powerful enough (4.25 microwatts) to travel virtually anywhere in the bloodstream, even the cranial artery.

Film Poster by Tom Chantrell

And why is piezoelectricity the answer? Other techniques have been tried, but Professor James Friend, team leader at Monash University, Australia, has shown that piezoelectric motors can be scaled down, even to a size that works in the bloodstream. His team has already built several of these motors and he is now working on ways to improve their control. By the way, the researchers have given the micro-motor a name: Proteus. And that takes us back to Raquel and the Fantastic Voyage....

For more information and an interesting video of the team's work, go to:
http://www.iop.org/News/news_32484.html

Quality of life will stand to benefit from this medical breakthrough. They could be used to treat strokes and hardened arteries in senior citizens. They could also be used to treat cancer patients. Microbots could also be an enormous benefit to military personnel on or near the battlefield. In much the same way medivac helicopters have been used to reduce fatalities, future front line medics could use catheter tubes to insert microbots into patients to address bloodstream blockages, infections and other problems.



Courtesy of Sandia National Laboratories, SUMMiTTM Technologies, www.mems.sandia.gov

SEM image of a spider mite on a polysilicon MEMS gear-train. Spider mites range in size from 0.5 mm to 1 mm. Original image and many others are available online at: http://mems.sandia.gov/scripts/images.asp

Microelectromechanical systems (MEMS) (also written as *micro-electro-mechanical*, or *MicroElectroMechanical*) is the technology of the very small, and merges at the nano-scale into nanoelectromechanical systems (NEMS) and nanotechnology. MEMS are also referred to as micro-machines (in Japan), or *Micro Systems Technology - MST* (in Europe). MEMS are made up of components between 1 to 100 micrometers in size (i.e. 0.001 to 0.1 mm) and MEMS devices generally range in size from 20 micrometers (20 millionths of a meter) to a millimeter. They usually consist of a central unit that processes data, the micro-processor and several components that interact with the outside such as microsensors.

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http://en.wikipedia.org/wiki/MEMS

The Zero Hour- Silver Bullets for Peace in the Middle East

MAJ Todd Hathaway
FA 52 Nuclear and Counterproliferation Officer

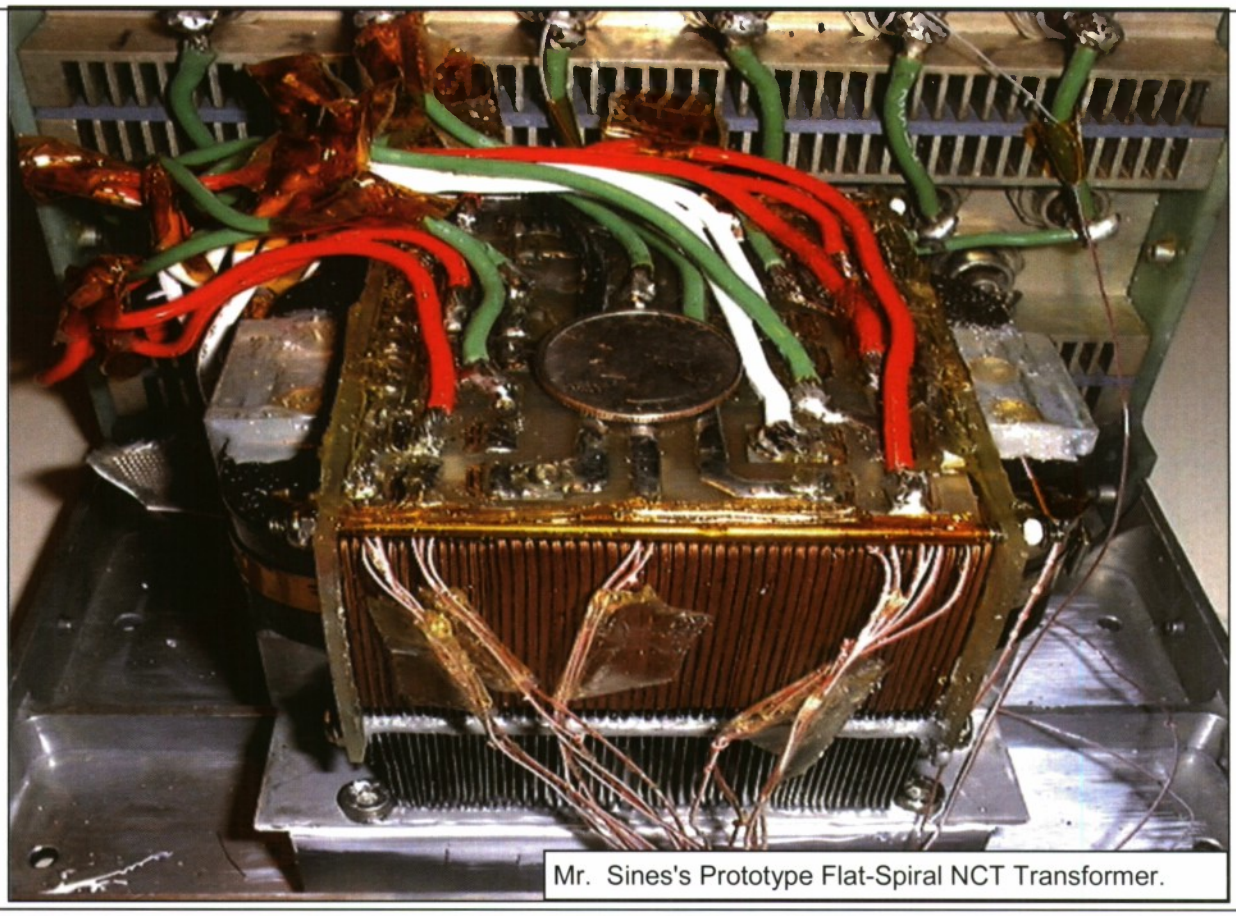
In times of crisis people unite. A global crisis of greater proportions than any other event in human history will ultimately precipitate the trend towards global consensus in the coming months and years. What will such a crisis entail? For now, conflict over seemingly finite energy resources is a major factor aggravating an untenable stalemate of geopolitical and economic forces in the Middle East. Tensions between Israel and Iran through the perpetual conflict between Israel and its immediate neighbors appear to be independent of the energy issue, but are they? Tensions overtly arise from Iran's pursuit of 'peaceful' nuclear energy. What if we offered Iran a way forward that did not require nuclear energy? The United States could provide Iran and the rest of the world 'silver bullet' advanced energy technologies. Problem solved, right?

What would Iran's likely response be? Well, what choice would Iran's government have if the offer was publicly disclosed through official channels at the United Nations? If Iran's government accepts the offer to replace dual-use nuclear power development with an advanced energy technology that cannot pose an existential threat to Israel, problem solved. If Iran declines, Russia and China could no longer justify to the international community their continued support for Iran's nuclear program. Again, problem solved, as Iran's government needs Russia and China's full backing to remain in power.

Since reviewing the U.S. Army National Ground Intelligence Center's report (NGIC-1823-0869-07, published on 5 July 2007) on zero point energy research, Army Major Todd Hathaway chose to conduct an independent investigation of advanced energy technologies that do not fall into conventional alternative energy fields of research and development. This independent investigation culminated in events held in Bethesda, Maryland, on 20 August 2007, and Charlotte Hall, Maryland, on 28-29 June 2008. Based on the interviews and research conducted over the last five years, it is clear that advanced energy technologies commonly identified as zero point energy technologies are not only real; they are being brought to full scale production through strictly independent, privately funded initiatives.

The difficulties in bringing advanced energy technologies to the military and the public have compromised our nation's ability to end continued dependency on foreign hydrocarbon fuels. All hydrocarbon-based energy production devices are obsolete, including hybrid cars, since they have conventional battery banks and high replacement costs. Even the hydrogen cars using the new fuel cell

Mr. Tomion's Electrodynamic Field Generator's primary power system with a sustained input plasma discharge at 300V in a rarified argon environment.



Mr. Sines's Prototype Flat-Spiral NCT Transformer.

Mr. Sumaruck's Military Prototype Zero-Amp Unit.

technology fall into a similar category of pedagogic obsolescence, as hydrogen production only shifts the problem by serving merely as an energy storage technology, and does not solve the real problem of our dependency on imported hydrocarbon fuels.

Advanced energy technologies have many advantages over hydrocarbon fuels and conventional alternative energy technologies. The volume of hydrocarbon fuels imported to the United States could be drastically reduced to a level that would eliminate the need for nations to protect current and future overseas energy resources in order to maintain energy and material demands by shifting a small fraction of either private or government R&D funding (less than one-tenth of one percent of the current R&D budget) to advanced energy technologies. The economics of advanced alternative energy systems are considerably less expensive than our present multi-trillion dollar hydrocarbon fuel based energy and transportation infrastructures. Advanced energy technologies would also preserve the integrity of the planet's ecosystem once implemented on a global scale.

Eddie Sines is a Vietnam veteran and a retired electronics technician from Naval Research Laboratory. Mr. Sines has been working on a novel generator design to channel magnetic flux and generate electricity. Upon further development, this new method of power generation has the potential to produce megawatts of clean electricity for powering electrical cars, trucks and everything in our homes within the next ten years, free of the standard power grid - no more blackouts or brownouts during severe weather and other unexpected events. Mr. Sines' power generation technology could replace centralized power plants with clean, highly efficient distributed electrical power systems. Mr. Sines developed a novel transformer design while researching the concept at Naval Research Laboratory, a design that allows 5-10 times greater power throughput at a fraction of the weight of conventional transformers. His unique transformer design is scalable and could save DoD hundreds of millions of dollars through power losses reduction while also minimizing our overseas logistical footprint by incorporating his improved

transformer design into preexisting equipment and overseas/domestic installation energy infrastructures.

