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USMA Chemistry and Life Science – Reaction Center for Army Chemical Intellectual Capital

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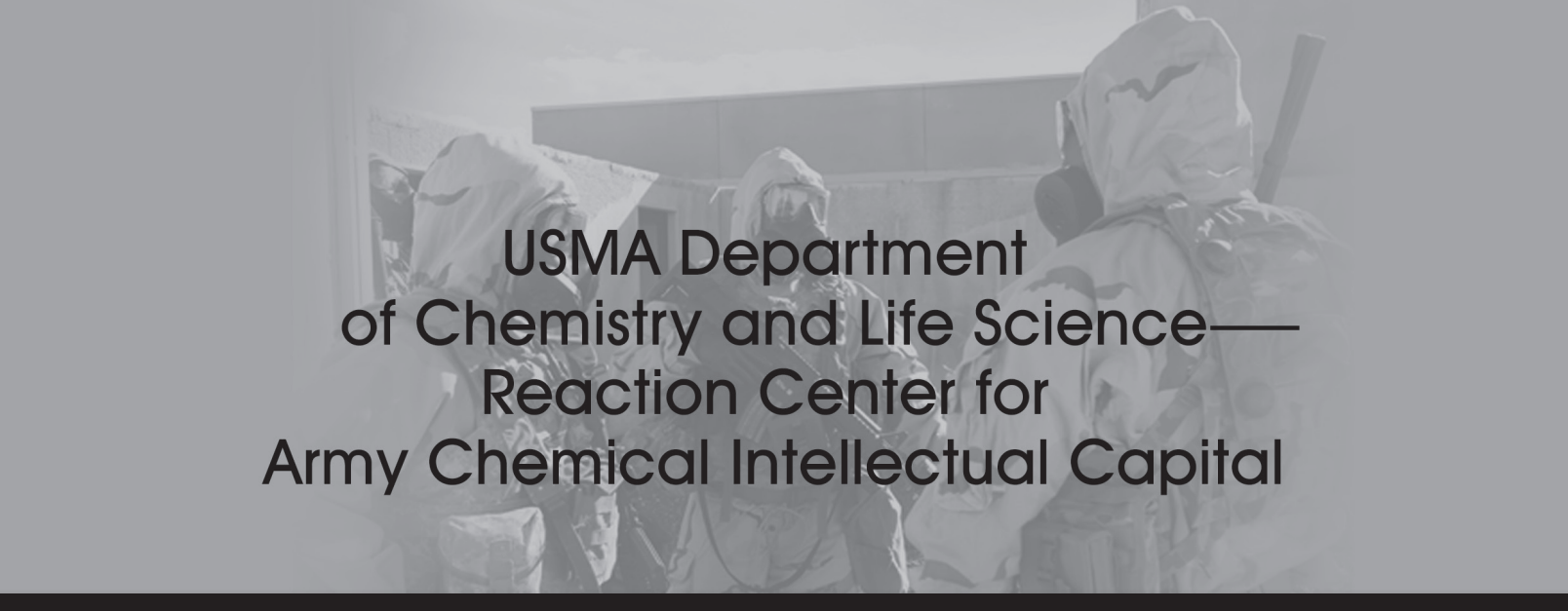
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USMA Department of Chemistry and Life Science— Reaction Center for Army Chemical Intellectual Capital

By Colonel F. John Burpo, Lieutenant Colonel Richard L. Comitz, and Major Stephen G. Hummel

CBRN Officers

The threats and hazards of chemical, biological, radiological, and nuclear (CBRN) events are as real today as they have ever been. The United Nations has launched several investigations into the accusations of Syria and the Islamic State of Iraq and the Levant using chemical weapons on civilians. More than 10 incidents from 2014 to 2018 have been investigated; and evidence of the use of chlorine, sarin, and mustard agents has been found.¹⁻⁵ These threats, in addition to North Korea's continued testing of nuclear weapons, the aggressive posturing of Russia, the Ebola outbreak in West Africa, and the unpredictability of Iran, make CBRN a vital concern. This is evident in the fact that countering weapons of mass destruction is prioritized in nearly every strategic guidance document identifying threats to the United States.^{6,7}

