

## **Author Bios**

**Dr. Adam D. Williams** is currently a Senior R&D System Engineer in the Global Security Research & Analysis Department at Sandia National Laboratories.\* At SNL, he serves as a program manager for the Partnership for Nuclear Threat Reduction under the Department of State's Office of Cooperative Threat Reduction. He also conducts systems studies on nuclear security, nonproliferation and complex risk mitigation for Laboratory Directed R&D (LDRD), National Nuclear Security Administration (NNSA) and the Electric Power Research Institute (EPRI) initiatives. Dr. Williams earned his Ph.D. in Engineering Systems at the Massachusetts Institute of Technology and also holds a B.S. in Mechanical Engineering (2004) and an M.A. in International Affairs from Texas A&M University (2007). He also serves as the SNL representative on the Steering Committee of the Gulf Nuclear Energy Infrastructure Institute (GNEII) in Abu Dhabi.

**Dr. Rodney K. Wilson** is the Director of the Center for Global Security and Cooperation at Sandia National Laboratories. The Center develops systems engineering and technology solutions for United States government agencies responsible for Nonproliferation and Arms Control, Cooperative Threat Reduction, and International Security. His prior assignments at Sandia include: Director for National Security Studies and Integration, Chief of Staff to the Deputy Laboratories Director for Nuclear Weapons Programs, and Head of Corporate Planning, Studies and Government Relations. Dr. Wilson earned a B.S. in Engineering Science from the University of Michigan in 1975, and an M.S. and Ph.D. degrees in Theoretical and Applied Mechanics from the University of Illinois in 1977 and 1981, respectively. He is also a fellow of the MIT Seminar XXI Program in International Security, and a member of the International Institute for Strategic Studies, Institute of Nuclear Materials Management, and Council on Foreign Relations.

\* **SAND-Peer Review.** Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA-0003525

# **“Defense by Other Means”: Future Evolution(s) of Cooperative Threat Reduction**

## **Abstract [187/200]**

This article discusses likely future contexts of, and options for, global threat reduction activities to support nonproliferation goals in a dynamic geopolitical environment over the next five to ten years. Threat reduction activities span a continuum from unilateral actions the U.S. might take with little cooperation and transparency at one end to cooperative actions associated with negotiated treaties and agreements at the other. This study focuses on cooperative approaches embodied in the Cooperative Threat Reduction (CTR) program that has, for more than two decades, been the most visible program in reducing the threats posed by Weapons of Mass Destruction (WMD). We argue that CTR’s evolution can be described in terms of the relationship between desired states of U.S. influence on outcomes, the ability to generate a common threat definition, and appetite for collaboration on threat reduction. To that end, the paper provides an introduction and overview of CTR initiatives over its 20+ year history and a review of relevant Congressional legislation and trends. After introducing and describing the CTR Possible Futures Framework, this paper offers five possible options for—and discusses the implications of—CTR’s next evolution.

## **Introduction**

With the fall of the Berlin Wall, Senator Sam Nunn stated that the world was

on the verge of either having the greatest destruction of nuclear weapons in the history of the world or the greatest proliferation of nuclear weapons, nuclear materials, and scientific know-how on how to make these weapons, as well as chemical weapons, ballistic missiles, even biological weapons the world has ever seen.<sup>1</sup>

---

<sup>1</sup> Mary Beth D. Nikitin and Amy F. Woolf, “The Evolution of Cooperative Threat Reduction: Issues for Congress,” *Congressional Research Service*, R43143 (June 2014), p. 3.

Cooperative Threat Reduction (CTR) was born in the fundamental shift from competition to cooperation with Russia in the early 1990s<sup>2</sup> and was founded on “the premise that governments have a responsibility and a mutual interest in working together to reduce the threat”<sup>3</sup> posed by weapons of mass destruction (WMD). In one analysis of CTR’s evolution, Weiner<sup>4</sup> concluded that “lessons from CTR’s history can be used to improve both performance and implementation”<sup>5</sup> as the program expands its threat reduction remit globally (e.g., beyond Russia) and technologically (e.g., beyond nuclear weapons). Similarly, the 2017 *Symposium on Cooperative Threat Reduction Programs for the Next Ten Years and Beyond* concluded “CTR remains the foundation of the U.S.’s ability to reduce the threat from WMD abroad by maintaining and provide technical capabilities to eliminate WMD programs.”<sup>6</sup> Because of this evolution, in this paper the term *traditional CTR* refers to programs or activities conducted to date that have been funded under CTR-related legislation—though a more detailed lexicon, summarized in Table 1., was established by a 2009 National Academy of Sciences (NAS) report.<sup>7</sup>

Table 1. Various interpretations of *CTR*, as articulated by the NAS Committee on Strengthening and Expanding the Department of Defense Cooperative Threat Program.<sup>8</sup>

<b>CTR Variation</b>	<b>Description</b>
USG CTR	The broader, whole-of-government set of threat reduction programs
DOD CTR	Programs exclusive to the Department of Defense
CTR 1.0	The entire set of programs to this point
CTR 2.0	The [2009 NAS] concept of a future engagement programs

<sup>2</sup> Andrew C. Weber and Anya Erokhina. (2015) “Cooperative Threat Reduction and Its Lessons,” in Joseph F. Pilat & Nathan E. Busch, eds., *Routledge Handbook of Nuclear Proliferation and Policy* (Florence: Taylor & Francis, 2015).

<sup>3</sup> U.S. Congress. Senate - Foreign Relations. *Next Generation Cooperative Threat Reduction Act of 2013*. By Jeanne Shaheen. 113th Cong., 1st sess. S. Bill., Sec (2), 6, lines 13-18

<sup>4</sup> Sharon K. Weiner (2009) “The Evolution of Cooperative Threat Reduction,” *Nonproliferation Review*, 16(2), p. 211-235.

<sup>5</sup> *Ibid.*, p. 229.

<sup>6</sup> National Academy of Science’s Committee on International Security and Arms Control, “Cooperative Threat Reduction Programs for the Next Ten Years and Beyond: Proceedings of a Symposium-In Brief” (Washington, D.C: The National Academies Press, 2018), p. 11.

<sup>7</sup> National Academy of Science’s Committee on Strengthening and Expanding the Department of Defense Cooperative Threat Program, “Global Security Engagement: A New Model for Cooperative Threat Reduction” (Washington, D.C: The National Academies Press, 2009).

<sup>8</sup> NAS 2009, p. 21.

CTR has been described as a “clearly evolutionary initiative”<sup>9</sup> where its “globalization...has been a hallmark of five [U.S. Presidential] administrations.”<sup>10</sup> Yet, U.S. governmental responsibility to reduce WMD threats is growing in sophistication and complexity. Today’s geopolitical environment pose emerging dangers that will be best addressed through continued CTR-related global technical engagement. Consider, for example, risks related to the expansion of global nuclear energy (e.g., Turkey), particularly within countries that have no prior history with such programs (e.g., Vietnam and the U.A.E.). Another set of risks stem from the security (and possibly safety) risks associated with modernization programs in countries that already possess nuclear weapons. The current speed of innovation poses yet a different set of risks related to technological surprise (e.g., additive manufacturing) and the speed of technological advances (e.g., in cyber and space domains). While each of these also serve as new opportunities for increased collaboration in mitigating related dangers, their emergence in states or regions where no existing international agreements exist, or have become outdated, pose additional difficulties for CTR-type engagements.

The most recent change in U.S. presidential administrations provided a logical time to review the trajectories of the overarching CTR-related policy framework and inherited engagements. In response, this paper proceeds with some explicit policy assumptions, as these are necessary to bound the scope and structure of analysis. We recognize that policymakers may choose different points of emphasis for U.S. policy, which would of course influence the resulting decisions about CTR’s future. However, we believe that policymakers will generally agree on a number of these factors with regard to WMD.

Thus in the near future, we assume that the United States will:

- Consider WMD of all types to continue to pose the greatest threat to US and global security<sup>12</sup>;

---

<sup>9</sup> James Ellis (1997) “Nunn-Lugar’s mid-life crisis,” *Survival*, 39 (1), p. 84-110.

<sup>10</sup> Ambassador Laura Holgate, “Global Security Engagement for the next ten years and beyond,” Remarks to the National Academy of Sciences Symposium on Cooperative Threat Reduction Programs for the Next Ten Years and Beyond (September 18-19, 2017).

<sup>11</sup> Nikitin & Woolf 2014, p.3.

<sup>12</sup> This has been validated in recent efforts by ISIL to obtain nuclear, radiological and chemical weapons. For a more thorough discussion, please see: Stephen Hummel, “The Islamic State and WMD: Assessing the Future Threat,” *CTC Sentinel*, Vol. 9, No. 1 (January 2016), p. 18-21.



- Respond to countries and non-state actors attempting to seek (or increase) CBRN weapons, including latent capabilities, as challenges to U.S. power;
- Want to, at least minimally, continue to strengthen the global non-proliferation regime and arms control efforts through cooperative efforts;
- Retreat from a “benignly cooperative world” perspective and “acknowledge the existence of powerful competitive dynamics in the world today”<sup>13</sup>;
- Engage cautiously in cooperative non-proliferation efforts with Russia and China of mutual interest (while appropriately responding to competitive overtures)<sup>14</sup>;
- Consider, even if highly unlikely, opportunities for cooperative non-proliferation efforts with “rogue states” like North Korea and Iran;
- Favor non-proliferation efforts more directly influenced by U.S. interests and show less interest in innovations with new partners for threat reduction;
- Seek to engage in increasingly difficult (e.g., “semi-permissive”) contexts for threat reduction, with a focus on less cooperative efforts; and,
- Increasingly rely on local responses to regional security issues prominent in U.S. foreign policy and national security decisions (e.g., Saudi Arabia’s sentiments that Arabs should be responsible for Middle East security issues).

