



The World's Most Destructive Weapons



Thirty Years of the
Center for the Study of
Weapons of Mass Destruction
1994–2024



Institute for National Strategic Studies
National Defense University



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Foreword

The contours of today's global security environment are shaped by a reemergence of Great Power competition, the persistence of violent extremism, rapidly emerging disruptive technologies, the weaponization of information, demographic shifts, climate change, and other factors complicating the decision space for national security leaders.

The National Defense University (NDU) is committed to providing outcomes-based education and focused research to prepare military and civilian government leaders to outthink the opposition and provide strategic advantage to our nation, allies, and partners as we navigate the increasingly complex set of national and global security challenges.

Current and anticipated future threats include a dramatic expansion of the weapons of mass destruction (WMD) capabilities of potential adversaries. As Secretary of Defense Lloyd Austin wrote in his foreword to the 2023 Department of Defense *Strategy for Countering Weapons of Mass Destruction*, "Actors are integrating WMD into their military strategies in manners that greatly increase the risk of miscalculation in a crisis or employment in a conflict." The buildup of nuclear capabilities, advanced delivery systems, the use of chemical weapons as a tool of assassination, and the increasing and reckless threats to employ various forms of WMD require us to move past the dated notions that weapons of mass destruction are separate from the tools of contemporary statecraft or always represent a low-probability threat. Our allies and partners rely on the United States to remain stalwart in opposing China and Russia's revisionist, destabilizing regional and global agendas, including countering and deterring any advantage Beijing or Moscow might seek by leveraging WMD to attempt to coerce other actors.

The Center for the Study of Weapons of Mass Destruction, a strong component of the Institute for National Strategic Studies, is rightly celebrating its 30th anniversary at NDU. As the following

pages demonstrate, the Center continues to fulfill a critical role in ensuring national security leaders understand the challenges of WMD as these leaders develop effective strategies and policies to defend the homeland from attack, deter WMD use, prevail if deterrence fails, and prevent new WMD threats.

This publication provides a window into the evolution of strategic threats to national security over the past 30 years and the impressive contributions that the WMD Center makes to stay abreast of and address those threats. The Center's provision of timely research, direct support to decision-makers, and commitment to WMD education will remain a uniquely valuable and vital part of the national security enterprise.

—Michael T. Plehn, Lt Gen, USAF
17th President, National Defense University

Introduction

As this volume demonstrates, the Center for the Study of Weapons of Mass Destruction (CSWMD) provides national security leaders with the expertise they need on weapons of mass destruction (WMD) but cannot get from other sources. In the Department of Defense (DOD) and elsewhere, policy and operational staffs—from action officers to senior leaders—typically do not have the time and opportunity to “dig deep” on complex questions, reflect on events beyond the daily demands of the inbox, and develop in-depth functional expertise that reveals the nexus of political, military, technical, and historical factors shaping many contemporary security challenges.

On WMD issues, the Center has been a trusted resource to help fill that gap for 30 years. Combining deep expertise, extensive policy experience, and a wide-ranging professional network, the Center helps stakeholders across the WMD community unpack hard problems and frame solutions. It does so not as an advocate of a particular position, but as an incubator of ideas, an honest broker of contending approaches, and a neutral forum for candid conversation and consensus-building. The Center has always appreciated and creatively leveraged the “power to convene” to enable the most effective policy and planning outcomes. Just as important is the Center’s work in preparing the next generation of military and civilian leaders and contributing to original research and the creation of new knowledge in the WMD field.

Over three decades, the Center has been an important source of continuity across many administrations and the constant rotation of civilian and military officials across government. To the degree that this has contributed to wise and consistent policy, we are grateful for the opportunity to serve in a nonpartisan way. It has been an important part of our mission to help national security teams prepare in advance for the WMD challenges they will face, and to help them formulate and execute

policy when asked. Close partnerships and relationships of trust with our sponsors are the hallmark of how we operate.

As one of my predecessors notes in the pages ahead, “People are everything.” The Center’s strength as an organization has always been driven and defined by the expertise, skills, and dedication of its staff—deputy directors, chiefs of staff, policy and research fellows, administrative professionals, Pathways student trainees, and distinguished expert consultants. I am privileged to act as the Center’s fourth Director, surrounded by strong, committed professionals who daily demonstrate excellence in teaching, research, policy analysis, and leader development in support of policy at all levels to address WMD challenges. We continue, in the tradition of our predecessors, to work each day to ensure that leaders in DOD and the broader national security community are as informed and prepared as they need to be.

In the pages that follow, we have gathered our history—and to some degree, our future as well. We begin with the personal reflections of the Center’s first three directors. We then offer a retrospective of how the work of the Center evolved from 1994 to the present day, in the context of how the fight against WMD has itself evolved. These intertwined stories highlight the key inflection points in the countering-WMD mission and the ways in which the Center has helped decisionmakers understand shifting landscapes and develop appropriate responses. It is not intended to track exhaustively everything the Center has done, but rather to highlight work that, in our modest assessment, has been meaningful and impactful across the “WMD space.” I want to acknowledge the efforts of several Center alumni in preparing this narrative—Distinguished Fellow W. Seth Carus, former Acting Director John Caves, and former Director Chuck Lutes. As a special acknowledgment, I want to thank former Distinguished Fellow Paul Bernstein for his unflagging efforts to shape many different pieces into a cohesive whole. I am grateful to them not only for the good cheer with which they undertook this assignment, but also for their past leadership and notable contributions to many of the projects discussed in the text.

Following the retrospective, you find five short essays that examine current or emerging challenges that are shaping our thinking about the period ahead. Prepared by staff members Justin Anderson, Amanda Moodie, Diane DiEuliis, Pat Terrell, Sarah Gamberini, and me, these essays look at the nuclear, biological, chemical, information, and education aspects of that forming agenda for WMD policy, research, and teaching. We hope you find these useful to your own work.

Finally, I acknowledge Jeffrey Smotherman, Christine Moritz, John Church, Joanna Seich, and Latosha Adams—under the direction of William Eliason—of NDUPress, who played a vital role in preparing this volume for publication. I also thank Melody Smith for continuing to enable the Center’s success for over 10 years.

—Brendan G. Melley, Director

Reflections From Past Center Directors

Ambassador Robert Joseph

It was my good fortune and privilege to serve for 6 years as the founder and first director of the Center for Counterproliferation Research—now the Center for the Study of Weapons of Mass Destruction—at National Defense University (NDU). As noted in this retrospective of the Center’s role in strengthening U.S. national security, the Center’s original mandate in 1994 emphasized both research and education to improve our understanding of the impact of WMD proliferation on defense requirements, broadly defined to include the full spectrum of related challenges from military doctrine to fielded capabilities. Critical to our success was the full support of Ash Carter, then serving as Assistant Secretary of Defense for International Security Policy, who became Secretary of Defense some two decades later. Ash provided the vision and leadership necessary to bring into the Pentagon an awareness of these new threats and the need to develop effective responses to counter them. Ash’s success paved the way for the success of the Center.

At the earliest stage in our efforts, we realized that the Center offered a unique platform to bring together not only the many affected DOD components but also those elements of the broader interagency community involved in what was to become a national-level response to WMD threats from rogue states and terrorists. Therefore, in addition to the important role played by the Center in strengthening DOD’s ability to deter and, if necessary, prevail in conflict against a WMD-armed adversary, the Center has had a lasting impact on broader policy. This was seen most directly in the

administration of George W. Bush, which placed countering WMD at the center of its national security policy. After President Bush assumed office, his first speech on national security, given at NDU, incorporated many of the lessons learned from the Center's work.

This work would also serve as the foundation for several Presidential directives, including the need to transform deterrence policy (National Security Presidential Directive [NSPD] 4), counterproliferation strategy (NSPD-17), interdiction (NSPD-20), and biodefense (NSPD-33). The Center's

influence was equally apparent in a series of international initiatives taken by the administration that provided new and innovative tools for preventing and protecting against the full spectrum of WMD threats. These included, among others, the G8 Global Partnership, which provided billions of non-U.S. dollars to non-proliferation assistance programs, and the Proliferation Security Initiative, now endorsed by more than 110 states, which strengthened interdiction efforts.

As this retrospective makes clear, the Center has for 30 years been able to attract the best and brightest minds in the field, both as staff and as working colleagues in government, academia, and national security think tanks. In particular, the Center has benefited from great leadership—John Reichart, Chuck Lutes, and Brendan Melley. Their legacy and their many contributions are described below. But most important is what lies ahead of us. As we look at the ever-expanding and increasingly complex threat from WMD in the hands of peer states, rogue states, and terrorists, the Center will have an even more important role to play in defending our great Nation.



Ambassador Robert Joseph

Dr. John Reichart

I joined Bob Joseph just 6 months after he founded the Center for Counterproliferation Research. Little did I know that it would become my professional home for 20 years. When I succeeded him as Director in early 2001, I told anyone who asked that I had the best job in government. And indeed, I did.

I'd like to set forth in this brief reflection just a few thoughts on why the Center became so successful.

NDU provided an ideal location for the free exchange of ideas. I'm not sure Secretary Carter or Ambassador Joseph fully understood the brilliance of locating the Center at NDU, but it became clear over time that several attributes of NDU proved to be essential in the Center's success. Foremost

of these was the University's longstanding policy of nonattribution. Over time, it became clear to the many hundreds if not thousands who participated in Center events—ranging from very small group discussions to very large symposia—that this policy was real and that participants in Center activities could speak freely and openly without fear of attribution as they came together at NDU to try to solve some of the most challenging defense and national security issues. Time after time, this policy helped foster a sense of openness and frankness that I had never witnessed elsewhere in my 40 years of government service.

People are everything. From the start, the Center was blessed by having a flexible hiring system that was free of some of the rigidities of civil service restrictions. We were able to hire the finest group of individuals it was my privilege to work with. It was Ambassador Joseph's and my belief that even a few people of the highest caliber working together as a team could make substantial contributions. Indeed, in many respects, smaller was better. The Center began with just three people, and even as the magnitude of the mission increased substantially, the Center grew only modestly—to about 20 by the time I departed in 2015. It is a testament to the dedication and quality of Center staff that so much could be accomplished with relatively limited numbers.

Innovation was encouraged. While the Center was always something of an orphan at NDU in its first two decades—we never had a direct funding line; more on that later—NDU's leadership (which changes roughly every 3 years) never said no when we floated ideas to make the Center better able to accomplish its missions. Consequently, we were able to run many “experiments” to explore new approaches to achieve better outcomes. This willingness to innovate eventually resulted in activities like the Program for Emerging Leaders and the joint program with Missouri State University to award master's degrees and graduate certificates in WMD Studies.

For many years, the Center was seen by its many external funders as a shared national asset. I don't think anyone could have foreseen that an organization within government without direct funding would still be in existence after 30 years. I never did, and I doubt Ambassador Joseph ever did either. In retrospect, most of the credit must go to some visionary high- and mid-level political appointees and career personnel who understood the value of the Center—and this is key—not just to the success of their respective organizations, but to the Nation's overall security. These visionaries are too numerous to mention here, but they included individuals from the Defense Threat Reduction Agency and its predecessor organizations; the Office of the Under Secretary of Defense for



Policy; the Office of the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs; and the Joint Requirements Office for Chemical, Biological, Radiological, and Nuclear Defense on the Joint Staff.

Mr. Chuck Lutes

I first encountered the Center for Counterproliferation Research (as it was called then) in the early 2000s. In the Pentagon's infinite post-9/11 wisdom, I, as a complete neophyte, was appointed to lead the Joint Staff/J5's newly created WMD Division. With the Iraq war looming, ostensibly over Saddam Hussein's WMD programs, it occurred to me that this role was much too important to assign to someone like me who could barely spell WMD. But I was in good company. The sad truth was that very few military officers knew anything about the subject. Those who did told me I needed to make friends with the WMD Center at NDU. They couldn't have been more right! John Reichart and his staff were more than patient in schooling me on the essentials of nuclear, chemical, and biological programs, even while busy leading the interagency community in thinking about the larger and nettlesome policy issues presented by the Iraqi WMD challenge. In short, the Center's staff became my new best friends.

That friendship was cemented further a short while later when I was assigned as a military fellow to the Center's then-sister organization, the Institute for National Strategic Studies (INSS). For 3 years I worked one floor up from the Center, but I might as well have had a second office in their spaces. As an NDU colleague, I noticed that the Center functioned differently than INSS or any other research center inside the Washington Beltway, many of which had stellar individual experts in a variety of national security topics. The "secret sauce" of the Center was and is its culture of teamwork. Many a time I witnessed, and sometimes was invited to, a brainstorming session crammed around the coffee table in John Reichart's small office. Every researcher and intern had a voice, and every problem was considered from all angles. I have not seen anything like that anywhere else.

In later roles at the White House and in the Office of the Secretary of Defense, I was quick to push the "Easy Button" by calling on the Center to help me think through an urgent WMD problem. Many of my colleagues in the interagency community did the same. Even when I could not provide funding, the Center was quick to say yes to helping, as it understood that its value to the Nation was in helping to solve these wicked problems. And nobody did it better.

After a decade of working with and admiring the Center, I jumped at the chance to join the team. The experience of being on staff was even better than collaborating from the outside. The opportunity to work on the most important issues of the day within a culture of teamwork and intellectual honesty was second to none. I felt like I made a difference every day. But what I had not appreciated from the outside was that while all that policy support was being provided, the Center

was making a long-term difference by educating everyone from young professionals and mid-level analysts to senior military officers and civilians. Through its many efforts in education and leader development, the Center has ensured that the important lessons of our collective WMD experience are being inculcated in the current and future cadre of leaders. This is the Center's true legacy that must be nurtured and sustained.

The highlight of my career came when I was fortunate enough to become the Center's third Director. John Reichart is right that it is the best job in government. But in many ways, it may also be the easiest, because everyone on the staff is talented, everyone is enthusiastic, and everyone is rowing in the same direction. I would like to extend my sincere appreciation to all my colleagues, past and present, who have made the Center the Nation's premier institution of research, education, and policy advice in the WMD field.



Mr. Chuck Lutes

Looking Back

Prelude: A New Challenge for Defense Planning

In the 1980s, the United States became increasingly concerned about the proliferation of WMD. The widespread use of chemical weapons during the Iran-Iraq War—culminating in the 1988 Iraqi attack on the Kurdish town of Halabja, which killed several thousand civilians—led Washington to reenergize international negotiations to control chemical weapons. At the same time, the intelligence community was reporting that a growing number of countries were acquiring or seeking to acquire chemical and biological weapons.¹ These worries, however, were seen largely as nonproliferation issues to be addressed through diplomacy and enhanced export controls. They were not viewed as a problem that affected DOD's core missions.

The 1991 Persian Gulf War changed that perception. The need to deter Iraqi employment of chemical and perhaps biological weapons was a priority for the most senior officials in the U.S. Government, starting with President George H.W. Bush. This raised the profile of WMD challenges throughout the defense establishment. The war also highlighted significant gaps in the U.S. military's chemical and biological defenses, including inadequate detection equipment and supplies for passive defense. Accurate and timely intelligence was a major weakness that undermined efforts to understand the threat (including Iraq's nuclear aspirations) and to target WMD-associated infrastructure during the bombing campaign. While the effort to deter Saddam Hussein from using WMD during the war is widely viewed as having succeeded, this experience pointed to the need to better understand deterrence in a post-Cold War world increasingly shaped by our concerns about WMD-armed

regional actors. Following the war, DOD had serious questions about its ability to respond to similar challenges in the future.²

The institutional response to these concerns began to take shape in 1992 as the Office of the Under Secretary of Defense for Policy considered lessons learned from the Gulf War, including possible implications for organization, programs, and defense strategy more broadly.³ Secretary of Defense Dick Cheney's review of defense strategy late in the George H.W. Bush administration concluded that "U.S. forces must be capable of operating against adversaries who possess weapons of mass destruction."⁴

The stage was thus set for the incoming Bill Clinton administration to take a fresh look at defense planning with a consideration for growing concerns about WMD. The Bottom-Up Review (BUR) of 1993 initiated a transition from a Cold War defense posture to one better suited to the emerging security environment. While the BUR focused on several security challenges, two received particular attention: WMD proliferation and the potential for conflicts initiated by increasingly capable regional actors—such as Iraq and North Korea—that might be prepared to challenge the United States or its allies. These problems intersected, of course: regional conflicts could easily involve adversaries armed with WMD.⁵ The WMD challenge had been a particular concern of Secretary of Defense Les Aspin's when he served as Chairman of the House Armed Services Committee.

