Sailors aboard the USS Ronald Reagan conduct a countermeasure wash down to remove potential contamination during Operation Tomodachi. (U.S. Navy/Nicholas A. Groesch)

CWMD Strategy Gap
Capacities, Capabilities, and Collaboration

By Margaret E. Kosal

In 1994, then Chief of Staff of the U.S. Army, General Gordon Sullivan, recognized the increasing threat of chemical, biological, and nuclear weapons and the capability gaps exposed by the challenges of operating in a weapons of mass destruction (WMD)-contaminated environment. Although threats from WMD are neither new nor unrecognized at the highest levels of the U.S. Government (USG) and Department of Defense (DOD), remarkable gaps and inconsistencies between strategic level policy and operational capabilities persist. During the past 15 years, countering–WMD (CWMD) has been a top priority as expressed throughout multiple national and department-level strategy and policy documents, to include the *National Security Strategy* (NSS); the *National Military Strategy* (NMS); the *National Defense Strategy* (NDS); the *Defense Strategic Guidance* (DSG); and Quadrennial Defense Review (QDR). While a prevention strategy is laudable and important, the disparity between strategy and the required operational capabilities and capacities needed for securing, interdicting, and eliminating WMD reveals potential gaps that must be recognized and accounted for to ensure a credible deterrent posture. Future threats, especially biological, are likely to be more complicated than current or past conceptions.

Strategic Context

The U.S. national security community and military services continue adapting to the evolving global environment. The strategic dialogue is shaped by multiple sources, to include the release this year of a new NSS and a new NDS; increased attention to the reemergence of great power competition; uncertainty on the role of combat operations in Afghanistan; an ongoing civil war in Syria; a resurgent Russia in the Crimea and elsewhere; multiple missile tests by North Korea and claims of new ballistic capabilities to reach the continental United States; and lingering opaque nuclear questions in Iran. In a 2015 statement, the Director of the Defense Advanced Research Projects Agency articulated a consensus of the future operational environment outlook as

Dr. Margaret E. Kosal is an Associate Professor in the Sam Nunn School of International Affairs at the Georgia Institute of Technology.

> *an extended period during which our national security will face a wide range of different types of threats from a wide range f different actors—nation-states are in the mix, but so too are terrorist organizations and criminal organizations and even individuals. And each of these—all of these different kinds of actors have—of course they have the conventional means of waging war, or inflicting damage, but now they also have some new tools. Cyber is a very obvious example. Many of these actors also have increasing access to weapons of mass destructions, or weapons of mass terror.*[2]

The perception of the threat of WMD from state and non-state actors continues to increase in scale, scope, and complexity.

Additional impacts on the strategic dialogue took form in new directions from the Trump Administration, a new Secretary of Defense with little public history of engaging the CWMD mission (unlike former Secretary of Defense Ashton Carter, who had long been involved in Cooperative Threat Reduction [CTR] and other nuclear nonproliferation policy work), ongoing questions about the federal budget and the continuing effects of sequestration, and the operational priorities required for a shift in the nation's strategic focus during the rebalance (or pivot) to Asia. As then Deputy Secretary of Defense, Ashton Carter articulated

> *Everything's on the table: roles and missions, war planning, business practices, force structure, personnel and compensation, acquisition and modernization investment, how we operate, how we measure and maintain readiness.*[3]

CWMD efforts consistently reveal gaps between strategy and available military options. CWMD is among the highest priorities for the U.S. domestic and the international security community in the 21st century.[4] Denying the acquisition and use of WMD by hostile states, sub-state actors, or non-state actors as part of nonproliferation and counterproliferation, coupled with possessing robust capacity to manage potential consequences are desired strategic ends. CWMD encompasses both conflict and post-conflict activities centered on securing and destroying material and delivery systems; but, more broadly, it also entails activities intended to address the associated programs, infrastructure, and expertise.[5] It includes activities that span the range of "prevent," "shape," "contain," and "respond" concepts.[6] CWMD proliferation involves a broad range of actors, materials, technologies, activities, and legal considerations all of which have implications on the roles of military and civilian government departments. Considerations such as risk, time sensitivity, geographic location, and international relations add greater complexity.

Prevention of WMD is a laudable and important goal, but disparities between that objective and the operational means required to secure, interdict, and eliminate WMD has resulted in capability gaps. Greater recognition is needed to affect strategy and additional levers at the policy level. Part of the challenge in narrowing the gap between CWMD strategy and its enabling capabilities and capacities is attributable to multiple endogenous and exogenous cultural, policy, and institutional factors.

Cultural, refers to the absence of a strong sense of "cultural ownership" of the problem set to and risk averse innovation posture that drives evolutionary technology development to differences in service and agency cultures; *Policy*, in which roles, responsibilities, authorities, and equities are spread across the different proponents to the highly compartmentalized nature of CWMD programs; Finally, *institutional*, refers to both internal and external inadequate improvisations for active

defense capabilities, for building partnership capacity (BPC), or for operational preparation of the environment activities.[7] For example, PL 103–160 restricts the Joint Chemical and Biological Defense Program to development of passive defense capabilities, which are not adequate improvisations for active defense capabilities. For multiple reasons, including history and organizational structure, there is de-prioritization of Joint Force Land Component Commanders roles in CWMD missions in some Joint Environment and Combatant Commands (e.g., USSTRATCOM). In many agencies and efforts, the emphasis has been historically and remains focused on efforts to "the left of boom," i.e., non-proliferation and arms control; the think tank, policy wonk, and scholarly world that serves as a gestation and holding venue for many who move into formal policy positions emphasizes nonproliferation efforts.

There are a number of organizations and agencies involved in these efforts, however a significant level of national capacity resides in the military. In particular, the national capacity—across the scientific, technical, operational, and tactical spectrum—and the most probable responsibility for executing missions to secure, exploit, and eliminate WMD are overwhelmingly in the U.S. Army. Serious efforts regarding prevention are relatively recent and only now beginning to coalesce, an observation highlighted as of 2009, where across the USG, DOD, and the U.S. Army, "the elimination mission is still in its infant stages, support among the services and commands is tenuous, and concepts and capabilities are still lacking."[8]

Case Studies

Ten cases studies illustrate the gaps between CWMD objectives and the joint force capabilities and capacities needed for attaining them. A set of significant variables (or strategic attributes) expounds upon the capacity, capability, and usability of components inherent in military force design. These CWMD historical cases have been divided into two sub-categories. "Major" cases include U.S.-led efforts where military forces played a major role. "Other" cases include examples of operations and disarmament efforts that were coordinated at the multi-national level, initiated or led by other nation-states; cases in which the United States provided significant assistance; or instances that were domestic law enforcement cases illustrative of future threat scenarios. Several non-military, non-combat cases are included because of the relative lack of military operations involving WMD. These "other CBRN/CWMD" cases illustrate the importance and role of the variables. While assessment of the cases is not a perfect analytical tool, they provide a useful representation of the major qualities of such operations. All were conducted in permissive or semi-permissive environments.