Additionally, in her remarks to the 2017 NAS CTR Symposium, Ambassador Laura Holgate noted that future CTR-related activities will be challenged by a decline in the attractiveness of partnering with the U.S., the rise of U.S.-Russian tensions, widespread impatience on the lack of nuclear disarmament progress, achievement of most large WMD (e.g., missiles, infrastructure, chemical weapons, and biological facilities) elimination missions, downward pressure on threat reduction budgets, and broad access to information and technology relevant to deadly weapons.<sup>15</sup> Because of the high level of completion of original CTR objectives<sup>16</sup>, this paper explores lessons learned to

---

<sup>13</sup> Dr. Christopher Ford, Assistant Secretary, Bureau of International Security and Nonproliferation, “Arms Control and International Security: Competition Among the Nuclear Powers and the New Arms Race,” Remarks to the Foreign Policy Association (June 6, 2018); also indicated by Vikram Singh’s remarks in NAS 2018.

<sup>14</sup> Ibid.; Weiner 2009

<sup>15</sup> Holgate 2017.

<sup>16</sup> Weber & Erokhina 2015.

understand how the mission, vision, and objectives of the original CTR program anchored its evolution to mitigate the changing geopolitical threat environment. This paper then defines different potential “futures” that characterize U.S. CTR initiatives and then describes prospective supporting technical capabilities. Lastly, policy options for engaging in CTR initiatives are provided, as well as a discussion of their implications for technical capability development and opportunity to increase threat reduction.

## **Past Evolution of Cooperative Threat Reduction**

### ***CTR’s History & Successes***

Following a 1991 visit by Senator Nunn to the Former Soviet Union (FSU)<sup>17</sup> to meet with Mikhail Gorbachev, U.S. legislation provided funds to reduce the threat from nuclear weapons awaiting destruction (as part of the Strategic Arms Reduction Treaty); concerns over Russian command and control; and, the impact of a declining Russian economy on its vast WMD infrastructure. This legislation began what became known as the Cooperative Threat Reduction (CTR) program. All funding for CTR activities initially went to the Department of Defense (DOD) who utilized experts from other organizations like the Departments of Energy (DOE) and State (DOS) to engage with Russia and the FSU until 2003. In 1997, the DOS and DOE began requesting their own funds, and by 2014, the DOD, DOS, DOE and the Department of Homeland Security (DHS) each had efforts in 4 regions and more than 30 countries. Table 2, below, summarizes key aspects of legislation regarding the evolution of traditional CTR engagements.

Table 2. Key attributes of relevant U.S. legislation describing the ability of the U.S. to engage in reducing WMD threats—and outlining the evolution of CTR.

<b><i>FISCAL YEAR</i></b>	<b><i>PUBLIC LAW NO.</i></b>	<b><i>NOTABLE PROVISIONS</i></b>
<b>1991</b>	102-228	The “ <b>Soviet Nuclear Threat Reduction Act of 1991</b> ” passed, establishing CTR to

<sup>17</sup> Also known as “Newly Independent States from the Former Soviet Union,” or NIS.

		<ul style="list-style-type: none"> <li>•Destroy chemical, biological, radioactive or nuclear (CBRN) weapons</li> <li>•Assist in transporting, storing, disabling and safeguarding weapons to be destroyed</li> <li>•Establish verifiable nonproliferation of such weapons</li> </ul>
<b>1993</b>	102-484	<p>Threat reduction programs should seek to:</p> <ul style="list-style-type: none"> <li>•Prevent diversion of scientific expertise from the former Soviet Union (FSU)</li> <li>•Establish science and technology centers in FSU</li> <li>•Expand military-to-military contacts between U.S. and FSU</li> </ul>
<b>1994</b>	103-160	<ul style="list-style-type: none"> <li>•Authority to facilitate transportation, storage, safeguarding and elimination of nuclear and other weapons from the newly independent states (NIS), and prevent diversion of scientific expertise</li> </ul>
<b>1996</b>	104-106	<ul style="list-style-type: none"> <li>•Annual reporting requirements for project(s) scope, funding and performance outlined</li> </ul>
<b>1998</b>	105-85	<ul style="list-style-type: none"> <li>•CTR funds NOT authorized to assist in START II Treaty weapons elimination until Russia agreement on cost-sharing</li> </ul>
<b>2001</b>	106-398	<ul style="list-style-type: none"> <li>•Annual reporting requirements updated (repealing previous restrictions) and expanded to include audit information, budgets and estimates of CTR objectives completed</li> </ul>
<b>2003</b>	107-248	<ul style="list-style-type: none"> <li>•Temporary authority to waive certification requirement to continue Shchuch'ye Chemical Weapons Destruction (CWD) facility construction</li> </ul>
<b>2004</b>	108-136	<ul style="list-style-type: none"> <li>•Limited authority to use CTR funds (&lt; \$50M) outside the FSU for emerging threats</li> <li>•Limitation on BW Defense joint research until facilities certified and secure</li> <li>•Temporary authority to waive CWD funding limitation</li> </ul>
<b>2005</b>	108-375	<ul style="list-style-type: none"> <li>•Extension of CWD funding waiver authority</li> </ul>
<b>2006</b>	109-163	<ul style="list-style-type: none"> <li>•Permanent Waiver of restrictions on use of funds in the FSU</li> <li>•Report on obstacles and challenges to CTR implementation required</li> </ul>
<b>2007</b>	109-364	<ul style="list-style-type: none"> <li>•Extension of CWD funding waiver authority</li> <li>•NAS study on Prevention of Proliferation of BW commissioned</li> </ul>
<b>2008</b>	110-181	<ul style="list-style-type: none"> <li>•Sense of Congress to set “new initiatives for CTR”<sup>18</sup></li> <li>•NAS on future of CTR study commissioned<sup>19</sup></li> <li>•Removal of funding limit authorization &amp; specifying use of funds outside the FSU</li> <li>•Repeal of restrictions on assistance to FSU states</li> </ul>

<sup>18</sup> More specifically, this legislation calls for continuing work in Russia and the FSU, expanding CTR into Asia and the Middle East and seeking opportunities for engaging with DPRK.

<sup>19</sup> Entitled Global Security Engagement: A New Model for Cooperative Threat Reduction (NAS 2009).

		<ul style="list-style-type: none"> <li>•NAS Study on Prevention of Proliferation of BW commissioned</li> </ul>
<b>2010</b>	111-84	<ul style="list-style-type: none"> <li>•Specifications for accepting CTR contributions from foreign governments or international (e.g., NGO) organizations</li> <li>•Studies on CTR Metrics by Secretary of Defense and NAS commissioned</li> </ul>
<b>2011</b>	111-383	<ul style="list-style-type: none"> <li>•Limitation on use of FY11 CTR funds for Centers of Excellence in non-FSU countries</li> <li>•Specification for joint Defense/Energy plan on nonproliferation and CTR activities with China (FY11-16)</li> </ul>
<b>2012</b>	112-81	<ul style="list-style-type: none"> <li>•Limitation on funding for Cooperative Biological Engagement Program</li> <li>•Limitation on use of FY12 CTR funds for Centers of Excellence in non-FSU countries</li> </ul>
<b>2013</b>	112-239	<ul style="list-style-type: none"> <li>•Report on CTR programs in Russia by Secretary of Defense with State, Energy, DNI</li> </ul>
<b>2014</b>	113-66	<ul style="list-style-type: none"> <li>•Required a strategy to modernize CTR and prevent WMD proliferation in MENA<sup>20</sup></li> <li>•Quarterly briefings and complete assessment of Syria CW stockpile/destruction status</li> <li>•FY10 authority for urgent threat reduction activities extended to December 31,2018</li> </ul>
<b>2015</b>	113-291	<ul style="list-style-type: none"> <li>•Neither DOD nor DOE can spend authorized CTR funds until the Secretaries of Defense and Energy certify that Russian forces are out of Ukraine and Russia is in compliance with INF and CFE Treaty obligations</li> </ul>
<b>2016</b>	114-92	<ul style="list-style-type: none"> <li>•Authorizes CTR funds to be available for obligation from FY2016-FY2018</li> </ul>

CTR activities in the early 1990's were almost exclusively associated with DOD-led destruction of nuclear weapons and facilities.<sup>21</sup> Through the late 1990s, CTR funds were transferred to DOS (for initiatives such as WMD scientist redirection, export controls, border security and the Nonproliferation and Disarmament Fund) and the DOE (for activities in materials protection control & and plutonium disposition). In 2001, CTR further expanded its scope (e.g., chemical weapon destruction in Russia & Albania and the Iraqi Scientist engagement program) and geographical reach (e.g., engagements with

<sup>20</sup> This included key provisions from Senator Jeanne Shaheen's (D-NH) 'Next Generational Cooperative Threat Reduction Act of 2013' and Congressman Jeff Fortenberry's (R, NE-1) 'Cooperative Threat Reduction Modernization Act of 2013.'

<sup>21</sup> National Academy of Sciences 2009.

the Middle East and North Africa).

By the early 2000s, both DOE and DOS CTR activities began having significant impact in parallel with DOD CTR efforts.<sup>22</sup> One example is how complementary efforts by the DOS Nonproliferation and Disarmament Fund and DOD's CTR program combined to completely eliminate Libya's uranium enrichment program.<sup>23</sup> By providing immediate and longer term funding, this CTR engagement was able to remove fissile materials (and related production equipment) and nuclear weapons components (including delivery mechanisms), as well as "[divert] technical and scientific expertise to civil purposes."<sup>24</sup> Such CTR successes led Congress to commission the National Academy of Sciences (NAS) to assess program results and offer recommendations. Deemed "CTR 2.0" in its 2009 report, the NAS suggested that CTR "should be expanded geographically [and] updated in form and function" to enhance its ability to reduce global threats.<sup>25</sup> The primary recommendations of CTR 2.0, however, were never fully realized.