Peter Sumaruck is a Vietnam veteran who served as a Navy Seal sniper. After 20 years of research, Mr. Sumaruck has built and demonstrated a portable 5 kW generator that is close-looped; e.g., the device is not connected to an external power source during operation for extended periods of time. The inventor is willing to demonstrate the unit to military personnel. A larger 50 kW unit is also under development.

Jim Boswell has developed a wind turbine that doesn't actually use the wind for power generation, but extracts energy from what can be best described as an electromagnetic phenomenon. The B800 unit sells for $15,000, and purportedly produces nearly 3 kilowatts continuously, plus or minus around 200 watts -- easily enough to supply power for a 2,000 square foot home. Mr. Boswell also sells the B1500, which provides 30 kW of continuous power for commercial customers. Installation costs for either unit remain under $1000. Mr. Boswell also has a hybrid wind/solar technology for powering streetlights and parking lot lights, which he says could save the city of Fresno an estimated $40 million annually, the state of California $80 billion annually, and the U.S. $800 billion annually -- nearly the amount of the recent stimulus package. Mr. Boswell is also interested in manufacturing larger units and installations of as high as 4 megawatts in size.

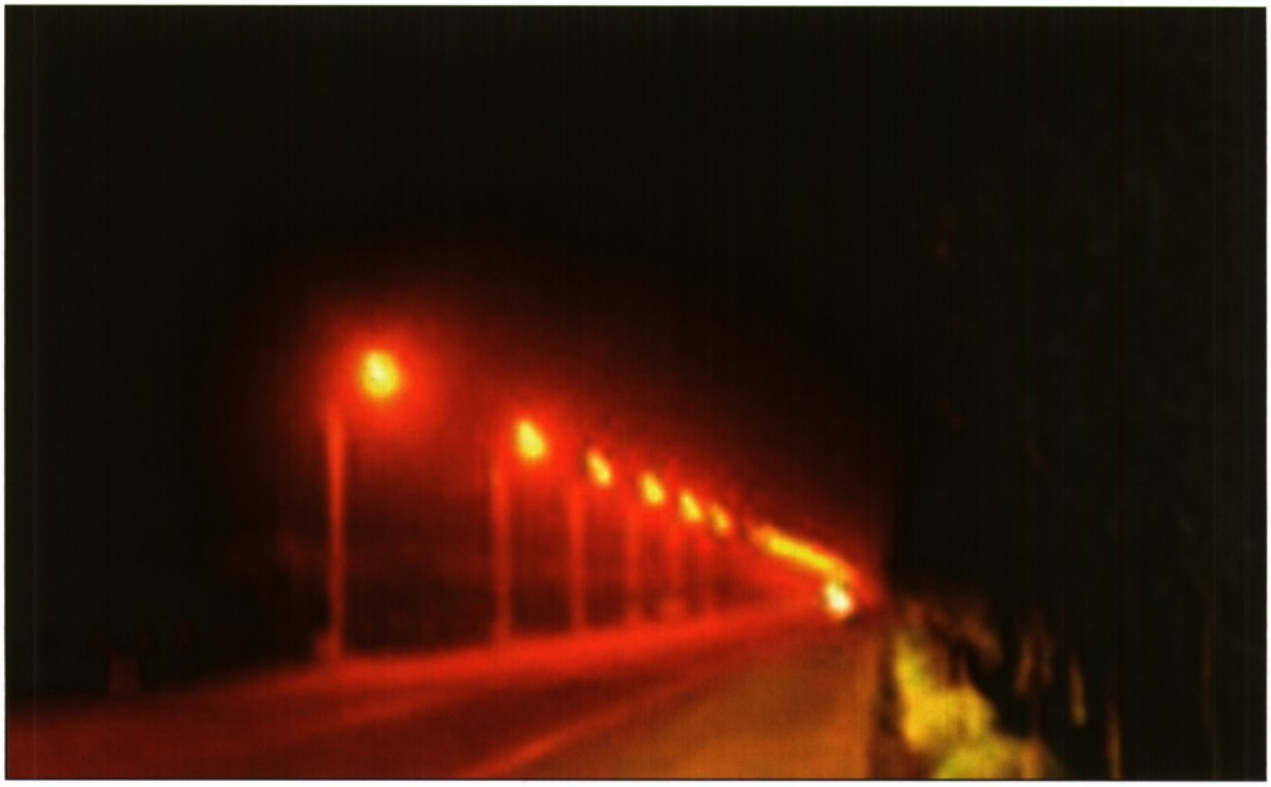
Mr. Boswell's B1500, which produces nearly 30,000 Watts, stands 20-30 feet tall on a 3-foot by 2-foot deep concrete pad.

The best case scenario for wind generation production is "on" about 15-20% of the time on average. The best case of Sun energy is 1/3 of the 24-hour day, and a comparable output of 3 kilowatts, costs $30-40,000 installed. When weighing the $5/Watt installed price for the B800, remember that this generator is claimed to provide a steady, continuous output at nearly 3 kilowatts, hence the quicker return on investment. Depending on the cost of electricity, Mr. Boswell says the unit can pay for itself in less than three years.

Mr. Boswell has contacted media, private industry and government officials from local to national levels, but the standard response has been essentially null -- at least directly. Recently, Mr. Boswell has been receiving among other things, threats with the theme of "stop building your equipment." Since then, for security purposes, he dismantled the fuel-less motor technology; but the patented "wind turbine" is still powering his home. Other researchers listed in this article have had similar experiences. Though Mr. Boswell is primarily interested in manufacturing this technology with the "Made in U.S.A." label, his requests have fallen on deaf ears in the United States; but the technology has garnered a lot of interest in China, Japan, and South Korea.

Carl Falsnes is a Canadian researcher who has developed a hybrid of Stan Meyer and Herman Anderson's technology. His prototype will be powering vehicles and generators using only hydroxy gas. Mr. Falsnes also resurrected Nicola Tesla's wireless power transmission technology as recently demonstrated online. There are many other examples of new "silver bullet" technologies, but all of these independently funded projects remain in early stages of development, and the researchers continue to seek necessary funding to bring their respective technologies into production.

If advanced alternative energy technologies were adopted worldwide, the impetus for nations to protect their energy resources around the world could be eliminated. Every person on the planet could have access to an unlimited supply of electrical energy and the means of producing clean water. All nations could fully embrace the Kyoto Protocol, as these advanced energy technologies reduce the level of environmental pollutants during operation. Cost savings is also an attractive feature of these technologies when you consider the total cost of our nation's dependency on fossil fuels, with a collapsing global economy a direct result of continued hydrocarbon fuel dependence. In effect, we could change the world as we know it, as energy scarcity would become a thing of the past. The hurdles to transforming our nation's energy infrastructure are many and the technical solutions are by no means simple; however, current research findings have shown that obstacles to berthing a post-hydrocarbon fuel society are surmountable given sufficient time and re-



Mr. Boswell's streetlights line a street in fog at approximately 3 a.m. in China.

search funding to scale these technologies to megawatt range output.

A follow-on event with live demonstrations of advanced energy technologies was held at the Southern Izaac Walton League in Waldorf, Maryland on May 30-31, 2009. This event is similar to previously scheduled events summarized online at www.altenergy2012.com. A National Press Club briefing and meetings with members of Congress will be scheduled as demonstrated technologies are independently validated and replicated through The Orion Project (www.orionproject.org) and Advanced Energy Research Organization (www.aero2012.com), as well as through other independent R&D initiatives. The military is in a position to review these and other technologies as they are made available for field testing; however, funding from the government and private industry remain elusive and no formal process is in place for reviewing new technologies on site. Bringing a final product to market in a timely manner is also being compromised by a global economy in precipitous decline. The military is in a position to overcome any obstacles to bringing advanced energy technologies to the rest of the world.

We must support these advanced energy research initiatives, rather than rely on processes that have failed to support independent research initiatives. Mankind can no longer afford the luxury of maintaining the status quo in the realm of energy consumption. It is time for massive change on a global scale; and supporting advanced energy technology research and development that will inevitably benefit everyone is our last and best hope to avoid a cataclysmic transition to a post-hydrocarbon fuel society. For more information on advanced energy technologies, order the books, "Breakthrough Power - How Quantum-leap New Energy Inventions can Transform Our World" by Jeane Manning and Joel Garbon and "The Energy Solution Revolution" by Brian O'Leary. Additional information on various advanced energy technologies can also be found online using keyword searches for the topic of interest, with many of these technologies listed online at www.altenergy2012.com and www.peswiki.com/index.php/Directory:Best_Exotic_Clean_Energy_Technologies.

Major Todd Hathaway is a graduate student at the University of Maryland at College Park and is completing an M.S. in Nuclear Engineering en route to a Ph.D. in Nuclear Engineering. He has a B.S. in Metallurgical Engineering from Iowa State University and an M.S. in Administration from Central Michigan University. He was previously assigned as an Interagency Integrations Officer at the Defense Threat Reduction Agency. His email address is todd.c.hathaway@us.army.mil and may be contacted directly at 240-997-4582.

Opportunities for Higher Education in Nuclear Engineering at the University of Maryland

MAJ Todd Hathaway
FA 52 Nuclear and Counterproliferation Officer

There is a rapidly growing national need for the education of a large number of graduate-level nuclear engineers at the U.S. Department of Energy, at nuclear utilities, and at energy consulting companies. A rapid expansion in the number of nuclear power plant licenses is expected within the next five years, and smaller, portable nuclear power plants under development throughout the world. The University of Maryland is committed to the education and training of future graduate-level nuclear engineers, researchers and national leaders. The program combines cross-disciplinary engineering principles in nuclear sciences and reliability with new concepts in nuclear engineering, advanced research approaches and practical industrial methods. The education Nuclear Engineering graduate students receive is directed toward a greater emphasis of safety, reliability and the environment, while maintaining program strengths in reactor engineering.