Case study selection focused on instances involving WMD elimination (WMD–E), CBRN–interdiction, CBRN–counterterrorism, or WMD consequence management (WMD–CM) efforts, including foreign consequence management.[9] The cases were selected as representative of the range of military operations involving at least one WMD. The screening criteria for case selection among each of the categories was that the operation had occurred after passage of the Goldwater–Nichols Department of Defense Reorganization Act of 1986, and the operation had a critical element that relied upon ground forces, i.e., strategic bombing or missile strikes alone would not accomplish the objective.

The "major" cases include U.S. and international efforts to detect, disarm, and dismantle former Iraq President Saddam Hussein's WMD program. That group is further divided into two different efforts that are considered separately. The first is the Iraq War and UN Special Commission (UNSCOM) that oversaw the destruction and

dismantlement of the 1990s-era program.[10] The second is comprised of CWMD operations associated with Operation *Iraqi Freedom* (OIF).[11]

TABLE 1: Major Cases.

Case	Year	Location
Operation *Desert Storm* and the UN Special Commission	1990–99	Iraq
Tirana	2003–07	Albania
Libya	2003–12	Libya
Operation *Enduring Freedom* (Tarnak Farms)	2002	Afghanistan
Operation *Iraqi Freedom*	2003–08	Iraq

The disarmament, destruction, and/or removal of WMD materials and agents from two states, Albania and Libya, are treated as individual cases. Specifically considered are the removal of nuclear materials and infrastructure from Tuwaitha and Tajoura, and the destruction of chemical weapons and infrastructure at Ruwagha and Jufra in the Libya case, and removal of 16 tons of Soviet-era chemical weapons stored in a bunker outside Tirana, Albania.[12] Pursuit of WMD by a non-state actor is the subject in the case of al-Qaeda's training camp, Tarnak Farms, located in the Kandahar vicinity of Afghanistan during Operation *Enduring Freedom* (OEF).[13]

The "other" cases include an example of foreign consequence management in which the U.S. military was called upon for assistance, Operation *Tomodachi* in response to the Fukushima Daiichi radiological disaster after the 2011 tsunami following an earthquake off Japan's eastern shore.[14] While the United States was not asked to assist in consequence management in Chernobyl, the capabilities and capacities needed for a Chernobyl-type nuclear disaster are also assessed.[15] Chernobyl was selected to show an example of scope and scale in civilian nuclear disaster that far exceeded Fukushima.

TABLE 2: Other Cases.

Case	Year	Location
Operation *Tomodachi* (Fukushima Daiichi)	2011–12	Japan
Chernobyl	1986	Ukraine
Goiânia	1987	Brazil
Aum Shinrikyo	1993–95	Japan
William Krar	2003	United States

The remaining cases involve individuals or non-state actors. Aum Shinrikyo was a Japanese apocalyptic cult that is most well-known for the March 1995 attack on the Tokyo subway system using sarin nerve agent.[16] Aum Shinrikyo also pursued biological weapons. The Goiânia case refers to the 1987 radiological incident in which a vial containing radioactive material used for medical imaging, specifically the salt cesium-137 chloride, was found at an abandoned hospital site and removed by scavengers looking for scrap metal.[17] The theft and subsequent distribution of the radioactive material resulted in deaths, morbidity, and significant cleanup. The final case, William Krar, was an American domestic terrorist who pled guilty to federal charges of building and possessing chemical weapons.[18] Krar is an example of a lone wolf or loosely-networked individual who pursued WMD.

Although, Syria fell outside the formal criteria for inclusion in the review due to non-reliance on ground forces, the significant international efforts to remove Syria's declared CW stocks and subsequent destruction at sea are worthy of consideration. Among the five variables, "niche capabilities" was the single variable deemed as vital. Destruction of the chemical weapons via neutralization aboard the MV *Cape Ray*, part of the civilian U.S. Maritime Administration's Ready Reserve Fleet that can be rapidly activated to support DOD or emergencies, necessitated adaptation

and demonstration of significant technical capability before deployment. This was accomplished primarily by the U.S. Army's Edgewood Chemical and Biological Center (ECBC), whose mission is to ensure operational readiness by protecting the warfighter from non-medical chemical and biological threats. This unity of effort extended beyond the services and the DOD to the U.S. State Department and international partners, including the Organization for the Prohibition of Chemical Weapons (OPCW), the international organization responsible for implementation of the Chemical Weapons Convention.

Case Study Attributes

These 10 cases were then examined against five critical force design attributes—strategic reach; dispersed objectives; unity of effort; interoperability; and niche capability—to assess strategic gaps between capabilities and capacities to execute C–WMD operations.

Strategic Reach (See Table 3)

The need for strategic reach varied across the cases. The major cases include three with a significant military element during or after major combat operations and two cases in which the military played a role because comparative capability or capacity did not exist within other parts of the USG. Across the major cases, the need for capability and capacity in a timely manner was insignificant due to the permissive or semi-permissive environment or relatively small amounts of material which already existed. In Operation *Desert Storm*, OEF, and OIF, strategic reach was enabled as part of a major operation under which the CBRN-related mission was pursued. Capability was often improvised and capacity was assembled in response to an event or discovery of CBRN materials, rather than in a proactive manner reflecting organic capabilities integrated into the force.

Strategic reach varied greatly across the domestic and foreign consequence management (FCM) cases. During Operation *Tomodachi*, strategic reach was vital because of the nature of the accident to which the U.S. was responding. In the cases of Chernobyl, Goiânia, and Aum Shinrikyo, strategic reach was assessed as vital from the perspective of the responding state (not the United States). Like *Tomodachi*, a domestic nuclear accident such as Chernobyl, domestic radiological incidents like Goiânia, and domestic chemical (as well as biological) incidents perpetrated by non-state actors demand a timely response for several reasons. First, radiation release must be controlled or limited and further degradation of the nuclear infrastructure at the site prevented to the maximum extent. Second, hazardous material (radioactive and chemical) must be recovered to limit further contamination. Finally, personnel

TABLE 3: Strategic Reach as a Critical Force Design Attribute.