While the emphasis during the late 2000s and early 2010s was on nuclear security (e.g., the Nuclear Security Summits<sup>26</sup>), other significant accomplishments related to original CTR activities have also occurred, including completion of the 17-year-long program at the Semipalatinsk Test Site in Kazakhstan in 2012 and the 2014 destruction of Syrian chemical weapons.<sup>27</sup> Since 2010, however, many activities covered under CTR have been

---

<sup>22</sup> U.S. Government Accountability Office, (2012) "Nonproliferation and Disarmament Fund: State Should Better Assure the Effective Use of Program Authorities," *GAO-13-83* (Washington, D.C.: Government Printing Office, 2012); Nikitin & Woolf 2014.

<sup>23</sup> Here, the elimination of the Libyan enrichment program is instructive, as the near-immediate response was funded by an ancillary source (DOS's Nonproliferation and Disarmament Fund) until the conditions for spending CTR funds in Libya (e.g., being taken off the DOS list of state sponsors of terrorism) were met. This indicates the importance of both timely and flexible funding (and governmental support) to support rapid technological responses. For more, please see: James E. Goodby, Daniel L. Burghart, Cheryl A. Loeb and Charles L. Thornton (2004) "Cooperative Threat Reduction for a New Era," *Center for Technology and National Security Policy*, (Washington, D.C.: National Defense University, 2004), accessed September. < [http://www.nti.org/media/pdfs/CooperativeThreatReductionForANewEra.pdf?\\_id=1323825759](http://www.nti.org/media/pdfs/CooperativeThreatReductionForANewEra.pdf?_id=1323825759)>

<sup>24</sup> Ibid, pg. 35.

<sup>25</sup> National Academy of Sciences 2009.

<sup>26</sup> Matthew Bunn, (2016) "The Nuclear Security Summit: Wins, Losses and Draws," *Nuclear Security Matters*, (Cambridge, MA: Belfer Center for Science and International Affairs at the Harvard University Kennedy School of Government, 2016).

<sup>27</sup> Weber & Erokhina 2015.

reduced (e.g., work at the Sevmash nuclear site in Russia). This was due in large part to completion of many of the original CTR objectives, rising tensions between the U.S. and Russia, and reprioritization of the U.S. federal budget. These same forces resulted in the CTR Memorandum of Understanding, known as the “umbrella agreement” governing CTR activities with Russia since 1992, expiring on June 7, 2013.<sup>28</sup> Further, the U.S. Congress passed legislation in 2015 limiting funding for CTR projects in response to Russian military activities in Ukraine.

Yet, some CTR-related threat reduction activities with Russia have sustained under the Multilateral Nuclear Environmental Programme in the Russian Federation (MNEPR). This program, provides a narrower umbrella agreement for conducting CTR-type activities and was “negotiated to allow European partners to give funds to nonproliferation and radiological cleanup projects in Russia under the G-8 Global Partnership.”<sup>29</sup> However, the Russian Ministry of Defense (MOD) does not participate in this agreement, meaning that original CTR missions related to strategic WMD (previously based on joint U.S./Russian collaboration) are now solely the responsibility of the Russian MOD. Other CTR efforts to dismantle, secure and prevent the proliferation of nuclear, chemical or biological weapons (or materials), however, are continuing in such regions as Southeast Asia and the Middle East, with particular projects in Afghanistan, Africa, China, India, Pakistan, Iraq and Libya.<sup>30</sup> Figure 1 maps a summary of major evolutionary changes in CTR and relevant geopolitical activities over the last several decades.

Definitions of potential threats and engagement options for reducing them have expanded over the history of CTR to match geopolitical changes. These include the expanded definition of WMD, the geographical scope of potential engagement, increasingly narrow

---

<sup>28</sup> Richard Weitz, “Russian-U.S. Cooperative Threat Reduction Beyond Nunn-Lugar and Ukraine,” *Arms Control Today*, July 8, 2014, < [https://www.armscontrol.org/act/2014\\_0708/Features/Russian-US-Cooperative-Threat-Reduction-Beyond-Nunn-Lugar-and-Ukraine](https://www.armscontrol.org/act/2014_0708/Features/Russian-US-Cooperative-Threat-Reduction-Beyond-Nunn-Lugar-and-Ukraine)>; Nikitin & Woolf 2014.

<sup>29</sup> Nikitin & Woolf 2014, p.8.

<sup>30</sup> U.S. Department of Defense. “Fiscal Year 2016 Budget Estimates: Cooperative Threat Reduction Programs,” <[http://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2016/budget\\_justification/pdfs/01\\_Operation\\_and\\_Maintenance/O\\_M\\_VOL\\_1\\_PART\\_2/CTR\\_OP-5.pdf](http://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2016/budget_justification/pdfs/01_Operation_and_Maintenance/O_M_VOL_1_PART_2/CTR_OP-5.pdf)>.

implementation projects with Russia (and reduced U.S. personnel in country<sup>31</sup>), and the increasing importance of regional security issues. Current CTR efforts have evolved from dismantling warheads toward capacity building across such activities as facility security, material disposition, and emergency response.<sup>32</sup> Throughout its history, CTR programs have supported strategic stability by identifying, responding to and reducing emerging nuclear, chemical or biological threats in creative ways. As CTR seeks to move forward—especially in response to both internal U.S. and international political dynamics—continued success may be predicated on “developing an innovative, collective approach to all-hazards threat reduction.”<sup>33</sup>

Despite these documented successes, CTR is not universally heralded. Early critiques focused on the struggle to meet the “perceived critical short term emergency”<sup>34</sup> of Russian nuclear weapons and to address the urgency of eliminating these “loose nukes” before domestic (and international) political support waned.<sup>35</sup> These criticisms questioned the effectiveness of lumbering cost transfer mechanisms that slowed implementation<sup>36</sup> to meet CTR’s explicitly stated goals of destroying nuclear weapons, transporting/safeguarding weapons on their way to destruction, and establishing verifiable safeguards with Russia.<sup>37</sup> Related criticisms involve CTR project implementation delays, which have been commonly caused by funding problems, procedural disagreements, lacking coordination between U.S. agencies, or difficulty in negotiating appropriate access.<sup>38</sup> Where CTR’s evolution is often perceived as positive, others call it “mission creep” away from the core purpose of securing loose Russian nuclear weapons and materials. One such critic described CTR as a “program that began as a response to [the U.S.’s] most urgent national security challenge has simply become

---

<sup>31</sup> Weitz 2014.

<sup>32</sup> Weber & Erokhina 2015.

<sup>33</sup> *Ibid.*, p. 464.

<sup>34</sup> Ellis 1997

<sup>35</sup> Rich Kelly, “The Nunn-Lugar Act: A Wasteful and Dangerous Illusion,” Cato Foreign Policy Briefing No. 39, March 18, 1996, < <https://www.cato.org/publications/foreign-policy-briefing/nunnlugar-act-wasteful-dangerous-illusion>>

<sup>36</sup> Ellis 1997

<sup>37</sup> Kelly 1996

<sup>38</sup> Weiner 2009

another Pentagon bureaucracy and foreign aid boondoggle.”<sup>39</sup>

Another criticism asserted that by either securing obsolete technology or completing work that should be funded by Russia, CTR-projects were enabling Russian funds to be used for their nuclear weapons modernization programs. In short, according to one critic, “CTR-funded projects are a U.S. subsidy for the Russian arms industry.”<sup>40</sup> Overall, these concerns concentrated on the early days of the program and the intervening projects to date are perceived to demonstrate CTR’s success in threat reduction. Yet, criticism regarding appropriate measures of success for CTR projects has continued from its early days “as the programme expanded and developed a life of its own...it became increasingly complex, and...few objective standards of success could be applied to it.”<sup>41</sup> Identifying and codifying appropriate success metrics is inherently difficult given that CTR projects exist at the intersection of nuclear technology and nuclear policy, which makes this a continuous challenge—and likely source of criticism—for future evolution(s).

Over its history, CTR has evolved from a specific program into a policy tool—composed of specific projects and supported by international institutions—to reduce global threats posed by WMD materials, technologies and expertise. CTR has built and maintains a set of technical capabilities that enable the U.S. and partners to address emerging and unexpected threats in a timely manner. CTR has become less the special program it was in 1991 when it was established and more a wide-ranging mechanism—and key element of U.S. strategy—for reducing global threats.

### ***The Role of CTR in the Nuclear Posture Review***

Over the course of its successful history of supporting U.S. efforts to reduce WMD threats, CTR has even had varying influences in recent Presidential Administration, as indicated in major U.S. national security documents like the Nuclear Posture Review

---

<sup>39</sup> Kelly 1996

<sup>40</sup> Ibid

<sup>41</sup> Ellis 1997, p. 100.



(NPR). As the objectives, format and content of the different NPRs have evolved over time, so has the role of CTR. The first NPR, completed in 1994 under the Clinton Administration, emphasized the importance of cooperating with Russia as the world entered a new, highly uncertain international security environment. This NPR stated that

A major focus of the Nuclear Posture Review was nonstrategic nuclear forces (NSNF) and safety, security, and use control. The United States decided in the NPR to completely eliminate two out of its five types of NSNF, and to augment several aspects of nuclear safety and security. These efforts were discussed with Russian civilian and military leaders in the hope that they would take similar measures to reduce NSNF and improve nuclear safety, security, and use control. The United States is prepared, under the Cooperative Threat Reduction program, to cooperate with and support Russia in these endeavors.<sup>42</sup>

In contrast, the 2001 NPR under the Bush Administration did not explicitly mention CTR. This NPR did suggest the influence of CTR-related engagements by encouraging continued cooperation with Russia and stating the continuing importance of countering the unabated proliferation of nuclear, chemical and biological weapons and ballistic missiles.<sup>43</sup> Under the Obama Administration, the 2010 NPR included CTR as prominent aspect of an expanded nuclear strategy. In addition to naming the prevention of nuclear terrorism and proliferation as two pressing security issues for the U.S., this NPR stated

The United States has given high priority to strengthening and accelerating international efforts to prevent nuclear terrorism by: securing and eliminating weapons of mass destruction and their means of delivery through cooperative threat reduction programs at

---

<sup>42</sup> For more, please see the “Nuclear Posture Review-Extract from the 1995 Annual Defense Report,” accessed at [http://fas.org/nuke/guide/usa/doctrine/dod/95\\_npr.htm](http://fas.org/nuke/guide/usa/doctrine/dod/95_npr.htm).