The program's advantages for Army FA52 officers lie in its location and facilities. The College Park campus is near the headquarters of the U.S. Department of Energy and the U.S. Nuclear Regulatory Commission, the headquarters of the nuclear power unit of the Bechtel Corporation, and nuclear utilities in Maryland, in Virginia and southern Pennsylvania. The program's facilities include a 250 kW nuclear research reactor, a neutron activation laboratory, a 10 MeV linear electron accelerator and a gamma ray irradiation laboratory. The facilities also include laboratories for microelectronic failure analysis, radiation chemistry analysis as well as dosimetry and extensive computational capabilities.

In addition to the core curriculum, each student selects a secondary area of study, a process that allows them to tailor their education with a focus that will support their professional objectives. The learning environment is excellent, with small classes, and a faculty dedicated to education with a great deal of personal attention given to students. The Graduate Program in Nuclear Engineering, administered by the Department of Materials Science and Engineering, offers graduate study leading to the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees. The program's multi-disciplinary faculty provides the required depth of knowledge to its graduates entering a career in nuclear engineering and to practicing engineers seeking to enhance and extend their capabilities.

The program concentrates in basic and applied nuclear engineering, engineering research in its broadest sense. Research that is actively pursued includes risk and reliability assessment of nuclear systems, complex system safety and maintainability and failure mechanisms associated with the radiation environment. The areas of radiation chemistry and radiation engineering are key research thrusts of the program. The present notable competencies of the program are:

- The program's reactor safety and nuclear probabilistic risk assessment research program has achieved international recognition, and the Program's nuclear engineering program is contributing to the international improvement of nuclear power plant safety by providing training in nuclear safety and operation to local consulting firms and government officials.
- The Graduate Program in Nuclear Engineering program is the only such program in the State of Maryland and the tri-state area (Maryland, Virginia and Delaware, even extending to southern Pennsylvania).
- The program trains engineers for employment in Maryland's private industry, utilities and government agencies.
- The Program's radiation engineering program is unique to Eastern U.S., offering expertise in radiation chemistry and physics as well as radiation effects in microelectronics and space deployable systems.
- The program is the only one

of its kind that combines advanced reactor designs with a scientific approach to design for reliability and safety.

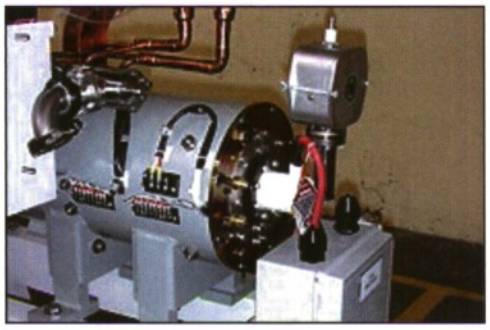
- The program's faculty has international reputation not only in the field of nuclear engineering, but also in materials, mechanical, and reliability engineering. Our faculty members have published books, been elected to fellowship in professional societies, and garnered a variety of special awards.

The Laboratory for Radiation and Polymer Science, directed by Professor Mohamad Al-Sheikhly, has pursued the chemistry and materials of the radiation processing industry since 1960. The Laboratory supports companies and government laboratories with radiation-related research and consulting services in three areas:

- Applied radiation and physics of polymers: crosslinking scission, polymerization, and effects on reinforced and filled polymers. These include the development ofproducts for ordinary commercial use (packaging materials, elastomers, membranes, textiles, etc.); and the degradation of insulating materials in space satellites and nuclear reactors;
- Radiation sources technology, such as transport of high energy electrons in complex targets, dosimetry, and optimization studies; and
- Fundamental aspects of radiation bearing on applied problems, such as radiation chemistry of crystalline alkane and semicrystalline polymers, initiation mechanisms of vinyl polymerization, and radiation effects on morphology and metrology of polymers.

The Radiation Facilities at the University of Maryland have recently installed a brand new, state-of-the-art high-energy linear accelerator (LINAC). The TB-10/15 LINAC (L3 Communications, San Leandro, CA) generates a 10 MeV electron beam with an average beam power of 15 kW and compliments the existing medium-energy LINAC. The high-energy beam provides an opportunity for research and industrial applications which lower energy LINACs are incapable of accomplishing, including medical sterilization. This is possible due to the unique ability of high-energy electrons to be converted to photons with a relatively high efficiency. In addition to its high energy electron beam, the L3 LINAC is also equipped with a scanning magnet and horn assembly which sweeps a beam of electrons over a 60 cm surface in either a horizontal or vertical orientation, depending on the specific application. This feature provides the University of Maryland with an ideal setup for pilot-scale studies of radiation processing. Research and industrial applications of the high-energy LINAC include:

- Polymer modification
- Sterilization of medical devices
- Radiation treatment of food products



The LINAC's electron gun.

One of the key advantages for FA52 officers is the option to begin coursework prior to a full-time assignment at the University of Maryland. Several independent study courses are available, many of which are listed online at http://www.testudo.umd.edu/ScheduleOfClasses.html (under ENNU). Up to six credits may be transferred from another institution towards degree completion requirements. The academic degree completion plan can be tailored to suit the needs of every FA52 officer, with flexibility built into both the M.S. and Ph.D. degree programs. For those FA52 officers interested in a follow-on assignment at the Armed Forces Radiobiology Research Institute (AFRRI) in Bethesda, Maryland, M.S./Ph.D. research can be conducted on site at AFRRI, as well.

Questions about the Graduate Program in Nuclear Engineering at the University of Maryland may be sent to Dr. Aristos Christou at christou@umd.edu or the Academic Advisor for Army FA52 officers, is Dr. Mohamad Al-Sheikhlys. His email address is: mohamad@umd.edu.

Major Todd Hathaway is a graduate student at the University of Maryland at College Park and is completing an M.S. in Nuclear Engineering en route to a Ph.D. in Nuclear Engineering. He has a B.S. in Metallurgical Engineering from Iowa State University and an M.S. in Administration from Central Michigan University. He was previously assigned as an Interagency Integrations Officer at the Defense Threat Reduction Agency. His email address is todd.c.hathaway@us.army.mil and may be contacted directly at 240-997-4582.

"Peace Is Our Profession" The U.S. Air Force During the Cold War

CW5 Stephen A. Gomes
Joint Nuclear Targeting Officer, U.S. Army Nuclear and CWMD Agency

Prologue

Soon after World War II, it became clear that the world was not to enjoy the peace it had valiantly fought to preserve. The Communists made it known that they would expand where they could. Potential targets of opportunity were areas of political upheaval and economic distress. The ultimate target then and now is democracy itself, and above all its strongest supporter, the United States.

Our national policy of opposing aggression against the free world led us to support many nations when they were threatened with Communist takeover. The United States helped Europe recover from the war under the Marshall Plan; we joined in organizing NATO and other defense alliances. We organized the West Berlin Airlift when West Berlin was threatened. We played a major role in repelling Communist aggression against the Republic of Korea. We were almost at the brink of nuclear war with the Soviet Union during those tense days in October of 1962 with the Cuban Missile crises. Communist aggression was confined during the Cold War as a result of our nuclear deterrence polices.

In this segment of a continuing series of United States Forces during the Cold War, I will discuss some of the delivery platforms and weapons used by the U.S. Air Force (USAF) in their arsenal of democracy during the Cold War. The genesis begins with the first atomic weapons to be em-

B-29 Superfortress "Enola Gay" piloted by COL Tibbets, the world's first Atomic Bomber. Photo: USAF

B-29 Superfortress "BOCKSCAR" piloted by MAJ Sweeny, dropped the second Atomic Bomb.

ployed in combat, the "Little Boy" and "Fat Man".

On 6 August 1945 at 08:15 AM a high flying B-29 Superfortress bomber named "Enola Gay" piloted by Colonel Paul Tibbets of the 393d Bombardment Squadron, 509 Composite Group, released a Mark I atomic bomb called "Little Boy". This was the first atomic bomb used against the Empire of Japan, the target: Hiroshima. The weapon was developed by the secret Manhattan Project during World War II. The Hiroshima bombing was the second nuclear explosion in history; the first was the "Trinity" test. Mr. Martin Moakler (USANCA) wrote a 3 part article regarding Trinity (see Endnotes for more information[1]). This destructive power from a single weapon previously thought unimaginable, now became a reality. According to most estimates, the immediate effects of the blast may have killed as many as 70,000-80,000. And a like number later died from related blast and burn injuries. Additionally, more casualties arose from exposure to radiation.

The "Fat Man" was the second atomic weapon used against the Empire of Japan, the Little Boy having been released just three days earlier. On 9 August 1945, at 11:02 AM, the B-29 Superfortress bomber named "Bockscar"; piloted by Major Charles Sweeney, of the 393d Bombardment Squadron, 509 Composite Group released Fat Man over Nagasaki, Japan. Fat Man was detonated at an altitude of approximately 1,800 feet over the city. Due to Nagasaki's hilly terrain, the damage was somewhat less extensive than the relatively flat Hiroshima. An estimated casualty resulted with approximately 39,000-75,000 people killed by the bombing at Nagasaki and like Hiroshima, many more died of radiation exposure and injuries associated directly and indirectly from the blast.

After the second detonation, war with the Empire of Japan officially ceased and an unconditional surrender was enacted, thus ending the Second World War.