Definition	Benchmark	
The capability and capacity for timely response to a full range of contingencies around the world.	Vital	Capability and capacity present while timeliness of response driven largely by adversary actions.
	Critical	Capability and capacity present while timeliness of response controlled largely by friendly factors.
	Important	Capability and capacity present, but timeliness of response is a lesser degree.
	Insignificant	Capability is present but capacity and timeliness of response are a lesser degree.
	Negligible	Not required.

TABLE 4: Dispersed Objectives as a Critical Force Design Attribute.		
Definition	**Benchmark**	
The ability to operate in a synergistic manner across multiple operational objectives and vast geographic areas.	Vital	Multiple objectives requiring simultaneous operations.
	Critical	Multiple objectives requiring sequential, but not simultaneous, operations.
	Important	Series of objectives that do not require close coordination.
	Insignificant	Single objective.
	Negligible	Not required.

suffering from exposure must be treated. In the William Krar case involving improvised chemical weapons devices and delivery, interdiction occurred prior to weapon employment without any indication of specific intent or plan to use the devices. While strategic reach was not significant in the major cases, it was vital in the other cases, thereby demonstrating the need for a timely response to a full range of contingencies around the world.

Dispersed Objectives (See Table 4)

The ability to respond to dispersed objectives was important based on the broad geographical scope of the operation. Across the major cases, the majority involved only one or a limited number of sites. Additionally, the CWMD response did not require close coordination of operations. In the other cases (FCM, domestic terrorism), the attribute was assessed as insignificant due to the limited scale or constrained geography of the area of operations. It is unlikely that future non-state actor adversaries will remain this one-dimensional.

Unity of Effort (See Table 5)

The major CBRN cases illustrate the critical nature of unity of effort across DOD, the USG, and the multi-national community. For example, the Department of Energy and the International Atomic Energy Agency (IAEA) provided capabilities in the cases involving nuclear materials such as Desert Storm/UNSCOM, Libya disarmament, and Operation McCall, which removed 550-tons of low-grade uranium from Iraq in 2008. Similarly, across all four of the major chemical weapons cases, international community involvement was necessary either as part of the UN-mandated operation or via the OPCW, which oversees destruction of

TABLE 5: Unity of Effort as a Critical Force Design Attribute.		
Definition	**Benchmark**	
Coordination and cooperation toward common objectives, even if the participants are not necessarily part of the same command or organization—the product of successful unified action.	Vital	Requires shared understanding of the objectives across force, joint, interagency, and multinational environments.
	Critical	Requires shared understanding of the objectives across force, joint, and interagency environments.
	Important	Requires shared understanding of the objectives across force and joint environments.
	Insignificant	Requires shared understanding of the objectives across force.
	Negligible	Not required.

Source: Unity of effort definition as described by Joint Chiefs of Staff, Joint Pub 1–02, 304.

chemical stockpiles under the Chemical Weapons Convention (CWC). The Tarnak Farms case was essentially a site exploitation with respect to attempted biological development and acquisition. Such a case highlights an unresolved issue regarding the lack of a standing multinational body at the international level tasked with the biological weapons mission. After Operation *Desert Storm*, destruction of the Iraqi stockpiles was overseen by the UN-mandated operation, which required passage of a UN Security Council Resolution and creation of an ad hoc organization. There is no existing international partner charged with biological weapons elimination.

In the non-military and non-state actor cases, unity of effort was assessed as insignificant largely due to the domestic scope and scale of response or the unwillingness of the nation, e.g., the former Soviet Union, to acknowledge the incident. The exception is Operation *Tomodachi*, which involved coordination and cooperation across Japanese domestic law and emergency response, Japan's Self-Defense Forces, U.S. forces, the IAEA, and Tokyo Electric Power Company—the largest privately owned electric utility in the world. Operation *Tomodachi* should not, however, be seen as the model or most likely scenario for a CBRN–foreign consequence management (FCM) operation as the situation was permissive both in terms of close relationships between the nation-states and uniformed military and in the nature of Japanese civil society. This unique case may not reflect the most likely CBRN–FCM scenario to which the United States might be called in the future.

Interoperability (See Table 6)

Interoperability is assessed as critical for CBRN operations executed in other than permissive environments. The lack of joint CBRN capabilities interoperability in *Desert Storm* prompted the creation of the Joint Chemical and Biological Defense Program (CBDP) in the National Defense Authorization Act for Fiscal Year 1994. The CBPD consolidated responsibility and authority for capabilities development in the Office of the Secretary of Defense rather than in the services. With the exception of Operation *Tomodachi*, in the other non-major cases the success or limits of interoperability were assessed to be insignificant due to the relatively small scale or scope of the operations.

TABLE 6: Interoperability as a Critical Design Force Attribute.

Definition	Benchmark	
The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together.	Vital	Requires interoperability across force, joint, interagency, and multi-national environments.
	Critical	Requires interoperability across force, joint, and interagency environments.
	Important	Requires interoperability across force and joint environments.
	Insignificant	Requires interoperability across force.
	Negligible	Not required.

Source: Interoperability definition as described by Joint Chiefs of Staff, Joint Publication, 1–02, 146.

TABLE 7: Niche Capabilities as a Critical Design Force Attribute.		
Definition	**Benchmark**	
Identified special skills or materials required to efficiently and effectively accomplish objectives.	Vital	Panoply of special skills and materials ready to efficiently and effectively accomplish the mission.
	Critical	One or two special skills or materials available to efficiently and effectively accomplish the mission.
	Important	Special skills or materials, once identified, are scalable to efficiently and effectively accomplish the mission.
	Insignificant	Special skills or materials present, but not scalable to efficiently and effectively accomplish the mission.
	Negligible	Not required.

Niche Capabilities (See Table 7)

Niche or specialized capabilities and skills were assessed as vital based on the requirement for technical or material means and capacity. Each case required specialized detection, protection, and means to secure material physically for exploitation, elimination, or transport. In three of the major cases, specialized demilitarization capabilities were needed; in no case was capacity tested due to the relatively small scale of CBRN materials involved. All of the non-military cases needed specialized diagnostic, treatment, decontamination capabilities, and skills.