The concern for nuclear weapons and other WMD permeated the BUR. This encompassed fears of indigenous development of WMD as well as the potential leakage of such weapons from the former Soviet Union. According to the BUR, 20 or more countries—in addition to the 5 declared nuclear weapons states—possessed WMD or were seeking to acquire them. The BUR particularly focused on the consequences of nuclear proliferation, arguing that friendly countries might reject U.S. assistance if faced with a nuclear-armed adversary. In addition, the BUR posited that such hostile powers could threaten U.S. forces directly, as well as air and seaports critical for the entry of U.S. forces into a theater of operations. A nuclear-armed regional power might even be able to target cities in the United States.⁶

To address these dangers, the BUR called for a renewed emphasis on traditional nonproliferation efforts, to include tougher export controls and stronger international regimes for control of WMD, but also higher priority for the Cooperative Threat Reduction program initiated in the Bush years to address the new problem of "loose WMD" in the former Soviet Union. Speaking to the United Nations in September 1993, President Bill Clinton declared, "I have made nonproliferation one of our highest priorities. We intend to weave it more deeply into the fabric of all our relationships with the world's nations and institutions. We seek to build a world of increasing pressures for nonproliferation."⁷

But Les Aspin had also concluded that the nonproliferation approach alone was insufficient to ensure that U.S. and allied military forces would not have to face WMD-armed adversaries.⁸ Thus, the BUR argued, "DOD must also focus on counterproliferation efforts to deter, prevent, or defend

against the use of WMD if our nonproliferation endeavors fail.”⁹ In announcing the Defense Counterproliferation Initiative on December 7, 1993, Aspin stated that a “policy of prevention through denial won’t be enough to cope with the potential of tomorrow’s proliferators. . . . [W]e are making [the] essential change demanded by this increased threat. We are adding the task of protection to the task of prevention.”¹⁰

In this way, the WMD problem became a principal concern of the defense planning enterprise. By “protection,” Aspin was referring to the need to ensure that U.S. and allied forces deployed to fight regional adversaries would succeed in the face of WMD threats and attacks. The Defense Counterproliferation Initiative was intended to catalyze the work needed to ensure that WMD would not be an obstacle to deterring or prevailing in regional wars. This meant creating a new DOD mission and organization for counterproliferation; providing new guidance to the Services, combatant commands, and Joint Staff; acquiring new military capabilities to defeat the regional WMD threat; strengthening intelligence to support DOD’s counterproliferation mission; and working with allies. These efforts defined the counterproliferation agenda moving forward.

Within a month of Aspin’s speech, Assistant Secretary of Defense Ash Carter supported the establishment of the Center for Counterproliferation Research at NDU with a mandate to assist DOD in three areas: the adaptation of forces, planning, and doctrine through the education of senior officers; policy-relevant research; and building a shared vision of counterproliferation with top leadership and the broader security policy community through conferences and seminars. The Center launched in June 1994, and in the years that followed, it organized its work around these three lines of effort.

Making Contact

The Center’s mandate required engaging quickly with the stakeholders in the new counterproliferation mission. The Center launched a yearlong effort to bring together elements of each Service to examine how WMD might affect the warfighter. Three separate workshop series (for the Army, the sea Services, and the Air Force) were convened at NDU. These sessions helped to orient warfighters to the strategic and operational challenges presented by adversary WMD and to frame research and analysis needs. Equally important, the sessions began a process of community-building that was sorely needed. It was evident from the start that many participants, even within the same Service, had never met or interacted before. In retrospect, this early engagement with the Services was the beginning of the Center’s foundational effort to help build and maintain a government-wide community to focus on the WMD problem—an imperative that to this day remains central to the Center’s mission.

DOD also needed a deeper understanding of how the WMD threat was evolving. Les Aspin had flagged the need for better WMD intelligence to support military planning. Of particular concern

were North Korea, Iran, Iraq, Libya, and Syria.¹¹ U.S. defense strategy was to sustain a force capable of executing two nearly simultaneous major theater wars—probably against North Korea and Iraq.¹²

The Center undertook several initiatives focused on gaining more insight into WMD operational threats. A principal concern was to better understand plausible WMD-use concepts that adversaries might adopt. A seminal 1997 study that examined the potential WMD threat in 2025 argued that WMD could be employed by near-peer competitors on the higher end of the capability spectrum

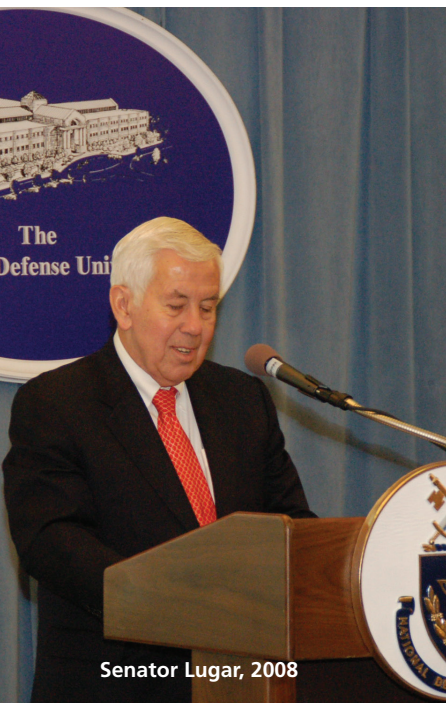
as well as by nonstate actors on the lower end. These adversaries might have a range of motivations to acquire and use WMD, could use them against different types of targets to achieve a few objectives, and might employ them in unexpected ways.¹³

Insights into “how, when, and why” adversaries might use WMD became the foundation for developing a family of counterproliferation planning wargames that explored possible adversary use and how this could be countered. Originally developed in conjunction with U.S. Air Force staff, this gaming work initially supported Air Force counterproliferation initiatives. Subsequently, it was adapted more broadly to enhance awareness of counterproliferation issues, including in support of the 1997 Quadrennial Defense Review, which sought to deepen DOD’s institutional commitment to the counterproliferation mission. By 1999, nearly 2,000 military and civilian officials had participated in some version of the game.

These games provided insight into community perspectives on the nature of the threat as seen in the late 1990s. Game participants

generally accepted that deterrence remained the first line of defense against WMD-armed adversaries, but that U.S. forces required capabilities to fight and prevail in a nuclear, chemical, or biological environment. They agreed that while there were pockets of strength with respect to preparedness, there was no “silver bullet” solution to the challenges that WMD posed. Participants worried about unconventional employment strategies, including cover attacks on the U.S. homeland using chemical or biological weapons. Close cooperation between the United States and its allies was deemed essential. Non-U.S. participants had roughly similar perspectives to those of U.S. players. Through this and other activities, the Center was able to help DOD policymakers better understand attitudes toward WMD in allied and partner nations—especially in the North Atlantic Treaty Organization (NATO)—and thereby strengthen efforts to broaden support overseas for counterproliferation.¹⁴

The Center was able to leverage this body of gaming work when the Defense Threat Reduction Agency (DTRA) asked it in 2000 to co-direct the development of a spanning set of chemical,



Senator Lugar, 2008

biological, radiological, and nuclear (CBRN) weapons scenarios that could be used by a wide range of stakeholders in their counterproliferation analysis and planning. This effort to create a common basis for planning involved close collaboration between the Center, DTRA, other DOD agencies, the Intelligence Community, and outside experts. Like many Center projects, it reflected a broad spectrum of views, not just those of the Center or DTRA. Nine scenarios were developed, and the work was distributed widely.

The Center had the opportunity to translate what had been learned about WMD threat and response into revised joint doctrine. In the early 1990s, joint doctrine did not support the concepts that undergirded the Defense Counterproliferation Initiative (DCI). Joint Publication 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense*, released 18 months after the DCI was announced, continued to reflect a narrow doctrinal focus on nuclear, chemical, and biological defense. The Center led the work to conceive and draft a new version that better captured the full range of activities required to operate in the face of WMD threats and attacks. The updated JP 3-11, *Joint Doctrine for Operations in Nuclear, Biological, and Chemical Environments*, was published in July 2000.

Focused Warfighter Engagement

The late 1990s saw a concerted effort by the Office of the Secretary of Defense (OSD) to better align combatant commands' operational plans with counterproliferation policy direction. Key to this effort was a series of engagements with U.S. Central Command and U.S. Pacific Command to help them achieve the necessary alignment of policy and plans and advance the integration of counterproliferation into regional war plans. These extended engagements—Coral Breeze in 1997 with U.S. Pacific Command and Desert Breeze in 1998 with U.S. Central Command—broke new ground both in socializing the chemical and biological threat with combatant commands' staffs and leadership and in examining the WMD operational challenge in a highly granular way. Center staff were key players in these activities in support of OSD, providing threat, policy, and technical expertise as part of the core team, and facilitating a workshop at the general-officer level that explored WMD deterrence concepts.

The Department drew on the results of Coral Breeze and Desert Breeze and other studies to focus attention on several specific operational challenges. One area of significant concern was how to protect against and immediately react to the consequences of chemical or biological attack at a fixed

“I have seen the benefits of the Center. I saw it as Assistant Secretary of Defense; I saw it as Under Secretary of Defense for Acquisition, Technology, and Logistics; and I saw it most recently as Deputy Secretary of Defense, and I know my bosses Secretaries Perry, Gates, Panetta, and Hagel all benefited from it as well. It has made a tremendous contribution to our security and to combating weapons of mass destruction.”

—Ash Carter
former Secretary of
Defense

site. The Center supported one important line of effort here—the Restoration of Operations (RestOps) Advanced Concept Technology Demonstration (ACTD). ACTDs were an acquisition innovation—programs that bypassed the traditional acquisition process to accelerate the development and deployment of new capabilities that warfighters deemed urgent. In 2000 and 2001, the Center supported the Policy Integrated Product Team of the RestOps ACTD.

“The Center has been the leading intellectual base for the entire WMD community in anticipating and navigating the sea changes in the WMD threat environment. Building the next generations of well-prepared leaders for evolving WMD challenges is an enduring need and a vital role for the Center.”

—John Lauder,
former Director of the
CIA's Nonproliferation
Center and Chief of the
Intelligence Community's
Arms Control Intelligence
Staff

Deterrence and the Nuclear Dimension

Helping DOD better understand deterrence in the post-Cold War strategic environment was an important line of effort for the Center. Foundational to Les Aspin's concern about WMD proliferation was a belief that future adversaries might be difficult or even impossible to deter. As Chairman of the House Armed Services Committee before becoming Secretary, Aspin had openly worried about this possibility.¹⁵ The BUR was only slightly more circumspect: “[T]he unpredictable nature of some Third World regimes, coupled with the fact that potential adversaries may have more at stake in a regional conflict than the United States, means that the United States' ability to deter such actions may at best be uncertain.”¹⁶

A major concern was nuclear weapons, especially in the hands of rogue states. While the need for a Cold War-style nuclear posture seemed diminished, there was uncertainty about how the United States should shape its nuclear strategy, doctrine, and capabilities in the new environment. Immediately after the Cold War, the United States had unilaterally reduced its reliance on nonstrategic nuclear force and had canceled or limited production of several nuclear systems—a policy initiative the Center analyzed in one of its WMD Case Studies.¹⁷ The United States had also initiated changes in nuclear planning with the goal of becoming better prepared to address regional WMD threats. And it had leveraged nuclear deterrence in the effort to dissuade Iraq's leader, Saddam Hussein, from using WMD during the 1991 Persian Gulf War.

As the Clinton administration undertook its Nuclear Posture Review in late 1993, there were open questions about the role of nuclear deterrence in countering WMD threats, especially chemical and biological weapons. The deliberations for the review in fact revealed policy differences on these questions. Between 1995 and 2000, the Center hosted a series of workshops that explored declaratory policy, nuclear force posturing, nuclear employment considerations in regional crises

and conflicts, command and control, and the role of strategic missile defenses in strengthening deterrence through denial.

Additionally, the Center initiated an independent review of U.S. nuclear strategy in collaboration with the Center for Global Security Research at Lawrence Livermore National Laboratory. The goal was to take a “fresh, long-term look” at the role of nuclear weapons and the requirements of an effective nuclear strategy. The study called particular attention to the strategic importance of the nuclear weapons infrastructure in an uncertain security environment and the need to better integrate denial capabilities into the Nation’s deterrence posture. The report, *U.S. Nuclear Policy in the 21st Century: A Fresh Look at National Strategy and Requirements*, was issued in 1998.¹⁸

The Center’s work on deterrence provided the foundation for the George W. Bush administration’s determination to deny rogue states the ability to hold American cities hostage to nuclear attack with long-range ballistic missiles. It did so in part by highlighting the limitations imposed by the 1972 Anti-Ballistic Missile (ABM) Treaty on defending American territory from missile attack. While the treaty had played a central role in our Cold War concept of deterrence, the Nation was now confronted with new threats that required new capabilities for deterrence and defense. In a major speech at NDU on May 1, 2001, President Bush emphasized the need for a new security framework that moved beyond the constraints of the ABM Treaty.¹⁹

Biological Weapons

The Center’s research focused extensively on biological weapons threat and response. Many of the activities already discussed incorporated a biological warfare component. For example, the Center’s wargames typically attributed a biological weapons capability to adversaries, which enabled insights for subsequent analytic efforts. Some of this work documented the history of biological terrorism to deepen understanding of terrorist motivations to acquire biological agents. The Center also hosted workshops to explore possible state motivations for employing biological weapons. One project explored the use of lightweight masks to protect against biological aerosols. While focused on the warfighter, this effort had its greatest influence in 2020 when its results were used to support initiatives by the Department of Health and Human Services to promote expedient masks to protect against COVID-19.

“The Center’s most important asset is its people . . . their expertise and willingness to speak truth to power. It is unique in that it works, classified and unclassified, within the USG and with external partners, all of whom want to work with the Center because of its deep expertise, and more importantly, because it seeks to do the right thing for the country.”

—Jim Miller, former Under Secretary of Defense for Policy

Educating the Joint Force

Education was a core component of the mission assigned to the Center. Beginning in 1995, the Center introduced the study of countering WMD into the NDU curriculum through an elective course on counterproliferation at National War College. This course gave students an integrated overview of the warfighting challenges posed by weapons of mass destruction. This course in various iterations has now been taught for nearly three decades and is part of an ongoing series of electives that have been taught by Center staff.

Subsequently, the Center used the counterproliferation wargame developed in the mid-90s to support numerous DOD education and training activities. In 1996 and 1997, this game was played by all National War College students, as well as by students at the Armed Forces Staff College (now the Joint Forces Staff College). In 2000, students from both the National War College and the Industrial College of the Armed Forces (now the Eisenhower School for National Security and Resource Strategy) played a version of the game. In addition, it was conducted in courses offered by the Defense Special Weapons Agency (now the Defense Threat Reduction Agency), the U.S. Army Quartermaster Corps, the U.S. Army Signal Corps, and the U.S. Army Chemical School.

The Center also assumed a role in encouraging and supporting the efforts of other professional military education institutions to teach counterproliferation. In December 1994, the Center hosted the WMD Curricula Working Group meeting that brought together educators from the senior Service colleges. The Center would build on this work in later years to facilitate more proactively the development of WMD content for the professional military education classroom and provide expertise to various schoolhouses.

WMD Terrorism

WMD terrorism was not a consideration in the Defense Counterproliferation Initiative. For many years it was argued in intelligence and policy circles, “Terrorists want a lot of people watching, not a lot of people dead.”²⁰ However, in the 1990s, it began to appear that this was no longer the case. Some terrorists were in fact interested in causing mass fatalities. The February 1993 bombing of the World Trade Center in Manhattan was intended to bring down both towers, as happened 8 years later in the 9/11 attacks. The release of sarin nerve agent in the Tokyo subway by Aum Shinrikyo in March 1995 killed 13 and injured another 1,000 people, and the bombing of the Alfred P. Murrah Federal Building in Oklahoma City a month later killed 168 people. These and other mass casualty attacks seemed to confirm that we were entering an era of catastrophic terrorism potentially enabled by terrorist acquisition and use of WMD.²¹

A focus on WMD terrorism became policy in June 1995 with the release of Presidential Decision Directive 39 (PDD-39), *U.S. Policy on Counterterrorism*. Intended to better integrate interagency

counterterrorism responsibilities, it assigned “the highest priority” to countering WMD terrorism. PDD-39 directed DOD to support the Federal Bureau of Investigation and the Federal Emergency Management Agency in responding to large-scale terrorism events, whether domestic or foreign. It also directed DOD to give high priority to capabilities to address WMD terrorism threats.²² Subsequently, Congress gave the Department authority to provide support to domestic law enforcement in dealing with chemical and biological weapons threats. The DOD role further expanded with the congressionally mandated Nunn-Lugar-Domenici Domestic Preparedness Program. This program required DOD to take a more active role in preparing the country for domestic WMD terrorism incidents, especially those involving CBRN weapons.