Post War Transformation

On 21 March 1946, the United States Army Air Forces (USAAF) was divided into three separate commands: Tactical Air Command (TAC), Air Defense Command (ADC), and Strategic Air Command (SAC). The National Security Act of 1947 established a new element, The Department of the Air Force on 18 September 1947. Effective 26 September 1947, personnel of the Army Air Forces (AAF) were transferred from the Department of the Army (formerly the War Department) to the Department of the Air Force. SAC retained its organization and mission after the USAAF became the U.S. Air Force (USAF) on 18 September 1947. [2]

A revision to National Defense

Following the end of combat operations in Korea, President Eisenhower, called for a review of current national defense policies. It was determined that nuclear weapons and air power were key elements to deter war. Instead of maintaining large conventional land and sea forces the Eisenhower administration determined airpower would be a major component to deter or defeat adversaries in future conflicts.

Key elements of the revised national defense policies now included reliance on nuclear weapons; heavily modernizing air power, better integration of strategic forces; and support of NATO. The Eisenhower administration's doctrine of "massive retaliation," stated in short, that the United States would not limit a response to aggression made the adversary think about the notion of war and the possible escalation that might ensue.

SAC and American National Strategic Policy

National strategic policy during the Cold War with the Soviet Union was based primarily on nuclear deterrence. As an instrument of this policy, SAC would be the cornerstone.

The main planning element of the Air Force became the responsibility of SAC. SAC's original mission statement, expressed by General Carl Spaatz, then commanding general of the USAAF, was:

"The Strategic Air Command will be prepared to conduct long-range offensive operations in any part of the world, either independently or in cooperation with land and naval forces; to conduct maximum-range recon-

naissance over land or sea, either independently or in co-operation with land and naval forces; to provide combat units capable of intense and sustained combat operations employing the latest and most advanced weapons; to train units and personnel of the maintenance of the Strategic Forces in all parts of the world; to perform such special missions as the Commanding General Army Air forces may direct". [3]

General Curtis E. LeMay took command of SAC in 1948 transforming it to an unparalleled combat force ready to retaliate on a moment's notice. General LeMay was a strong advocate of strategic bombing. This doctrine focused on the destruction to an adversary's cities and industrial centers. General LeMay believed that the existence of the atomic bomb made this type of warfare the only workable strategy, rendering battlefield conflicts essentially obsolete.

In a period of five years, under General LeMay's command, SAC had achieved an unprecedented level of striking power. From its initial handful of wartime B-29 Superfortress bombers, only a few of which were "Silverplate" early nuclear capable aircraft, SAC transitioned to its first, truly intercontinental bomber, the Convair B-36. Of the seventeen wings in the atomic force, eleven were equipped. The B-47 force had grown from 62 to 329 planes, the B-36 force reached 185, and the reconnaissance RB-36 component numbered 137. At its peak, the SAC force included more than 1,500 bombers, most of them the swept-wing B-47. Supporting the bomber force then were more than 500 tankers and 200 fighter aircraft. America projected its nuclear power with air bases from Greenland to North Africa, within striking distance to the Soviet Union. [4]

Demonstrating SAC's retaliatory capability

Operation Chrome Dome was an airborne alert mission designed to deter enemy forces from planning a surprise attack on the United States. This airborne mission allowed SAC to have an immediate retaliatory capability. Bombers flew along routes covering parts of Western Europe to North Africa. To keep the B-52s airborne for long periods, refueling squadrons performed numerous air refueling missions. These operations lasted for five years in the early 1960s. [5]

U.S. Air Force delivery systems in the Cold War included aircraft and various types of guided missiles. The guided missiles included surface to surface Intermediate Range Ballistic Missiles (IRBM), Medium Range Ballistic Missiles (MRBM), and Intercontinental Ballistic Missiles (ICBM). Other U. S. Air Force missiles employed at the time consisted of air-to-air; and air-to-surface.

The discussion will only focus on Cold War era weapons, and weapons still in the inventory will not be listed. I won't go into details of every weapon produced, employed, experimental, or canceled as this would go beyond the scope of this article. I will list a few representative examples of the weapons employed by the USAF during the Cold War.

F-100 Supersaber dropping its nuclear payload.
Photo: USAF

Aircraft

Typical U.S. Air Force aircraft were fighters, light bombers often referred as "tactical bombers" and heavy bombers. Volumes can be written on aircraft alone, so I'll only list a few representative aircraft.

Among some of the notable aircraft that graced the skies with nuclear armament was the North American F-100 Super Saber, an aircraft cable of supersonic speeds in level flight constructed mostly of titanium. The Republic F-105 was a Mach 2 fighter-bomber that could carry a single nuclear bomb internally for high-speed, low-altitude penetration. The F-102 and F-106 charged with air defense of the Continental United States under the Air Defense Command were armed with the AIM-26 nuclear tipped air to air missile.

Bombers used during the Cold War included the B-36 Peacekeeper, a massive jet and conventional piston engine bomber capable of reaching targets globally, the B-47 Stratojet jet bomber was a medium-range bomber capable of flying at high subsonic speeds and primarily designed to penetrate Soviet airspace. The B-47's were operational from the 1950s to early 1960s, and was the backbone of SAC until the B-52 became fully operational.

Convair B-58 Hustler The first operational supersonic jet bomber capable of Mach 2 speed for the USAF was

KC-135 Stratotanker refueling a B-52 bomber. In flight refueling helped to keep bombers airborne 24 hours a day during Operation Chrome Dome. Photo: USAF

the Convair B-58 Hustler. This aircraft was developed during the late 1950s as a result of a SAC requirement for an aircraft to employ nuclear weapons at high speeds and altitude. With the introduction of highly accurate Soviet surface-to-air missiles, the B-58's mission profile changed into a low-level penetration role, limiting its range and strategic value.

General Dynamics FB-111 was a multi-role aircraft entering service in 1967, and retiring in 1998. As a long-range interdiction/strike aircraft it was designed to penetrate Soviet air defenses at low altitudes and at high speeds to deliver its nuclear payload.

Boeing B-52 "Stratofortress" This is a long-range strategic bomber operated by the U. S. Air Force since 1955, still performing its conventional mission and available for its nuclear mission. The B-52 Stratofortress replaced the Convair B-36 as the main bomber to conduct the nuclear deterrence mission. With new upgrades and extension programs, this 54 year old war bird still has many more years of life. It is said that the last pilot to command a B-52 has yet to be born.

Tanker Aircraft

Not often thought about as part of the nuclear infrastructure were tanker aircraft. To keep bomber aircraft airborne constantly, many air refueling aircraft were needed. The most prolific Tanker was the KC-135, a modified Boeing 707. This aircraft was first introduced to the USAF in August 1956, with full production commencing in the following year. The last KC -135 was delivered to the Air Force in 1965 and this aircraft continues this mission today.

Tactical and Strategic Bombs

Through the years, the USAF inventory contained many bombs that were type classified as "Tactical", later changing to "non-strategic" and Strategic. These ranged from several kilotons to megatons yields. These newer bombs were more powerful and lighter weight compared to the days of Little Boy and Fat Man. Many early bombs are still in service well beyond the end of the Cold war era.

Surface to Surface Cruise Missiles

Martin MGM-1 "Matador" was the first operational surface-to-surface cruise missile built by the U.S. similar in concept to the German V-1 of WWII. Originally flown in 1949, by the end of 1953 the first squadron was operational, but not deployed until 1954, as the 1st Pilotless Bomber Squadron, Bitburg Air Base, Germany, armed with a nuclear warhead. The missile was capable of flying over 700 miles and at an altitude of 30, 000 feet.

Martin "Mace" The Mace had a dual role as a mobile-launched variant called the MGM-13 and CGM-13 for a container-launched version. The Mace was a tactical surface-to-surface missile developed from the MGM-1 Matador. Mace was launched from a mobile trailer or a hardened bunker using a solid fuel booster rocket for initial acceleration and a turbojet for sustained flight. Deployment began in 1959 with the missile remaining in service until the early 1970s.

General Dynamics/McDonnell Douglas BGM-109G "Gryphon" This was a ground-launched Cruise Missile (GLCM) developed in the 1970s to provide the Air Force with a highly mobile, reliable, precision-guided, ground-based system for delivering "tactical" thermonuclear warheads. Congress approved the project on the contingency that it be an adaptation of the Navy's BGM-109 Tomahawk sea-launched cruise missile (SLCM). The U. S. Air Force developed the mobile launcher and Launch Control Center (LCC) necessary to make the SLCM land-mobile. [6]

Plumbbob John Nuclear Test, the only live test of a Genie rocket on July 19th 1957. Fired from US Air Force F-89J over Yucca Flats, Nevada Test Site at an altitude of ~15,000 ft (4.5 km). [9]

Surface to Air Missiles

CIM-10 "BOMARC" The CIM-10 BOMARC was a joint development with Boeing and Michigan Aeronautical Research Center, hence the name BOMARC. The Program was a joint U.S. and Canadian effort between 1957 and 1972 to protect against the Soviet bomber threat. This strategy required the deployment of tactical stations armed with BOMARC missiles along the east and west coasts of North America and the central areas of the continent.