Insights

Trends for CWMD threats run parallel to a complex and uncertain future as the United States contends with rapid social and technological changes and sometimes limited understanding regarding the precise nature of the threat. Proliferation of WMD is characterized mainly by two drivers that exist in complementary yet separate conceptual spheres. The first consists of the characteristics inherent in countering nuclear threats.[19] Those characteristics drive policies to account for the knowledge and material proliferation of nuclear weapons capability. The second driver arises from the continued evolution of chemical, biological, and radiological (CBR) threats. This factor drives policies to account for innovation and technology diffusion of CBR capabilities. Current policy and joint publications have expanded the definition of proliferation to account for this duality, thereby resulting in a singular encapsulation of the problem.[20] The threat-actors who underlie these drivers consist of states and non-state actors. There is also potential for dynamic inter-play among these two variables spanning a range of state to state-sponsored to the extreme self-radicalized lone wolf ventures.

Policy trends in CWMD appear to be consistent with current approaches to strategy formulation. Policy is guided by objectives and priorities presented in various national level strategic documents involving security and CWMD such as the NSS and the NDS.[21] In keeping with a whole of government approach to security generally, and CWMD specifically, there is inherently an expansive and growing interagency portfolio regarding CWMD policy. The interagency contributive approach, and individual agency contributions to security and CWMD, exist at levels relative to the scope, authority, and mission designated for each department or agency. For example, the prominent policy component in CWMD is non-proliferation. The U.S. State Department leads this effort with policies and guidelines that attempt to prevent proliferation of associated technologies, materials, and knowledge.[22] In DOD, there are two main civilian focal points for CWMD policy—the Deputy Assistant Secretary of Defense (DASD) for CWMD and the Assistant Secretary of Defense (ASD)

for Nuclear, Chemical, and Biological (NCB) Defense. The DASD–CWMD performs activities pursuant to the goals of "prevent and counter global trafficking in WMD/missiles; protect and defend against WMD use and the proliferation of WMD; and respond by preparing for a post–WMD environment, and helping countries to build capacity and control ungoverned spaces, and attacking networks across all threats."[23] The ASD—NCB "is the principal advisor to the Secretary of Defense, the Deputy Secretary of Defense, and the Undersecretary of Defense for Acquisition, Technology, and Logistics for matters concerning nuclear, chemical, and biological defense programs."[24] There are no projected seismic shifts in their policy ownership or stated goals; however, policy is evolving to account for more activities prior to a crisis or incident and to reflect a "prepare, prevent, contain, and respond" approach toward reducing the threat of WMD.

Until recently, the vast majority of the CWMD operational capabilities was resident in U.S. Strategic Command (USSTRATCOM). The Standing Joint Force Headquarters–Elimination (SJFHQ–E) was activated in February of 2012. It is an evolving organization that re-located from Aberdeen Proving Grounds, Maryland to Fort Belvoir, Virginia, where it initially co-located with the USSTRATCOM Center of Combating WMD (SCC–WMD) and the Defense Threat Reduction Agency (DTRA). These developments suggest institutionalization of an organizational capability to enable and facilitate WMD-Elimination missions. Challenges remain, but the relocation of SJFHQ–E to reside in the same building as DTRA clearly creates a potential for synergies during missions to enable and facilitate elimination of WMD activities, especially in non-permissive environments.[25]

The U.S. Special Operations Command (USSOCOM) plays a critical role in CWMD from a counterterrorism and counterproliferation perspective. In 2014, USSOCOM was assigned additional responsibilities for the CWMD mission space. In 2016 responsibility for coordination of the CWMD mission across DOD transferred from USSTRATCOM to USSOCOM.[26] While the responsible institutions and physical locations of many technical and operational capabilities for CWMD have not substantially changed, USSOCOM's assumption of the lead role for coordinating CWMD activities presents yet another organizational challenge. Last year the Congressional Research Service identified a number of potential issues, to include authorities, mission focus, and resourcing, associated with transfer of the coordination role for CWMD.[27] A year later, these challenges remain as reiterated during a conference discussion by a panel of Special Operations Forces experts.[28]

An increasing number of organizations will have to work together to define the future of CWMD operations. The CWMD mission requires a whole-of–government approach as various capabilities reside in different government organizations. These agencies will need to integrate with standing units, like USSOCOM and missile defense. Finally, the technical nature of the CWMD mission highlights the important relationship between operational forces and the defense science and technology enterprise that supports it.

Being able to respond in a timely and coordinated manner is likely to be an increasingly important factor in execution of CWMD operations. In the case studies, the low assessment of capacity to respond to dispersed objectives was largely a function of the permissive to semi-permissive environments that characterized those operations. Scenarios involving increasing numbers of dispersed WMD sites requiring timely response can be expected in the future. The capability and capacity to seize, assess, and secure as many, if not all, potential WMD sites in a timely—*days not weeks*—and simultaneous manner is critical for limiting

proliferation of WMD, particularly in an unstable, unknown, or non-permissive environment.

Operational capabilities continue to trend toward a need for interagency—and in some cases international—design using a whole-of-government approach, which must begin by accounting for the number of interagency members that possess CWMD capabilities and expertise, albeit with varying levels of capacity. From a national perspective, there is value in the size and diversity associated with the national CWMD enterprise. As new threats and challenges arise, the dynamics of having as many as 16 interagency partners focused upon generating viable policy options is considered a model to sustain, especially as CWMD may or may not be the principal driver in a strategic dilemma. The interagency approach serves to protect the unique nature of each agency's CWMD-associated programs, while positioning national policymakers with an ability to generate whole-of-government approaches derived from the contributive efforts of their agency's fielded expertise. Such an approach demonstrates a desire to sustain flexibility within the strategic framework that suggests more value can be obtained from practical coordinating functionality than through designation of proponency for a given function. Within the Joint Force, proponancy for various CWMD missions continues to trend toward Geographic Combatant Commands with specified roles for Functional Component Commands as outlined in Joint Publication 3–40, *Countering Weapons of Mass Destruction*.

The CWMD mission also reinforces the need for strategic reach of services. The collapse of regimes with large stockpiles of chemical, biological, radiological, or nuclear weapons; the theft of WMD by a non-state actor; or the consequence management needed to mitigate a WMD attack will require a rapid response for greatest impact. This could in turn, require the re-evaluation of the nation's strategic mobility assets and rapid deployment models.

Unity of effort across the USG with respect to CWMD is likely to be increasingly important and also increasingly difficult to achieve. The likelihood of future WMD proliferation, combined with importance of the CWMD mission for national security presents a problem on which multiple organizations can both identify and provide focus. The challenge in achieving effective cooperation towards a common set of objectives occurs when the involved organizations have different perspectives on the importance of the variables associated with the problem at hand. Put another way, the sheer number of agencies likely to be involved in the CWMD mission will naturally result in a certain amount of bureaucracy that can be difficult to work through when attempting to coordinate efforts toward a common objective.

