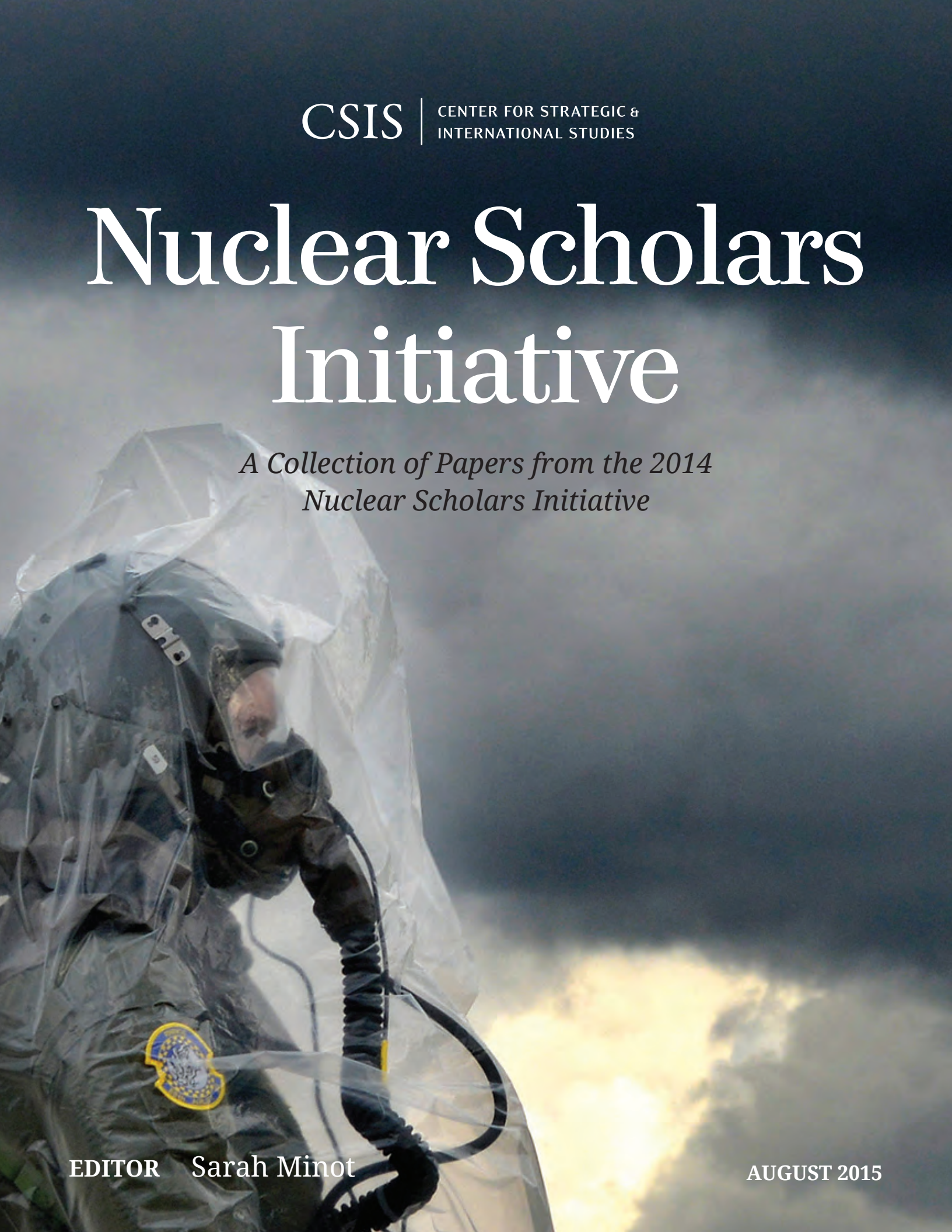




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Nuclear Scholars Initiative

*A Collection of Papers from the 2014
Nuclear Scholars Initiative*

EDITOR Sarah Minot

AUGUST 2015

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Many of the most pressing national and international security challenges are tied to nuclear weapons. The need to reduce the prevalence of nuclear weapons globally and prevent their use by states and nonstate actors runs parallel with the need to maintain certain nuclear capabilities and the intellectual assets that support them. Both tracks present long-term challenges that, to be managed, will require sustained effort by talented and dedicated professionals. The Project on Nuclear Issues (PONI) seeks to help improve the effectiveness of U.S. nuclear strategy and policy through professional development and networking activities that target the next generation of leaders in the field.