The operational environment is not the only place a CBRN threat is encountered. Industrial, energy, medical, pharmaceutical, and academic research sectors also present potential CBRN threats. These concerns are pervasive in many dangerous regions that have their own complexities. When CBRN threats are combined with increasingly available technology, the result is an exponential increase in danger and complexity in these areas. Now more than ever, the Army needs officers who are experts in CBRN, capable of articulating threats, and creative in problem-solving capacities to synchronize effective responses.^{8,9} Senior commanders and leaders, not only in the U.S. Army but also throughout the Department of Defense (DOD) and U.S. government, require such advisors to help them understand CBRN threats and make informed policy and operational decisions. In order to ensure effective and timely support, this CBRN expertise must be deliberately integrated at echelons to form an effective network of intellectual capital to conduct research, analysis, policy formulation, and operations.¹⁰

The 2017 edition of the milSuite Smartbook, Department of the Army (DA) Pamphlet (PAM) 600-3, which outlines commissioned officer and warrant officer development and career management programs for each of the Army's career branches and functional areas, states the following for the Chemical Branch: "The [Chemical] branch is aligned under the maneuver support functional group in the operations functional category and is focused primarily on the development, integration, and employment of tactical capabilities that identify, prevent, and mitigate the entire range of chemical, biological, radiological, and nuclear (CBRN) threats and hazards through CBRN operations; that support operational and strategic objectives to combat weapons of mass destruction (WMD) through nonproliferation, counterproliferation, and CBRN consequence management; and [that] allow our sister Services and unified action partners to operate safely in a CBRN environment. Additional functions include scientific, developmental, and material management activities for these programs. The branch provides the Army with a highly trained corps of CBRN experts to advise commanders and staffs at all levels in DOD."¹¹ It is incumbent on the officers to be experts in CBRN and activities of the programs necessary to carry out the mission.

The milSuite Smartbook further defines skills and knowledge that are essential for CBRN officers. Specifically, it cites decision making in a complex environment, tactical and technical knowledge, multifunctionality, and situational understanding of the operational environment.¹² These areas explicitly and implicitly point to a level of knowledge that is above entry-level Soldiers; and the deeper the understanding, the better prepared an officer may be.

As part of the career development of a CBRN officer, education is key at every level. While the CBRN educational construct provides an initial foundation on which to develop the necessary professional skills for a CBRN officer, advanced

technical graduate degrees provide an enormous benefit, especially when coupled to a broadening assignment. The mil-Suite Smartbook provides a number of pathways to enhance an officer's career, but few provide the opportunity to obtain an advanced technical degree.¹³

USMA Department of Chemistry and Life Science

A route to enhance a CBRN officer's skill set through an advanced technical degree is via a broadening assignment combining advanced civil schooling with a utilization assignment in the Rotating Faculty Program at the U.S. Military Academy (USMA)—West Point, New York. The Department of Chemistry and Life Science (CLS) maintains six dedicated rotating faculty positions, each tied to an advanced civil schooling allocation for a master's or doctorate degree. CLS is uniquely poised to develop CBRN officers with chemical and biological technical expertise, addressing many of the persistent threats described above.

The USMA mission is "to educate, train, and inspire the Corps of Cadets so that each graduate is a commissioned leader of character, committed to the values of Duty, Honor, [and] Country and prepared for a career of professional excellence and service to the Nation as an officer in the U.S. Army."¹⁴ CLS supports the achievement of the USMA mission with its own mission to educate, train, and inspire cadets with a firm foundation in the fields of chemistry, life science, and chemical engineering so that each graduate is a commissioned leader of character who can leverage his or her understanding of science and engineering to implement solutions using critical thinking and problem-solving skills and be prepared for a career of professional excellence and service to the Nation as an officer in the U.S. Army.

Within the realm of CBRN, the argument could be made that every process involves fundamental chemistry. For chemical and biological weapons, CLS offers the opportunity for officers to become experts in the underlying chemistry and biological processes from which these weapons are derived and that they affect. Such an understanding enables CBRN officers to be more proficient in distilling a breadth of complex scientific data about these weapons to nonscientists.

A faculty tour in CLS provides an enriching transition path from organizational leadership, building on the previous role of company grade officers with direct leadership and preparation of Soldiers for combat. Field grade officers often perform their duties through direct and indirect leadership in mixed military and civilian workplace environments. USMA offers an opportunity to prepare for these roles through the Advanced Civil Schooling Program and a subsequent utilization tour as a faculty member. Just as important as the faculty role in developing Army leaders with

each graduating class, USMA's "second graduating" class is the cohort of field grade officers who complete their faculty experiences better prepared to solve problems at the operational and strategic levels.