<sup>43</sup> For more, please see J.D. Crouch, “Special Briefing on the Nuclear Posture Review (January 2002),” January 9, 2002, <<http://www.fas.org/sgp/news/2002/01/npr-briefing.html>>.

the Departments of Defense, State, and Energy, including the flagship Nunn-Lugar program. And assisting other countries to strengthen their national capacities for nuclear materials protection, control, and accounting through these programs, United National Security Council Resolution 1540, and multilateral cooperative threat reduction programs.<sup>44</sup>

While under President Trump, the 2018 NPR has narrowed its focus to increase emphasis on strengthening the U.S. deterrent capability, threat reduction – specifically in terms of countering nuclear terrorism and proliferation – remains a key issue. The NPR notes the importance of increasing transparency and predictability “through strategic dialogues, risk-reduction communication channels, and the sharing of best practices related to nuclear weapons safety and security.”<sup>45</sup> The NPR continues to emphasize the importance of the nearly three-decade old effort to keep nuclear and radiological materials out of the hands of terrorists, noting that “[t]he most effective way to reduce the risk of nuclear terrorism is to secure nuclear weapons and materials at their sources.”<sup>46</sup> Collaboration with foreign partners is still seen as a key mechanism for achieving this goal, as the 2018 NPR continues to recognize the importance of international agreements (e.g., the Nuclear Nonproliferation Treaty, NPT) and other multilateral organizations (e.g., the Nuclear Suppliers Group and International Partnership for Nuclear Disarmament and Verification).

---

<sup>44</sup> U.S. Department of Defense, Office of the Secretary of Defense, “Nuclear Posture Review Report,” April 2010, < [https://www.defense.gov/Portals/1/features/defenseReviews/NPR/2010\\_Nuclear\\_Posture\\_Review\\_Report.pdf](https://www.defense.gov/Portals/1/features/defenseReviews/NPR/2010_Nuclear_Posture_Review_Report.pdf) >.

<sup>45</sup> U.S. Department of Defense, Office of the Secretary of Defense, “Nuclear Posture Review,” February 2018, < <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF> >, p.xvi

<sup>46</sup> *Ibid.*, p. 66-67

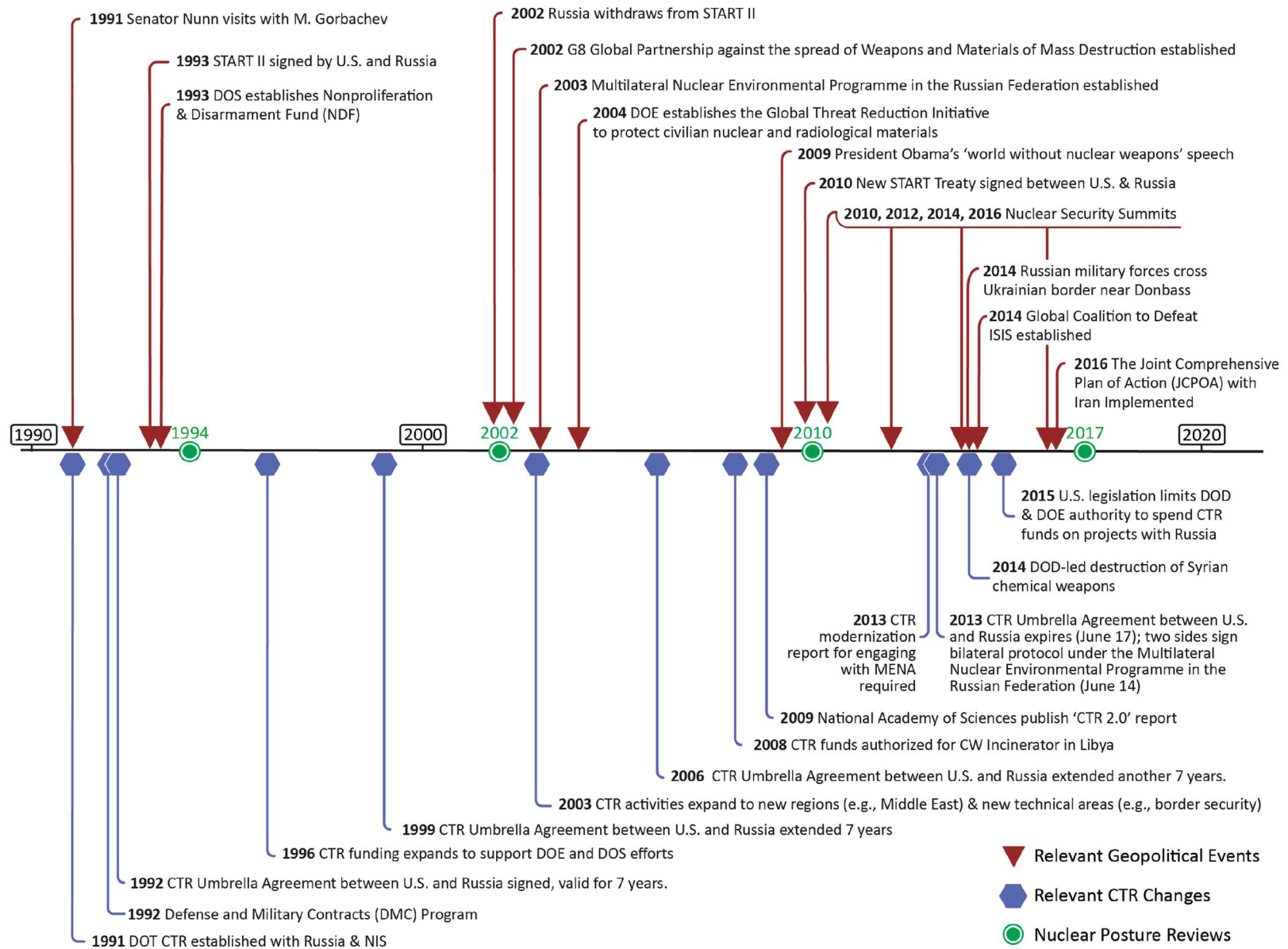


Figure 1. Timeline of major changes to Cooperative Threat Reduction (CTR), mapped against relevant geopolitical events

## **Future Evolution(s) of Cooperative Threat Reduction**

The CTR framework presented in this paper is based on the multiple influences that drove the evolution of CTR over its more than 20-year history. First, traditional CTR efforts have succeeded because of two principal factors: (i) they were based on (varying levels of) cooperation, and (ii) they employed appropriate technical solutions to reduce emerging threats. Second, the expansion of WMD-related capabilities across geographic regions necessitated the application of CTR lessons to this increased threat profile to the U.S.

Though not fully adopted, the 2009 NAS report also provided a number of recommendations germane to future CTR evolutions and the geopolitical assumptions, given that “CTR 1.0 engagements have become a portfolio of loosely coordinated actions implemented by departments and agencies across the USG.”<sup>47</sup> Among those include *Recommendation 3-1a*’s call for CTR to develop into a program inclusive of a range of participants across government, academia, industry and nongovernmental organizations. This recommendation also argues for an expanded set of tools and engagement mechanisms to be developed and shared across the U.S. CTR implementers. Similarly, *Recommendation 3-1b* calls for CTR to include multilateral partnerships that address both country- and region-specific security challenges. This recommendation also argues for CTR to provide support to the implementation of international treaties and other security instruments aimed at reducing threat, such as the G8 Global Partnership, the Proliferation Security Initiative, United Nations Security Council Resolution 1540, and the Global Initiative to Combat Nuclear Terrorism.

In addition, there will be a number of “legacy commitments” associated with CTR—including the original Nunn-Lugar program, the Proliferation Security Initiative (PSI), UNSCR 1540, the Chemical Weapons Convention (CWC), the Biological Weapons Convention (BWC), and the Nonproliferation Treaty (NPT)—that will shape the future of threat reduction. In addition, a set of contemporary commitments have emerged from this

---

<sup>47</sup> National Academy of Sciences 2009, p. 11.

current administration—such as Nuclear Security Summit (NSS) Process<sup>48</sup>, the International Partnership for Nuclear Disarmament and Verification (IPNDV)<sup>49</sup>, the Deterrence Dialogue with Japan<sup>50</sup>, the Joint Comprehensive Plan of Action (JCPOA) with Iran<sup>51</sup>, and the Middle East WMD Free Zone (ME/WMDFZ)<sup>52</sup>—that may also influence the future of CTR. More specifically, the next evolution of CTR will have to reconcile recent activities (e.g., JCPOA or the IPNDV) with future concerns (e.g., continued proliferation efforts by North Korea, nuclear latent countries, or nuclear energy expansion in the Persian Gulf). As the current and future administrations adopt their own set of commitments to enhance threat reduction, they will also have to decide when and how to reconcile the successes of traditional CTR efforts, this set of inherited legacy commitments and its own CTR-related agenda.