PONI maintains an enterprise-wide membership base; hosts four major conferences and several smaller events each year; maintains an online blog; holds live debates on critical nuclear weapons issues; runs a six-month academic program for young experts; organizes bilateral exchanges involving young experts from the United States and abroad; and distributes regular news and event announcements to members. More information can be found at www.csis.org/isp/poni.

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Introduction and Acknowledgments

Sarah Minot

Addressing an increasingly complex array of nuclear weapons challenges in the future will require talented young people with the necessary technical and policy expertise to contribute to sound decisionmaking on nuclear issues over time. To that end, the CSIS Project on Nuclear Issues (PONI) runs a yearly Nuclear Scholars Initiative for graduate students and young professionals. Those accepted into the program are hosted once per month at CSIS in Washington, DC, where they participate in daylong workshops with senior government officials and policy experts. Over the course of the six-month program, scholars are required to prepare a research paper. This volume is a collection of those papers.

PONI owes many thanks to the outstanding Nuclear Scholars Class of 2014 for their dedication and outstanding work. Special thanks are due to the senior experts who provided mentorship for the research papers, including Linton Brooks, Frank von Hippel, Edward Ifft, George Quester, Jeffrey Lewis, Frank Miller, Chris Twomey, Rich Wagner, William Tobey, Steve Henry, Scott Sagan, and George Perkovich. PONI would also like to thank all the experts who came to speak to the nuclear scholars during their workshop sessions. The Nuclear Scholars Initiative could not function without the generosity of these knowledgeable individuals.

PONI would like to thank our partners, especially the Defense Threat Reduction Agency and the National Nuclear Security Administration, for their continued support. Without them, the Nuclear Scholars Initiative would not be possible.

The following papers from the 2014 Nuclear Scholars Initiative were produced during a six-month program from January to June 2014. The papers were finalized in December 2014, and their content reflects information, views, and opinions from the 2014 program timeline. All views, positions, and conclusions expressed herein are solely those of the authors and do not reflect any official institutions or affiliations.

U.S.-China Nuclear Dynamics in the Context of a New Model of Major Power Relations

Seongjin James Ahn¹

Bearing in mind the potential security risks of failing to properly manage U.S.-China nuclear dynamics in the future, the larger purpose of this chapter is to explore ways in which U.S.-China nuclear dynamics can be taken to new levels of official engagement and cooperation. The objective of this chapter is to consider the prospects and implications of framing U.S.-China nuclear dynamics in the new model for major power relations. Placing U.S.-China nuclear dynamics in the context of a new model for major power relations has its challenges. For one thing, the new model is simply not a mature concept. Moreover, China generally seems outright uninterested in official discussions with the United States over nuclear cooperation. However, a new model of major power relations may be an opportunity for China and the United States to set a new tone for building trust and prioritize nuclear issues in the bilateral relationship. First, this chapter will briefly describe what the new model of major power relations is. Second, the new model's main challenges, gaps, and opportunities will be discussed. Third, the chapter will begin to explore issues of appropriateness, feasibility, and policy utility in framing U.S.-China nuclear relations in the new model of major power relations.

Introduction

There is a growing imperative in the twenty-first century for deeper cooperation between China and the United States on nuclear weapons issues. Presently, security tensions among countries in Asia are on the rise. The source of these tensions is primarily driven by maritime territorial disputes—in which China is a claimant in multiple cases—but these conflicting claims also have direct implications for broader security dynamics, including

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nuclear issues. As the security dynamics in Asia change, it is increasingly important for China and the United States to remain engaged with each other on nuclear weapons issues with a view toward strengthening communication, regional peace, and strategic stability. To date, nuclear dynamics between the two countries have been relatively stable,² but this may not always remain the case. Although there is no imminent concern about a nuclear confrontation between China and the United States,³ the overall geopolitical environment in Asia is changing and there is always the risk that some form of conflict can occur that may directly or indirectly involve the two nuclear weapon states.