The Center contributed to these efforts in two ways. In 1997, it supported the Consequence Management 911-BIO Advanced Concept Technology Demonstration by hosting two integration workshops and facilitating the opening workshop prior to the field demonstration at Dugway Proving Ground. In addition, the Center facilitated two consequence management workshops in partnership with the Joint Staff to explore the challenges posed by WMD terrorism attacks targeted at military deployments during a response to an overseas crisis.²³ The Center also facilitated a WMD terrorism workshop for the State Department’s Coordinator for Counterterrorism.

In the next phase of its work, the Center would find itself deeply engaged in helping DOD and the interagency community respond to the events of September 2001.

Paradigm Shift

If the Persian Gulf War was an eye-opening event compelling our attention to the strategic and operational threats posed by regional WMD, the events of September 2001 were an earthquake, leading to profound changes in the country’s broader conception of security both abroad and at home. These changes continue to ripple through American society and security policy.

The threat of mass casualty terrorism in the homeland, especially terrorism posed by or inspired by jihadist groups, moved to the forefront of U.S. security concerns. Defense planners remained concerned about deterring and defeating rogue state WMD on the battlefield. But it was now clear that WMD posed a broader and more complex national challenge—one that would lead not just to

“I pulled from a discussion with the WMD Center in the late 1990s the basis for the Masks for America program instituted during the COVID-19 pandemic. The strategic national stockpile, all the PPE, the masks, and particularly N95 masks, had expired in the year prior to the pandemic. So we manufactured 355 million new three-ply, washable masks. All of that came from discussions with the WMD Center 20 years earlier.”

—Robert Kadlec, former Assistant Secretary of Health and Human Services for Preparedness and Strategic Response

an expanded counter-WMD mission for DOD, but also to new roles and responsibilities for other Cabinet departments, with integration among them being a key enabler of success.

"I can't overstate how important it is to focus on developing our next generation of leaders. Doing so pays dividends across portfolios, and across generations. The WMD Center has been at the forefront in leading such educational initiatives in CWMD. The expertise, awareness, and networking developed through its critical programs have equipped our leaders to better understand, prepare for, and respond to strategic and tactical WMD challenges. These educational programs must be supported and nourished."

—Wendin Smith, Security Policy Director, NATO Political Affairs and Security Policy Division, and former Deputy Assistant Secretary of Defense for Countering WMD Policy

Al Qaeda's attacks heightened the Nation's sense of vulnerability to catastrophic terrorism, including attacks that could feature WMD. Terrorists could not employ such weapons on a mass scale and thereby threaten the Nation's existence, but those capable enough to acquire even crude WMD seemed motivated and ruthless enough to use them, and more likely to do so than state actors who faced an arguably different cost-benefit calculation. The anthrax letters sent to prominent people in the United States that appeared shortly after 9/11 and whose perpetrator remained undetermined for years thereafter contributed to these growing fears. This heightened sense of national vulnerability to unconventional threats underpinned the urgency with which the administration of George W. Bush defined its security strategies, executed its global war on terror, created the homeland security enterprise, and assessed the threat posed by rogue states like Iraq.

In September 2002, President Bush stated in the introduction to his National Security Strategy the seriousness of the WMD threat and his determination to combat it: "The gravest danger our nation faces lies at the crossroads of radicalism and technology. Our enemies have openly declared that they are seeking weapons of mass destruction, and evidence indicates that they are doing so with determination. The United States will not allow these efforts to succeed."²⁴

Three months later, the Bush administration released its unclassified version of National Security Presidential Directive (NSPD) 17/Homeland Security Presidential Directive (HSPD) 4, the *National Strategy to Combat Weapons of Mass Destruction*.²⁵ This first-ever national counter-WMD strategy was prepared under the direction of the Center's founder, then serving as a Special Assistant to the President and Senior Director on the National Security Council staff, and drew directly on the Center's work. NSPD-17 signaled a proactive search for a stronger and more di-

verse set of tools to enable a comprehensive campaign against WMD proliferation and WMD terrorism, with an emphasis on attacking the proliferation process itself and hardening the Nation against possible WMD attacks.

As the counter-WMD paradigm shifted, so did the Center's portfolio and capacities, expanding to meet new types of demand from the policy, operational and intelligence communities. The Center

began to devote more effort to terrorist WMD threats, especially to the homeland, while continuing to address state-actor WMD challenges to U.S. forces abroad, allies, and partners. It collaborated with a broader range of government organizations, including those in the new areas of homeland security and homeland defense, and increased its education offerings for DOD and the interagency community through new courses, programs, and activities. In 2004, President Bush cited the work of the Center in commending NDU for “providing vital insights into the dangers of a new era.”²⁶ Later that year, the Center changed its name to the Center for the Study of Weapons of Mass Destruction (CSWMD) to better reflect the broader problem space it was now addressing.

Nightmare Scenarios

Center experts were in increasing demand to support policymakers in the wake of 9/11. One of the Center’s earliest contributions in this period was the assignment of its Deputy Director to the Office of the Vice President in 2001–2003, where he served as Senior Advisor for Biodefense and participated in a variety of efforts to enhance the Nation’s protection against biological weapons, particularly considering vulnerabilities highlighted by the anthrax letter attacks. The Center also published *Anthrax in America: A Chronology and Analysis of the Fall 2001 Attacks* in late 2002.²⁷

If a large-scale biological attack was a nightmare scenario for U.S. policymakers, emergency responders, and medical professionals, so was the possibility of terrorists acquiring and detonating a nuclear weapon or improvised nuclear device (IND). In 2002, the Center developed and conducted for multiple audiences a tabletop exercise examining the implications of the loss of control of a foreign state’s nuclear weapon, including the danger that nonstate actors would transport the weapon and detonate it in the United States. Whereas the potential loss of control of a nuclear weapon or associated expertise from the former Soviet Union (FSU) had been a major U.S. concern since the end of the Cold War and was the principal focus of the Cooperative Threat Reduction program, the Center’s 2002 exercise scenario featured a non-FSU nuclear-weapons state in a region with high jihadi activity. The Center would continue in ensuing years to conduct this and similarly focused tabletop exercises for policymakers, operators, intelligence community members, and professional military education classes to illuminate the continuing challenges of “loose nukes” in the new era.

While the priority was and remains preventing terrorists from acquiring and detonating a nuclear device, the Nation also needed to plan how to manage the immediate consequences should prevention fail. Civil defense against Soviet nuclear attack had long since atrophied. In 2004, DTRA asked the Center to identify the key questions that emergency responders would need answered in the immediate aftermath of the detonation of an IND in a major U.S. city. The Center convened state and local emergency response planners and operators, Federal officials, and nuclear weapons

experts over four workshops for a focused discussion of postdetonation information needs. The U.S. Department of Homeland Security (DHS) used the Center's analysis and findings in its contribution to *Planning Guidance for Response to a Nuclear Detonation*, first issued by the Homeland Security Council in 2009.²⁸

Expanding the Policy Toolkit

In addition to thinking through nightmare scenarios for biological or nuclear attack, the Bush administration was also working to develop new policy tools that would provide greater flexibility to attack the proliferation process itself and thereby increase barriers to the further spread of WMD. It was important to strengthen the international treaty regime, but it was equally important to look outside the regime to develop approaches focused on practical cooperation with security partners willing in informal ways to leverage their collective will, capabilities, and legal authorities.

"The Center brought people together that were not normally in the same room. The ability to bring that kind of talent, often with diverse ideas, to bear on a problem has really paid dividends."

— Vayl Oxford, former Director of the Defense Threat Reduction Agency

The Center assisted in this effort. It worked with State Department and DOD partners on two multilateral initiatives under which partner governments endorsed a set of principles and committed to cooperate to reduce WMD proliferation, particularly to nonstate actors, without formal treaties and implementing secretariats. In 2003, the Proliferation Security Initiative (PSI) heralded a new, proactive approach to the interdiction of WMD, their delivery systems, and related materials and technologies.²⁹ Interdiction had been identified as a new policy tool in NSPD-17 and NSPD-20. Center experts have since routinely supported OSD, DTRA, the State Department, and geographic combatant commands in developing and facilitating tabletop exercises and conducting analysis for PSI activities, up to the present day.

In 2006 the Global Initiative to Combat Nuclear Terrorism (GICNT) was created as a vehicle for like-minded nations to work together to strengthen global capacity to prevent, detect, and respond to nuclear terrorism.³⁰ The Center assisted the Office of the Under Secretary of State for Arms Control and International Security in developing the GICNT concept and operating structure.

The Center captured the early history, ongoing work, and potential evolution of this new global counterproliferation network in two Occasional Papers, *International Partnerships to Combat Weapons of Mass Destruction*,³¹ and *Proliferation Security Initiative: Origins and Evolution*.³²

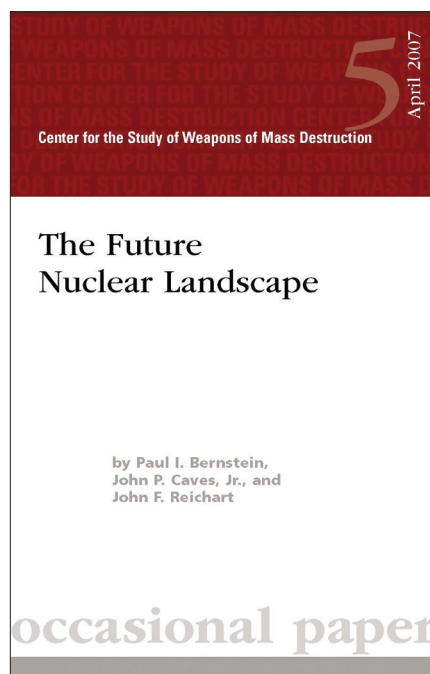
War and Post-War

Operation *Iraqi Freedom*, launched in March 2003, also embodied the new approach to the WMD threat. If WMD earlier had been viewed as a likely condition of conflict—an obstacle to prevailing in regional wars that U.S. forces would need to deter or fight through to achieve an objective—these weapons were now themselves the principal objective in going to war. In Operation *Iraqi Freedom*, eliminating an intolerable WMD threat was a central feature of the rationale for war offered by senior leaders. One implication was that the joint force needed to be prepared not only to fight and win on a contaminated battlefield, but also to secure, neutralize, and even destroy an adversary’s WMD, potentially under less than permissive conditions. At the request of OSD, the Center participated during the run-up to Operation *Iraqi Freedom* in DOD’s planning for how U.S. forces would locate and dispose of Iraqi WMD.

This mission, referred to as WMD Elimination, was organized hastily in advance of the invasion with the expectation of finding a substantial and well-developed Iraqi WMD program. However, it was found that Iraq had not reconstituted the major programs that were in place prior to its 1990 invasion of Kuwait. These programs had largely been dismantled under United Nations auspices after Operation *Desert Storm*, even if Saddam Hussein suggested otherwise as a form of strategic deception. This was a fortunate discovery for numerous reasons, including that U.S. plans for eliminating Iraq’s WMD had serious shortcomings. For example, there was inadequate appreciation that a WMD program encompassed far more than just actual weapons, or that an initial operation by military authorities would need to be transitioned to another entity to complete a more comprehensive elimination program. As Deputy

Secretary of Defense Paul Wolfowitz observed at the Center’s May 2003 annual symposium, “In future conflicts we should not end up playing ‘pickup games’ when we are trying to put together forces for eliminating weapons of mass destruction in the aftermath of a conflict.”^{29,33}

Having witnessed the inadequate preparations for WMD elimination before Operation *Iraqi Freedom*, in late 2003 the Center began an effort to capture lessons learned from this experience so that the United States and its partners would be better prepared to plan and execute future WMD elimination operations, which were expected to be a significant element of plausible crises or conflicts. The Center initially conducted small meetings with personnel who had participated in the WMD elimination operation in Iraq, and then held larger and more structured events that included



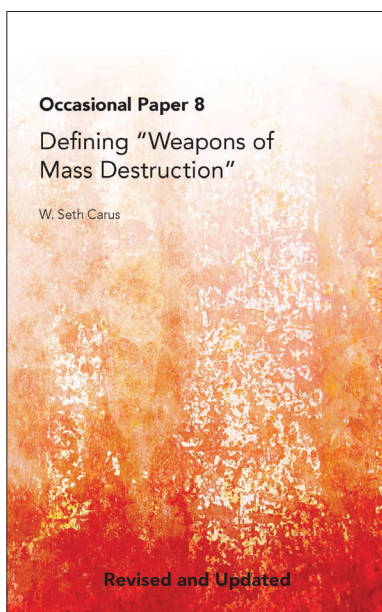
a broader range of officials and experts. The Center published its findings in an influential Occasional Paper in late 2004, *Eliminating Adversary Weapons of Mass Destruction: What's at Stake?*³⁴ This foundational work shaped guidance in the 2006 and 2010 Quadrennial Defense Reviews to regularize DOD planning and organization for future WMD elimination missions,³⁵ leading to the establishment of two bodies under the U.S. Strategic Command (USSTRATCOM): first, the Joint Elimination Coordination Element (JECE), and later, the Standing Joint Force Headquarters for Elimination (SJFHQ-E).³⁶ WMD Elimination also became a formal military mission.

This was just one element of the post-Operation *Iraqi Freedom* effort to establish a more coherent DOD framework for combating WMD planning and operations to which the Center contributed. Gaps in doctrine needed to be filled. Experts at the Center continued to support the Joint Staff in

this area, actively participating in the drafting of Joint Publication 3-40, *Joint Doctrine for Combating Weapons of Mass Destruction*, a new doctrine document applying the national strategic guidance for combating WMD provided in NSDP-17.³⁷ The Center contributed to subsequent updates of this document, as well as to periodic updates of the JP 3-11.

More than this, DOD needed a strategic framework for organizing and executing the combating-WMD mission. In 2005 the Center assisted the Joint Staff in conceptualizing and drafting the first *National Military Strategy to Combat Weapons of Mass Destruction*, which established eight military mission areas aligned with national strategy and DOD policy.³⁸ This framework integrated longstanding and well-understood operational tasks such as active and passive defense with new ones such as elimination and interdiction, and usefully clarified DOD's role in mission areas such as security cooperation and threat reduction activities.

Also central to the new DOD framework was the designation of USSTRATCOM as the first lead combatant command for combating WMD, with a mandate to synchronize DOD activities, develop a global concept plan (CONPLAN 8099) to assist other combatant commands in their planning, and advocate for required capabilities. To execute this mission, the USSTRATCOM commander established the USSTRATCOM Center for Combating WMD (SCC-WMD), staffed principally at DTRA headquarters with the DTRA Director "dual hatted" as the SCC Director. The Center worked closely with USSTRATCOM staff and later also the SCC-WMD during its stand-up, including by helping its leadership and staff move "up the learning curve" with respect to the issues, players, and organizational relationships in the combating-WMD arena. This included a 2-day event at NDU in late 2005 to introduce and orient USSTRATCOM to the interagency environment for combating WMD.



Focused Research

Parallel to these large muscle movements in DOD’s combating-WMD military mission, policy-makers continued to pay attention to motivations to acquire WMD and how to influence them. In 2005, the Office of the Under Secretary of Defense for Policy asked the Center to examine why some states that had seriously considered or initiated nuclear weapons programs had ultimately turned away from that path. The goal was to shed light on what might dissuade current or future nuclear proliferators. Evidence of a North Korean nuclear weapons program and indications of Libya’s and Iran’s pursuit of one had stoked the WMD community’s concern about potential “nuclear cascades,” whereby one state’s illicit nuclear weapons program might precipitate further proliferation.