### ***CTR Possible Futures Framework***

Considering the history of CTR described above, it is difficult to limit possible evolutionary trajectories. To that end, it is useful to categorize various possible CTR futures in terms of key variables or balancing points that capture the role of the U.S. in CTR-related efforts. In terms of those variables or balancing points, policy decisions regarding CTR projects are defined by the following: (1) whether the effort is a direct bilateral engagement by the U.S. or multilateral coalition in which the U.S. participates

---

<sup>48</sup> For more, please see: Arms Control Association, “Nuclear Security Summit at a Glance,” August 2017, <<https://www.armscontrol.org/factsheets/NuclearSecuritySummit>>.

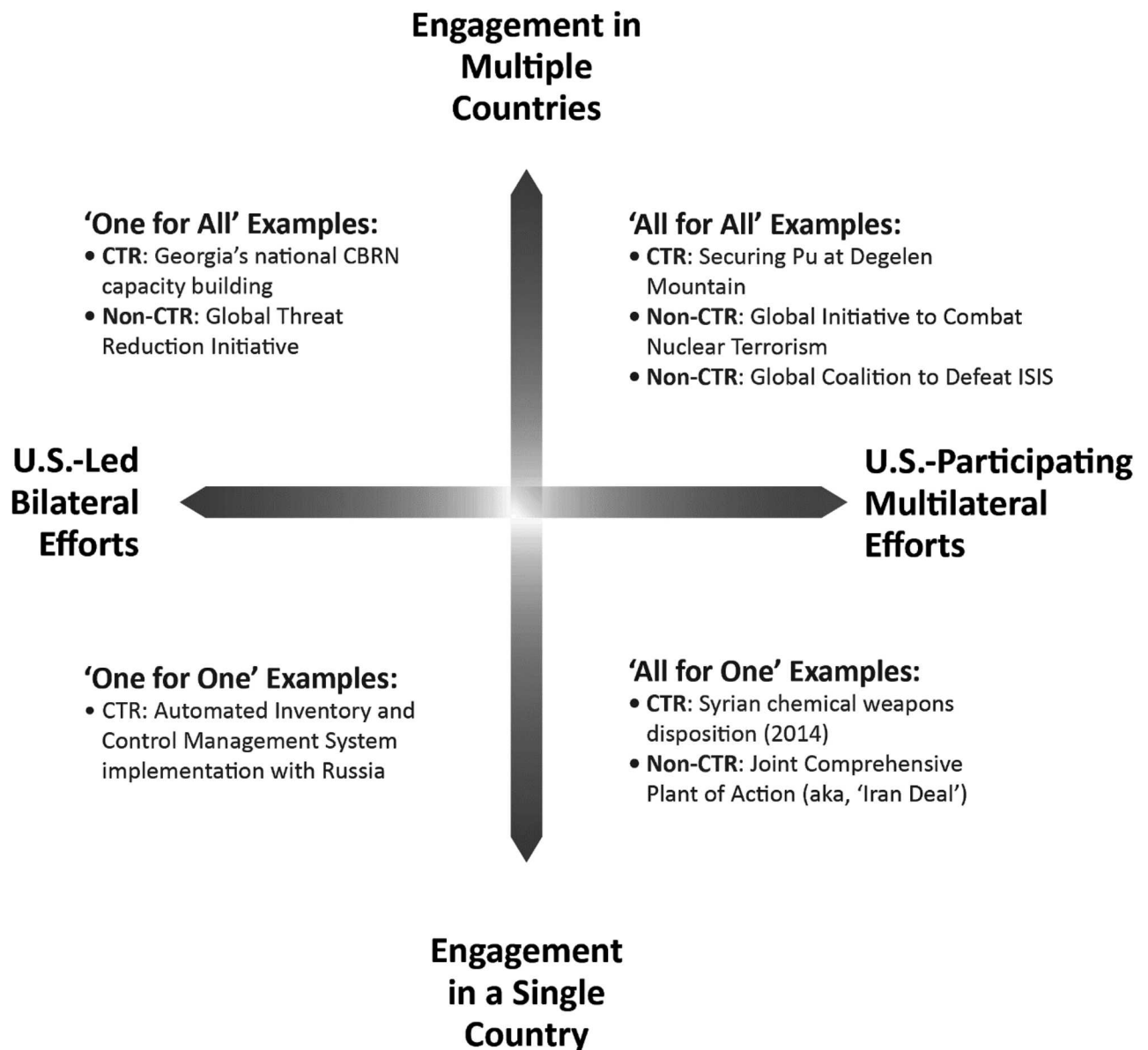
<sup>49</sup> For a general overview, please see: International Partnership for Nuclear Disarmament Verification, “Engaging a Diverse Group of Countries to Develop Innovative Monitoring and Verification Solutions,” 2018, <<https://www.ipndv.org/>>. For details on development and deliverables, please see: International Partnership for Nuclear Disarmament Verification, “Phase I Summary Report: Creating the Verification Building Blocks for Future Nuclear Disarmament” November 2017, <[https://www.ipndv.org/wp-content/uploads/2017/12/IPNDV-Phase-I-Summary-Report\\_Final.pdf](https://www.ipndv.org/wp-content/uploads/2017/12/IPNDV-Phase-I-Summary-Report_Final.pdf)>

<sup>50</sup> For example, please see: Yukio Satoh, “U.S. Extended Deterrence and Japan’s Security,” *Livermore Papers on Global Security* (Livermore, CA: Lawrence Livermore National Laboratory, Center for Global Security Research, October 2017), <<https://cgsr.llnl.gov/content/assets/docs/satoh-report-final.pdf>>, p. 58-63.

<sup>51</sup> For example, read the original U.S. documents at U.S. Department of State, “Joint Comprehensive Plan of Action,” 2018, <<https://www.state.gov/e/eb/tfs/spi/iran/jcpoa/>>. For a discussion by a panel of experts, please see the essays at: Center for Strategic and International Studies, “JCPOA: One Year Later,” 2018, <<https://www.csis.org/programs/international-security-program/isp-archives/proliferation-prevention-program/iran/jcpoa-one>>.

<sup>52</sup> For more, please see: Arms Control Association, “WMD-Free Middle East Proposal at a Glance,” July 2017, <<https://www.armscontrol.org/factsheets/mewmdfz>>.

and (2) the number of countries the effort is designed to engage. As illustrated in Fig. 2 and described in more detail below, the CTR Possible Futures Framework uses these two variables as orthogonal axes to describe possible options for CTR-related efforts over the next five- to ten-year timeframe.



*Fig. 2. Cooperative Threat Reduction (CTR) Possible Futures Framework*

Over the course of its history, a wide range of projects have been implemented to reduce threats and increase strategic stability under the aegis of CTR. Initially born as a bilateral set of projects to engage with Russia on matters of nuclear nonproliferation and security (e.g., warhead dismantlement)<sup>53</sup>, CTR's success resulted in a continued expansion of program objectives and global reach (e.g., chemical/biological weapons dismantlement and enhancing emergency response capabilities).<sup>54</sup> Because the U.S. has held various roles in these projects over the program's history, possible CTR futures are likely to span across the U.S. threat reduction policy spectrum ranging in emphasis from U.S.-led bilateral efforts to U.S.-participating multilateral efforts. CTR's future is also likely to be shaped by the different perceptions of the relationship between associated costs and risks by the U.S. and other countries; perceptions that will change with time.<sup>55</sup>

In addition to the geopolitical assumptions listed in the previous section, this axis of the CTR Possible Futures framework is subject to several relevant factors. First is the perceived degree of importance to the U.S. of serving as the primary influencing power in any specific threat reduction projects. The second factor is the fact that and increasing emphasis on multilateral efforts will have to be established on increasingly collective agreement on common threats.<sup>56</sup> The last influence is the receptiveness of the U.S. (and potential collaborators) to shared threat reduction approaches given changes in current events, diplomatic relationships and geopolitics. Future evolution(s) of CTR will be shaped by different combinations of these factors. Because CTR efforts have been traditionally tied to national security arguments, misalignment on these assumptions will drive both preference for, and might lead to difficulty in, future CTR efforts. In other words, the interaction between the desired level of U.S. influence, ability to achieve a common threat definition and appetite for collaboration will drive future CTR evolution(s).

---

<sup>53</sup> According to National Academy of Sciences 2009, work known as "CTR 1.0" and "DOD CTR."

<sup>54</sup> According to National Academy of Sciences 2009, work known as "USG CTR" and (the proposed) "CTR 2.0."

<sup>55</sup> Holgate 2017.

<sup>56</sup> National Academy of Sciences 2009.



Movement and placement along this axis is driven by several influences stemming from the sitting U.S. administration and Congressional profile. Both the ability to pass related legislation authorizing various elements of the U.S. government (e.g., DOE, DOD, national laboratories, etc.) to participate and the existence of Congressionally approved budgets directly affect the level of influence the U.S. is able to achieve in implementing CTR projects. Similarly, the willingness of (potential) partner countries to participate and the permissiveness of specific operating environments provide the context in which future CTR efforts will need to be designed and implemented. More specifically, any-related U.S. administration lack of confidence in potential partner capabilities (e.g., maintaining effective control over special nuclear material) or regional abilities (e.g., identifying and recovering “loose” special nuclear material) to support CTR efforts will influence CTR program design and implementation. Lastly, the importance given to CTR—as indicated by its inclusion in U.S. national strategies like the NPR—will ultimately determine the size of the potential solution space for engaging with other countries to reduce emerging global threats.

The evolutionary history of CTR has also demonstrated the inclusion of multi-nation and/or regional engagements. As efforts to engage with Russia took hold, CTR efforts began to engage in the immediate vicinity (e.g., the former Soviet Union) and then across other geographical regions. Similar to the spectrum of U.S. roles in engagement discussed above, future CTR projects are subject to the ability to garner collective agreement on a common threat and the receptiveness of shared approaches among potential recipient or host countries. In some cases, U.S. national security interests could be better served by engaging in a more bilateral manner, specifically when there is a different understanding of the threat to be reduced or uncooperative environments. In other cases, alignment in threat definition and desire to collaborate may lead to multilateral or regional CTR-related engagement. This is also influenced by which security issues the current U.S. administration considers most important for U.S. national and global security. If individual country security issues are paramount, then CTR-related efforts will primarily focus on engagements that will mitigate specific country’s security problems. Conversely, if regional security issues are paramount, then CTR-related efforts



will primarily focus on engagements to alleviate security problems facing geographically co-located countries. Here, how the cooperativeness of the implementation environment and relative importance of specific versus regional security issues interact will determine the future state of CTR efforts.