As China finds itself increasingly at odds with its neighbors, the heightened potential for conflict in the region has implications for nuclear weapons policies in both China and the United States. Renowned nuclear scholar Jeffrey Lewis asserts that nuclear issues are ultimately linked to broad regional security issues, and vice versa. He states, “While nuclear issues do not always play an explicit role in these dynamics, they are a major component of the broader geopolitical environment within which all players evaluate risk.”⁴ Lewis further explains that for countries like China and the United States, where nuclear weapons play a more concrete role in bilateral relations (as opposed to countries that do not possess nuclear weapons), “broader strategic interactions and issues of the relationship *cannot be separated* from the nuclear dynamics.”⁵

Bearing in mind the current security environment in Asia and the notion that nuclear issues are inextricably linked to overall security matters, China and the United States should not neglect or suspend deeper cooperation over nuclear weapons, as important questions continue to mount. What are the implications of contemporary regional dynamics in Asia on China’s nuclear posture? Will constant maritime confrontations cause China to feel politically isolated and strategically enclosed? Will isolation and conflict drive China to change its nuclear policy, augment its nuclear posture, or further modernize its nuclear forces? How does the current U.S. “rebalance to Asia” policy (which is broadly viewed in China as a policy of containment)⁶ impact China’s nuclear posture? For China, what changes in Asia’s security environment might impact U.S. nuclear policy? Are tensions in the region affecting U.S. posture of extended deterrence? Are U.S. military assets in the theater a growing challenge to China’s nuclear forces?

Rather than risking future nuclear tensions due to a lack of communication, understanding, or coordination, China and the United States could utilize official channels to address and bring clarity to some of these questions and issues. Such efforts would also

2. Elbridge Colby and Abraham Denmark, eds., *Nuclear Weapons and U.S.-China Relations: A Way Forward*. A report of the PONI Working Group on U.S.-China Nuclear Dynamics (Washington, DC: CSIS, 2013).

3. Ibid.

4. Jeffrey Lewis, “China’s Nuclear Modernization: Surprise, Restraint, and Uncertainty,” in *Strategic Asia: 2013-14: Asia in the Second Nuclear Age*, ed. Ashley J. Tellis, Abraham M. Denmark, and Travis Tanner (Washington, DC: National Bureau of Asian Research, 2013).

5. Ibid. Emphasis added.

6. Bonnie S. Glaser, “Pivot to Asia: Prepare for Unintended Consequences,” in *CSIS Global Forecast 2012: Risk Opportunity, and the Next Administration*, ed. Craig Cohen and Josiane Gabel (Washington, DC: CSIS, 2012), http://csis.org/files/publication/120413_gf_glaser.pdf.

benefit the entire region. In 2013, a working group of U.S.-China nuclear relations experts at the Center for Strategic and International Studies (CSIS) Project on Nuclear Issues (PONI) underscored the importance of deepening bilateral cooperation. They recommended in a report that “Active steps should be taken to avoid conflict and successfully manage U.S.-China nuclear dynamics.”⁷ But how can this be accomplished?

An essential question to ask is: are the current channels or mechanisms for managing U.S.-China nuclear dynamics adequate to address both the emerging and traditional challenges between the two states? And would bilateral nuclear dynamics improve if a new framework for discussing the issues were introduced? Over the last decade or so, U.S. and Chinese scholars and experts on nuclear weapons issues have been engaged in multiple track 1.5/2 forums, with the objective of providing clarity on each country’s stance on nuclear weapons. In the absence of official government-to-government-level exchanges on nuclear issues, these dialogues have been instrumental in meaningfully advancing the discussions, and important practical achievements have been made through them. While the participants of the dialogues have done excellent work to skillfully communicate and establish understanding around challenging nuclear issues, by their nature the forums themselves are limited in their capacity to manage U.S.-China nuclear dynamics because they are not official channels. Furthermore, progress via these forums tends to be incremental, and discussions are restricted by a basic lack of trust between the two countries.

In order to see significant progress, perhaps what is necessary for the future of U.S.-China nuclear dynamics is an entirely new context for nuclear management. In particular, a framework could be developed that elevates nuclear issues to discussions between top-level authorities in both countries. Furthermore, such a framework should account for the shifting security environment in Asia; be conducive to changing and improving general attitudes toward nuclear cooperation and facilitate openness; explore mutual security incentives that encourage the two countries to look beyond historical issues; and establish a fresh tone for building trust.