The Center’s Nuclear U-Turns project (also known as “Rollback/Roll Forward”) looked at countries that had voluntarily pulled back from their nuclear aspirations, ended their programs, or given up their weapons. The research findings evaluated and ranked the principal factors that motivated nuclear rollback in these countries; classified known or potential nuclear aspirants according to the kind of hedging strategies they likely would pursue if they chose to maintain some option to pursue nuclear capability in the future; and suggested specific measures to dissuade future proliferators based on the rollback case studies.³⁹ This work was widely briefed and well received across the government and broader WMD community, and featured prominently in a 2008 staff report to the Senate Foreign Relations Committee on regional proliferation risks.⁴⁰

A second research initiative in this period produced a foundational document for understanding WMD as a policy, technical, operational, and legal concept. Commissioned by DTRA, this treatise—*Defining “Weapons of Mass Destruction”*—documented one of the lingering challenges of the post-9/11 era: increased attention to WMD threats, especially to the homeland, had exposed preexisting differences and generated new ones regarding how various Federal, State, and local entities defined WMD.⁴¹ These differences created confusion and bureaucratic friction that complicated efforts to develop and implement whole-of-government security solutions. For example, the traditional national security community (mainly the National Security Council [NSC] staff, DOD, the State Department, and the Intelligence Community) generally defined WMD as chemical, biological, radiological, and nuclear weapons, whereas the emergent homeland security community (including the Homeland Security Council staff, the Department of Homeland Security, and the Department of Justice/Federal Bureau of Investigation) tended to



also consider certain types of conventional weapons, especially high explosives, to be WMD. Other differences concerned whether the term WMD pertains only to weapons that cause mass destruction or to any weapon featuring CBRN as causative agents, regardless of lethality; whether mass disruption (as opposed to mass destruction) should be the bounding criterion; and whether the term WMD encompasses the associated means of delivery of the weapon. Originally published in 2006 and updated in 2012, this monograph has remained a vital source of information and insight to individuals and offices engaged in WMD-related activities.

Wicked Problems

The ability to attribute WMD attacks was a continuing concern of policymakers given the challenges to effective attribution and its vital importance to deterrence and accountability. In 2007, the Center conducted two interagency tabletop exercises to examine capabilities to attribute nuclear and biological attacks in the United States. The goal was to identify shortfalls in existing capabilities and recommendations to fill those gaps. The workshops brought together a wide range of experts, including key congressional staff and others who would occupy senior positions in future administrations. The insights they gained, in combination with the Center's after-action report, contributed to the NSC-led preparation of a classified attribution annex to NSPD-17 and to practical measures to enhance the Nation's ability to attribute nuclear and biological attacks.

Building on this work, a third interagency tabletop exercise examined the challenges of coordinating the response to a complex WMD crisis across multiple geographic and functional U.S. combatant commands, the broader U.S. interagency community, and allies and partners. This exercise, developed in close collaboration with the USSTRATCOM Center for Combating WMD, posited the loss of control of a non-U.S. nuclear weapon far from U.S. shores and assessed the challenges of locating and recovering the weapon before it could be detonated by a terrorist actor in the United States. As with the attribution tabletop exercises, participants in this event included future senior officials in the Barack Obama administration, including a Deputy Secretary of Energy, Under Secretary of Defense for Policy, and Deputy Assistant Secretary of Defense for Countering WMD. Preparing to respond to the specific threat addressed in the tabletop exercise—"loose nukes"—would be a major focus during the Obama years. DOD would produce a tailored contingency plan, and the Intelligence Community would sponsor several classified tabletop exercises. The Center designed and facilitated several of these exercises and made a staff expert available to help prepare the contingency plan.

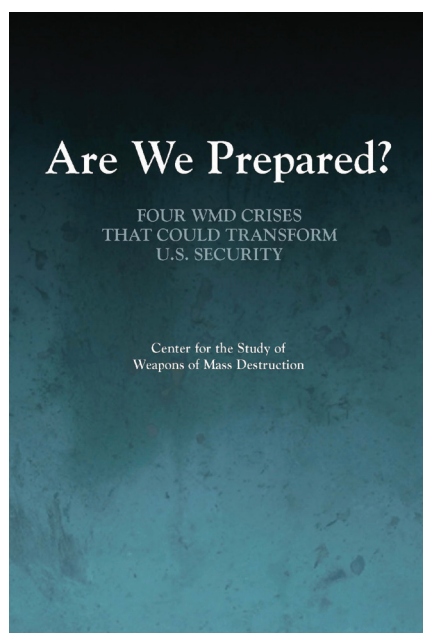
The Center's multiple research and policy support projects analyzing "wicked" WMD problems had highlighted the importance of preparing current and future leaders for complex contingencies that would not necessarily conform to prior crises. This work had also shed light on shortfalls in national and DOD readiness for such contingencies. To enable sharper leader focus on these issues

during a transition period, in 2008–2009 the Center synthesized much of its post-9/11 work into a publication that helped shape the countering-WMD efforts of the Obama administration. This book, *Are We Prepared? Four WMD Crises That Could Transform U.S. Security*, examined four WMD threat scenarios, how well prepared the Nation was to prevent or respond to them, and what was required to enhance deterrence and preparedness.⁴² The challenges associated with the scenarios (collapse of the nonproliferation regime, a WMD-armed failed state, a biological terror campaign, and a nuclear detonation in a U.S. city) informed the new administration’s assessment of WMD threat and response as captured in the new 2010 Quadrennial Defense Review.

Chemical Weapons

Though not featured in *Are We Prepared?* the threat posed by chemical weapons was also a significant aspect of the Center’s work in the post-9/11 period. Interagency policy attention to chemical weapons following 9/11 and prior to the 2013 outbreak of the Syrian civil war had focused on potential terrorist employment of toxic industrial chemicals in the homeland and adversary development and use of nontraditional agents, particularly fourth-generation agents (FGAs, also known as Novichok agents from the Russian for “newcomer”). In support of the Office of the Under Secretary of Defense for Policy, the Center actively participated in this interagency policy work, primarily contributing expertise regarding nontraditional agents. The Center organized and led the first interagency conference on the NTA threat in 2004.

Until 2009, most of this interagency policy work on chemical threats proceeded under the direction of the Homeland Security Council staff. The Center participated in the Homeland Security Council staff’s development of HSPD-22, Domestic Chemical Defense Strategy, issued as a classified document in 2007, and drafted that strategy’s section on nontraditional agents. The Center also contributed to the Homeland Security Council staff’s assessment of the consequences of potential terrorist use of FGAs, should terrorists somehow acquire these advanced nerve agents, and to the development of practical measures that emergency responders could take to mitigate those consequences. This task was complicated by the fact that almost all information about Novichok agents was classified at the time and most emergency responders lacked security clearances. Classification of FGA information was considered essential to preventing the proliferation of these agents to non-state and most state actors.



In 2009, the publication of *State Secrets* by Vil S. Mirzayanov, a former scientist in the Soviet chemical weapons program, placed sensitive information about FGAs into the public domain, heightening the risk that these little-known but dangerous agents would proliferate. The NSC staff asked the Center to conduct a review of the FGA threat and associated U.S. policy to inform formal interagency deliberations about how to respond to the situation created by the Mirzayanov publication. The Center led five classified interagency workshops and drafted recommendations approved by the Arms Control Interagency Policy Committee in June 2009 to update FGA policy and enhance preparedness.

During 2010–2012, the Center completed two major projects assessing military implications of adversary NTA use. The first concerned FGAs and was requested by the Joint Requirements Office for Chemical, Biological, Radiological, and Nuclear Defense, an arm of the Joint Staff. The Center developed a classified tabletop exercise and conducted it for several defense groups. This exercise illuminated FGA challenges for military audiences who were underinformed about the threat, and it reinforced Pentagon-led efforts to enhance joint force FGA defense preparedness.

The second project examined fentanyl as a chemical weapon at the request of the Office of the Under Secretary of Defense for Policy. Fentanyl and its analogues were of growing concern to defense and homeland security officials, considering Russia's use of them to resolve a hostage crisis at a Moscow theater in 2002, subsequent indications of other countries' interest in them as chemical weapons, and their growing prevalence in the illicit drug trade. The Center conferred with a range of technical, operational, and policy experts from the United States and select allies. Its findings were initially briefed in 2012 to senior DOD CBRN officials and helped catalyze DOD technical and operational investigations that informed the Department's assessment of fentanyl as a military threat. The Center's findings also were briefed in various forms to other official audiences in subsequent years, including allies and partners. Of particular significance, they were integral to the State Department's successful initiative to persuade the Conference of the States Parties of the Organization for the Prohibition of Chemical Weapons to clarify in 2021 that the aerosolized use of fentanyl compounds and other chemicals that act on the central nervous system for law enforcement purposes is inconsistent with the Chemical Weapons Convention (CWC).⁴³

In 2012–2013, the intensifying Syrian civil war moved traditional chemical agents back to the forefront of U.S. policy deliberations on chemical weapons threats. Syria had a substantial chemical weapons program primarily featuring sarin and mustard agents, and it was feared that various combatant groups could access the weapons or that the Syrian regime might resort to their use. At the request of the Office of the Under Secretary of Defense for Policy, the Center joined with an interagency working group to examine legal authorities, constraints, and options for U.S. and multilateral action to secure or eliminate Syrian chemical weapons and to respond to their employment. The

Center subsequently organized a workshop with a delegation from Jordan to familiarize the delegation with these legal considerations, including national obligations under the CWC.

In August 2013, following earlier indications of small-scale use of chemical weapons, the Syrian regime conducted a large-scale sarin attack in Eastern Ghouta, killing more than a thousand civilians. As the United States and the United Kingdom considered military retaliation, Russia proposed that its ally Syria join the CWC (it was one of the few states at the time that had not joined), and, in accordance with treaty obligations, declare its chemical weapons program and subject it to destruction under international supervision. Syria agreed to the proposal and joined the CWC.

Washington and its partners then wrestled with the technical, operational, and political challenge of determining how and where to destroy Syria's declared chemical weapons. The NSC staff asked the Center to conduct an interagency workshop to review the various technical and operational options under consideration. Center staff had already been involved through the DOD Threat Reduction Advisory Committee (TRAC) in identifying potential technical approaches. The NSC-sponsored workshop was instrumental in crystalizing consensus on the Army's proposed solution to render safe Syria's sarin and mustard weapons aboard a U.S. vessel at sea and dispose of the byproduct materials at appropriate facilities.⁴⁴ Though the Syrian regime and, at lesser scale, the so-called Islamic State, would employ chemical weapons for several more years, they did so with less loss of life because they were limited largely to the toxic industrial chemical chlorine rather than the far more lethal agents sarin and mustard eliminated by the U.S.-led destruction operation.

"I have valued the work of NDU's Center for the Study of Weapons of Mass Destruction for decades. On the National Security Council Staff, access to in-depth analysis helped with policy planning. As an academic, I appreciated the scope of the Center's work across a wide range of topics. Now, at Los Alamos National Laboratory, the Center is a trusted partner in holding workshops on core U.S. national security interests."

—William Tobey, former Deputy Administrator of the National Nuclear Security Administration

Two Nuclear Problems

By 2011, the nuclear revolution was 65 years old, but its potential to profoundly shape the lives of nations was as salient as ever. That year, a crisis involving civilian nuclear energy rather than nuclear weapons occurred in Japan, engaging the Center. An earthquake and the resulting tsunami caused catastrophic loss of life and other damage, including a radiation containment crisis at the Fukushima-Daiichi nuclear power plant. The United States played a leading role in the international effort to assist Japan in responding to the compounding losses and dangers of the disaster. The Center was able to apply its consequence management expertise and experience supporting U.S. Pacific Command

engagement with regional governments on consequence management and interdiction to contribute directly to the U.S.-led effort and to integrate lessons learned into lectures and briefings for those with disaster response responsibilities. In early 2012, the Center ran a U.S.-Japan interagency seminar to take a fresh look at the Fukushima response to identify the policies, capabilities, processes, practices, and training and exercises of greatest utility in preparing for potential future disasters.

The United States was also struggling with a different kind of nuclear challenge. The Obama administration's 2010 Nuclear Posture Review recognized the need to focus greater attention on ex-

"Where you could have the Center, as a government think tank, come in and run a scenario for our bilateral deterrence dialogues with the South Koreans and Japanese, we could then have a discussion and we could even criticize the scenario because neither of us developed it. The participants could raise issues that maybe neither government particularly wanted to raise, but which we really needed to talk about. . . . The Center helped me, and I think extended deterrence a good bit."

—Elaine Bunn, former Deputy Secretary of Defense for Nuclear and Missile Defense Policy

tended nuclear deterrence relationships with allies in NATO and in East Asia, given the changing security environment. South Korea and Japan faced a growing nuclear threat from North Korea, as well as a growing Chinese military power, resulting in new security anxieties and new challenges for allied assurance. The Nuclear Posture Review outlined a strategy for strengthening regional deterrence that included bilateral dialogues with South Korea and Japan that in fact built on consultations that took place during the deliberations for the review. Here, the Center drew on its expertise in nuclear deterrence and regional security to assist the Office of the Under Secretary of Defense for Policy in framing and launching these dialogues. Center staff engaged counterpart organizations in Seoul and Tokyo to advance a mutual understanding of extended deterrence challenges and requirements and designed and facilitated tabletop exercises that served as the basis for the initial set of dialogues. This line of effort in support of OSD would expand as the dialogue process matured during the years that followed, with emphasis on engagement with Seoul and Tokyo.

Education, Leader Development, and Continued Community-Building

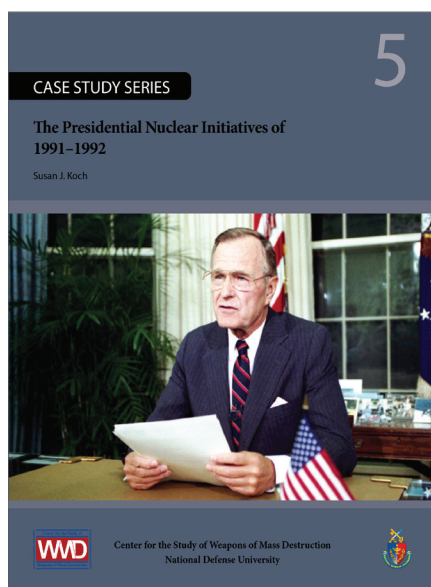
It is no surprise that education and leader development became a larger and more important feature of the Center's portfolio during the post-9/11 period. The need was great. Senior and working-level officials, both civilian and uniformed, require at least foundational knowledge—and in some cases more—of WMD threat and response if they are to effectively lead countering-WMD (CWMD) organizations and devise and implement effective policies. Chemical and biological weapons pose unique challenges that long have been inadequately addressed in professional military education, especially after most states joined the 1982 Biological Weapons Convention and 1997 Chemical Weapons Conven-

tion prohibiting such weapons. The extensive body of experience and expertise in nuclear deterrence developed over many decades dissipated as the Cold War ended and Russia became an ostensible partner rather than implacable adversary. The rise of rogue states and jihadist terror groups with an interest in WMD, and potentially less easily deterred from using such weapons, required a new understanding of the nature of WMD threats and how to counter them.

The Center was well-positioned to meet this need, which was formalized in 2007 when the Center was designated as the Chairman of the Joint Chiefs of Staff's focal point for WMD in joint professional military education,⁴⁵ as recommended by the Joint Requirements Office for Chemical, Biological, Radiological, and Nuclear Defense (JRO-CBRND). This office was committed to improving WMD education in DOD and made the Center its partner, providing substantial resources to support education and leader development activities. The Center hired additional staff and launched new courses and programs, with an emphasis on infusing these activities with fresh and relevant insights from its policy support and research experience.

In its role as focal point, the Center established a WMD Education Consortium that brought together curriculum developers and instructors from across the professional military education (PME) community on a regular basis, with the goal of sharing best practices and discussing substantive WMD issues. The Center's engagement with the PME enterprise was extensive. Among the most significant efforts were the following:

- ◆ Electives at NDU built on the original course offered in the mid-'90s, expanded to include offerings on consequence management, deterrence, biosecurity, and WMD in mass media. This enabled NDU to offer its degree students a Concentration in WMD Studies, which was managed by the Center.
- ◆ Curriculum Development has focused on assisting joint and Service schools to develop and deliver WMD courses. As examples, the Center worked closely with Joint Forces Staff College and Army War College to build full-length courses and provided subject-matter experts as instructors.
- ◆ Guest Lectures across the PME community have provided Center experts an opportunity to share with students their unique perspectives on CWMD policy, plans, and programs based on their direct experience.



- ◆ WMD Case Studies prepared by Center experts and outside specialists examined historical responses to real-world WMD challenges to provide PME instructors with a tailored resource that could be used to impart lessons with respect to leadership and policymaking.

The Center also created innovative education and leader development activities outside the PME community. The Program for Emerging Leaders (PEL) was an initiative to build a networked cadre of rising leaders in the interagency community with the knowledge to understand WMD challenges and the skills to work across organizational lines to identify and implement effective responses.



Dr. Thomas Schelling, 2010

Through education, outreach, mentorship, and debate, PEL cultivated trusting relationships among future leaders. The program was highly competitive and was widely viewed by community leaders in and out of government as a unique professional development opportunity. More than 400 early- and mid-career professionals were part of PEL beginning in 2008, through the most recent cohort. In parallel, the Center's WMD Spotlight Seminar Series provided a monthly opportunity to members of the WMD community, especially those not enrolled in formal education, to hear and interact with senior officials and experts on topical WMD issues.