Trends in CWMD technical capabilities continue to reflect an approach to research and development that focuses on niche requirements. Technical capabilities are pursued through an array of partnerships and programs to address the varied challenges associated with WMD. These technical efforts are at times disparate, given the varied customer base and needs associated with the CWMD enterprise, which includes identification to elimination requirements for situations that range from episodic to enduring. In the military, capabilities development is pursued through identification of anticipated or current needs from Unified Commands through the joint requirements process.[29] Working groups exist to flatten the enterprise knowledge of technical capabilities, which is essential moving forward to address the variance in CWMD problem sets, each of which requires a unique approach. The potential for increases in the number of systems and forces involved in CWMD will add complexity. Larger and more varied involvement also raises the importance of interoperability when attempting to provide or accept services between disparate organizations.

A Spanish patrol boat escorts the USG-owned MV Cape Ray through the Strait of Gilbraltar en route to the Mediterranean Sea. The USG modified and deployed the Cape Ray to dispose of Syrian chemical agents. (U.S. Navy/Desmond Parks)

CWMD has historically been a country-based problem, as illustrated by the long-standing challenges in places such as North Korea, Iran, and Syria. Accordingly there is an obvious need for attention to the risks associated with episodic or enduring WMD threats from state actors. However, the range of potential adversaries has expanded to non-state actors since the last quarter of the 20th century. Niche capabilities needed for CWMD are likely to proliferate, while at the same time, the need for greater coordination and integration of capacities, capabilities, and actors involved in guiding and implementing CMWD tasks will only rise. In response there has already been a bifurcation of CWMD organizations, operational constructs, and policy to limit acquisition and respond to use by states versus non-state actors, most prominently in the interagency. In addition, policy dialogue is attempting to better define the problem space that exists between counterterrorism and counterproliferation and to develop solutions for how best to align resources to address these separate but complementary challenges. An ability to respond to objectives that lie between traditional counterterrorism and counterproliferation, i.e. "minding the gap," may be needed to account for the variance in mission, focus, targets, time horizon, and modus operandi resident in the two missions. In view of trends which suggest more actors, not fewer, in response to the scope and scale of CWMD challenges, no one entity is seen as being able to singularly respond to

all facets of the problem. For that reason, CWMD mission success increasingly relies on joint constructs within DOD; USG interagency cooperation; and contributions from allied and partner nations.

Multiple efforts, both inside and outside the DOD, the Joint Staff, Army, the Combatant Commands, and the interagency community have delineated or are working to determine specific tactical and operational CWMD capability gaps, however the key force attributes for an expeditionary force structure that provides the requisite mix of security and CWMD capabilities has yet to be developed. Within the Army, for example, CWMD infrastructure and force structure initiatives are evolving to account for the shift in strategic focus.[30] Meanwhile, CWMD capabilities and capacity are subject to the same budgetary, structure, and infrastructure pressures visited upon the total force. The infrastructure trends suggest that CWMD capabilities will become overwhelmingly reliant upon a CONUS-based, deployable force. One foreseeable challenge involves how best to meaningfully integrate CWMD capabilities into existing force structure to improve response and readiness while simultaneously ensuring protection of the requirement for specialized training and certifications. The trend toward force structure change has obvious second-and third-order implications from a force design perspective. The DSG force sizing construct—the overall capacity of the joint force—from 2012was based on the requirements to conduct counterterrorism and irregular warfare; deter and defeat aggression in two places simultaneously ("defeat and deny"); maintain effective nuclear deterrent; and defend the homeland and support civil authorities. While "counter weapons of mass destruction" is one of the 10 missions noted in the DSG, it is not an explicit factor in the force-sizing equation. As a result, CWMD as a component of force structure is subject to capability considerations, more so than capacity considerations, although opportunities exist for implicit association of CWMD force structure capability requirements with capacity. Infrastructural force array derived from a CONUS-based approach also produces challenges as to how best to integrate CWMD capabilities and capacity with maneuver forces, the laboratory base, and the interagency community. Significant focus should be placed on identification of technical capabilities and employment considerations required by forces to tactically secure and/or transport WMD sites at scale, including activities in contested areas or potential subterranean environments. Finally, investigation suggests there may be synergistic effect that can be achieved from co-location of tactical units with CWMD capabilities, along with a science and technology base.[31]

Conclusion

There are disparate efforts in CWMD at all echelons of the USG that result in a lack of prioritization, fusion, coordination, and oversight of efforts. Within the ground forces, capacity and capability are fractured and not wholly integrated into the conventional force. There is a need for greater technical capability and capacity, both within technical uniformed and civilian research and development.[32] Programmatically, a paucity exists of approaches to develop anything other than passive countermeasures. For example, active defense—interception of a threat agent en route including but not limited to missile-based interception—is perceived as too hard technically or not part of the dialogue, often due to varying conceptions of what such would entail.[33] Additionally, much greater cognizance of non-traditional agents (NTAs) and emerging threats—at the low and high ends of the technological spectrum—is needed to address technical and operational challenges and to enable strategic and operational flexibility to respond to new and unforeseen threats.

Internationally, a lack of willingness of other states to engage operationally and tactically in

CWMD, especially WMD–E, efforts carries implications that result in the United States, and often the ground forces effectively, "going it alone," which exacerbates capability and capacity gaps. CWMD and WMD–E military-to-military programs as part of "shaping" and "prevention" strategies and efforts of global engagement would increase global security in support of stated strategic objectives.[34]

There is a need to think strategically beyond current challenges. In the late 20th and early 21st century, the nation has struggled—and continues to do so—to deal with technologically-enabled proliferation challenges. Anticipating the types of threats that may emerge as science and technology advance, the potential consequences of those threats, and the probability that new and more diverse types of enemies will obtain or pursue them is necessary in preparing for the future security of the nation.[35] The potential synergies between biotechnology and other emerging technologies, like nanotechnology and the cognitive neurosciences, not only suggest tremendous potential for advancement in technology for military applications, but also raise new concerns.[36] In the 21st century, both nation-states and non-state actors will have access to new and potentially devastating dual-use technology.[37] Robust research and analysis (ranging from the academic to intelligence communities) and planning that bridges the gaps between the life and physical sciences, engineering, the social sciences, and the operational world is crucial for devising implementable and executable strategies that will better enable the United States to be prepared for the WMD challenges of the future.