Air to Air Missiles

DOUGLAS AIR-2A "GENIE" The AIR-2A Genie air-to-air rocket was the world's first nuclear-armed air-to-air interceptor missile and consequently was the most powerful ever deployed by the United States Air Force. It was carried by Air Defense Command's F-89J, F-101B, and F-106A interceptor aircraft. [6]

HUGHES AIM-26 "FALCON" The AIM-26A was the only guided nuclear-armed air-to-air missile ever deployed by the USAF. Development of a nuclear-armed derivative of the AIM-4 Falcon began in 1959 to give interceptor aircraft a head-on kill capability against enemy bombers, since radar homing technology of the day was too inaccurate for a conventionally armed missile. The AIM-26A became operational with F-102 interceptors in 1961. The nuclear warhead and the all-weather capability of the radar guidance made the AIM-26A the most powerful air-to-air missile ever deployed. [6]

Air to Surface Missiles

North American Aviation Corporation AGM-28 "Hound Dog" The AGM-28 Hound Dog missile was a supersonic, jet powered, air-launched cruise missile. The Hound Dog was originally envisioned as a temporary standoff weapon for the B-52, to be used until the AGM-48 Skybolt air launched ballistic missile could be deployed. The Skybolt program was canceled and the Hound Dog was deployed for 15 years, retiring in 1975, replaced by newer weapons.

Boeing AGM-69 "SRAM" The Short-range attack missile, or SRAM was a nuclear air-to-surface missile designed to replace the older AGM-28 Hound Dog stand-off missile. The requirement for the weapon was issued by SAC in 1964, and the SRAM entered service in 1972. It was carried by the B-52, the FB-111A, and, for a very short period starting in 1986, by the B-1Bs. [7]

Intermediate Range Ballistic Missiles (IRBM)

PGM-17 "Thor" Development of the Thor was initiated by the US Air Force in 1954 as a Tactical Ballistic Missile. The goal was a missile system that could deliver a nuclear warhead over a distance of 1,150 to 2,300 miles (1,850 to 3,700 km). Thor was the first operational ballistic missile in the arsenal of the United States, operated by the US Air Force. Named after the Norse god of Thunder, it was deployed in the UK between 1959 and September 1963 as an Intermediate Range Ballistic Missile (IRBM). It was later augmented in the U.S. IRBM arsenal by the PGM-19 Jupiter.

Medium Range Ballistic Missiles (MRBM)

PGM-19 "Jupiter" In December 1955, the U.S. Secretaries of the Army and Navy announced a dual Army and Navy program to create a land and sea based MRBM. Because of naval basing, the Jupiter MRBM was designed as a short squat missile to ease handling aboard ships. The Navy withdrew from the project in November 1956 in favor of the solid fuel Polaris missile. Despite the withdrawal of the Navy from the project, the Jupiter MRBM retained its original dimensions. As a result, the Jupiter was too wide to be carried aboard contemporary cargo aircraft. Jupiter was America's second MRBM design, the first being Thor. In November 1956, the Department of Defense assigned all land based long range missiles to the U. S. Air Force. The U. S. Army retained battlefield missiles with a range of 200 miles (320 km) or less.

The Jupiter MRBM program was transferred to the U. S. Air Force. Jupiter was withdrawn from service in 1963.

Intercontinental Ballistic Missiles (ICBM)

SM-62 "Snark" The Northrop SM-62 Snark was a specialized intercontinental cruise missile with a nuclear warhead operated by SAC from 1958 until 1961. It takes its name from Lewis Carroll's fictional monster. The Snark was launched from a light platform by two rocket booster engines. It switched to an internal jet engine for the remainder of its flight. An advanced feature of the Snark was its ability to fly missions of up to 11 hours and return for a landing. Landing was accomplished by setting the Snark on a flat, level surface allowing it o skid to a stop like a conventional glider and the missile could be flown repeatedly. [8]

Convair Division of General Dynamics CGM-16/HGM-16 "Atlas"
Originally designed as an ICBM in the late 1950s, Atlas became the foundation for a family of successful space launch vehicles (SLV). The Atlas rocket family is today used as a launch platform for commercial and military satellites, and other space vehicles. The Atlas was first tested in 1957 becoming the first successful U.S. ICBM.

Glenn L. Martin Company LGM-25 "Titan II"
The Titan II was a significant improvement over the Titan I. The Titan II was originally designed as an ICBM, and later used as a medium-lift SLV to carry payloads for the Air Force, National Aeronautics and Space Administration (NASA) and National Oceanic and Atmospheric Administration (NOAA).

The Martin Company received a contract for the missile in June 1960. The Titan II used storable propellants, a significant step towards safety and reliability. The Titan I's fueling configuration was time consuming and dangerous, as it had to be raised from its silo and fueled before launch. The use of storable propellants enabled the Titan II to launch directly from its silo.

The Titan II was first flown in December 1961 and the missile, redesignated as the LGM-25C, reached initial operating capability in October 1963. The last Titan II missile, located at Silo 373-8 near Judsonia, Arkansas, was deactivated on May 5, 1987.

LEM-70 "Minuteman II" ICBM
The LGM-30F Minuteman II was an improved version of the Minuteman I missile. Development on the Minuteman-II began in 1962 as the Minuteman Is entered SAC's nuclear force. Minuteman-II production and deployment began in 1965 and completed in 1967. It had an increased range, payload, guidance system, and better accuracy.

LGM-118 "Peacekeeper" ICBM
The LGM-118A Peacekeeper, dubbed the "MX missile" (for Missile-eXperimental), was a land-based ICBM deployed by the United States starting in 1986. The development of the Peacekeeper began with the counterforce, hard-target mission. It was to be used against hardened enemy missile silos with first-strike capability. This required high accuracy, survivability, range and a flexibility that was not available in other ICBMs. The last Peacekeeper was removed from alert on September 19, 2005 during the final deactivation ceremony when the 400th Missile Squadron inactivated as well.

Epilogue

After the collapse of the Soviet Union, many of the services reorganized, as there was no longer a perceived "threat." The USAF underwent a significant reorganization of their commands. Among the vanquished were the war fighting elements that had defined the U. S. Air Force for nearly 45 years, Strategic Air Command and Tactical Air Command. These two units were combined into a single command as the newly created Air Combat Command (ACC). Air refueling and transportation now came under Air Mobility Command (AMC), assuming control of the tankers that once belonged to SAC. The ICBM force was now under new management with yet another new command called Air Force Space Command (AFSPC). [3]

Summary

America and perhaps the world relied on the U.S. Air Force and to SAC in particular for nuclear deterrence. The professionalism displayed by these crews could read like that of a personal citation: For exceptional performance, and devotion to duty that reflect great credit upon you and the U.S. Air Force. This dedication to duty was certainly in keeping with their unit motto:
"Peace Is Our Profession."

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(This banner was previously used on all SAC Bombers and Air Refueling Tankers.)

Chemical Warfare: Part II

Mr. A. Mark Diglio
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In January 2009 Combating WMD Journal Issue 3, we focused on the history of Chemical Warfare (CW) in ancient times. The article reviewed how CW developed over the centuries from earliest times. The intent was to demonstrate that chemicals can be used in primitive ways to inexpensively create devastating impacts. This issue presents a review of CW history in modern times, World War I (WW I), CW use prior to 1920. Subsequent articles in this series will look at CW use in WW II, through the present and information to assist in preparedness and planning. Before embarking upon review of early Modern CW, it is important to be reminded of why we need to be prepared.

The Threat

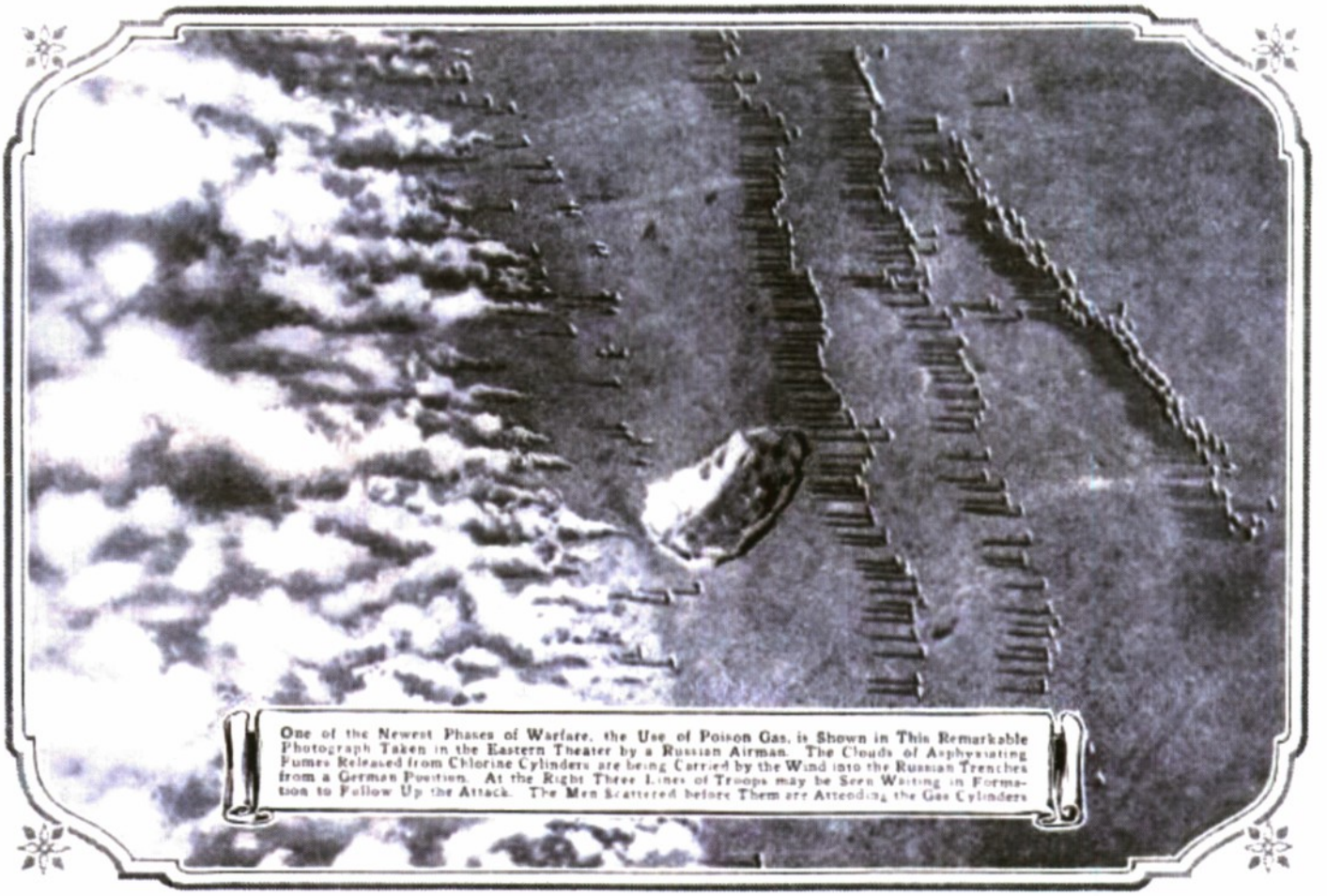
There is a growing air of global malcontent. It is not a passing fad. It is a part of life we must all be aware of, adapt to and as a society aggressively act upon. The strongest threat of terrorism comes from that of the radical Islamic movement in the Muslim world. Their numbers are now estimated around 15% of the global Muslim community. Why? They are the only significant organized religion that believes in killing "non-believers" to get closer to god. If left to their own designs, radical Islamic terrorism will continue to grow causing fear and death to rise as if it were a world cancer. This radical branch of Muslim religion stops at nothing, the Jihad (personal struggle), to fight the ways of the West (primarily America, Britain, and Israel) by killing non-believers like insects. They bolster their numbers by lying to the young, the poor, and the uneducated by coercing and intimidation about the 'Evil West'. Their ranks include the young, poor and uninformed. Their resources are vast and include those that are Western educated engineers and doctors. The organization originally funded with oil money from the Middle East has developed elaborate networks of organized white collar crime schemes as well as investment in legitimate businesses. Their funding is used for propaganda, recruitment, weapons, training, espionage and research. This threat is real and will not dissipate. When ignored, it will only continue to grow stronger.[1]