Engagement with the civilian academic world was also important. In 2012, at the request of the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Programs, the Center partnered with Missouri State University (MSU) to establish and teach a Countering WMD Graduate Fellowship Program. Each year this program enabled up to 20 DOD employees already assigned to WMD duties to complete outside their regular work hours a rigorous 2-year program leading to a master's degree in WMD Studies from MSU. One hundred and twenty-six students earned master's degrees, and another 64 received graduate certificates, gaining an in-depth understanding of WMD issues from both academic and practitioner perspectives, thus preparing them to make a larger contribution to DOD in the WMD arena.

The innovative WMD education and leader development programs that the Center delivered (through the sponsorship of JRO-CBRND and the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Programs) beginning in 2007 expanded the quantity and quality of learning and professional development opportunities for a broader range of DOD and some interagency

personnel, even as the Center continued to advocate for the inclusion of greater WMD content in PME.

Finally, as an adjunct to focused education and leader development programs, the Center was deeply committed to broader community-building. The Center hosted the first of its 2-day, classified annual symposia in 2001. These events, which continue today, aim not just to discuss and debate contemporary developments in the WMD field, but also to sustain and strengthen the community of professionals engaged in the combating-WMD mission. Annual symposia brought together senior officials and working-level experts both in and outside government in a classified and nonattribution environment intended to promote the candid exchange of information and ideas. Keynote speakers over the years have included national security advisors, Cabinet secretaries and their deputies, Members of Congress, and combatant commanders.

Looking to the WMD Future

A decade after the attacks of September 2001 seemed like a useful moment to consider the future of WMD and the combating-WMD enterprise. The Center did just this in 2011, initiating a major research project to study the future of WMD during a period of rapid technological change and geopolitical uncertainty—in particular, a more assertive Russia and a rising China. The project was welcomed by the Center’s various sponsors and subsequently supported by JRO-CBRND. Consulting both open and classified sources, Center experts conducted an extensive literature review and met with a wide range of government and nongovernmental experts on technology, geopolitics, and WMD from the United States, the United Kingdom, and other allies. The project yielded two written products. One was a monograph—*The Future of Weapons of Mass Destruction: Their Nature and Role in 2030*—envisioning how the intersection of technological and geopolitical change would shape the nature and role of WMD by 2030.⁴⁶ The second was an unpublished paper examining the WMD potential of a few emerging or possible exotic technologies. Their findings were widely read and influenced the subsequent direction of strategy, policy, operations, and technology development. The United Kingdom’s Ministry of Defence cited the monograph in producing its own restricted report on the future of chemical and biological warfare. In 2020, the coauthors of the monograph issued an updated assessment—*The Future of Weapons of Mass Destruction: An Update*—that considers the implications of subsequent technology and geopolitical developments.⁴⁷

“The concept that education requires research and that is how it differs from training has been hard for the Defense education system to understand. The Center recognized this as a really big problem and made a significant effort to correct it.”

—Amb. Linton Brooks, Distinguished Fellow, National Defense University, and former Administrator, National Nuclear Security Administration

Taking Stock—and Moving Forward

By the mid-2010s, DOD was ready to assess the progress of the counter-WMD effort to date, and to position the mission to meet emerging challenges. Much had transpired in the two decades

“The Program for Emerging Leaders constitutes a small group of professionals with broad and deep experience in the lost art of WMD and strategic deterrence. The dynamics of nuclear weapons (and other WMD) and the theory and doctrine of strategic deterrence were foundational to post–World War II U.S. national security policy and defense posture but waned considerably after the Cold War and 9/11 due to perceptions that nuclear conflict risks had diminished. However, recent developments have dramatically underscored the urgency of improving our understanding of these catastrophic threats and how they can be deterred.”

—Hon. Kenneth Rapuano, former Assistant Secretary of Defense for Homeland Defense and Global Security

since the Defense Counterproliferation Initiative was launched. It was now time to gather the lessons learned from that body of experience and put them in service of a coherent strategic framework going forward. The Bush-era national strategy (NSPD-17) remained in place, and the Joint Staff’s 2006 military strategy to combat WMD still stood as the department’s sole strategy document.

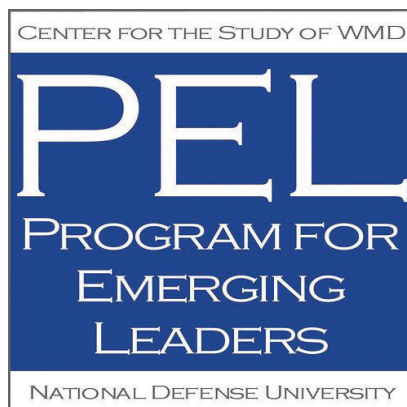
In 2014, the Center played a lead role in supporting the Office of the Under Secretary of Defense for Policy as it prepared a new DOD *Strategy for Countering Weapons of Mass Destruction*.⁴⁸ Building on DOD’s recent experiences in dealing with WMD threats primarily from terrorists and rogue or failing states, the strategy emphasized early action to shape the incentives of aspiring or active proliferators and defeat acquisition activities using a “pathway defeat” concept developed by U.S. Special Operations Command (USSOCOM).⁴⁹ It also prioritized capabilities to counter the most significant operational threats to the joint force and activities best executed by DOD, rather than by inter-agency and international partners.

Having helped shape the strategy, the Center was uniquely positioned to assist in key aspects of its implementation, including in adapting the organizational constructs needed to execute DOD’s strategic vision for the mission. The USSTRATCOM commander, in his capacity as global synchronizer of the countering-WMD mission, asked the Center to develop a Senior Leader Seminar to help all combatant commanders better understand the requirements of synchronization. The scenario-based discussion among the four-stars was a significant step in operationalizing the new DOD strategy, and the commander of USSTRATCOM announced his intent to continue the seminars on an annual basis. In subsequent seminars, Center experts took on an expanded role in leading the discussion. When President Obama in 2016 transferred responsibility for synchronizing CWMD activities from USSTRATCOM to USSOCOM and broadened the role to that of a “coordinating authority,” the Center worked closely with both commands and OSD to ensure continuity in four-star engagement. The Se-

nior Leader Seminar series has continued annually under successive USSOCOM commanders and to this day plays an important role in shaping the CWMD mission and preparing senior military leaders for complex WMD contingencies, especially those that cross multiple areas of command responsibility.

As the 2016 Presidential election approached, the Center once again sought to raise awareness of WMD and nuclear policy issues among prospective officials in a new administration. The 2016 annual symposium focused on WMD challenges likely to confront the next President and his team, discussing in depth issues such as regional nuclear deterrence, North Korea's WMD programs, issues for a new round of strategic guidance documents, emerging chemical and biological warfare concerns, the Joint Comprehensive Plan of Action to limit Iran's nuclear program, and protecting the homeland against WMD terrorism.

Building on insights gained at the symposium, the Center published a paper in November 2016, *Weapons of Mass Destruction: Challenges for the New Administration*.⁵⁰ This piece homed in on a set of problems seen as casting a large shadow over the work of a new administration: deterring and managing escalation in a regional conflict with a nuclear-armed adversary; preparing for WMD contingencies on the Korean peninsula; holding the line against further erosion of global norms opposing the development and use of chemical and biological weapons; and containing nuclear proliferation pressures in the Middle East by limiting or rolling back Iran's nuclear program and shoring up consensus on the Nuclear Nonproliferation Treaty. The paper offered several recommendations that served as a rough blueprint for policy action in the ensuing years—specifically, steps to strengthen regional nuclear deterrence, reduce incentives for WMD proliferation, increase resources and improve organization for CWMD contingencies, and closely monitor and exploit rapidly unfolding science and technology developments.



Diving Deeper on Emerging Technologies

The ways in which new technologies or innovative scientific and technological applications could lead to new types of strategic or operational threats has been a focus of Center's work from the beginning. By carefully scanning the horizon, it might be possible to identify and get ahead of such threats. Fast-paced developments in a variety of fields in the first part of the 21st century promised new technological revolutions but also raised several national security concerns.

Beginning in 2016, the Center deepened its exploration of this problem space, looking specifically at implications for the countering-WMD mission in its “Emergence and Convergence” project. This initiative identified emerging scientific and technological advances of greatest concern and ways in which they might interact to create new or adapted WMD threats. Starting with a wide range of technologies such as additive manufacturing, advanced robotics, nanotechnology, advanced nuclear technology, and synthetic biology, the project team engaged technology experts through workshops and in-depth surveys to identify potential WMD risks, opportunities, and governance challenges.⁵¹ The study examined three broad trends associated with emerging technologies that are

“The Center has been instrumental in shaping the thinking of senior leaders by bounding the problem and focusing the time and attention of the four-star commanders, whether that be in USSTRATCOM, USSOCOM, or others, and by getting them to focus, think, and understand the nuances of complex problems.”

—Ken Myers, former Director of the Defense Threat Reduction Agency

fundamentally reshaping the WMD threat space and weakening the traditional counter-WMD toolkit: digitization, convergence, and democratization.⁵² The project also catalyzed additional research into the use of commercial drones,⁵³ the challenges of defense innovation,⁵⁴ and a larger body of work in synthetic biology and gene editing.⁵⁵

Biotechnology—because of both its potential to shape new biothreats and biodefenses and its growing importance as an element of the national economy—became a major focus of the Center’s work. Indeed, the Center’s experts in this area contribute directly and significantly to the national conversation on biotechnology and biodefense at both the senior and working levels, often helping to facilitate collaboration among the defense, public health, academic, and nongovernmental-organization communities. In 2016, the Obama administration became concerned about the development and widespread adoption of the CRISPR gene-editing tool.⁵⁶ The straightforward ability to edit genes and genomic sequences raised fears in the CWMD community that rogue actors could use this innovation to develop some type of targeted biological weapon. Policymakers across multiple agencies had differing views on or insufficient understanding of these risks and needed a forum for a deeper discussion than the regular interagency process could provide. The Center hosted an important conference that brought together a variety of stakeholders and helped forestall a reflexive (and premature) government effort to place restrictions on CRISPR.⁵⁷ Equally important, this event sparked more robust discussions among scientists, technologists, and policymakers in a variety of venues, both formal and informal, leading to the initial idea of “Biosecurity by Design,” which calls for risk assessments across the spectrum of biotechnology.⁵⁸

Center experts participated in two mandated studies led by the National Academies of Sciences. The first, “Biodefense in the Age of Synthetic Biology” (2018), developed a risk-assessment framework for emerging biotechnologies and applied it to gain preliminary insights into how concerns about biological weapons should be prioritized. The second, “Safeguarding the Bioeconomy” (2020),



provided a definition of the U.S. bioeconomy and how it can be measured, and identified national security risks associated with the use of biotechnology across economic sectors. Both consensus studies acknowledged the difficulties in assessing the risks of biotechnology and other emerging technologies, given the wide range of novel WMD threats that could be imagined. To address this issue, the Center hosted a workshop titled “How Do ‘Emerging Technologies’ Become ‘Emerging Threats?’” The resulting report looked beyond technical factors alone but noted that preventing bad actors from acquiring critical technical expertise or tacit knowledge plays an important role in denying access to emerging technologies that may pose a threat to society.⁵⁹

When COVID-19 emerged, the Center was well positioned through its expertise to help draw key lessons from the pandemic for the biodefense community and other concerned communities. Early in the pandemic, the Center drew on its ongoing research into misinformation and disinformation to highlight the so-called “infodemic”⁶⁰ of false narratives about COVID that, unsurprisingly, echoed previous disinformation campaigns directed at U.S. biodefense research.⁶¹ Additionally, the Center’s experts examined issues such as the origins of COVID-19,⁶² military readiness during a pandemic,⁶³ biosecurity governance,⁶⁴ priorities for the health-security nexus,⁶⁵ the importance of genetic attribution,⁶⁶ and the need to develop a more dynamic, responsive National Stockpile to enhance future preparedness.⁶⁷

The pandemic also stimulated new thinking on biological threats and the requirements of bio-defense in the context of Great Power competition.⁶⁸ Major biodefense assessments were underway at both the national and DOD levels. Center experts made important contributions to the 2022 *National Biodefense Strategy and Implementation Plan for Countering Biological Threats, Enhancing Pandemic Preparedness, and Achieving Global Health Security*.⁶⁹ They played an even larger role the following year in DOD's first-ever Biodefense Posture Review, helping to draft the document and working closely with leaders of the review to shape key reforms to the biodefense enterprise to better enable it to advance the priorities of the National Defense Strategy in the face of an increasingly complex biothreat landscape.⁷⁰ Subsequently, the Center was asked by the Department of Homeland

"Your convening capacity, the quality of the research, and the community that you bring around that research is so highly valued. Those are huge parts of the success of the Center."

—Laura S.H. Holgate,
U.S. Ambassador to the
International Atomic
Energy Agency and other
international organizations
in Vienna, Austria

Security to help conduct its own Biodefense Strategic Review to examine the department's policies, programs, and operations and ensure they are aligned with the national-level priorities.

Nuclear Deterrence and Great Power Competition

While various technology revolutions were driving new thinking about WMD threat and response, dramatic shifts in the broader security environment were reshaping the basic framework for national security policy and defense planning. Roughly two decades of intense focus on the war on terror and the long wars in Iraq and Afghanistan increasingly gave way to the demands of renewed Great Power competition. Xi Jinping's rise to the presidency of China in 2012 and Vladimir Putin's unexpected invasion and annexation of Crimea in 2014 were harbingers of more belligerent behavior from both nations over the decade that followed. Both leaders saw themselves as embodying national ambitions to assert a more prominent role in global affairs by challenging American power and the U.S.-led international order. Both were prepared to leverage military power to advance this goal and make this challenge concrete to Washington. Both saw nuclear weapons as a significant factor in competing with the United States.

To be sure, defense planning still had to account for nonstate actors operating out of the greater Middle East—most prominently the so-called Islamic State (IS), which used mustard and chlorine gas in Iraq in the mid-2010s.⁷¹ But by this time the United States had begun to rebalance U.S. forces to place greater emphasis on the Indo-Pacific region in anticipation of intensified competition with China, while also moving expeditiously with NATO Allies to reinforce the Alliance's conventional deterrence posture on its eastern flank in the wake of continuing Russian aggression.

But the question of nuclear deterrence loomed large, as well, as the promise of a “world without nuclear weapons” that dominated Obama’s first term gave way to renewed nuclear anxiety in Europe and East Asia. After Crimea and the nuclear saber-rattling that accompanied Russia’s military action, there was now growing concern that Russia might be prepared to leverage its advantage in nonstrategic nuclear weapons to support conventional aggression—to deter a full-scale NATO response, rescue a failing conventional campaign, or create conditions for a favorable settlement. Such a strategy seemed to strike at gaps in American and allied planning: the significant time required to generate a full-scale NATO response to a quick-strike incursion on NATO soil, the difficulty of dislodging Russian forces once entrenched, and the potential for Russia to threaten limited nuclear escalation to paralyze, coerce, and deter. This fait-accompli strategy, enabled by the implicit or explicit threat to cross the nuclear threshold, worried DOD policymakers and planners at the working level, but needed to be socialized at higher levels and to a broader audience—including regional combatant commands charged with planning and prosecuting regional wars against nuclear-armed adversaries.

In 2014, the Center initiated its Nuclear Escalation Project to promote greater awareness of this challenge both in and outside the nuclear community and more focused work among deterrence and strategic-forces analysts. Through interviews, papers, briefings, and tabletop exercises, Center experts helped to unpack the problem and develop approaches to strengthen deterrence of limited nuclear use in the context of conventional conflict. To take a deeper look, the Center teamed with



WMD Annual Symposium at NDU, 2019

Lawrence Livermore's Center for Global Security Research to host a series of roundtables in 2015–2017 that brought together Russia experts, nuclear policy experts, and conventional war planners.⁷² These workshops developed or reinforced a number of concepts or approaches that later became focal points for DOD policy development, including the need to consider additional regional nuclear capability and the importance of a more integrated approach to deterrence and defense planning.