Several key influences will drive preferences (and CTR success criteria) for engaging with a single or multiple countries. First and foremost is the relative importance of regional security issues—both to the sitting U.S. administration and any potential region being considered for CTR engagement. For example, the atmosphere for CTR-related engagement will look markedly different in a region where two member nations possess nuclear weapons than it would in a region where the sole possessor of nuclear weapons is undergoing political regime collapse. In the former, the desire (and tendency) might be to rely on engaging with the individual nuclear weapons state in order to reduce regional tensions and security challenges (perhaps via warhead dismantlement). In the latter, the desire might be to emphasize regional engagement in order to reduce the threat from uncontrolled nuclear weapons in the area (perhaps via increasing capabilities in regional border security). Another key influence is the degree to which potential collaborator countries will agree to emphasize either individual or regional CTR efforts. As potential partner countries weigh their own national security and strategic interests, their willingness to collectively engage a specific country or a group of countries will vary. Changes in domestic and international politics may result in environments in which CTR-related outcomes are best achieved via initiatives led by another country with responsibilities spread among a coalition of countries. This may also allow for longer term implementation and increased stability of threat reduction objectives where changing political environments in any of the coalition members might otherwise interrupt progress.

### ***Possible CTR Futures***

The CTR Possible Futures Framework uses these two spectra to create four categories of possible CTR futures, as illustrated in Figure 2. These four categories are defined by sets of related assumptions regarding a sitting U.S. administration's perception of CTR-

related activities. These assumptions are summarized in Table 3, below.

Table 3. Cooperative Threat Reduction-related assumptions for a Sitting U.S. Administration according to the CTR Possible Futures Framework.

	<b>Possible Future #1: <i>One for One</i></b>	<b>Possible Future #2: <i>One for All</i></b>	<b>Possible Future #3: <i>All for All</i></b>	<b>Possible Future #4: <i>All for One</i></b>
<b>Desired Influence</b>	Maintain the role of primary influencer on threat reduction	Maintain the role of primary influencer on threat reduction	Serve as part (and not necessarily the leader) of a coalition for threat reduction	Serve as part (and not necessarily the leader) of a coalition for threat reduction
<b>Primary Determinant of Threat Reduction</b>	Enhancing individual country security	Mitigating regional* security issues	Mitigating regional* security issues	Enhancing individual country security
<b>Appetite for Collaboration</b>	Low value on cost/reputation sharing or unwilling potential partners	Low value on cost/reputation sharing or unwilling potential partners	High value on cost (and reputation) sharing with willing partners	High value on cost (and reputation) sharing with willing partners
<b>Common Threat Definition</b>	U.S.-biased definition of threat(s) in <i>individual country</i> to be reduced	U.S.-biased definition of <i>regional</i> threat(s) to be reduced	Collective agreement on <i>regional</i> threat(s) to be reduced by coalition of partnering countries	Collective agreement on threat(s) in <i>individual country</i> to be reduced by coalition of partnering countries
<b>Implementation Environment</b>	U.S. unilateral engagements supported within a single country	U.S. unilateral engagements supported within a set of regional countries	Multilateral** engagements supported within a set of regional countries	Multilateral engagements supported within a single country
*Regional means “shared concerns among geographically co-located countries” **Multilateral means “coalition of partnering countries”				

### *Possible Future #1: “One-for-One”*

The first category describes CTR efforts that have a greater emphasis on U.S.-led bilateral efforts and greater emphasis on individual country engagement (and is illustrated in the lower left-hand quadrant of Figure 2). This category, nicknamed “One for One,” believes that U.S. threat reduction objectives are best met with bilateral efforts with individual countries. Per the framework, activities within this category assume that the U.S. places high value on being the primary influencer on reducing threats in individual countries—perhaps because either potential partner countries are unwilling to support or the implementing environment is not supportive of multilateral activities.

The traditional CTR program had its origins in this category as the initial set of activities sought to reduce the threat stemming from nuclear weapons in Russia and the former Soviet Union. Consider, for example, U.S. efforts to implement the Automated Inventory and Control Management System (AICMS) to track and catalog nuclear weapons with Russia’s 12<sup>th</sup> Main Directorate—Glavnoye Upravleniye Ministerstvo Oborony or GUMO<sup>57</sup> (a directorate within the Russian General Staff with responsibility for nuclear munitions, including their security) as the type of CTR activity that populates this category.

### *Possible Future #2: “One-for-All”*

The second category of the CTR Possible Futures Framework describes threat reduction activities that place greater U.S. emphasis on U.S.-led bilateral efforts and greater emphasis on multilateral or regional engagement. This category (illustrated in the upper left-hand quadrant of Figure 2) is nicknamed “One for All” and believes that U.S. threat reduction objectives are best realized with U.S.-led engagement with multiple countries. According to the framework, activities within this category similarly assume that the U.S. places high value on being the primary influencer on reducing threats—again perhaps because of an unwillingness for countries to partner or ineffective multilateral engagement mechanisms—but by mitigating regional (e.g., shared concerns among geographically co-located countries) security issues.

---

<sup>57</sup> Weber & Erokhina 2015

One example of threat reduction related activities previously under the CTR umbrella is the application of the innovative approach to capacity building provided in Georgia's national CBRN prevention, preparedness and response capabilities to the Asia-Pacific and Middle East regions.<sup>58</sup> An example of a threat reduction effort that would fit into this category, but not be considered a part of traditional CTR, is the U.S.-led Global Threat Reduction Initiative (GTRI)—a program that works in and across various countries to convert HEU to LEU; remove excess nuclear and radiological materials; and, protect high priority nuclear radiological materials.<sup>59</sup>

### *Possible Future #3: "All-for-All"*

The third category of possible CTR futures describes threat reduction efforts that place greater U.S. emphasis on multilateral efforts and greater emphasis on regional engagement. Nicknamed "All for All," this category believes that U.S. threat reduction objectives are most effectively achieved through a group of countries coordinating to engage with a group of regional countries (and is illustrated in the upper right-hand quadrant of Figure 2). Per the framework, activities within this category assume that a sitting U.S. administration sees success in threat reduction as predicated on participation in (and cost-sharing with) a coalition of partnering countries focused on mitigating regional security concerns.

One example of activities that would fit within this category is the 17-year engagement between the U.S., Russia and Kazakhstan to secure legacy weapons-usable Plutonium in the experimental tunnels within Degelen Mountain at the Semipalatinsk Test Site.<sup>60</sup> This activity also illustrates how a coalition of partners under the traditional CTR umbrella coordinated to reduce regional security issues. Additionally, the voluntary international

---

<sup>58</sup> Weber & Erokhina 2015

<sup>59</sup> For more, please see: U.S. National Nuclear Security Administration, "GTRI: Reducing Nuclear Threats Fact Sheet", May 29, 2014, < <http://nnsa.energy.gov/mediaroom/factsheets/reducingthreats>> or U.S. National Nuclear Security Administration, "Prevent, Counter, and Respond—A Strategic Plan to Reduce Global Nuclear Threats—FY2018-FY2022," November 2017, < <https://www.energy.gov/downloads/prevent-counter-and-respond-strategic-plan-reduce-global-nuclear-threats>>.

<sup>60</sup> Weber & Erokhina 2015.

partnership committed to strengthening global capacity to reduce the threat of nuclear terrorism, the Global Initiative to Combat Nuclear Terrorism<sup>61</sup> and the regular proposals for a Middle East Weapons of Mass Destruction-Free Zone<sup>62</sup> by both international organizations (e.g., the United Nations or the Review Conferences of the Nuclear Non-Proliferation Treaty) and groups of collaborating nations (e.g., Arms Control and Regional Security Group [ACRS]<sup>63</sup>) represent example activities within this category, though not considered under the traditional CTR umbrella.

For the last five years, the U.S. has participated in the Global Coalition to Defeat ISIS to “focus the international community’s attention on countering the global/transnational threat of ISIS/Da’esh.”<sup>64</sup> This effort represents the broadest type of coalition of countries (75 at this date) cooperating to address what began as a regional security issue, but which now has become a global threat.<sup>65</sup> The coalition may represent a new structure for future CTR activities. If the recent successes of this coalition are sustained (and their mission is achieved), this instantiation of the *all-for-all* concept will be an important case study.

#### *Possible Future #4: “All-for-One”*

The last category within the framework describes threat reduction activities that place greater U.S. emphasis on multilateral efforts and greater emphasis on individual country engagement. This category believes that U.S. threat reduction objectives are more effectively met through groups of countries coordinating together to engagement with individual countries, and is nicknamed “All for One” (and is illustrated in the lower right-hand quadrant of Figure 2). According to the framework, activities within this category assume that a sitting U.S. administration sees success in threat reduction as predicated on

---

<sup>61</sup> For more information, please see: Global Initiative to Combat Nuclear Terrorism, “Overview,” 2015, < <http://www.gicnt.org/> >.

<sup>62</sup> Chen Kane, “Planning Ahead: A Blueprint to Negotiate and Implement a Weapon-of-Mass-Destruction-Free Zone in the Middle East,” *CNS Occasional Paper No. 22*, April 22, 2015, < [https://www.nonproliferation.org/wp-content/uploads/2015/04/Planning\\_Ahead\\_WMDFZ.pdf](https://www.nonproliferation.org/wp-content/uploads/2015/04/Planning_Ahead_WMDFZ.pdf) >.