Photo Courtesy of the Associated Press

Radical Islamic terrorists are not the only threat for use of CWMD. Governments of considerable power have fallen. In their wake is the opportunity for rogue factions or fallen governments to pursue any and all means to regain financial and political power. This series of articles on CW are presented to raise awareness of CWMD that we may better deter, detect and defeat their use both from terrorists and rogue nations.

Chemical Warfare Ancient Times Relook

A brief recap of highlights from Part I, the history of CW in ancient times and some of its more noteworthy uses follows. CW involves the use of chemical substances to incapacitate, injure, or kill an enemy or enemy's environment. For example, in early times, salt was used to destroy farmland. Recently, oil tankers were taken hostage for million dollar ransoms in the Indian Ocean. On February 1, 1991, Saddam Hussein set fire to all the oil wells in Kuwait turning daytime battle skies black and drenching the Dessert Storm war zones with choking air. CW started before 1000 BC with the Chinese use of poisonous smokes to sicken enemy troops. Poisoned tipped arrows were used in some conflicts (in recent times, poisoned tipped umbrellas, darts and knives were used for assassinations). The Greeks used poisons to kill their enemies in 590 BC. In 190 BC, Hannibal hurled deadly poisonous snakes aboard enemy



Aerial photograph of a chlorine gas attack by the Germans against the Russians in 1916. From *Popular Mechanics* Magazine March 1916. [10]

ships. In 678 AD, the Greeks defeated the Arab fleet using Greek Sea Fire, an inextinguishable oil based fire. 1241 AD, the Mongols used poison gas in the Battle of Legnica. 1456 AD, Belgrade defenders fired Arsenic bombs, grenades and soaked rags against the Turks. In the Anglo-French 30 Years War (1618 to 1648 AD), stinking jars and toxic bombs were used in great quantities. The methods and variety of chemicals used for warfare are seemingly endless.

The Stage for Modern Chemical Warfare

The use of CW was considered barbaric after the 17th century. Civilized countries made tacit and formal gentlemen's agreements over the 18th and 19th centuries to ban their use. In America's own Civil War, for example, plans were made to use chlorine gas, hydrochloric and sulfuric acids–but they were never acted upon by the Union. American leaders deemed it too inhumane. Before the second half of the 19th century, many poisonous chemicals were discovered, but could not be produced on a mass scale. It was industrialization after 1850 that raised the urgency and concern for international address to prohibit chemical warfare. For the first time, countries had industrialized with the capability to produce mass quantities of synthetic chemicals. It was this fear of poison applied on a massive scale that promoted international agreements banning use of poisons.

In an attempt to limit the unchecked destructiveness of war, on July 29, 1899, the Hague Declaration was signed. It prohibited the use of projectiles for diffusion of asphyxiating or deleterious gases deeming their use 'immoral.' On October 18, 1907, Europe signed the Hague Convention Respecting the Laws and Customs of War on Land noting it was especially forbidden "to employ poison or poisoned weapons." While the United States agreed in principle with the Hague agreements, it did not immediately sign. Despite these anti-CW accords, most industrialized countries continued both research and plans to prepare for potential CW use. Research was justified for deterrence. However, much less publicized was offensive research to get the military advantage if ever needed or retaliation-in-kind should someone else use it first.

The world scene changed with the

A Chronology of the Escalation of CW in WW I	
April 22, 1915	Germany releases the first successful modern CW attack with chlorine gas near Ypres, Belgium.
April 24, 1915	Germans conduct a second chlorine gas attack at Ypres against Canadian troops.
May 31, 1915	Germans use chlorine phosgene mix along 12 kilometers of Russian front, at Bsura-Rumka. Some 12,000 bottles of gas were used, resulting in 9,000 casualties, including 6,000 deaths.
July 15, 1915	Germans fired 100,000 155mm benzyl bromide shells in Argonne.
Dec 19, 1915	Germany released 88 tons of phosgene from 4,000 cylinders against Brits at Nieltje, Flanders.
Mar, 1916	US used 75 artillery shells of phosgene for the first time in Verdun, France with devastating effect.
July, 1916	Allied forces used shells filled with hydrogen cyanide during the Somme offensive.
Mar, 1917	Airplanes are used for the first time to spread CW, phosgene, creating vast lethal concentrations.
July 12, 1917	Germans first use mustard gas by Ypres, Belgium.
Sep, 1917	First use of "Clarks" arsine based gases that cause nausea and vomiting that passed through gas masks. [4]

start of the Great War. WW I erupted in 1914 on the European continent, massive waves of men and equipment thrown against each other. For the first time, a major conflict quickly evolved into a stalemate in the trenches. Troops gained a few miles over the course of months only to lose them the next. This stalemate lasted for nearly a year. With forces evenly matched, both sides were looking for an advantage to break the impasse. [2]

Early Modern Times

WW I ushered in a new era for CW use. For the first time, warring nations employed industrially produced chemicals in mass quantities with deadly mass effectiveness. Because Germany had the lead possessing the world's most advanced chemical industry (in large part due to its strong textile dye industry and its world lead in dyestuff production), it enjoyed an inherent advantage in this type of warfare over other countries. Germany also had some of the world's best chemists of the day. They discovered how to make ammonia industrially, a key ingredient to easy production of many CW agents. It lessened Germany's dependence on foreign suppliers for nitrates which would be cut once the war started. [2]

Interestingly, the French were actually the first to use chemicals in WW I, August 1914. They used ethyl bromoacetate for riot control against the Germans, but too mild to be effective. The French argued it was not poisonous enough to constitute violation of the accords. None-the-less, it provided Germany a weak excuse to claim The Hague agreements invalid. Also, Germany argued the Hague Declaration only prohibited poisonous projectiles.

Germany tried several times before getting CW to work on a large scale. October 1914, 3,000 explosively charged shells loaded with a lung irritant (dianisidine chlorosulfate) were used on the English. It didn't work because the high energy explosive burnt the chemical, neutralizing any effects. On January 15, 1915, Germany unsuccessfully used another irritant (methylbenzyl bromide - tear gas) by firing 18,000 shells upon the Russians near Bolimow, but subfreezing temperatures prevented the liquid agent from vaporizing rending it harmless.[3] However, the Germans weren't about to give up. Thanks to, Fritz Haber, a renowned German chemist that founded the Haber Institute (some refer to him as the father of modern CW); Germany later earned the notorious title of first country to successfully use CW in modern times.

April 22, 1915, an otherwise pleasant sunny spring day in Belgium near Ypres, marked the dawn of a new era of CW. Germany's third attempt to use CW (chlorine gas) in WW I, again an experiment, opened a 4-mile wide hole in the trench line. It was so effective that German commanders were unprepared with any reinforcements to advance and take advantage of their victory.