This effort generated further opportunities for Center experts to provide thought leadership and advance community thinking through analysis and research. There were also important opportunities to contribute directly to leader awareness and the policy process. In 2015 Center staff worked closely with OSDP, the Joint Staff, and the Intelligence Community to create and facilitate a senior-level DOD tabletop exercise focused on the problem of adversary nuclear escalation in regional war. This exercise became the model for a series of games played at the Deputies and Principals level at the National Security Council in 2016.⁷³

The 2018 Nuclear Posture Review highlighted the challenge presented by adversary escalation strategies and directed important adaptations to plans, doctrine, and nuclear forces to enhance regional deterrence. Center specialists worked with OSD and others to support implementation of these initiatives, including those related to the nuclear-armed sea-launched cruise missile (SLCM-N),⁷⁴ conventional-nuclear integration in the joint force and in NATO's deterrence posture,⁷⁵ and more focused attention to nuclear issues in professional military education. Independent research by the staff on these and related topics influenced the broader discourse on how to adapt strategic forces to the new environment.⁷⁶

The questions about Russia raised in the original work of the escalation project have only been underscored by Moscow's open attempts at nuclear coercion in its second invasion of Ukraine beginning in early 2022. But in recent years the focus has also shifted to China, considering its ongoing nuclear modernization and expansion. Coupled with China's clear intent to acquire the conventional means to reunify Taiwan by force, the significant growth in China's nuclear arsenal raises the question of whether Beijing, like Moscow, sees nuclear coercion as an important element of its strategy for regional conventional war against the United States. Center experts in deterrence, nuclear policy, and China are today looking at this very question in studies that assess China's regional nuclear forces and novel approaches to managing intrawar deterrence in a regional conflict over Taiwan. In parallel, the Center has hosted private senior-level roundtables that give current leaders in the strategic-forces community an opportunity to talk to past leaders about the complex challenges related to deterrence and escalation risk in limited wars with nuclear-armed adversaries.

Still Searching: The Persistent Rogue State Nuclear Problem

Successive U.S. administrations dating back decades and spanning the political spectrum have been searching in vain for the policy formula that will effectively address the major nuclear-proliferation “hard cases”—North Korea and Iran—whether the goal is to prevent, limit, or roll back these nuclear programs. Even as Great Power competition has come to dominate national strategy and defense planning, these lesser powers—perennial proliferation provocateurs, one might say—continue, by virtue of their existing and latent capabilities, to pose a major security challenge with respect to nonproliferation, ally assurance, deterrence, and the possibility of regional conflict. The last decade has seen highly consequential developments in this arena, and the Center has been closely engaged in assessing them and performing policy-relevant research and analysis, often to explore new ideas and concepts as previous policy prescriptions have proved inadequate.

Center researchers have explored the strategic culture of North Korea and Iran and the implications of cultural factors in shaping their nuclear aspirations and strategies.⁷⁷ Early concerns that the North Korean regime was fragile catalyzed lines of effort examining its possible collapse⁷⁸ and approaches to eliminating its nuclear capabilities and program in such a scenario.⁷⁹ As North Korea’s nuclear arsenal grew in size and sophistication, Center experts sought to quantify its potential growth, identify the various pathways Pyongyang could follow in further developing forces and doctrine,⁸⁰ and assess the implications for deterrence and defense of public pronouncement by the regime on questions of nuclear strategy and command and control.⁸¹

And as North Korea’s missile programs expanded and diversified, it was imperative to consider options to neutralize these systems that were not exclusively dependent on midcourse ballistic missile defense interceptors. Building on innovative DOD analysis conducted during the Obama years and responding to congressional concerns voiced in 2017 and the Donald Trump administration’s 2019 Missile Defense Review, Center experts launched a major study to examine strategic, operational, technical, and organizational issues associated with institutionalizing missile defeat or pre-launch attack operations as a complement to existing deterrence and missile defense strategies. The Center briefed principals on the classified recommendations from this work and prepared them for the review of the Secretary of Defense. Recently, senior military leaders have been reviving the central argument of this work—the need for greater institutional focus on “left of launch”—a clear reaction to the dynamic ways in which missile warfare is evolving and concerns about the limitations of traditional interceptor strategies.⁸²

“The Center played an important role in separate bilateral discussions with the ROK and Japan that accelerated the development of a common vocabulary, common concepts, and a common grasp of the challenges of deterring a nuclear armed North Korea.”

—Brad Roberts, former Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy

Iran's patient and determined quest to acquire the technologies, materials, and know-how to manufacture nuclear weapons has presented its own set of challenges and perils. Especially as the Obama administration's effort to negotiate limits on Iran's capacities gained momentum mid-decade, Center experts produced a number of assessments examining topics as diverse as the possible military dimensions of Iran's nuclear program, the domestic politics of Iran's nuclear debate, Iran's posture in the negotiations that led to the 2015 Joint Comprehensive Plan of Action,⁸³ and the role of the International Atomic Energy Agency in weighing Iran's compliance with its nonproliferation obligations.⁸⁴

"The Center hosted a lot of our roundtable discussions on the Fukushima crisis with all of the departments and agencies and really got us on the road to fixing a lot of the dichotomy between the domestic and the international aspects of the response."

—Julie Bentz, former Deputy Director of the Defense Threat Reduction Agency

Still Standing: The Continued Success of Extended Nuclear Deterrence

Not surprisingly, persistent nuclear challenges from both Great Powers and regional aspirants have led to increasing anxiety among allies concerned about the deteriorating nuclear security environment. This anxiety has sharpened the demand signals for security assurances from the United States. Indeed, the growing role of allies and partners in conventional deterrence and defense as described in successive national defense strategies only underscores the need to ensure that extended nuclear deterrence relationships are as strong and enduring as possible. Russian, North Korean, and Chinese actions have made the task of assuring allies both more urgent and more complex over the last decade. The Center has worked closely with the policy and operational communities to adapt extended deterrence approaches in both Europe and East Asia.

In part, this work has been an extension of efforts initiated after the 2010 Nuclear Posture Review to establish sustained extended deterrence dialogues with South Korea and Japan, and to work in NATO to raise the Alliance's "nuclear IQ" at both working and senior levels. The Center's support to these activities continues to this day but has also taken on new dimensions. In NATO, Center experts have helped to explain and socialize concepts for a closer synchronization of conventional and nuclear deterrence planning; talked to NATO staff about the challenges of decisionmaking in nuclear crises; facilitated senior-level tabletop exercises looking at stressful nuclear-crisis scenarios; and taught classes on nuclear policy at the NATO School.

In East Asia, the twin challenges of North Korea and China have demanded new thinking about extended deterrence and regional security. The Center's thought leaders in this area have made important contributions through original analysis and research. A notable example is the 2021 study on the



implications for extended deterrence of the shift in U.S. regional bomber operations from “Continuous Bomber Presence” to “Bomber Task Forces.” Drawing on extensive interviews with government officials and nongovernmental experts in Australia, Japan, and South Korea, the authors found serious shortfalls in how the United States communicated this change in operations to its key regional allies.⁸⁵ A follow-on effort developed a framework for allied assurance employing concepts for capability, credibility, and communication. These research products were well received in the combatant command community, particularly at USSTRATCOM and the U.S. Indo-Pacific Command, where some of the recommendations were taken for action.

Most recently, the Center has been closely involved in the innovation taking place in the U.S.-South Korea nuclear deterrence relationship. Center experts assisted OSD in developing the concept for the Nuclear Consultative Group that was established by the 2023 Washington Summit and that sets the bilateral extended deterrence relationship on a new footing. Additionally, the Center hosts a 4-day Extended Nuclear Deterrence Immersion Course now being offered twice a year to help South Korean military and civilian officials become more informed about U.S. deterrence strategy, capabilities, and plans. Both these initiatives are intended to advance the important goal of helping our ally in Seoul understand how deterrence would function in a crisis, how its interests would be considered, and how it could contribute to deterrence operations.⁸⁶

Arms Control and Nonproliferation

From the vantage of the mid-2020s, it seems clear that the New START agreement of 2011 was the high-water mark for nuclear arms control in the contemporary era. Despite the hopes the treaty

generated for still deeper cuts in arsenals and reduced reliance on nuclear weapons in global politics, the prospects for further regulation of nuclear weapons have steadily dimmed in recent years. Russia's material breach of the 1987 Intermediate-Range Nuclear Forces (INF) Treaty led the United

"The WMD Center has always been a positive, informed entity whose experts have deep history and a mastery of details, many of whom have been working in their respective field for years and are widely recognized for their expertise. They are a trusted resource to which I would regularly turn and could always rely. Be it a TTX, a research paper, hosted discussion, a roundtable, or anything else, I knew that the WMD Center could be counted on to provide excellent analysis and support. Their deep knowledge and understanding of the problem at hand helped policymakers reach informed decisions, and I think achieved many good results."

—Hon. Madelyn Creedon, former Assistant Secretary of Defense for Global Strategic Affairs

States to withdraw from the agreement in 2019. While Washington and Moscow agreed in 2021 to extend New START for 5 years, dialogue with Russia aimed at defining an approach to a successor treaty has been stymied by Russia's second invasion of Ukraine and significant differences in the two sides' goals for a next phase of arms control. In parallel, efforts to engage China on nuclear stability issues have largely been rebuffed by Beijing. As China continues its nuclear expansion and U.S.-Russia dialogue founders, the expiration of New START in early 2026 raises the specter of an unconstrained nuclear arms competition between the three Great Powers. This outcome is not inevitable, but it is one that the United States must consider.

Working these issues has been an important line of effort for the Center. As the future of the INF Treaty became increasingly uncertain, Center experts examined the unique attributes that contributed to the treaty's success—but also to its demise after three decades of global political and technological change.⁸⁷ They also drew lessons from the INF experience for future arms control negotiations.⁸⁸ As concerns grew about China's nuclear breakout, the Center worked with the Air Force to study how a New START-type framework could be applied to negotiating limits on China's forces. Later, as the environment for arms control became more challenging, these same experts helped the Air Force examine the implications for its programs of New START expiration without a follow-on agreement in place.

The erosion of nuclear arms control as a form of risk reduction and a marker on the path toward broader disarmament has had unsurprising consequences in the nonproliferation arena. Both governments and nongovernmental organizations, frustrated by the apparent inability of the Great Powers to make further progress on reducing nuclear arsenals and by persistent stalemates in the review process for the Nuclear

Nonproliferation Treaty (NPT), have sought to pressure the United States and its allies through the Treaty on the Prohibition of Nuclear Weapons—known informally as the "ban treaty." This treaty was passed by the United Nations General Assembly in 2017, albeit without support from the nuclear powers and their allies, and has 70 states parties.

Making sense of this development, crafting a response to the ban treaty, and preparing for the 2020 NPT Review Conference were key concerns for senior U.S. officials. The Center was asked by a senior director at the National Security Council staff to help develop approaches to this set of challenges, including how to counter the narrative perpetuated by advocates of the ban treaty that nuclear weapons states, including the United States, were unwilling to take meaningful steps toward the goal of nuclear disarmament embodied in the NPT. Functioning as a policy incubator, the Center hosted a series of small, invitation-only expert roundtables that critically assessed the factors that could enable greater progress toward disarmament. The group concluded that such progress could occur only when conditions in the security environment were more conducive—conditions that would enable a broad-based improvement to global security resulting from the sharply reduced salience of nuclear weapons. Given that nuclear weapons and strategies of nuclear deterrence are a response to genuine security dilemmas, there was work to do to improve the geopolitical environment. This study process led directly to a U.S. initiative called Creating an Environment for Nuclear Disarmament, which became a main pillar in the U.S. approach to the NPT and the ban treaty.⁸⁹

The Center was even more directly involved in efforts to strengthen the nonproliferation regime for biological weapons, detailing its leading subject-matter expert to the State Department's Biological Policy Staff twice (in 2016 and 2020) to support preparations for review conferences of the Biological Weapons Convention. This full-scope support included serving as interagency team lead in the development of U.S. positions, lead delegate to review-conference working groups, and negotiator for several parts of review-conference final documents.

"I chose the Center to establish the Countering WMD Graduate Fellowship Program because nurturing the next generation of leaders was an essential role for an educational entity like the Center, and it bore incredible fruit. The Center has created a network of leaders who provide expertise that OSD, the Joint Staff, and many other organizations don't have in residence."

—Hon. Andy Weber,
former Assistant Secretary
of Defense for Nuclear,
Chemical, and Biological
Programs

WMD in the Information Sphere

In drawing lessons from the decline of arms control, Center experts recognized that an exacerbating factor has been a sharp uptick in the use of disinformation in an increasingly contested information environment.⁹⁰ This has contributed to the steady erosion of the mutual trust required for an effective arms control regime. Center experts on information warfare and influence operations have helped shape the conversation—including through facilitated interagency discussions at the Deputy Assistant Secretary level—on the role that disinformation could play in future arms control debates, negotiations, and agreements. This is part of a focused research, policy support, and education effort

that is systematically examining the varied intersections of WMD and disinformation and the dangers they represent.

Gaining insights from Russia's attempt to influence the 2016 U.S. Presidential election, the Center assessed the effects of disinformation campaigns on global efforts to counter WMD. It found that the rise of social media weaponization has created new challenges for counter-WMD strategies that seek to increase openness and transparency among actors with potential WMD-like capabilities.⁹¹

Center experts were the first WMD specialists to brief the NATO Committee on Proliferation re-

"CSWMD serves a critical role in providing policymakers, military officials, and the academic community with a comprehensive and operationally relevant understanding of WMD. The Center's outsized impact is enabled by its relatively small cadre of first-rate scholars and practitioners who, through their expertise and sustained commitment to educate, render a seminal service to our national security. The growing salience of WMD issues in international security will only increase our reliance on the outstanding work of the Center in the future."

—Charles J. Ball, former Deputy Assistant Secretary of Defense for Threat Reduction and Arms Control

garding how Russian disinformation was undermining WMD prevention and control efforts, in particular the nonproliferation regimes for biological and chemical weapons.⁹²

CSWMD has conducted tailored training and exercises for numerous sponsors in DOD and the Departments of State and Energy, helping these organizations to better understand information threats, develop programs for internal information resilience, and contribute to the larger governmentwide fight to counter disinformation. The Center helped stand up the Information Resilience Office at DTRA as a testbed in DOD for addressing targeted disinformation through threat assessment, education, and public affairs. Going forward, the Center will use the lessons from this effort to help other government agencies establish their own plans for gaining information advantage.

More broad-based education and awareness of WMD disinformation is essential as WMD challenges persist in an increasingly complex information environment. The Center integrated this topic into its own education offerings. Electives led by Center experts helped students understand how visual media can shape the views of both policymakers and the public on WMD issues. In support of joint professional military education programs of instruction, these experts can help craft how operations in the information environment are taught and reflected in curricula and therefore seen as a valued field of study for future joint force leaders.

Ups and Downs in Education and Leader Development

Looking back over the last 15 years, it would seem self-evident that the rise in geopolitical turbulence, the emergence of new areas of global competition, the use of chemical weapons, the grow-

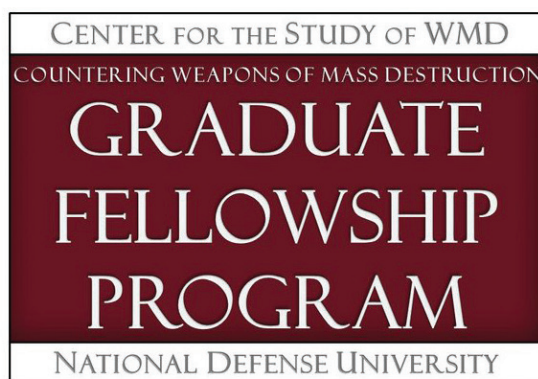
ing salience of nuclear arms, the erosion of arms control, the breakneck pace of technology, and the regular flow of fresh strategy documents from the Pentagon and the White House—all this and more—would produce a steadily sharpening demand signal for education on WMD and nuclear weapons and for leader development for both military personnel and career civilians in DOD and the interagency community.

And to some degree it has. About a decade ago, joint force leaders began to understand the importance of better educating future leaders on principles and concepts of deterrence and how they would need to be applied in a “post post–Cold War world” characterized by renewed competition among states armed with the most sophisticated and destructive weapons. When the Chairman of the Joint Chiefs of Staff adopted strategic deterrence as a special area of emphasis for professional military education in 2015, the Center was asked by NDU’s CAPSTONE program to develop a classroom module on deterrence that could be offered to general officers and flag officers as part of their preparation for senior-level assignments. Subject-matter experts from the Center have taught this class since 2016, providing well over 1,000 rising generals and admirals with foundational knowledge of strategic deterrence.

But this type of education needed to reach more than the most senior officers. The entire joint force needed to know more to be prepared for complex contingencies involving nuclear weapons and other WMD. The Center was one of the few organizations in the DOD system with the ready capacity to help fill this need—deeply knowledgeable subject-matter experts with both policy and classroom experience.

These specialists have taught in multiple joint and Service schoolhouses from academies to senior war colleges, as well as in professional continuing education courses that provide vital enrichment opportunities for those with nuclear and WMD responsibilities.