Objective, Approach, and Limitations

In the last two years, a new concept in the U.S.-China bilateral policy sphere has emerged called a *new model for major power relations*. This concept broadly refers to a new approach to enhancing relations between the two major powers. Although the concept has already gained some traction among top officials in both countries, so far it remains ambiguous as to what a new model for major power relations is. There is no clear agreement about the new model—besides the fact that it generally signifies a mutual interest in improving bilateral relations. There have been many in both China and the United States who have attempted to define what a new model should be, including Chinese government officials who have offered their views through a number of public speeches. Although some in the United States are optimistic about the new concept’s potential for improving bilateral

7. Colby and Denmark, *Nuclear Weapons and U.S.-China Relations*.

relations, others, including government officials, seem hesitant without having further clarification about what it entails.

Despite its current ambiguous status, the fact that the concept of a new model for major power relations is still in a malleable state may be a valuable opportunity for policy influencers to shape it. It may be worth considering how a new model could be a viable and promising vehicle for the way forward in U.S.-China nuclear dynamics. So far, nuclear issues have not been seriously considered as a component in the new model for major power relations. Although it would be naïve to think that any single policy or framework could be a panacea to the many challenges related to managing U.S.-China nuclear dynamics, the idea merits some exploration.

Bearing in mind the potential security risks of failing to properly manage U.S.-China nuclear dynamics in the future, the larger purpose of this chapter is to explore ways in which U.S.-China nuclear dynamics can be taken to new levels of engagement and cooperation. The objective of this chapter is to consider the prospects and implications of framing U.S.-China nuclear dynamics in the new model for major power relations, and whether doing so would actually contribute to improving the status quo of U.S.-China nuclear relations. First, the *new model of major power relations* is briefly described. Second, the main challenges, gaps, and opportunities of the new model are discussed. Third, some of the practical challenges and value of placing nuclear issues in the new model are explored.

It is important to acknowledge that there are some clear limitations of this chapter. First, it is not a comprehensive study. It merely attempts to introduce the idea of prioritizing nuclear issues in the new model, and in doing so it just scratches the surface. Second, as noted above, the concept for a new model for major power relations is not yet an official policy or agreement adopted by China and the United States. Official guidelines for this concept are lacking, and it remains a wonder whether the concept will ever amount to anything more than a new slogan that attempts to shine a positive light on an important bilateral relationship in international affairs. However, despite these limitations, this chapter attempts to contribute to the improvement of U.S.-China nuclear dynamics and to add to the ongoing policy discourse about what the concept for a new model of major power relations should look like and entail.

A New Model of Major Power Relations⁸

In the context of a China that is rising in global affairs, the idea for a new model of major power relations between China and the United States was put forward as an answer to the disturbing conundrum that has historically afflicted emerging and established powers—a

8. The following resources were used as research for the analysis in this paper: CSIS Project on Nuclear Issues, 2014 Nuclear Scholars Initiative meetings; meetings and interviews with both Chinese and American nuclear scholars in the United States; and secondary source research.

problem referred to as the “Thucydides trap.”⁹ In an article published in *New Statesman* on July 18, 2012, former Secretary of State Hillary Clinton poignantly described the dilemma by simply asking, “Could the US and China write a new answer to the old question of what happens when an established power and rising power meet?”¹⁰

On one end of the spectrum, there are some experts, such as John J. Mearsheimer of the University of Chicago, who have a critical outlook on the future of U.S.-China relations and believe that conflict is inevitable. In the essay entitled, “Can China Rise Peacefully?” Mearsheimer argues, “The result will be an intense security competition with considerable potential for war. In short, China’s rise is unlikely to be tranquil.”¹¹ Others, however, believe that resigning to Mearsheimer’s version of the future is both unacceptable and unnecessary. On the other end of the spectrum, there are those who are more optimistic about the ability to manage U.S.-China relations and avoid repeating history’s Thucydides trap. For instance, Joseph Nye of Harvard University asserts that “power is not always a zero sum game,” and, “it is a mistake to allow historical analogies to determine our thinking.”¹² In an article for *China-U.S. Focus*, he further stated, “Given the global problems that both China and the United States will face, they have much more to gain from working together than in allowing overwrought fears to drive them apart,” and, “we should be asking how China and the US can create a new great power relationship.”¹³

Although the pundits at both ends of the spectrum have valid views about the potential future of U.S.-China relations, what is important is that political leaders in both China and the United States understand the great costs of engaging in conflict and thus have an interest in avoiding it. By exploring a new model for major power relations, leaders are attempting to design a new course for China and the United States in order to avoid unnecessary conflict. With regard to nuclear weapons, developing a new course that avoids the pitfalls encountered by two other major powers, Russia and the United States during the Cold War, may prove essential for U.S.-China relations and the overall regional security in the Asia-Pacific.