From the opening passage of "A Higher Form of Killing" by Robert Harris and Jeremy Paxman:

"At five o'clock, three red rockets streaked into the sky, signaling the start of a deafening artillery barrage. High-explosive shells pounded into the deserted town of Ypres and the villages around it. At the same time the troops sheltering near Langemarck saw two greenish-yellow clouds rise from the enemy's lines, catch the wind, and billow forward, gradually merging to form a single bank of blue-white mist: out of sight, in special emplacements protected by sandbags and concrete, German CW pioneers were opening the valves of 6,000 cylinders spread out along a four-mile front. The cylinders contained liquid chlorine – the instant the pressure was released and it came into contact with the air it vaporized and hissed out to form a dense cloud. At thirty parts per million of air chlorine gas produces a rasping cough. At concentrations of one part per thousand it is fatal. The breeze stirred again, and one hundred and sixty tons of it, five feet high and hugging the ground, began to roll toward

German troops fitted in gas masks escape a phosgene cloud in 1916.[11]

the Allied trenches. Chemical Warfare had begun."[3]

More specifics are provided in John Tucker's War on Nerves. 1,600 large and 4,130 small steel cylinders filled with pressurized liquid chlorine, a total of 5,730 cylinders and 168 metric tons. Heavier than air, the 5 foot high cloud drifted across the no man land into the trenches at a leisurely pace of four miles per hour. Gradually the warmth of the ground caused the cloud to expand to a height of about thirty feet and assume a yellow-green color, darker near the ground and lighter on the top. Allied estimates inflated to underscore outrage were placed that a total of 5,000 men were killed with an additional 10,000 casualties. The taboo against the use of poison gas had been broken. Now the international gloves banning CW were coming off.

By summer of 1915 following the successful German use of chlorine gas, both sides prepared to protect against CW by issuing millions of gas masks. While the early designs were crude by today's standards, the masks bought time and often meant the difference between life and death. The earliest protection was only liquid soaked rags, grossly inadequate for real protection. The allies had an advantage in gas mask designs over the Germans in that they did not have as severe a limitation on available resources for filter media and mask materials. The Germans used what they had, to do the best they could, and they did exceedingly well. While weak in gas mask and protection, the Germans experimented using a variety of CW agent compound and technique firsts. For example, Germany was first to discover that gas masks challenged with a variety of agents dramatically lowers the mask's effectiveness. Due to the unpredictability of the weather, effective planning for use of CW was complex at best. Times for release and reenforcements were difficult to coordinate. The best time of delivery often changed, but timing was critical for success and to avoid bringing the horror to your own troops.

At the beginning of the final year of WW I in 1918, it was estimated one of four projectiles fired by both sides were chemical. At WW I's conclusion with the signing of the November 11, 1918, one in two shells fired were chemical. (Allied forces overwhelmed the Germans which were in steady retreat hence their signing of a cease fire. Hostilities remained until formal signing of the Treaty of Versailles seven months later, June 28, 1919. While phosgene caused the most deaths in WW I, mustard caused the most casualties.[5] However, this may be due in large part to the late introduction of mustard gas during the last year of fighting (July 1917). Mustard burns leave scars for a lifetime and mustard is a known carcinogen. Even if you survive the exposure, you may not survive the ravaging of your body 20 years later from inoperable cancer.

Chemical Warfare Technology Development Timeline [6]				
	Agents	***Dissemination***	***Protection***	***Detection***
1900s	Chlorine Chloropicrin Phosgene Mustard gas	Wind dispersal		Smell
1910s	Lewisite	Chemical shells	Rosin oil clothing Gas mask	
1920s		Projectiles w/central bursters	CC-2 clothing	
1930s	G-series nerve agents	Aircraft bombs		Blister agent detectors Color change paper
1940s		Missile warheads Spray tanks	Protective ointment (mustard) Collective protection Gas mask w/Whetlerite	
1950s				
1960s	V-series nerve agents	Aerodynamic	Gas mask w/water supply	Nerve gas alarm
1970s				
1980s		Binary munitions	Improved gas masks (protection, fit, comfort)	Laser detection
1990s	Novichok nerve agents			

This is a photo of an unidentified Canadian soldier with mustard gas burns in WW I, 1917-1918. Damp areas of clothing, or exposed areas allowed the agent to penetrate, causing excruciating injuries. [6]

The body tries to heal and cleanse itself from this heinous silent actor, but can't. Particularly nasty if one inhaled the gas and survived, there is a high probability of contracting lung cancer long after the single mustard exposure.

An estimated 1.3 million died from CW in WW I with about 100 thousand that died from CW in combat. Compare this to 26.7 million WW I deaths by other forms of warfare of which 6.8 million died in combat.[4] Note the number dying from conventional wounds is 4 times higher than conventional combat deaths, but the number chemical wounds resulting is deaths is 13 times higher for CW. This is what Robert Harris and Jeremy Paxman refer to as "a higher form of killing" the title of their 2002 book.[3]

The primary CW agents used in WW I were chlorine gas, phosgene and mustard. Cyanide was dabbled with as with cyanogen chloride, but not in great quantity. WW I prompted the U.S. to form what later became the Chemical Corps. [9] Countries developed protection from chemicals – gas masks with carbon filters and protective over garments. This in part, is what limited the effectiveness of CW in WW I compared to conventional weapons. None the less, it was a great factor in combat effectiveness due to the labors of chemical protection equipment, primarily, a gas mask. There are physical limits on how long one can wear a gas mask, how effect one can aim a rifle, or see approaching assailants. However, all nuclear biological and chemical contamination can be defeated through use of proper equipment only if protection is available and used. When unprotected, CW fatalities and wounded casualties were high in WW I and will be today.

During WW I, well employed CW would swamp the enemies hospital care facilities. Frequently, the only remedy for exposure during WW I was bed rest. Few doctors knew how to treat or properly identify the exact CW agent of exposure or the proper treatment. [8]

Summary of Modern CW in WW I

Initially, Germany held the lead in chemical agent deployment. From 1915 to 1918, the tactical employment of chemical weapons varied between the belligerents. However, by late 1918, both sides were using similar delivery systems and chemical agents. The effect of gas should be neither belittled nor exaggerated. The numbers of gas casualties were often inflated or decreased, depending on the needs of the moment for propaganda reasons. "The novelty of the weapon, the secretiveness of the chemists, and the inexperience of the troops provided ideal conditions for the growth of legends, for claims and counter-claims, and for assertions that went unchallenged." After the signing of the armistice, the use of chemical agents during World War I caused the public and the military to closely examine them, and prepare for their future use. [7]

Closing Remarks

Following WW I, developed countries raced to develop more deadly CW agents than chlorine, phosgene, blister agent and mustard. They succeeded, Germany again in the lead. Agents were developed that are invisible, odorless, colorless so potent a drop will kill – nerve agents, an unfortunate by-product of pesticide research. This topic will be further explored in a future issue. Remember, it is only through awareness, planning and constant vigilance that we will combat chemical WMD and terrorism.

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CBRN Standardization in NATO (Non-Medical)

Mr. Frank R. Jordan
U.S. Head of Delegation to CBRN Working Group (CBRNWG)
and Joint Capability Group on CBRN (JCGCBRN)

Threats of global terrorism and proliferation of Weapons of Mass Destruction (WMD) are major challenges to the NATO alliance. These challenges significantly enhance the importance of multinational force interoperability with respect to CBRN-related doctrine; tactics, techniques, and procedures; training, and materiel. NATO armed forces must be prepared and capable of operating in chemical, biological, and radiological environments or when encountering toxic industrial hazards. The foundation for NATO armed forces interoperability is achieved through the NATO Standardization Program.

NATO standardization is vital to combined operational effectiveness across the spectrum of NATO military operations. The objective of standardization is to achieve a required critical level of interoperability that fosters increased national burden sharing to NATO missions and contributes to the ability of Alliance forces to train, exercise, and operate effectively both together and with forces of Partnership for Peace (PfP) and other non-NATO countries.

The Alliance encourages national and NATO authorities to develop, agree to, and implement concepts, doctrine, procedures and designs that enable interoperability during multinational operations. The promulgation and implementation of CBRN-related NATO Standardization Agreements (STANAGs) and other allied publications help countries to achieve required levels of interoperability and to better accomplish common strategic, operational and tactical tasks; to understand and execute common procedures; and to employ techniques, materiel and equipment more efficiently.

The responsibility for the development of non-medical CBRN-related STANAGs primarily rests with two working groups within the NATO structure: the doctrine focused Chemical, Biological, Radiological and Nuclear Defense Operations Working Group (CBRNWG) and the materiel focused Joint Capability Group on Chemical, Biological, Radiological and Nuclear Defense (JCGCBRN). Collectively these groups in collaboration with the NATO Strategic Commands and other NATO bodies are addressing CBRN interoperability standards for current and future CBRN terrorism and proliferation challenges. The collective products of these two groups establish NATO's CBRN interoperability standards for tactical units (general forces) and specialized CBRN elements such as the Multinational CBRN Battalion, -an integral component of the NATO Response Force-.

The CBRNWG is in its 48th year of developing, coordinating and assessing operational standardization matters. The group is comprised of voting members from all 26 NATO nations; non-voting participants from other NATO bodies and other NATO Strategic Commands; and observers from NATO PfP countries, Contact Countries, and Non-NATO bodies. Currently, the CBRNWG is responsible for 31 non-medical CBRN-related STANAGs and associated Allied Publications that provide guidance organized along the lines of the Allied Joint Publication 3.8 (AJP -3.8), *NATO Doctrine for CBRN Defence* and five of its agreed CBRN defense enabling components (detection, identification and monitoring; warning and reporting; physical protection; hazard management). Additional responsibilities of the working group includes evaluation of lessons learned from recent operations and exercises and monitoring of advances in CBRN defense capabilities to produce amended or new standards.

The JCGCBRN is a joint, tri-Service body responsible for equipment-related aspects of CBRN detection, identification, monitoring; sampling and identification; hazard management; physical protection; radiological and nuclear defense; challenge/threat. Membership is similar in composition as that of the CBRNWG. This group is responsible for 22 STANAGs and 19 Allied Engineering Publications which address CBRN materiel concepts, specifications, and test and evaluation procedures required to achieve CBRN survivability of NATO armed forces personnel and equipment. Additionally, the group fosters information exchanges on CBRN defense (to include technology advancements) and proposes cooperative developments related to CBRN defense equipment.