In keeping with previous incarnations of U.S. strategic documents, the latest NDS released this year retains an emphasis on CWMD through a set of explicit and implicit objectives, including one for "dissuading, preventing, or deterring state adversaries and non-state actors from acquiring, proliferating, or using weapons of mass destruction."[38] Defense planning scenarios should account for CWMD maneuver and technical force requirements as they align objectives with capabilities. Defense Planning Guidance missions should bridge strategic to operational concepts and explicitly include CWMD activities, including seizing, securing, interdicting, exploiting, and elimination of large numbers of WMD sites, above and below-ground, in non-permissive environments. CWMD considerations, in light of the robust efforts by tactical and operational organizations and combatant commands, have yet to meaningfully evolve into substantive requirements or analysis that accounts for this mission as contributive to force sizing.[39]

Nuclear-based deterrence has consistently been part of the U.S. NSS since President Truman was in office. With an appreciation for the ever-evolving and uncertain security environment, the Nuclear Posture Review (NPR) released this year updates perspectives on U.S. efforts in support of the ultimate global elimination of nuclear, biological and chemical weapons.[40] The perspectives in this recent NPR confirm and reinforce an imperative for underpinning CWMD policy objectives with the credible capabilities and capacities needed to accomplish them. As a nation, we are still functioning under a structure that originated in the Cold War era. In the post–WWII and Cold War environments, the nuclear weapons-based construct was dominant with good reason. While the existential threat from Russia's nuclear weapon stockpile remains, there are also increasing threats from other actors and states. The roles, capabilities, and capacities required by ground-based forces to execute CWMD operations and to win against WMD-possessing states have not been part of the national-level strategic dialogue. Decisive action in CWMD operations should be stressed as a national-level capability. Credibly communicated capabilities and capacities to seize, secure, and eliminate WMD in non-permissive environments should be emphasized as part of wider

prevention strategies, of particular import against future adversaries that seek technologically-enabled, asymmetric means of conducting warfare against the United States. PRISM

Notes

[1] Joint Chiefs of Staff, *Joint Pub 1-02 Department of Defense Dictionary of Military and Associated Terms* (Washington, D.C. 2013). WMD) are defined as "chemical, biological, radiological, or nuclear weapons capable of a high order of destruction or causing mass casualties and exclude the means of transporting or propelling the weapon where such means is a separable and divisible part from the weapon." The 2010 Quadrennial Defense Review on page 4 asserts "The instability or collapse of a WMD-armed state is among our most troubling concerns. Such an occurrence could lead to rapid proliferation of WMD material, weapons, and technology, and could quickly become a global crisis posing a direct physical threat to the United States and all other nations.' The 2014 QDR on page 7 re-asserts: "We will remain focused on countering WMD, which undermine global security."

[2] DARPA Director Arati Prabhakar during Press Briefing from the Pentagon, April 24, 2015, available at <http://www.defense.gov/transcripts/transcript.aspx?transcriptid=5227>.

[3] Remarks by Deputy Secretary Carter at the Center for Strategic and International Studies, May 23, 2013, available at <http://www.defense.gov/transcripts/transcript.aspx?transcriptid=5245>.

[4] White House, *National Security Strategy*, United States of America, February 2015, available at <https://www.whitehouse.gov/sites/default/files/docs/2015_national_security_strategy.pdf>;White House, *National Security Strategy*, United States of America, May 2010, Available at <www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf>; White House, *National Security Strategy*, United States of America, March 2006, available at<http://georgewbush-whitehouse.archives.gov/nsc/nss/2006/>; White House, *National Strategy for Countering Biological Threats*, December 9, 2009, available at <www.whitehouse.gov/sites/default/files/National_Strategy_for_Countering_BioThreats.pdf>; White House, *National Strategy to Combat Weapons of Mass Destruction*, December 2002, available at <www.state.gov/documents/organization/16092.pdf>; *Department of Defense Strategy to Counter Weapons of Mass Destruction*, June 2014, available at <http://archive.defense.gov/pubs/DoD_Strategy_for_Countering_Weapons_of_Mass_Destruction_dated_June_2014.pdf>; Chairman of the Joint Chiefs of Staff, *The National Military Strategy of the United States of America*, June 2015, available at <http://www.jcs.mil/Portals/36/Documents/Publications/2015_National_Military_Strategy.pdf>; Chairman of the Joint Chiefs of Staff, *National Military Strategy to Combat Weapons of Mass Destruction*, February 2006, available at <www.defense.gov/pdf/NMS-CWMD2006.pdf>; Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction, March 2005, available at <http://govinfo.library.unt.edu/wmd/about.html>; Commission on the Prevention of WMD Proliferation and Terrorism (Graham-Talent Commission), *Prevention of WMD Proliferation and Terrorism Report Card*, 26 January 2010, available at <www.preventwmd.gov/static/docs/report-card.pdf. Weapons of Mass Destruction Commission (Blix Commission)>, *Weapons of Terror: Freeing the World of Nuclear, Biological, and Chemical Arms*, Stockholm, Sweden, June 1, 2006, available at <www.wmdcommission.org/files/Weapons_of_Terror.pdf>; *The Weapons of Mass Destruction Commission (WMDC)*, December 16, 2006, available at <http://www.wmdcommission.org/sida.asp?ID=110>; General Assembly, "Resolution Adopted by General Assembly," *United Nation's General Assembly*, January 3, 2007, available at <http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N06/498/63/PDF/N0649863.pdf>; *Secretary General of United Nations General Assembly*, "The United Nations and Security in a Nuclear-Weapon-Free World," Secretary-General's Address to the East-West Institute of the United Nations, October 24, 2008, available at <http://www.un.org/apps/sg/printsgstats.asp?nid=3493>; NATO, "Weapons of Mass Destruction," NATO, October 27, 2010, available at <http://www.nato.int/cps/en/natolive/topics_50325.htm>; NATO, "Chemical, Biological, Radiological, and Nuclear Defense Battalion," *NATO*, October 26, 2010, available at <http://www.nato.int/cps/en/natolive/topics_49156.htm>.

[5] Rebecca Hersman, *Eliminating Adversary Weapons of Mass Destruction: What's at Stake*, (National Defense University Press, Washington D.C., 2004).

[6] *Department of Defense Strategy to Counter Weapons of Mass Destruction*, June 2014, available at <http://archive.defense.gov/pubs/DoD_Strategy_for_Countering_Weapons_of_Mass_Destruction_dated_June_2014.pdf>

[7] Lonnie Carlson and Margaret E. Kosal, "Preventing Weapons of Mass Destruction Proliferation—Leveraging Special Operations Forces to Shape the Environment," JSOU Monograph, January 2017, available at< http://jsou.libguides.com/ld.php?content_id=28362821>.