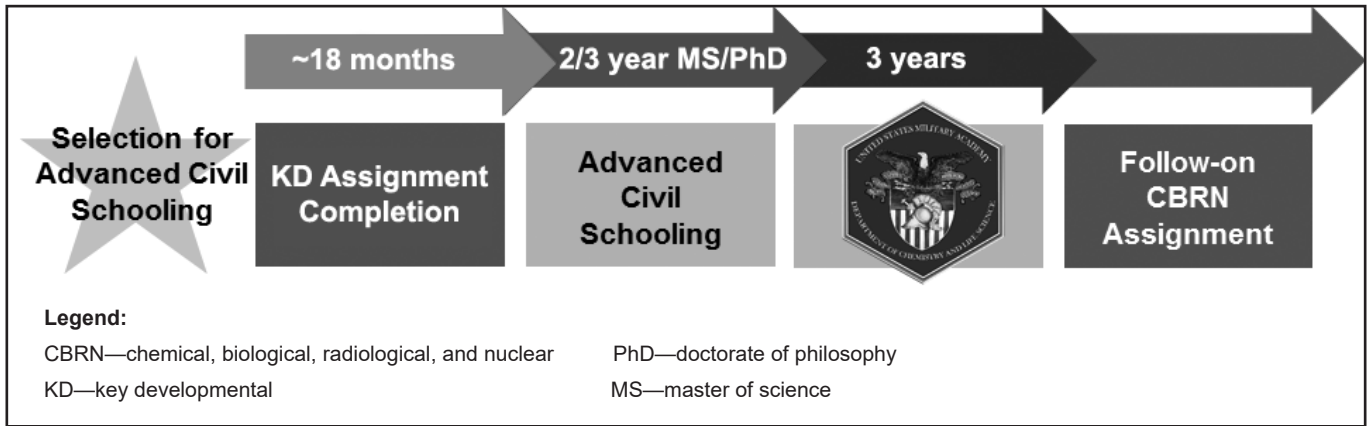
Advanced Civil Schooling

The USMA faculty is composed of approximately 25 percent civilians and 75 percent military officers. Within the military faculty, there are three groups (senior permanent military USMA professors [department heads and deputies], senior rotating faculty with doctorate of philosophy (PhD) degrees, and junior rotating faculty with master's degrees. All faculty positions involve some form of committee selection at the Army, USMA, or department level. PhD and master degree rotating positions in CLS are selected at the department level. The CLS department currently maintains six 74A positions on its table of distribution and allowances (TDA). (See Table 1.) TDA manning rules offer the flexibility to fill positions "one-up/one-down" in grade, enabling the department to better manage talent and potential tour extensions.

Line	Position	Grade	Position Code	Degree
14	Instructor / Researcher	0-4	74A	PhD
15	Instructor / Researcher	0-4	74A	PhD
22	Instructor	0-3	74A	MS
23	Instructor	0-3	74A	MS
24	Instructor	0-3	74A	MS
25	Instructor	0-3	74A	MS
Legend:				
PhD—doctorate of philosophy				
MS—master's of science degree				

Table 1: USMA TDA, 74A authorizations for CLS

Selection packets are submitted to the department for committee review and consist of a resume/curriculum vitae, personal statement, transcripts, standardized test scores, and letters of recommendation. Committee selections are normally conducted in December, with notifications occurring in January and a graduate school start date approximately 18 months later. This timeline allows officers to complete key developmental assignments and apply to graduate programs. CBRN officers have come from diverse undergraduate science, technology, engineering, and mathematics (STEM) experiences ranging from electrical engineering and engineering physics to microbiology and immunology. There is a great latitude in pursuing chemical- and biological-related graduate degrees that not only support the department's three program majors of chemistry, chemical engineering, and life science, but also enrich the chemical-biological expertise within the CBRN community. A few examples of graduate degrees attained by CBRN officers in the department are organic chemistry, analytical chemistry, nuclear chemistry, bioengineering, chemical engineering, and biology.