Following publication of the 2018 Nuclear Posture Review, growing concerns about the nuclear dimension of crisis and conflict led the Chairman in 2020 to formally designate “nuclear concepts and capabilities” as an enduring special area of emphasis in officer education. Now, schools have a requirement to teach these topics as part their curricula and will be evaluated on how well they achieve established learning outcomes. The outcomes being used to guide joint and Service schools were developed by the Center at the request of the Joint Staff (J7) as part of the process of implementing the Nuclear Posture Review. Working in collaboration with stakeholders in the Services and combatant commands, Center experts prepared a detailed framework for career-long nuclear education, recommending learning outcomes and more granular learning objectives for all students at the intermediate,



senior, and general/flag officer level, as well as for the planning cadre—those officers preparing for assignments on planning staffs. Full implementation of this framework is ongoing, but attests to the progress made in institutionalizing nuclear awareness and education, and the role that an organization like the Center can play operating at the nexus of policy, research, and education. Applying this template to broader CWMD issues is an important task going forward.

In its cornerstone programs outside the professional military education community, the Center's experience during the last decade has been mixed. By mid-decade, the Program for Emerging Leaders (PEL) and the Countering WMD Graduate Fellowship Program were well-established and successful in preparing the next generation of WMD practitioners and thought leaders. In 2017, the PEL expanded to include technologists from the national nuclear laboratories. PEL participants and WMD fellows teamed with students from the Nonproliferation Policy Education Center in a series of activities to include a “competitive symposium” in which the participants were challenged to develop solutions to contemporary problems with results judged by senior mentors with long careers in WMD-related fields.⁹³ Unfortunately, because of funding decisions, it is no longer possible for the Center to offer these programs to the next generation of WMD professionals. We provide a more detailed discussion later in this paper, in the essay “WMD Education and Leader Development.”

And in the End . . .

As the Center approached its 30th year, there were powerful reminders that it remained a “go-to” organization not only for strategic thinking, but also for strategy-building. From midwifing the earliest forays into counterproliferation planning to drafting the most recent strategy documents, the Center continues to work hand in glove with policy leaders to shape the foundational documents that guide our collective work. Within the last 2 years, senior Center experts have played leading roles in preparing the 2022 Nuclear Posture Review, the 2023 DOD Strategy for Countering Weapons of Mass Destruction, and DOD's 2023 Biodefense Posture Review. Taken together, these documents capture a significant part of the Nation's posture on some of the most consequential national security issues facing us. The prominent role played in these efforts by the Center's senior staff attests not just to the trust invested in them by policy leaders but also the vision they are able to bring to complex problems that will continue to test us well into the future.

Looking Ahead: Current and Emerging WMD Issues

Nuclear Weapons

In 2024, nuclear risks to the United States and its allies are on the rise. Moreover, these challenges appear likely to become more complex in the coming decade due to the following trends.

Nuclear weapons are increasing in importance in geopolitics, regional security dynamics, and national security strategies. The five permanent members of the United Nations Security Council (the United States, the United Kingdom, France, China, and the Russian Federation) are, per the Nuclear Nonproliferation Treaty (NPT), legally permitted to possess nuclear weapons. The United States, the United Kingdom, and France are currently committed to maintaining their nuclear forces at current levels. In contrast, China is rapidly expanding its arsenal (DOD estimates that by 2030 China will field 1,000 operational warheads) and Russia suspended its participation in New START—the arms control treaty placing legally binding limits on its “strategic” offensive nuclear forces—in early 2023.⁹⁴ If China remains on its present growth trajectory, in the 2030s the United States may face, for the first time in its history, two peer nuclear-weapon adversaries. Three states outside the NPT (India, Pakistan, and North Korea) publicly acknowledge possessing nuclear arsenals; all three are developing new nuclear-capable delivery systems, and Pyongyang continues to conduct nuclear weapons tests, last testing in 2017. In the Middle East, Israel has repeatedly stated it will not be the

first state to introduce nuclear weapons into the region, while the U.S. intelligence community's 2024 Annual Threat Assessment states, "Tehran has the infrastructure and experience to quickly produce weapons-grade uranium, if it chooses to do so."⁹⁵

The full picture of global nuclear force developments into the 2030s is complex and uncertain because of several factors, including state secrecy; varying testing and deployment timelines; and shifting policy, strategy, and budget decisions. In recent years, however, every state openly fielding nuclear forces has publicly reaffirmed the vital importance of these capabilities to its national security and devoted significant resources to their upkeep (and/or their expansion). Given the substantial costs of these programs, as well as post-Cold War debates within some U.S. and NATO member state policy communities regarding the efficacy of nuclear weapons (and nuclear deterrence), this was not a foregone conclusion a decade ago. But for now, and for the foreseeable future, nuclear forces will remain central to national security strategies, regional security dynamics, and international security dilemmas.

Challenges and Setbacks for Nuclear Diplomacy. Russia's 2023 decision to suspend New START signals the end of an era of U.S.-Russia nuclear arms control. Coupled with Russia's willful violation of the Intermediate-Range Nuclear Forces Treaty, refusal to negotiate reductions on "nonstrategic" nuclear weapons, and stonewalling of all forms of diplomacy in the wake of its ongoing illegal invasion of Ukraine, it appears likely New START will sunset without replacement. If so, for the first time in decades the world's two largest nuclear powers will have no treaty in place providing numerical limits to, or onsite inspections of, their respective deployed strategic nuclear arsenals.

Now in its fifth decade, the 1970 NPT is also showing signs of strain. North Korea left the treaty in 2003; it remains outside the accord and continues to defy international efforts to sanction or otherwise limit its ability to expand its nuclear forces. Iran was caught violating the NPT in 2002; it has continually shifted between cooperation and contention with the International Atomic Energy Agency, the NPT's watchdog.

If showing signs of wear and tear, the NPT—with 191 member states—reflects broad international support for norms and practices associated with preventing the proliferation of nuclear weapons (albeit with some notable exceptions, as stated above). No such consensus exists over efforts by a few states without nuclear weapons to outlaw nuclear arsenals through the Treaty on the Prohibition of Nuclear Weapons (TPNW). Lacking a verification regime or any pathway to implementation, the TPNW has failed to receive support from any state viewing nuclear forces (whether their own or those of an ally) as important to their national defense. Staunch opposition to the treaty represents a rare recent example of consensus among the five permanent members of the Security Council. Moreover, no state under the U.S. nuclear umbrella has signed the treaty. With 69 states parties as of 2024, however, the TPNW provides a window into present (and likely future) sharp disagreements within the international community over the role, purpose, and legality of nuclear weapons.

The above developments pose several challenges to the United States and its allies and partners, including but not limited to the following.

Increased Demands on U.S. Nuclear Forces for the Purposes of Deterrence and Assurance. As potential adversaries expand and diversify their nuclear arsenals, the importance and salience of deterring nuclear coercion and aggression against the United States—and extending deterrence to protect U.S. allies facing nuclear-armed opponents—have increased. U.S. nuclear forces are foundational to national and regional defense and deterrence strategies against nuclear and other existential threats. Efforts to modernize the U.S. strategic nuclear arsenal, however, require significant resources and must address a range of engineering challenges. The possibility of complementing or supplementing these forces with additional “nonstrategic” nuclear options has catalyzed political, policy, and strategy debates. Uncertainty also attends the outcome of the 2024 U.S. Presidential election as to America’s enduring commitment to post–World War II alliances and associated extended deterrence relationships.

In addition, the requirements of deterring adversaries and assuring allies are not identical. Moscow and Pyongyang’s overt nuclear saber-rattling, among other developments, has prompted allies under the U.S. nuclear umbrella in Europe and the Indo-Pacific to reassert the critical importance of U.S. extended deterrence guarantees to their national security. South Korea, for example, has sought—and received—additional forms of assurance through the creation of a bilateral Nuclear Consultative Group and the increased visibility on the Korean Peninsula of U.S. nuclear deterrent forces (including the first-ever visit by a B-52, in October 2023). But with nuclear threats likely to grow in the future, so too will assurance requests from multiple allied capitals.

Advances in technology, competition across strategic domains, and the integration and entanglement of nuclear and conventional forces by potential adversaries also raise important questions about the role of U.S. nuclear forces in deterring nonnuclear strategic threats, preventing escalation within regional conflicts, and convincing adversaries they will face unacceptable costs if they employ nuclear weapons (“tactical” or otherwise) on a conventional battlefield.

An Uncertain Future for Nuclear Arms Control and Risk Reduction Measures. U.S.-Russia nuclear arms control negotiations and treaties—as well as related agreements on threat reduction and nuclear security—played an important role in reducing Cold War arsenals and providing an important form of stability to relations between the world’s two largest nuclear powers. These agreements were also critically important to key alliance relationships and broader U.S. diplomatic efforts aimed at addressing nuclear risks.

Russia has now violated or jettisoned most of these agreements. Repeated U.S. efforts to engage Beijing on nuclear arms control or strategic stability talks have also come to naught. As noted above, the NPT is under duress; even the 1967 Outer Space Treaty (and its prohibition on nuclear weapons in space) is facing new questions regarding its current and future relevance.

Past agreements provided important contemporary benefits to U.S., allied, and international security. But the current and potential future willingness of potential adversaries to accept or manipulate nuclear risk—as well as their lack of adherence to, and preparedness to exploit, international law—represent significant obstacles to the ability to negotiate or implement future nuclear arms control agreements.

In considering the range of trends and challenges described above, it seems clear that U.S. deterrence and assurance policies, plans, and capabilities (conventional and nuclear) will need to adapt. U.S. forces may need to prepare to operate in a nuclear-contaminated environment. Combatant commanders may be asked to simultaneously prevail in a regional conflict while deterring opportunistic aggression elsewhere. New types of nuclear capabilities will be debated. The complex relationship between nuclear and nonnuclear forces, and the role of nuclear deterrence in an expanding, multidomain strategic forces toolkit, need to be better understood by policymakers, planners, and operators. How do crisis communications or approaches to strategic signaling need to evolve in the new strategic environment? These and other thorny questions central to the continued efficacy of deterrence will be on the Center's agenda in the period ahead.

At the same time, the dimming prospect for major-power nuclear arms control raises the stakes for developing other ways to manage or reduce nuclear risks. Novel or adapted approaches may well feature new tools and new actors. Still, unpredictable factors such as changes in foreign leadership or the resolution of ongoing conflicts could suddenly reinvigorate more traditional forms of nuclear diplomacy. Should this occur, there will be much work to do to develop strategies and positions that reconcile meaningful reduction of risk and the demands of effective deterrence, while also assuring high confidence in treaty compliance. Here, too, the Center is already deeply invested in this family of issues and remains a ready resource for DOD and other stakeholders, as well a source of independent research.

Biological Weapons

The life sciences have advanced at an unprecedented pace over the past three decades. Technologies such as genetic engineering and DNA and protein synthesis—which are being further enabled by artificial intelligence, machine learning, and automation—have improved our fundamental understanding of the natural world and enhanced our ability to design, build and purposely engineer living systems. Beyond expanding roles in medicine and agriculture, biology is also driving innovation in energy, materials, and chemistry. These groundbreaking developments have the potential to radically alter economies and societies more broadly. Yet these same technologies could create new security risks, making it easier to create and weaponize naturally occurring pathogens or develop new, more capable biological weapons.

Today's gene-editing technologies, including CRISPR-enabled systems and similar tools, could be used to equip known pathogens with new characteristics or enable the creation of new organisms with attributes that make them less detectable or treatable. Similarly, the convergence of biology with digital technologies such as artificial intelligence could lead to the invention or discovery of new weaponizable agents and delivery systems, or the greater diffusion of knowledge needed to develop and produce biological weapons. These same technologies, however, could also be used to create new methods to prevent the proliferation of biological weapons or develop countermeasures to them.

The development and application of many of these technologies are no longer limited to advanced industrial countries; less advanced nations are now pursuing successful research and development approaches, and many have emphasized the development of their pharmaceutical, biotechnology, and chemical sectors in their national strategies. As a result, the means to manufacture biological weapons may become more accessible to a wider range of actors as these technologies become easier to acquire. This also creates the potential for a new threat space as the bioeconomy—economic activity based on products, services, and processes derived from biological resources—becomes an increasingly important component of the global economy. As states adopt and implement policies to integrate biological resources and technologies into their national economies, they may also identify new opportunities to disrupt the ability of their rivals and adversaries to compete economically.

The continued advance of technology could change how governments, as well as motivated groups and individuals, think about the risks, costs, and benefits of pursuing biological weapons, with profound implications for the threat landscape. Consequently, it is vitally important to consider how to influence the intentions of would-be proliferators and users of biological weapons. In part, this involves protecting the norm against the development and use of biological weapons so that such weapons continue to be seen as morally reprehensible. Like-minded governments will need to continue working to strengthen the Biological Weapons Convention, reinforce mutual assurance of treaty compliance, and reaffirm that the use of biological weapons would be seen by the international community as “repugnant to the conscience of mankind.”⁹⁶

They will also need to buttress deterrence of bad actors engaged in the illicit weaponization of biology. While deterring biological threats to the homeland has traditionally relied largely on public-health resilience, the COVID-19 experience revealed many vulnerabilities that could have the effect of undermining such a strategy. One implication is that the United States and its allies should consider more comprehensive deterrence strategies that integrate capabilities, such as state-of-the-art forensics in support of attribution and the credible means to impose unacceptable costs in response to biological-weapons attacks.

The WMD Center will continue helping the DOD and interagency community understand and adapt to developments in this rapidly evolving field. The Center's expertise spans the necessary skill set—the biological sciences and the bioeconomy; nonproliferation; force protection; information

warfare; and strategic deterrence, among others—and it has a strong track record in identifying under-the-radar challenges and conducting insightful analysis at the intersection of science, strategy, and operations. The Center is deeply engaged with the diverse community of stakeholders concerned about the security risks of biology and is experienced in convening this community for problem-solving and consensus-building. These challenges are complex, to be sure, but not beyond our means to address effectively with the right leadership, expertise, institutions, and processes.

Chemical Weapons

Enormous strides have been made in the effort to eradicate chemical weapons. All but a handful of states are party to the Chemical Weapons Convention (CWC), which entered into force in 1997. Under the aegis of this treaty, states parties have undertaken enormous efforts to destroy declared stockpiles, production facilities, and storage sites. Yet despite this progress, a small number of bad actors continue to use chemical weapons, seeing in them utility to achieve some objectives. In the last decade, Syria, North Korea, Russia, and IS have used toxic agents to attack innocent civilians, military forces, or political opponents. Whether other autocratic regimes looking for solutions to military or political problems will follow suit is a source of concern. Paying attention to the chemical-weapons threat remains an important task for intelligence agencies, diplomats, and warfighters.

The world may never see an organized military force—apart from that of North Korea—conduct large-scale chemical attacks using munitions such as artillery and missiles. But we should expect to continue seeing small-scale use of chemical agents that have limited lethality and that avoid mass casualties. Regimes will be inclined to adopt this approach, with the goal of preserving a degree of deniability and stopping short of some perceived threshold that would trigger a U.S. or coalition military response.

There are a few plausible circumstances in which a regime might conclude that the use of chemical agents will create advantage at acceptable risk. Clearly, one such circumstance is whenever the intended victims are unprepared or lacking robust defenses. Beyond that, consider four scenarios:

- ◆ For assassination attempts, the dermal use of an advanced chemical agent with delayed onset of symptoms, allowing the perpetrator to escape before the victim is aware that he or she is contaminated.
- ◆ To slow the employment of military force, the use during a crisis of a synthesized toxin that could be difficult to detect or mistaken for a naturally occurring illness.
- ◆ To incapacitate or kill military forces, the use of riot control agents or pharmaceutical-based agents as a means of skirting CWC provisions. Although the CWC bans both forms of attack, some states—including Russia—assert contrary interpretations. On

May 1, 2024, the State Department determined that Russia's use of the chemical weapon chloropicrin against Ukrainian forces is a violation of the CWC.

- ◆ To target one's own civilians or specific minority groups under the pretense that such attacks, when carried out in the name of internal security, do not constitute a violation of the CWC or international law.

In any such scenarios, the illicit use of chemical weapons is likely to be accompanied by a deliberate disinformation campaign to obfuscate the truth, cover up the perpetrator's actions, mislead the public regarding the legality of those actions, or attempt to pass blame to the victims or their allies.