[8] Center for the Study of Weapons of Mass Destruction, *Are We Prepared?* (National Defense University Press, Washington D.C., 2009), 58.

[9] Joint Chiefs of Staff, *Joint Pub 1-02*. WMD–elimination (WMD–E) is defined as "actions undertaken in a hostile or uncertain environment to systematically locate, characterize, secure, and disable, or destroy weapons of mass destruction programs and related capabilities," and WMD–consequence management (WMD–CM) is defined as "Actions authorized by the Secretary of Defense to mitigate the effects of a weapon of mass destruction attack or event and, if necessary, provide temporary essential operations and services at home and abroad." DoDI 2000.21 defines FCM as "assistance provided by the USG to an HN (host nation) to mitigate the effects of a deliberate or inadvertent CBRNE attack or event and to restore essential operations and services." CJCSI 3214.01B similarly defines FCM as "assistance provided by the USG to an HN to mitigate the effects of a deliberate or inadvertent CBRNE attack or event and restore essential government services." CJCSI 3214.01B specifies that its provisions do not apply to "CBRNE response operations that are a direct result of US military operations."

[10] "Comprehensive Report of the Special Advisor to the DCI on Iraq's WMD," September 2004, available at <https://www.cia.gov/library/reports/general-reports-1/iraq_wmd_2004>.

[11] Unclassified Version of the Report of the Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction, Chapter One Case Study: Iraq, March 2005, available at <https://www.gpo.gov/fdsys/pkg/GPO-WMD/pdf/GPO-WMD-1-6.pdf>; Iraq Survey Group Final Report: Regime Strategic Intent—Key Findings," 2004, available at <https://www.cia.gov/library/reports/general-reports-1/iraq_wmd_2004/Comp_Report_Key_Findings.pdf>.

[12] Sharon Squassoni, Disarming Libya: Weapons of Mass Destruction, Congressional Research Service Report, September 22, 2006; Albert J. Mauroni, "Eliminating Syria's. Chemical Weapons," U.S. Air Force, Center for Unconventional Weapons Studies, Future Warfare Series, no. 58 (June 2017), available at <http://www.au.af.mil/au/cpc/pub/pdfs/monographs/58MauroniElimSyriaCW.pdf>; and John Hart, "The Smoking Gun of Non-Compliance," CBRNe World, December 2015, 17–20, available at <http://www.cbrneworld.com/_uploads/download_magazines/Syrias_Review_2015.pdf>. See also: Matthew V. Tompkins, "Albania's Chemical Weapons," *Nonproliferation Review*, 16, no. 1 (2009), 65–77.

[13] Rolf Mowatt-Larssen, "Al Qaeda Weapons of Mass Destruction Threat: Hype or Reality?" January 2010, available at <http://belfercenter.ksg.harvard.edu/files/al-qaeda-wmd-threat.pdf>; Melissa Finley and Jennifer Gaudioso, *Point of View: The Front Lines of Biological Weapons Non-Proliferation. Biological Threats in the 21st Century*, 417–424, available at <https://doi.org/10.1142/9781783269488_0025>; Report of the Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction, Chapter Three Case Study: Al-Qa'ida in Afghanistan, March 2005, available at <https://www.gpo.gov/fdsys/pkg/GPO-WMD/pdf/GPO-WMD-1-8.pdf>.

[14] Andrew Feickert and Emma Chanlett-Avery, "Japan 2011 Earthquake: U.S. Department of Defense (DOD) Response," Congressional Research Service, 22 March 2011; "Lessons Learned from Operation Tomodachi," available at <https://www.acq.osd.mil/dpap/ccap/cc/jcchb/Files/Topical/After_Action_Report/resources/Lessons_Learned_Operation_TOMODACHI.pdf>; "Chronology of Operation Tomodachi," National Bureau of Asian Research, available at <http://www.nbr.org/research/activity.aspx?id=121>.

[15] "Backgrounder on Chernobyl Nuclear Power Plant Accident, US NRC, May 2013, available at <https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/chernobyl-bg.html>; VF.Demin and B.I.Yatsalo, "Chernobyl" Lessons Learned for Post-Emergency Response," International Radiation Protection Program, available at <http://www.irpa.net/irpa10/cdrom/00885.pdf>; E. Buglova, J. Kenigsberg, " Analysis of Emergency Response After the Chernobyl Accident in Belarus: Observed and Prevented Medical Consequences Learned," available at <https://www.ipen.br/biblioteca/cd/go10anosdep/Cnen/doc/manu4.PDF>.

[16] Richard Danzig, Marc Sageman, Terrance Leighton, Lloyd Hough, Hidemi Yuki, Rui Kotani and Zachary M. Hosford, "Aum Shinrikyo: Insights Into How Terrorists Develop Biological and Chemical Weapons," Center for New American Security, 2012, available at <https://www.cnas.org/publications/reports/aum-shinrikyo-second-edition-english>; and DE Kaplan, "Aum Shinrikyo" (1995) in Tucker JB, editor. Toxic terror: Assessing terrorist use of chemical and biological weapons, MIT Press, 2000.

[17] J.L. Lipsztein, P.G. Cunha, and C.A. Oliveira, "The Goiania Accident: Behind the Scenes," Health Physics, 60:1, 1991; "The Radiological accident in Goiânia," Vienna: International Atomic Energy Agency, 1988, available at <https://www-pub.iaea.org/MTCD/publications/PDF/Pub815_web.pdf>; and F. Steinhäusler, "Countering Radiological Terrorism: Consequences of the Radiation Exposure Incident in Goiania (Brazil)" in I. Khripunov, L. Bolshov and D., Nikonov, (eds) Social and Psychological Effects of, Radiological Terrorism, Volume 29 *NATO*

Science for Peace and Security Series: Human and Societal Dynamics, November 2007.

[18] M.E. Kosal, "Near Term Threats of Chemical Weapons Terrorism," *Strategic Insights*, v. 5, issue 6 July 2006; and Reynolds, J. Michael, "HomeGrown Terror" Bulletin of Atomic Scientists, November 2004, 60:6, 48–57.

[19] Proliferation is defined as "the transfer of weapons of mass destruction, related materials, technology, and expertise from suppliers to hostile state or non-state actors," (JP 1-02). The definition was modified from early policy iterations to account for more than nuclear weapons. The term referenced in the NDS for CWMD dated May 2013 is "WMD Proliferation" defined as "The transfer of weapons of mass destruction or related materials, technology, and expertise from suppliers to state or non-state actors."