<sup>63</sup> Emily B. Landau, “The ACRS Experience and its Relevance to the WMDFZ Conference,” *The Nonproliferation Review*, Volume 19, No. 3 (Fall-Winter 2012), p. 365-375.

<sup>64</sup> U.S. Department of State, “Joint Statement of Guiding Principles from the Global Coalition to Defeat ISIS,” February 13, 2018, < <https://www.state.gov/r/pa/prs/ps/2018/02/278267.htm> >.

<sup>65</sup> For more on the activities of this coalition, please see: U.S. Department of State, “The Global Coalition to Defeat ISIS,” 2018, < <https://www.state.gov/s/seci/> >.

participation in (and cost-sharing with) a coalition of partnering countries focused on addressing security concerns in a single country.

One clear example of an activity in this category is the multilateral efforts in 2014 that saw Syrian chemical weapons materials leaving Latakia port under the protection of Russian and Chinese-assisted security forces on Danish and Norwegian ships on their way to commercial incineration facilities in the United Kingdom and Germany and coordinated by the U.S.<sup>66</sup> Similarly, the Joint Comprehensive Plan of Action (JCPOA)—which seeks to reduce the threat of a possible military nuclear program—coordinated between a multilateral coalition (e.g., China, France, Germany, Russia, the United Kingdom and the U.S.) and an individual country (e.g., Iran)<sup>67</sup> represents an engagement activity that does not fall within the traditional CTR umbrella, but still falls within this framework category.

The CTR Possible Futures Framework captures the geographic and methodological expansion of related efforts to reduce WMD threats. This framework also offers an expanded problem space and helps situate the evolution of CTR engagements from destroying nuclear warheads to capacity building (e.g., border security and emergency response). In addition, the CTR Possible Futures Framework allows for an expanded set of solutions to face new challenges to WMD threat reduction. One clear example of such a new challenge is the possibility of needing to remove nuclear warheads or special nuclear material from a failed state (e.g., one specific example of CTR efforts in “semi-permissive” environments). This challenge sits at the intersection of threat reduction and counter terrorism efforts to reduce global nuclear dangers. Here, the framework allows the preferences of the sitting Presidential Administration and Congressional profile to be at the forefront of determining what type of CTR-related action to take, whether it be a U.S.-led bilateral or a U.S.-membered multi-lateral coalition effort. Similarly, the capacity level of the failed state and its immediate neighbors may also influence the type

---

<sup>66</sup> Weber & Erokhina 2015.

<sup>67</sup> For more, please see read the original U.S. documents at U.S. Department of State, “Joint Comprehensive Plan of Action,” 2018, < <https://www.state.gov/e/eb/tfs/spi/iran/jcpoa/> >.

of CTR-action to take. In addition, the framework could possibly even identify CTR-related actions to take before the immediate need to remove materials of concern exists (e.g., capacity building in surrounding countries).

### **Technical Capabilities to Support the CTR Possible Future(s)**

As CTR has evolved in response to changes in objectives, new partners, dynamic threats, willingness of partners, expanded geography and possible engagement mechanisms, so has the related “scorecard” of metrics used to illustrate the program’s effectiveness. In the 1990s, effectiveness was directly tied to numbers of warheads removed (either transported to more secure locations, dismantled or destroyed) from former Soviet Union countries. This expanded in the early 2000s, exemplified in the 2004 CTR Scorecard<sup>68</sup> incorporating the following metrics of effectiveness: former Soviet nuclear warheads separated from missiles; ICBMs and mobile launchers destroyed; ICBM silos eliminated; strategic bombers eliminated; nuclear air-launched cruise missiles destroyed; SLBM launchers eliminated; strategic submarines destroyed; nuclear test tunnels and holes sealed; and, metric tons of chemical weapons stored awaiting destruction.

More recently, the 2014 CTR Scorecard<sup>69</sup> metrics have been placed into four categories: (1) strategic offensive arms elimination, which includes the number of warheads deactivated, missiles (ICBMs + SLBMs +ASMs) destroyed, launchers and silos destroyed and submarines dismantled; (2) chemical weapons destruction, which includes tons of agents destroyed and number of sites secured; (3) global nuclear security, which includes the number of sites secured, nuclear tunnels and holes sealed and shipments of special nuclear materials to origin countries; and (4) cooperative biological engagement program, which includes the number of pathogen collections consolidated and labs and/or sites secured. Following current trajectories, metrics to support future evolution(s) in

---

<sup>68</sup> Senator Richard Lugar, (2004) “Eliminating the Obstacles to Nunn-Lugar,” *Arms Control Today*, March 1, 2004, <[http://www.armscontrol.org/act/2004\\_03/Lugar](http://www.armscontrol.org/act/2004_03/Lugar)>.

<sup>69</sup> Defense Threat Reduction Agency. (2014) “CTR Program Measures and Counts: Scorecard,” Fiscal Year 2013, <<http://www.dtra.mil/Portals/61/Documents/CTR%20Scorecards/Nunn-Lugar%20CTR%20Scorecard%202014.pdf>>.



CTR will likely “be much harder...[and] difficult to quantify, much less take credit for.”<sup>70</sup> Thus, future evolution(s) should emphasize metrics of “engagement *to what end*...[where] Capacity building is one excellent example of an end...that can actually be measured.”<sup>71</sup>

Technical capabilities for possible CTR futures will be influenced by this evolutionary expansion of scorecard metrics. As much as any other aspect of CTR programs, maintaining a broad set of capabilities has been critical to being able to address unexpected and emerging threats. Lessons learned from early CTR successes in monitoring the movement and dismantlement of nuclear warheads helped drive current capabilities in monitoring and dismantling chemical agent and biological pathogen related facilities. Technical capabilities that support current CTR metrics include warhead dismantlement (e.g., tags and seals on separated warhead components), chemical agent disposition (e.g., incineration facilities), biological pathogen consolidation (e.g., containment freezers) and nuclear material security (e.g., access control systems for storage facilities).

In addition, the future evolution of CTR will likely necessitate the development of technical capabilities and the need for new, supporting metrics. For example, any increased CTR emphasis on human capacity building<sup>72</sup> will likely include such “soft metrics” as changes in nuclear security culture or center of excellence (COE) measures of success (e.g., participant throughput, types of course taught, subject matter expert (SME) exchanges, joint research projects). Associated technical capabilities might include security culture assessment tools, mechanisms for U.S. SMEs to assist with COE courses and frameworks supporting joint research projects related to CTR objectives. Another example stems from the possibility of CTR shifting toward an increased focus on confidence-building measures. Associated technical capabilities might include common databases of threat-related information (e.g., Radiation Measurements Cross-Calibration

---

<sup>70</sup> Holgate 2017.

<sup>71</sup> Holgate 2017, emphasis added by authors.

<sup>72</sup> Weber & Erokhina 2015.

program in the Middle East<sup>73</sup>), secured communications networks, expanded monitoring/verification technologies and situational awareness technologies. Additionally, technical capabilities related to recent inclusion of emergency preparedness and response include CBRN emergency planning and response trainings, as well as portable, robust and accurate CBRN material detectors and analysis capabilities. Lastly, any shift in CTR emphasis toward CBRN weapons or materials security (in place) presumes technical capabilities in security technologies that can be rapidly deployed, run on low power or are sustainable in uncooperative environments.

Each of the categories in the CTR Possible Futures Framework also present additional requirements on possible future technical capability needs. Whereas traditional CTR efforts (e.g., the “One for One” category) were based on technologies that may/may not be proprietary and maintenance was covered by the U.S. (at least for a fixed time period), future CTR efforts will face additional constraints. For example, the “One for All” category will need to develop technologies that are non-proprietary, implementable across different levels of supporting infrastructure and maintainable by the host region. Technologies supporting the “All for One” category will also need to be non-proprietary, but must also be (ideally) commonly available amongst coalition partners and maintainable by the host country. Similarly, technologies supporting the “All for All” category will need to be non-proprietary, (ideally) commonly available amongst coalition partners and maintainable by host region, but must also be implementable across different levels of supporting infrastructure. Lastly, technologies supporting the “One for One” and “One for All” categories are likely to be U.S. self-developed capabilities, whereas those supporting the “All for One” and “All for All” categories may need to co-development technical solutions.

---

<sup>73</sup> Amir H. Mohagheghi, Al-Sharif Nasser Bin Nasser and Mathew Sternat, (2015) “The Radiation Measurements Cross Calibration (RMCC) Project,” *Forum on International Physics* (College Park, MD: American Physical Society, 2015), <<https://www.aps.org/units/fip/newsletters/201509/rmcc.cfm>>.

## **Options Across Future Evolution(s) of Cooperative Threat Reduction**

Based on the discussion of CTR's evolutionary history, possible futures framework and prospects for technical capabilities to support the possible CTR futures, this paper offers four options for how CTR might evolve to continue achieving U.S. threat reduction objectives.

### ***Option 1: Maintain strong, wide-ranging threat reduction activities***

This option would include maintaining current policy support in and technical innovations for threat reduction that would allow the current evolution of CTR to continue. This option would seek to leverage past CTR successes and current engagement trends to identify new threat reduction opportunities. More specifically, this option would attempt to best match varying levels of cooperative activities to specific threat reduction needs and continue to utilize the entire CTR Possible Futures Framework. Given the current trends of more narrowly-scoped work with Russia and China, growing U.S. emphasis on securing WMD-related materials in place and increasing regional tensions, one variant of this option might be to define the government-to-government agreements more broadly to enable more flexibility within lab-to-lab or Track II activities, and decision-making among the parties to those activities. Similarly, technical development would stay on pace with current engagement trends and on par with the expected evolution of related projects (e.g., technology support for capacity building).