Today, the CBRNWG and JCGCBRN are addressing the challenges of global terrorism and proliferation of WMD. Continuous STANAG improvements are redefining the critical levels of interoperability required for NATO armed forces to meet and survive these challenges.

USANCA Officially Opens New Headquarters

Mr. Paul Bello, Fort Belvoir Eagle Staff Writer

Ms. Marny Malin, Fort Belvoir Eagle Staff Photographer

Tuesday 21 July 2009 marked a new chapter in the history of the United States Army Nuclear and Combating Weapons of Mass Destruction Agency. Not only was it the unveiling of its new, state-of-the-art headquarters, but a dedication to a noteworthy colleague from its past. Peter Bechtel, the agency's director since 2006, greeted guests by saying the 16th Street location was a manifestation of an opportunity received through Base Realignment and Closure in recent years. Since 1977, the agency had been consolidated and located at Fort Belvoir North, the old Engineer Proving Ground, which will soon be home to another organization - the National Geospatial-Intelligence Agency.

As USANCA moves forward with its mission of providing nuclear planning and execution across the globe, Mr. Bechtel said the building would also stand as a tribute to LTG Leslie Richard Groves - an Army engineer who helped design the Pentagon and an integral leader of the Manhattan Project during the early 1940s. With members of the Groves family looking on, including his son, Richard, LTG James D. Thurman, Deputy Chief of Staff, U.S. Army, said the occasion was not only a great day for the Army, but a great way to continue the father's legacy.

"I have the honor of watching men and women perform great work every day. They're the ones who move this big green machine forward," LTG Thurman said. "We live in an era of persistent conflict. The contributions of LTG Groves will continue with a new generation and we will do whatever it takes to defend the U.S.A.

"As I'm sure he would tell you, nothing can be stopped when everyone works together toward a common goal. " Being back at Belvoir brought many memories for LTG (R) Groves, who retired from the Army in 1982 as a lieutenant general, himself. According to him, he still recalls the afternoon of Aug. 6, 1945 - the day he was pulled out of class by a colonel and told the news that America had just dropped an atomic bomb on Hiroshima.

"I was taken to a pay phone and told by another colonel that I was going to be inundated with reporters asking me all sorts of questions. The colonel instructed me to decline all requests for interviews and simply say I didn't know what anyone was talking about," LTG (R) Groves told the audience.

"Even after a picture of my father appeared on the front page of a major newspaper, I still told reporters, I don't know what you're talking about.' I'm sure they were pleased to hear that and went off to write something very flattering about me, " LTG (R) Groves said. After a chorus of laughs, he continued to say the last two years of his father's service were quite difficult, due to the severity of the times. However, he said his father would be pleased to know that nuclear planning is continuing again with the Army and that it will go a long way in protecting the nation for years to come.

"Having his son and family here makes this ceremony all the more special," Mr. Bechtel said. "LTG (R) Groves was a true leader of his time and is part of our agency's long and vivid history. With this fully operational building, we will continue his vision of enhancing international programs well into the future." Mr. Bechtel said the new building will have a staff of 35 and provide further training on nuclear targeting and research. Mr. Bechtel said the building can provide secure video conferencing and additional space for storing classified material.

Photo by Marny Malin

LTG James Thurman, Deputy Chief of Staff, G-3/5/7 and retired LTG (R) Richard H. Groves shake hands after unveiling the plaque dedicated to LTG (R) Groves' father, Lt. Gen. Leslie Groves, during Tuesday's U.S. Army Nuclear and Combating Weapons of Mass Destruction Agency ribbon-cutting ceremony.

Plaque designed by CW5 Stephen Gomes, USANCA.

Code-Name Down Fall

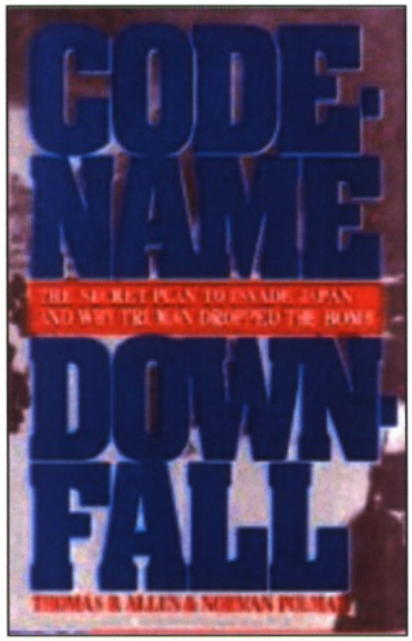
Lt Vern Conaway, USAF
Air & Space Power Journal Book Review

Norman Polmar and Thomas Allen present a clear repudiation of the idea that the dropping of the atomic bombs on Hiroshima and Nagasaki was unnecessary. Instead, the United States was planning a massive invasion of the Japanese home islands, code-named Downfall, in which the detonation of the bombs were nothing more than the United States trying to do everything in its power to end the war as quickly as possible. Whether the bombs ended the war or simply made the invasion easier was not an issue in deciding whether or not to use the bomb. The bomb was a weapon and in the arsenal.

The authors lead the reader through a concise but thorough background of both prewar plans involving a war against Japan and through the war itself, from the surprise attack at Pearl Harbor to the surrender of Japan aboard the USS Missouri. The background is excellently laid and the authors do a great job of bringing the war to life. From memoirs and interviews the reader gains insights into what the commanders on both sides of the lines were actually thinking.

Overall, *Code-Name Downfall* is an excellently researched book that proves its thesis well beyond a reasonable doubt. Almost all sources used are primary sources, including official memorandums from national archives, interviews, memoirs, official military plans, studies, and communications, and, most importantly, recently declassified Magic intercepts (of Japanese secret communications) that are on repository at the National Security Agency.

Polmar and Allen masterfully prove the thesis that the United



States was going to invade whether or not it used the bomb (unless Japan surrendered, of course). As the United States and its Allies made their way across the Pacific, the authors chronicle not only how the battles were fought but how the lessons learned would be applied in the plan for the final invasion of Japan. As the Allies drew nearer to Japan itself, the reader is exposed to the vastly intricate deception plans as well as to the contingency plans for the use of terror weapons (chemical and biological). The final invasion plan is also intricately laid out, from the arguments over when and where to land the invasion force to which forces were going to land on which beaches.

The key to the thesis, however, lies with the Magic intercepts. These intercepts clearly showed that the Japanese were in no way considering surrendering just because their homeland was about to be invaded. Rather, that only strengthened their will as the military prepared the entire population, including women and children, to defend the homeland against the Allies. Not only were the Japanese not open to negotiations in the least, there was no guarantee that the dropping of the two atomic bombs would end the war. In fact, American planners were calculating how many more bombs would be available for the invasion that was scheduled for 1 November 1945.

Thus, the invasion was destined to take place unless the atomic bombs ended the war. *Code-Name Downfall*, despite its shortage of detailed maps, shows that the atomic bombs were necessary considering the fact that the Japanese showed no intention of surrendering without a fight to the finish. Only the dropping of the bombs precluded that end.

Lt Vern Conaway, USAF Maxwell AFB, Alabama

Review used courtesy of *Air & Space Power Journal, 28 October 2008*
http://www.airpower.maxwell.af.mil/airchronicles/bookrev/allen.html

Combating WMD Resource Page

Theater Nuclear Operations Course (TNOC)

TNOC is the only course offered by a Department of Defense 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 officers TDY enroute to a FA52 assignment or currently serving in a FA52 position. There is limited availability outside of the FA52 community. Please call the FA52 Proponent Manager at (703) 806-7866 to inquire on available seats.

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.
Email: acecenter@cnttr.dtra.mil

Pandemic Influenza Overview

This class describes influenza types, variations, and effects, and identifies worldwide threats from pandemic influenza.

Examines U.S. strategy to combat the spread of pandemic influenza, identifies organization and responsibilities to implement countermeasures to pandemic influenza.

Identifies DOD plans and capabilities to respond to pandemic influenza by examining supporting technologies for detection, surveillance, protection, and mitigation of pandemic influenza.

Location: Distance Learning, register here:
https://dnws.abq.dtra.mil

Army Combating WMD Information Portal (ACIP)

The Army Combating WMD Information Portal (ACIP) is a USANCA sponsored web-based Combating WMD information resource for the Army Combating WMD community planning. The ACIP is the gateway to information and resources on Combating WMD information and is currently located on NIPR AKO USANCA Home Page. It is a prototype being developed on the unclassified network and will transition to the classified SIPR network as it matures. From AKO, search for USANCA. On the USANCA Home Page find the Army CMWD Information Portal (ACIP) and click "Open web site in a separate browser window" and open the ACIP to give it a trial run. The ACIP is being built to support you, the CWMD planner. Provide suggestions and comments regarding content and appearance to Mr. Jack Riegel.
His e-mail address is: jack.f.riegel@us.army.mil.

U.S. Nuclear Policy

This course explains the U.S. policy and its history; reviews NATO policy; discusses nuclear deterrence: theory, principles, and implications; discusses instruments of national power and implications for nuclear weapons; reviews nuclear surety and intelligence; discusses nuclear treaties and arms control.

This course is taught at the
Nuclear Weapons School (DNWS)
Albuquerque, New Mexico

Email: DNWS@abq.dtra.mil
Fax (505) 846-9168 or DSN 246-9168
Online Registration:
https://dnws.abq.dtra.mil/StudentArea/Login.asp

Past issues available online!

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https://www.cbrniac.apgea.army.mil/Products/Links/KeyDocs/Pages/USANCA.aspx

Titan II missile launching from silo. U.S. Air Force file photo

U.S. ARMY NUCLEAR AND CWMD AGENCY

Fort Belvoir, Virginia