[20] See Joint Chiefs of Staff, *Joint Pub 3-40, Countering Weapons of Mass Destruction* (Washington D.C. 2014), II–13.

[21] There are a number of strategic policy documents relevant to CWMD such as Sustaining US Global Leadership: Priorities for a 21st Century Defense, the National Security Strategy, the National Defense Strategy, the National Military Strategy, the Guidance for Employment of the Force, the Quadrennial Defense Review, the Nuclear Posture Review, the National Strategy for Countering Biological Threats, the National Strategy for Biosurveillance, and the Homeland Defense and Defense Support of Civil Authorities Strategy.

[22] Under Secretary for Arms Control and International Security oversees, "the negotiation, implementation, and verification of international agreements in arms control and international security. Other specific responsibilities include directing and coordinating export control policies to prevent missile, nuclear, chemical, biological, and chemical weapons proliferation."

[23] As expressed on the official website for the U.S. Deputy Assistant Secretary of Defense for Countering Weapons of Mass Destruction, available at <http://policy.defense.gov/OUSDPOffices/ASDforGlobalStrategicAffairs/CounteringWeaponsofMassDestruction.aspx>.

[24] As expressed on the official website for the U.S. Assistant Secretary of Defense for Nuclear, Chemical, and Biological, available at <http://www.acq.osd.mil/ncbdp/bio_weber.htm>.

[25] Interviews conducted with SJFHQ–E [2013] suggest that the move is expected to strengthen the relationship between the two organizations and create the opportunity for cross-fertilization of skills and knowledge to enable both organizations to better perform their expected roles at the operational level toward achieving policy aims.

[26] US Special Operations Command, *SOCO–2020: Forging the Tip of the Spear*, June 2014, available at <http://www.defenseinnovationmarketplace.mil/resources/SOCOM2020Strategy.pdf>. Dan Lamothe, "Special Operations Command takes a lead role in countering weapons of mass destruction," *Washington Post*, December 23, 2016, available at <https://www.washingtonpost.com/news/checkpoint/wp/2016/12/23/special-operations-command-takes-a-new-lead-role-countering-weapons-of-mass-destruction/>.

[27] Andrew Feickert, "U.S. Special Operations Forces (SOF): Background and Issues for Congress," Congressional Research Service, January 6, 2017, available at <

[28] Kyle Rempfer, "Countering WMDs Cannot be on SOCOM alone, Experts Contend," *Air Force Times*, March 1, 2018, available at <https://www.airforcetimes.com/flashpoints/2018/03/01/countering-wmds-cannot-be-on-socom-alone-experts-contend/>.

[29] Technical capabilities are pursued in response to adversarial capabilities or observed advances in the industrial base that demonstrate the potential for militarized utility by state or non-state actors.

[30] Re-balance to Asia-Pacific; down-sizing of Army structure; move to more CONUS-based Army posture.

[31] This is derived from survey work done with 20th Support Command (CBRNE); U.S. Army Research, Development and Engineering Command, specifically, Edgewood Chemical Biological Center (ECBC); U.S. Army Medical Research Institute of Chemical Defense (USAMRICD); U.S. Army Chemical Materials Agency (CMA); U.S. Army Element, Assembled Chemical Weapons Alternatives (ACWA); Joint Program Executive Office for Chemical Biological Defense (JPEO–CBD); U.S. Army Medical Research Institute of Chemical Defense (MRICD); and Standing Joint Force Headquarters-Elimination (SJFHQ–E) and others located at Aberdeen Proving Grounds, Maryland. To include Fort Belvoir, Virginia also captures the Defense Threat Reduction Agency (DTRA) and U.S. Army Nuclear and Chemical Agency (USANCA) to name a few more.

[32] National Research Council, *Determining Core Capabilities in Chemical and Biological Defense Science and Technology*, (Washington D.C.: National Academies Press, 2012).

[33] For greater discussion of what constitutes active defense against WMD weapons, see Bruce Bennett, "Responding to Asymmetric Threats," in *New Challenges, New Tools for Defense Decisionmaking*, Stuart E. Johnson, Martin C. Libicki, Gregory F. Treverton (eds), (Washington D.C.: RAND Corporation, 2003).

[34] Lonnie Carlson and Margaret E. Kosal, "Preventing Weapons of Mass Destruction Proliferation–Leveraging Special Operations Forces to Shape the Environment," JSOU Monograph, (January 2017), available at http://jsou.libguides.com/ld.php?content_id=28362821.

[35] Beyond traditional state-based adversaries, threats are increasing from non-state actors, including terrorists, see e.g., U.S. State Department, Office of the Coordinator for Counterterrorism, "Country Reports on Terrorism 2012, Chapter 4: The Global Challenge of Chemical, Biological, Radiological, or Nuclear (CBRN) Terrorism," (May 2013), available at <http://www.state.gov/j/ct/rls/crt/2012/209986.htm>; and other "converging" transnational actors that might seek to acquire and use CBRN weapons.

[36] Margaret E. Kosal, *Nanotechnology for Chemical and Biological Defense* (New York: Springer Academic Publishers, 2009) , available at <http://www.springer.com/materials/nanotechnology/book/978-1-4419-0061-6>; Sergio Bonin with contributions by Piers D. Millett, Margaret E. Kosal, R. Alexander Hamilton, and Alexey V. Feofanov, "Security Implications of Synthetic Biology and Nanobiotechnology: A Risk and Response Assessment of Advances in Biotechnology," United Nations Interregional Crime and Justice Research Institute (UNICRI), 2011; Margaret E. Kosal and Jonathan Y. Huang, "The Security Implications of Cognitive Science Research," Bulletin of Atomic Scientists (July 2008); *Neuroscience, Conflict, and Security*, The Royal Society (February 2012), available at <http://royalsociety.org/policy/projects/brain-waves/conflict-security/>.

[37] National Research Council. *Globalization, Biosecurity, and the Future of the Life Sciences* (Washington DC: National Academies Press, 2006).

[38] Department of Defense, *Summary of the National Defense Strategy* (Washington D.C., 2018).

[39] The Army reinforces the opaque nature of C-WMD with "we also believe that Countering Weapons of Mass Destruction may have implications for our capacity," from the 2013 *Army Strategic Planning Guidance* (Department of the Army: Washington D.C., 2013), 6.

[40] Office of the Secretary of Defense, *Nuclear Posture Review*, (February 2018).

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