This option would not result in a dramatic shift in either the amount of U.S. influence over or appetite for collaboration in CTR-related activities. It would also continue recent trends for a wider-ranging, more fluid set of common threat definitions—ultimately suggesting an emphasis on the “One for One” and “One for All” CTR Possible Future Framework categories.

### ***Option 2: Scale down activities with emphasis on the most significant threats***

A second option would be to reduce the current path of threat reduction activities. This option could include categorical reductions, including fewer government-to-government agreements and smaller scale lab-to-lab or Track II activities. Or this option could include

reducing current policy support in and limiting innovations for threat reduction, thereby restricting the current evolution of CTR. There are two possible variants of this option in the face of current geopolitical and programmatic trends influencing CTR.

*Option 2(a): Leverage past CTR successes and current engagement opportunities to best match varying levels of cooperative activities to reduce threats in more narrow sets of specific cases*

In this specific variant of the second option, the lessons learned and momentum generated by historical CTR efforts would be focused on achieving a smaller set of CTR-related objectives. This option would seek to match specific activities to achieve specific threat reduction targets. While the overall CTR program would be reduced, this option would consider activities from across the entire CTR Possible Futures Framework but choose to more selectively engage on a case-by-case basis. More specifically, this approach might select either engagement with Russia via a “One for One” strategy or China via an “All for One” strategy or securing WMD in place in North Korea via an “All for All” strategy. Technology development in this option would focus on optimizing a select set of capabilities to better serve reduced efforts across continuing engagements.

This option would result in varied levels of U.S. influence and appetite for collaboration, but the shift toward efficiently addressing more selective dangers or locations would likely result in higher likelihoods that a common threat definition could be identified. Pursuing this option would leverage the entire CTR Possible Futures Framework, but result in a reduced continuation of CTR’s wide-ranging legacy of success.

*Option 2(b): Leverage past CTR successes and current engagement opportunities to focus on ONE possible future (e.g., “All for All” or “One for All”) and associated strategies to best varying levels of match cooperative activities to reduce threats in specific cases.*

In this specific variant of the second option, future CTR engagement would focus on one particular category of the CTR Possible Futures Framework. This option would allow a decrease in overall policy and innovation support to threat reduction activities, but would

concentrate the smaller set of resources on a strategy that aligns with the objectives of the sitting U.S. administration. For this option, CTR-related efforts would become more narrowly scoped and clearly defined by the strategic constraints of the selected CTR Possible Futures Framework category. More specifically, this approach might select either engagement with Russia, China or securing WMD in place in North Korea, each via an “All for All” strategy. Technology development in this option would focus on expanding the set and depth of capabilities to better serve enhanced efforts in a narrower suite of engagements.

This option would result in a level of U.S. influence, commonality in threat definition, and appetite for collaboration directly shaped to fit the desires of the sitting U.S. Administration. Pursuing this option leverages the CTR Possible Futures Framework to leverage past successes from a particular category and would result in a CTR portfolio most clearly aligned with current Administration policies.

***Option 3: Expand strong, wide-ranging threat reduction activities***

The option would include categorical expansion of government-to-government agreements and lab-to-lab or Track II threat reduction activities. This option would include increasing current policy support in and innovations for cooperation in threat reduction, thereby accelerating the current evolution of CTR. More specifically, this option would leverage past CTR successes to expand opportunities for matching the full suite of potential of cooperative activities outlined in the CTR Possible Futures Framework to achieve threat reduction objectives (similar to calls in the 2009 NAS report). This option would treat the current trends of more narrowly-scoped work with Russia and China, growing U.S. emphasis on securing WMD-related materials in place in rogue states, and increasing regional tensions as a call to develop a more expansive and innovative set of CTR efforts. This option also better positions CTR to successfully engage in “semi-permissive” environments. More specifically, this approach might seek to engage with Russia via a “One for One” strategy, China via an “All for One” strategy and securing WMD in place in North Korea via an “All for All” strategy. Technology development in this option would need the flexibility and scalability to expand and

support a larger set of capabilities to better serve a growing suite of engagement efforts.

This option would likely result in an increase in U.S. influence over CTR, as the U.S. could leverage both its unilateral activities and participation in multilateral activities (presupposed by an increased appetite for collaboration) as evidence of its leadership in threat reduction. This in turn would result in a higher likelihood of identifying common threat definitions across a broader spectrum of issues. Pursuing this option would leverage the CTR Possible Futures Framework as a guide for identifying innovative threat reduction solutions to best fit a wider range of emerging threats.

#### ***Option 4: Eliminate CTR-related activities***

This last option would include categorical cancelation of all activities currently associated with CTR. The evolution across and innovation within government-to-government agreements, lab-to-lab engagements, and Track II activities with collaborating entities would be eliminated. Ostensibly, past CTR successes would be replaced by developing new mechanisms for achieving similar threat reductions that are more attuned to a more competitive global environment. Ideally, lessons from CTR's history would be incorporated into such new mechanisms, but CTR's emphasis on cooperation challenges the ability for its successes to be incorporated into more a more competitive, zero-sum mindset for threat reduction.

This option would likely result in a focus on the primacy of U.S. influence in unilateral measures to reduce threats identified and defined by the sitting U.S. Administration. Though indirect, such activities are logically consistent with the conceptual limits of the "One for One" and "One for All" categories of the CTR Possible Futures Framework.

#### **Conclusions**

Cooperative Threat Reduction (CTR) engagements have a proven track record that began with the bi-lateral engagement between the U.S. and the Former Soviet Union and ended with CTR becoming a fundamental mechanism for global security. This evolution was shepherded by changes in the desired levels of U.S. influence and appetite for

collaboration of sitting U.S. Administrations, as well as the ability to generate common threat definitions with partnering countries. Using these evolutionary drivers, the CTR Possible Futures Framework provides a tool by which to evaluate different policy options for navigating different potential CTR trajectories for reducing emerging threats in a more complex global environment. Leveraging CTR past success can act as stabilizing force in changing geopolitical tides and lay the foundation for future evolutions to expand the areas and topics of engagement. For example, former Senators Sam Nunn and Richard Lugar recently argued that

In the context of a more stable Korean Peninsula, we can look broadly to CTR as a model. A broad-based plan for cooperative activities in North Korea would provide incentives for the Kim regime to comply with difficult commitments and strict verification and monitoring that will necessarily be part of a serious denuclearization agreement.<sup>74</sup>

Calls for future CTR trajectories from the 2017 NAS Symposium echo the policy options related to the CTR Possible Futures Framework. Consider, for example, how Acting Deputy Assistance Secretary of State for Nonproliferation Programs Phil Doliff noted a need for “third generation CTR programs that are more flexible and responsive”<sup>75</sup> and former Deputy Assistant Secretary of State for Emerging Security Challenges and Defense Policy Mallory Stewart asserted that the U.S.

harnessed the capabilities we already had, and the experience working cooperatively with other countries through CTR, to design a program and create a multilateral

---

<sup>74</sup> Sam Nunn and Richard Lugar, “What to do if the talks with North Korea Succeed,” *The Washington Post*, April 23, 2018, < [https://www.washingtonpost.com/opinions/global-opinions/were-all-preparing-for-the-trump-kim-summit-to-go-wrong-but-what-if-it-goes-right/2018/04/23/77ada258-472c-11e8-9072-f6d4bc32f223\\_story.html?utm\\_term=.a1adde814c3a](https://www.washingtonpost.com/opinions/global-opinions/were-all-preparing-for-the-trump-kim-summit-to-go-wrong-but-what-if-it-goes-right/2018/04/23/77ada258-472c-11e8-9072-f6d4bc32f223_story.html?utm_term=.a1adde814c3a)>.

<sup>75</sup> NAS 2018, p. 5.

coalition to [remove and dispose of chemical weapons and material stocks in Syria] quickly.<sup>76</sup>

When combined with the implications for desired levels of U.S. influence on outcomes, the ability to generate a common threat definition, and the appetite for collaboration, the U.S. is likely to pursue either “leveraging past CTR successes and current engagement opportunities to best match varying levels of cooperative activities to reduce threats in more narrow sets of specific cases” (Policy Option 2(a)) or “expanding strong, wide-ranging threat reduction activities” (Policy Option 3). In so doing, future CTR efforts should be prepared to leverage the similar emphasis on multilateral engagement and a “demand pull” between what Ambassador Laura Holgate calls “cooperative risk management”<sup>77</sup> and the “All-for-All” and “All-for-One” categories of the CTR Possible Futures Framework.

As global threats evolve and spread from single countries and regional settings to a global scale, CTR-type engagements will need to be tailored and not based on a “one-size-fits-all” formula. In order to meet calls for next generation CTR to be fast, flexible, and threat-driven, participants in the 2017 NAS Symposium argued that the “cooperative part” is uniquely valuable in today’s interconnected world, ultimately concluding that CTR programs should both continue to address the traditional mission of WMD elimination and mitigate emerging threats from new technologies (e.g., additive manufacturing or cyber systems).<sup>78</sup> Maintaining core capabilities (e.g., a mutually agreed upon focus on threat reduction) and supporting functions (e.g. high level support for flexible and rapid response) that led to CTR’s legacy of success across possible future evolutions is necessary for reducing tomorrow’s global threats.

---

<sup>76</sup> NAS 2018, p. 3.

<sup>77</sup> Holgate 2017.

<sup>78</sup> NAS 2018.



**Acknowledgements**

We would like to thank our colleagues at Sandia National Laboratories (Dr. Amir Mohagheghi, Dr. Jason Reinhardt, Dr. Sheryl Hingorani and Eric Wallace), Lawrence Livermore National Laboratory (Dr. Brad Roberts) and Los Alamos National Laboratory (Dr. Brad Beck and Dr. Kory Sylvester) for their comments throughout the development of this article. We would also like to thank the anonymous journal reviewers for their insightful comments.