CHARACTERISTICS

The concept for a new model of major power relations between China and the United States was initially introduced to the public during a speech given by then Vice President Xi Jinping in February 2012.¹⁴ Ever since, a plethora of literature, commentary, and media reports on the concept has emerged in both countries, often by pundits seeking to explain

9. Robert B. Zoellick, “U.S., China and Thucydides,” *National Interest*, July–August 2013, <http://nationalinterest.org/article/us-china-thucydides-8642>.

10. Hillary Clinton, “The art of smart power,” *New Statesman*, July 18, 2012, <http://www.newstatesman.com/politics/politics/2012/07/hillary-clinton-art-smart-power>.

11. John J. Mearsheimer, “Can China Rise Peacefully?,” *National Interest*, April 8, 2014, <http://nationalinterest.org/commentary/can-china-rise-peacefully-10204>.

12. Joseph Nye, “A New Great Power Relationship?,” *China-US Focus: Foreign Policy*, February 26, 2013, <http://www.chinausfocus.com/foreign-policy/a-new-great-power-relationship/>.

13. Ibid.

14. Xi Jinping, “Speech by Vice President Xi Jinping at Welcoming Luncheon Hosted by Friendly Organizations in the United States (February 15, 2014),” *China-US Focus*, February 15, 2012, <http://www.chinausfocus>

why it is important and what it should be. In China, much of the literature is based on Xi's original vision, which China's foreign minister Wang Yi explained in a September 2013 speech at the Brookings Institute;¹⁵ Xi's vision for a new model is based on three "essential features": no conflict or confrontation, mutual respect, and win-win cooperation. In a nutshell, Foreign Minister Wang said that Xi's view of implementing the new model would require the following commitments:

1. Enhancing strategic trust: strengthening the foundations of the bilateral relationship by understanding that China does not have intentions of replacing the United States' position in the world;
2. Promoting practical cooperation: building the relationship on shared interests such as trade and investment;
3. Garnering public support: enhancing people-to-people cultural exchanges to gain wide public support in both countries, becoming increasingly more mutually tolerant and inclusive, and building trust;
4. Strengthening cooperation on important international issues: issues that may include cyber security, climate change, and global conflicts, as in the Middle East;
5. Prioritizing cooperation in Asia: focusing the building of a new model on Asia, where China and the United States have the greatest mutual interests.

Needless to say, these commitments are broad and would be applicable to a wide range of issues concerning U.S.-China relations. Many (if not all) of these features are also applicable to how U.S.-China nuclear dynamics could be managed moving forward. Bolstering support for Xi's idea, authorities in China have written extensively in support of a new model of major power relations, including figures such as Yu Hongjun, the vice minister of the International Department for the Central Committee of the Chinese Communist Party and president of the China Center for Contemporary World Studies. Hongjun wrote, "In the course of building a new-type China-U.S. relationship, both sides should realize . . . that the success of building such relationship serves the interests of both countries and all people in the world."¹⁶

Unlike the Chinese administration, government officials in the United States have not provided a similar type of official outline for a new model for major power relations. However, many U.S. scholars and experts have written about it, generally capturing similar broad and positive principles, but each with their own view of how it should be

.com/library/government-resources/chinese-resources/remarks/speech-by-vice-president-xi-jinping-at-welcoming-luncheon-hosted-by-friendly-organizations-in-the-united-states-february-15-2012/.

15. Wang Yi, "Toward a New Model of Major-Country Relations Between China and the United States" (speech, the Brookings Institution, June 20, 2013), <http://www.brookings.edu/~media/events/2013/9/20%20us%20china%20foreign%20minister%20wang%20yi/wang%20yi%20english%20prepared%20remarks.pdf>.