Advances in science and the emergence of new technologies will make it easier for bad actors to develop, weaponize, and employ chemical weapons. For example, developments in biotechnology could lead to simpler production pathways for chemical agents; in parallel, a deeper understanding of biological systems could generate interest in chemicals that inhibit bodily functions in novel ways not previously considered. Artificial intelligence applications could both accelerate and expand these possibilities. Scientists have already demonstrated that AI can generate potentially deadly chemicals.⁹⁷ In short, the possibility of entirely new or unfamiliar threat vectors cannot be ruled out.

While the large-scale production of some new agents will require specialized processing materials if the goal is to replicate stockpiles of traditional agents, the use of commercial chemical production facilities could reduce the production timelines for scaling up. The use of microreactors could support safe production at smaller scales that would be difficult to detect. Finally, autonomous systems create new challenges regarding dissemination of agents. Unmanned aerial vehicles designed to spray pesticides over large agricultural fields with pre-planned route mapping are ideal for chemical attacks against large, unprotected civilian groups. Smaller systems that have proved adept at dropping conventional munitions with precision—like the systems used in Ukraine—could just as easily deliver riot control agents or lethal chemical agents in combat.

To confront these challenges, governments will need to continue working collectively along several fronts to protect and strengthen the norm against chemical weapons use and to buttress the barriers to further proliferation. In the CWC framework, this means continuing to add new threat agents to the schedules of chemicals, training scientists in forensic techniques to support attribution of chemical weapons use, improving chemical security, and toughening states parties' implementing laws. Multilateral export-control regimes remain critically important to manage the spread of materials, equipment, and technologies that could enable covert production of chemical weapons. Finally, nations must do all they can to hold accountable any actors that illegally possess, transfer, or use chemical weapons.

There is much to do, and none of it simple or easy. Decisionmakers confronting these problems will continue to need help in understanding the threat landscape and in crafting responsive strategies

that are integrated across all key dimensions. Consider one of the scenarios noted above. Targeted, small-scale chemical attacks at critical military nodes in an escalating crisis or during the early stages of a conflict may seem to be a manageable problem, especially if military casualties are limited. But such an attack almost certainly will create compounding problems for commanders who may need to perform damage assessment, prepare for possible follow-on strikes, revise power projection and logistics operations, tend to civilian casualties and the “worried well,” and reassure allies. These problems will not be entirely operational in nature; any WMD attack is also political and strategic in nature. One implication is the need in peacetime planning to consider the potential for cascading effects in such contingencies from a theater-level perspective, rather than a strictly local one, and from a political-military vantage, rather than a strictly operational one.

The Center’s subject-matter expertise and experience tackling complex chemical-weapons challenges—Syrian chemical weapons, fourth-generation agents, and fentanyl, among others—is a community resource that policymakers and operators can leverage to support timely research, actionable analysis, leader awareness, and stakeholder consensus.

Information and WMD

Weapons of mass destruction exist in a complex and contentious information environment. The United States and its allies face a persistent malign threat as bad actors spread false or manipulated messages about WMD use and adherence to nonproliferation norms, and other false narratives centered on chemical, biological, and nuclear issues. Once viewed as a side issue, the challenges of the information environment increasingly are a core concern for practitioners navigating the WMD landscape. CSWMD is committed to helping policymakers understanding this problem and shape responsive strategies.

Disinformation and message manipulation are used by many authoritarian regimes to advance strategic goals, including undermining faith in democratic institutions; weakening U.S. alliances; and generally sowing chaos, which creates an opaque environment in which bad actors can behave with relative impunity. Because of the complexities surrounding WMD, there is too often a vacuum that bad actors can fill with falsehoods, half-truths, or self-serving narratives. They understand that publics are likely to believe a simple falsehood over the highly technical truth. In this way, disinformation effectively capitalizes on the fear and misunderstanding surrounding WMD and the lack of good, trusted, and digestible information about WMD, nonproliferation, and arms control. Planting a false seed of doubt about compliance with WMD norms, for example, can be deeply harmful to nonproliferation efforts and to the trust and common understanding of facts that undergird vital security institutions and processes.

Today, Russia practices the most aggressive form of WMD disinformation. Building on the same “active measures” strategies dating to the Soviet regime (including false narratives about the United States weaponizing viruses), Moscow leads the way among authoritarian governments in exploiting the current media environment to deliver malicious messages in a highly tailored, targetable, automated, and persistent way. In the WMD arena, the world has witnessed Russia pushing distorted narratives related to a few highly consequential events, including Syria’s use of chemical weapons, assassination attempts in NATO countries using Novichok chemical agents, and Russia’s second invasion of Ukraine, which has featured false charges that the United States is funding biological weapons laboratories in Ukraine and Georgia.

Recent Russian attempts to spread false claims demonstrate the ways in which disinformation can undermine disarmament treaties and multilateral fora. Russia has abused the consultative mechanism of the Biological Weapons Convention to push its allegations and derailed the convention’s ninth Review Conference in 2022. Additionally, treaty organizations and individuals employed by them have been named by Russian officials and their proxies as nefarious actors who research WMD and prepare to use them illegally. Especially as many of these organizations require the trust of local governments and populations, these narratives can have a corrosive effect that puts at risk important counter-WMD activities.

Russia and other hostile actors, including China, are likely to continue to target multilateral organizations, collaborative biological research, and global public health programs using bioweapons conspiracy theories. This is an inexpensive and effective way to attack the United States and its allies and partners. Whether the charge is “weaponizing disease” or proliferating the means to produce biological weapons, the goal is to cast the United States and its allies and partners in a negative light and to undermine relationships developed around cooperative work to build capacity that promotes public health and nonproliferation. The United States and its partners can expect similar attempts to undermine their credibility in other nonproliferation regimes, particularly as they seek to build consensus to strengthen the treaties in various ways, including through improved collective capacity to attribute WMD attacks. The world has seen how the questioning of facts, the promotion of false narratives, and attacks on the motives of accusers can be used to “muddy the waters” with respect to attribution in the hope of lending credibility to claims of denial.

A related area of concern is arms control. The next generation of arms control practitioners (negotiators, implementers, and analysts) will operate in an information environment dramatically different from the one their predecessors experienced in the first part of the 21st century. Even in interactions presumably based on mutual interest, new tools of information manipulation could be exploited to achieve advantage, whether in a process of negotiation or in the implementation of an agreement. Parties to an arms limitation treaty who seek advantage through ambiguous activities or

covert cheating can be expected to mount targeted disinformation activities to conceal, distort, or minimize noncompliant behavior.

Already challenging, the WMD disinformation problem will become only more complex and fraught as deepfakes and generative artificial intelligence become more commonplace in information warfare and influence operations. If there is a “silver lining” to the repeated—and in some ways predictable—targeting of WMD, it is in the opportunities that this targeting provides to plan and organize to “get ahead” of false information, achieve information advantage, and develop resilience to disinformation campaigns. Even though the struggle against disinformation too often feels unwinnable when facing authoritarian actors who weaponize information with little constraint, democracies possess the means to fight back. There is no “silver bullet” to do so, but it is possible to put in place layered, multiple defenses across government, industry, and society.

CSWMD is working with government agencies, allies, and partners to do just this. An important layer in a multifaceted defense against WMD disinformation is strategic messaging that effectively communicates facts about WMD threats and counter-WMD programs in a way that is accessible and tied to core narratives about U.S. commitments to allies, partners, and international norms. The effort to “pre-bunk” Russian disinformation on (nonexistent) U.S. chemical weapons in Ukraine is an example of seizing—and not ceding—control of a given narrative. Center experts can help officials convey what may be obscure facts or technical information in messages that resonate in the current information environment because they are more comprehensible to a less-than-fully informed public, are shareable on social media, contain a human element, and are tied to more recognizable narratives about security and risk reduction in a world with WMD.

Education is another layer of defense. One imperative is simply to ensure greater awareness at all levels in the WMD field of the nature and scope of the problem. Beyond this, media and digital literacy provide tools and strategies to discern a range of falsehoods and thereby render false messages less effective and more attributable. As part of the joint professional military education system, Center experts are uniquely positioned to advocate for and enable progress on the education front and will continue to work with policymakers, operators, and educators to better prepare future leaders for the tasks they will face.

This is an important element of CSWMD’s mission going forward—to routinize the study of disinformation as part of a comprehensive strategic approach to the WMD problem, and to normalize a layered defense against disinformation as part of the counter-WMD toolkit. As experience in fighting WMD disinformation grows, it will also be possible to apply lessons learned to other complex domains that are likely to be targeted with false information campaigns.

WMD Education and Leader Development

The first mandate from Ash Carter for the new Center for Counterproliferation Research at NDU in 1994 was “to ensure the incorporation of the subject of [nuclear, biological, and chemical] proliferation, and specifically its effects on national strategy and military operations, into the teachings and research programs of the National Defense University and other military academic centers.” Carter understood that any meaningful strategic approach to the WMD challenge required a long-term commitment to education. While the Center moved quickly on this mandate, national and DOD strategies have only slowly caught up to the education imperative.

Today, the foundational importance of awareness, education, and leader development is increasingly recognized explicitly in policy and strategy documents. Most recently, the 2018 and 2022 Nuclear Posture Reviews reinforced the importance of education and professional development for current and future leaders in the nuclear-deterrence enterprise. The 2023 DOD *Strategy for Countering Weapons of Mass Destruction* emphasizes that “military commanders and senior leaders [must] understand the implications of WMD” to prevent an “adversary’s ability to limit U.S. options either through coercion during a crisis or employment of WMD in a conflict.”⁹⁸ The strategy observes that eliminating the barriers between the conventional warfare and CWMD communities will require “leveraging Joint Professional Military Education (JPME) and Total Force education, continuing education, and enhanced training.”⁹⁹

Military leadership has taken note. The Chairman’s 2024 guidance on professional military education (PME) for officers cites both the 2022 Nuclear Posture Review and the 2023 CWMD strategy as “policy guidance to improve the common understanding of the implications of weapons of mass destruction across the Joint Force through PME. This includes nuclear concepts and capabilities as well as prevailing in a chemical, biological, radiological, or nuclear environment.”¹⁰⁰ In practical terms, this means that previous guidance focused on nuclear PME has now been reinforced and expanded to encompass the full spectrum of WMD. It is now incumbent on Service and joint schools to adapt their curricula accordingly. How quickly and effectively they do so remain to be seen. This is an important task for the Joint Staff, and CSWMD remains ready to assist as it has in the past. Indeed, the Center’s work in support of the Chairman’s earlier guidance on nuclear education provides a robust model for strengthening education on the broader set of WMD topics as now directed.

This clear demand signal from the leaders of the joint force is good news, of course. For too long in the competition for instructional time in PME, this vital topic has been treated as a niche field for specialists or simply considered synonymous with “CBRN defense training,” rather than being viewed as something that is strategically and operationally significant and a likely feature of modern war. As a sharper understanding of the WMD challenge takes hold in the PME community, there is now a basis for giving this topic higher priority in the classroom. The stakes are not trivial. Adversary employment of any form of WMD will challenge operational leaders and staffs who do not possess

a fundamental understanding of the risks to their mission, their forces, their combat capability, and their partners. There is no upside in being unprepared.

But this good news is tempered by less-welcome developments that put at risk other elements of the broad-based education and leader development effort that is required and that extends beyond the PME community. As a prominent example, consider the fate of two flagship CSWMD programs that were described earlier. Despite the demonstrated success and popularity of PEL and the Countering WMD Graduate Fellowship Program, it has been a challenge to sustain support and funding for them among senior countering-WMD policymakers. In fact, the elimination of funding by sponsoring agencies led the Center to sunset the graduate fellowship program in 2023, with PEL to follow in 2024. The end of these programs will result in a measurable loss of momentum in the effort to raise WMD awareness among early- and mid-career professionals and to facilitate the networks they need to work effectively across organizational lines to address complex WMD problems.

This apparent disconnect between the priority that the strategy documents place on WMD education and some of DOD's funding choices is puzzling and troubling. Some of it may stem from a residual perception in some quarters that the use of WMD by adversaries against the United States, its forces, or its allies is a "low probability." But real-world developments—nuclear threats against U.S. allies, regular use of chemical agents on the battlefield or as a tool of assassination, expanding arsenals coupled with wide-ranging advances in delivery systems—would seem to make that a risky proposition. It seems unwise to consider the use of WMD over the next decade as a low probability.

The disconnect may also be the result of an overly narrow approach to "return on investment" in an admittedly tight budget environment. Will it be possible to demonstrate a direct "return on investment" for the resources committed to WMD education and leader development? Perhaps not, or at least not in the way this concept is applied to material investments. But this is true for all organized forms of higher learning. Its value accrues and compounds over time and manifests itself downstream in myriad ways that may appear small, but that contribute to wise decisions and concretely benefit the security of the Nation.

This fundamental truth is why DOD leaders consistently assert that education is a key competitive advantage for the United States—and the reason why this will remain a high priority for CSWMD. Regardless of the ebb and flow of leadership attention and funding, the Center's basic approach to education and leader development is unchanged. The Center will continue to advocate for these values and work in all ways possible to help WMD professionals attain the subject-matter fluency they need to be effective. In doing so, the Center will leverage its unique strengths—access to senior leaders, extensive support to policy formulation and execution, and leading-edge research (classified and unclassified)—to provide students and practitioners at all levels with unmatched learning opportunities. The Center will continue to advocate for these values and work in all possible ways to help *joint force leaders* and WMD professionals attain the subject-matter fluency they need to be effective.

Conclusion

Any reader coming to the end of this paper is surely astonished at how much has happened in our corner of the national security universe we refer to as “WMD.” And this is the work of just one research center at one institution in one Cabinet department of one government. At one level it is a reminder that 30 years is a long time. Tallying up the work—the projects, events, and publications—reveals a staggering, sustained effort by a team always modest in size but, in the end, large in influence. At another level, it is a reminder that 30 years is but a nanosecond in the march of time. Mankind has been dealing with some form of WMD for well over a millennium and, sadly, is likely to be dealing with them in some form for centuries to come. So the wheel will continue to turn. Which means, among other things, that generational change is important.

Mindful of that, in preparing this publication we talked to a group of “grayhairs”—former senior officials with whom the Center has worked over the years, all of whom have held positions of responsibility in DOD and elsewhere addressing some aspect of the WMD problem. We wanted to hear from them not just about their personal experiences with the Center; we also sought their views on how WMD threat and response have evolved, the role of organizations like CSWMD in supporting decisionmakers and generating new thinking, and what worried them most about the future. It is not possible here to capture the full scope of these conversations, but here are some of the important takeaways:

- ◆ Never has so much advanced technology capable of producing high-consequence WMD effects been available to so many actors. This is a trendline that seems likely to endure for the foreseeable future.

- ◆ Although there has been a shift in strategic focus away from nonstate actor threats, the potential for WMD terrorism remains and this threat could become more salient in the future.
- ◆ In considering the potential for the use of biological and chemical weapons both on the battlefield and against the homeland, we need to take a critical look at our deterrence strategies for such threats and strengthen them as needed. This should include consideration of enhanced deterrence-by-denial capabilities (for example, missile defense and defeat) to address advances in delivery systems and new threat vectors. In a major war with a WMD-armed peer, once the WMD threshold has been crossed it may be difficult to control escalation.
- ◆ In looking at contemporary WMD challenges, it may be useful to revitalize the early phase of counterproliferation 30 years ago, which featured an aggressive search for new approaches and solutions. This included innovative approaches to interdict and disrupt WMD proliferation, novel technology applications to neutralize WMD threats, and new operational concepts to fully leverage military options, all under the aegis of a focused national strategy. What would it mean to reimagine this early phase of counterproliferation for the challenges of today and tomorrow?
- ◆ New concepts and capabilities may be needed to meet the challenges of detection and monitoring in what some have termed the era of “noncooperative threat reduction.”
- ◆ Societal trust in information has eroded, and American citizens need to be better informed to reduce the impact of disinformation related to WMD.
- ◆ CSWMD is the prototype of an organization whose core mission requires getting timely, tailored information and analysis in front of the right decisionmakers. The cruel math of time and prioritization limits the available attention to the consideration of “what ifs,” and policy agility is necessary to react effectively to inevitable surprises. Organizations purpose-built to meet this need are highly valuable to leadership.
- ◆ Equally important is the Center’s education and leader-development mission, which merits more sustained attention and support from DOD leaders.

Indeed, without exception the grayhairs strongly agreed on the imperative to invest time, creative thinking, and resources in WMD education and leader development, and for DOD to institutionalize these activities more deeply. The Center remains firmly committed to this goal and ready to do its part so that future generations are prepared to sustain and build on the work of earlier ones. So much has been accomplished since 1994 in the running battle to keep the Nation safe from bad

actors wielding the world's most destructive weapons. If we are to see safe passage to 2054, this work must continue with both vigor and rigor.



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