Timeline for advanced civil schooling selection and completion, utilization tour at CLS, and follow-on CBRN assignment

The Advanced Civil Schooling Program allows officers to attend a university of their choice, ranging from public to private schools. Senior faculty mentorship assists selected officers in finding the best university fit aligned with department needs, officer research interest, and timeline feasibility. The timeline for advanced civil schooling selection is 2 years for a thesis-based master’s degree or 3 years for a PhD, a 3-year utilization tour at CLS, and then a follow-on CBRN assignment. The graduate school broadening opportunity places the officer in a non-DOD environment. Through the company grade and early field grade ranks, many Army officers have limited interaction working with a non-DOD population. Graduate school provides an important opportunity for officers to work with current and future experts within their field of study. The graduate school experience also offers the unique leadership opportunity for officers to lead, interact with, and become part of a group with no rank structure. Ultimately, the officer and the Army benefit from better problem-solving skills at operational and strategic echelons.

Faculty Experience

USMA faculty participate in activities across five domains: teaching, scholarship, cadet development, faculty development, and service. CLS organizes all of those activities around Army- and DOD-relevant research, often in collaboration with DOD laboratories. Teaching cadets in the classroom results in technical knowledge and problem-solving skills that are then applied in the laboratory at USMA and during summer research internships for cadets and faculty. This integrative process, depicted in Figure 1, leverages the synergies of all five domains of faculty activity, such that every interaction is a developmental event for cadets and junior and senior faculty.

This integrative developmental model also ensures that the research an officer begins in graduate school continues and evolves upon joining the USMA faculty. CBRN officers have received funding for their research from organizations such as the Defense Threat Reduction Agency (DTRA), Fort Belvoir, Virginia, and the U.S. Army Edgewood Chemical Biological Center, Aberdeen Proving Ground, Maryland.

These research efforts have the further benefit that CLS CBRN faculty become directly engaged in the research programmatic efforts of the organizations in which they are likely to serve in the future. Additionally, there are ongoing CLS research efforts in the areas of material science and engineering for sensors and energy-based devices, molecular diagnostics and nerve repair, and explosives and pyrotechnics. The research conducted within CLS includes basic sciences and engineering and policy. Previous faculty have published articles in conjunction with the Combating Terrorism Center at West Point and worked with the Center for Combating Weapons of Mass Destruction at the National Defense University, Washington, D.C. These collaborative relationships have provided numerous unique opportunities for CBRN officers to brief senior military and civilian leaders, to include combatant commanders, the Secretary of Defense, and the Director of the Central Intelligence Agency.

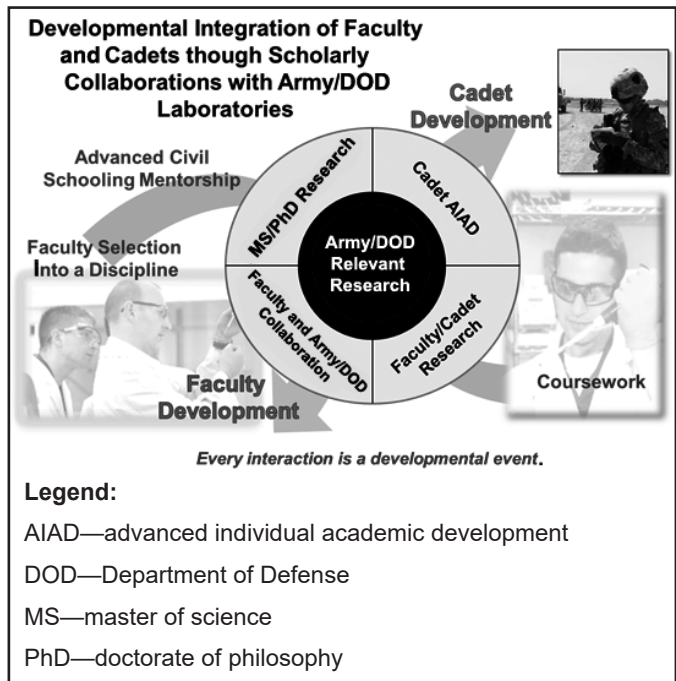


Figure 1. CLS developmental model integrating faculty and cadets through scholarly collaborations with Army and DOD laboratories

Given the time required to complete an advanced graduate degree and serve a 3-year utilization tour, career timelines often require careful management. To mitigate timeline challenges, many CBRN officers serving in CLS may complete Intermediate Level Education at West Point via distance learning or satellite during the summer.

CBRN Community Contributions

In addition to academic committee work associated with university faculty positions, CLS officers have contributed to the CBRN community beyond USMA in a variety of ways. Given their technical expertise and research in chemical and biological fields, combined with operational experiences across various unit types, echelons, and theaters of deployment, CLS faculty offer the CBRN network a unique perspective that facilitates the translation of basic and applied science into practical fielded systems, policies, and analysis. This service includes the following experiences:

- DTRA, Chemical and Biological Defense Program, Basic Science Reviews.
- DTRA, Chemical and Biological Defense Program, Program Management Reviews.
- DTRA, Chemical and Biological Defense Science and Technology conferences and warfighter panels.
- Edgewood Chemical Biological Center Technical Advisory Board.
- Edgewood Chemical Biological Center In-House Laboratory Independent Research and Surface Science Initiative grant proposal reviews.
- U.S. Army Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Imperatives Council of Colonels.
- Joint Program Executive Office—Chemical and Biological Defense, Chemical Biological Defense Acquisition Initiative Forum.

CBRN Community Enrichment

After further developing technical chemical and biological expertise, honing communication skills in the classroom, and leading in a diverse military-civilian organization, CLS faculty depart for follow-on assignments to contribute across the DOD CBRN community. Former CLS faculty have served at the—


- Office of the Secretary of Defense—Joint Staff.
- DTRA.
- Defense Intelligence Agency, Washington, D.C.
- National Defense University.
- Headquarters, Department of the Army.
- 48th Chemical Brigade, 20th CBRNE Command, Aberdeen Proving Ground, Maryland.
- U.S. Army Edgewood Chemical Biological Center.

Numerous former faculty serve in military and civilian positions at DTRA. Additionally, CLS permanent military faculty have also contributed to the CBRN community in 6-month to 1-year operational assignments within the 20th CBRNE Command, with duties involving contingency

operations development, science and technology integration, and strategic-communications integration. Further, emerging chemical and biological faculty and research positions at the Air Force Institute of Technology and the Armed Forces Radiobiology Research Institute at the Uniformed Services University offer potential follow-on assignment opportunities to sustain long-term research efforts. The former military faculty serving as senior civilians in these organizations represent USMA's "third graduating class" and further demonstrate the positive influence of CLS on the CBRN community across three time scales—the first graduating class of lieutenants, the second graduating class of field grade officers, and the third graduating class of chemical-biological leaders transitioning from military to civilian service. The integration and contribution of CLS across the CBRN community establishes its role as a nexus of chemical and biological expertise, as shown in Figure 2.

The Way Forward

CLS continues to develop synergistic relationships within the CBRN community and to enrich the chemical and biological intellectual capital for the Army and DOD CBRN community. Continued partnership between USMA and the U.S. Army Human Resources Command, Fort Knox, Kentucky, will ensure that the best officers pursue graduate technical degrees through the Advanced Civil Schooling Program. Combining teaching, research, and Service experience at USMA forges a developmental pathway to providing Army and DOD expert problem solvers with the ability to communicate and solve the most difficult future chemical and biological challenges at the operational and strategic levels.

For more information on opportunities available in CLS at USMA, contact <cls.personnel@usma.edu> or (845) 938-3767. 

Endnotes:

¹United Nations Security Council, *Seventh Report of the Organization for the Prohibition of Chemical Weapons—United Nations Joint Investigation Mechanism Addressed to the Secretary-General*, 2017.

²United Nations Security Council, *Sixth Report of the Organization for the Prohibition of Chemical Weapons—United Nations Joint Investigation Mechanism Addressed to the Secretary-General*, 2017.

³United Nations Security Council, *Fifth Report of the Organization for the Prohibition of Chemical Weapons—United Nations Joint Investigation Mechanism Addressed to the Secretary-General*, 2017.

⁴United Nations Security Council, *Fourth Report of the Organization for the Prohibition of Chemical Weapons—United Nations Joint Investigation Mechanism Addressed to the Secretary-General*, 2016.

⁵United Nations Security Council, *Third Report of the Organization for the Prohibition of Chemical Weapons—United Nations Joint Investigation Mechanism Addressed to the Secretary-General*, 2016.

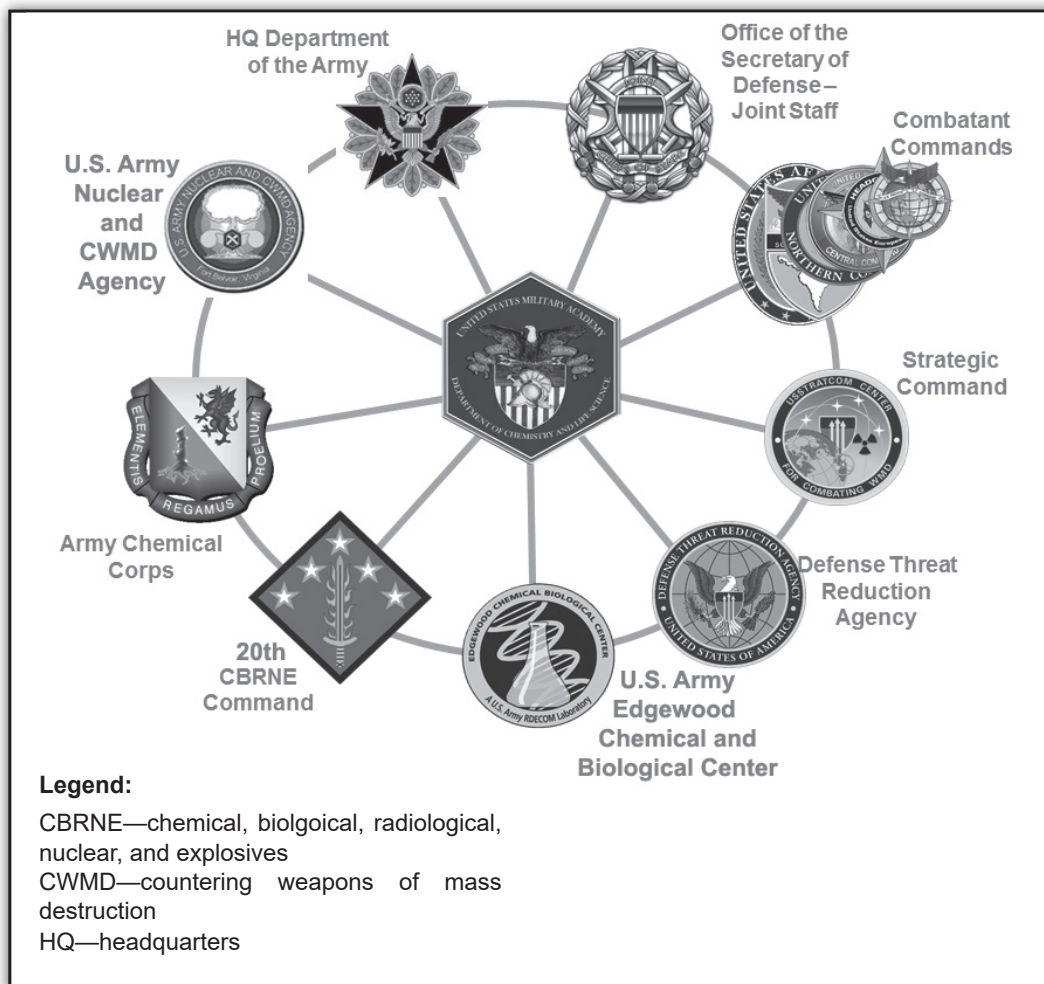


Figure 2. The CBRN community network with CLS serving as the nexus of chemical and biological intellectual capital.

⁶U.S. Department of Defense, *Quadrennial Defense Review*, 2014.

⁷U.S. Army, *Army Strategic Planning Guidance*, 2014, <http://www.g8.army.mil/pdf/Army_Strategic_Planning_Guidance2014.pdf>, accessed on 12 April 2018.

⁸Michael Aaronson et al., “NATO Countering the Hybrid Threat,” *PRISM 2*, No. 4, 2012, pp. 111–124.

⁹Brian P. Fleming, *The Hybrid Threat Concept: Contemporary War, Military Planning and the Advent of Unrestricted Operational Art*, Army Command and General Staff College, Fort Leavenworth Kansas School of Advanced Military Studies, 2011.

¹⁰Paul Wolfowitz, “Remarks by Deputy Secretary of Defense Paul D. Wolfowitz,” National Defense University WMD Symposium, 2003.

¹¹milSuite, Smartbook DA PAM 600-3, pp. 1-3, <<https://www.milsuite.mil/book/groups/smartbook-da-pam-600-3>>, accessed on 19 April 2018.

¹²Ibid.

¹³Ibid.

¹⁴USMA, “The West Point Mission,” <<https://www.usma.edu/about/sitepages/mission.aspx>>, accessed on 12 April 2018.

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Major Hummel serves on a nuclear disablement team, 20th CBRNE Command. He holds master’s degrees in chemical and physical biology from Vanderbilt University, Nashville, Tennessee, and in radiation biology from the University of Iowa, Iowa City.