16. Yu Hongjun, "China and the United States: Building New Relations Between Major Powers," *China Institute of International Studies*, November 25, 2013, http://www.ciis.org.cn/english/2013-11/25/content_6486747.htm.

approached and what it should entail.¹⁷ There are important nuances among them, which are clear in the literature, but an overarching sentiment that seems to unite the perspectives in the United States is one of serious interest and caution. In comparison to their Chinese counterparts, U.S. scholars seem relatively more reticent toward accepting a new model for bilateral relations without a deeper understanding of the details.¹⁸

Despite the concept being confronted with some skepticism,¹⁹ there is still interest in the foreign policy community in what a new model can potentially achieve for the future of U.S.-China bilateral relations and for the broader peace and stability of the region. In a positive sign, scholars and experts from both countries have collaborated to publish joint studies on the topic. For instance, American and Chinese think tanks and scholars joined the efforts through the Center for American Progress to compile a lengthy report entitled, “U.S.-China Relations: Toward a New Model of Major Power Relationship.”²⁰ Indeed, it would be beneficial if China and the United States approached a new model for major power relations with circumspection and thoughtful planning on key issues that are of importance to bilateral relations, including nuclear weapons.

Perhaps the most significant feature of the new model for major power relations is that leaders at the highest levels of government in both countries have shown support for the notion.²¹ In June 2013, while hosting President Xi at Sunnylands, California, President Barack Obama described how one of the broader purposes of their meeting was to explore the concept further: “Our thought was that we would have the opportunity for a more extended and more informal conversation in which we were able to share both our visions for our respective countries and how we can forge a new model of cooperation between countries based on mutual interest and mutual respect.”²² Thus, at the presidential level in both countries, there is a willingness to explore how a new model of major power relations might be beneficial for bilateral relations. National Security Advisor Susan Rice reiterated the administration’s position during a speech in Washington, DC, stating, “When it comes

17. In no particular order, Robert Zoellick, David Lampton, Stephen Hadley, Ely Ratner, Paul Haenle, and John Podesta are a few U.S. thinkers who have written about a new model for major power relations.

18. Yang Jiemian, Shao Yuqun, and Wu Chunsi, “Coexploring and Coevolving: Constructing a New Model of the Major Power Relationship between China and the United States,” in *U.S.-China Relations: Toward a New Model of Major Power Relationship* (Washington, DC: Center for American Progress, February 2014), <http://cdn.americanprogress.org/wp-content/uploads/2014/02/ChinaReport-Full.pdf>.

19. Michael S. Chase, “China’s Search for a ‘New Type of Great Power Relationship,’” *The Jamestown Foundation, China Brief* 12, no. 17 (September 7, 2012). http://www.jamestown.org/single/?tx_ttnews%5Btt_news%5D=39820&no_cache=1#.U6VkZI1dUhE.

20. Rudy deLeon and Yang Jiemian, eds., *U.S.-China Relations: Toward a New Model of Major Power Relationship* (Washington, DC: Center for American Progress, February 20, 2014), <http://americanprogress.org/issues/china/report/2014/02/20/84383/u-s-china-relations-toward-a-new-model-of-major-power-relationship/>.

21. On the same note, however, it is important to acknowledge that while the leaders in both countries agree that exploring a new model may be good for bilateral relations, as mentioned earlier, they have not agreed upon what the new model should be.

22. Barack Obama, “Remarks by President Obama and President Xi Jinping of the People’s Republic of China Before Bilateral Meeting” (remarks at Sunnylands Retreat, Palm Springs, CA, June 7, 2013), <http://www.whitehouse.gov/the-press-office/2013/06/07/remarks-president-obama-and-president-xi-jinping-peoples-republic-china->

to China, we seek to operationalize a new model of major power relations.”²³ In April 2014, Secretary of Defense Chuck Hagel met with China’s defense minister General Chang Wanquan in Beijing, where they jointly revealed intentions for developing a new model for U.S.-China military-to-military relations.²⁴ From China’s side, Foreign Minister Wang Yi also reiterated the importance of developing a new model for bilateral relations and provided deeper insights into the guidelines that Xi had laid out for achieving it.²⁵

Main Challenges to a New Model

If there is such interest from both top government authorities and foreign policy experts in both countries regarding a new model of major power relations, one might wonder why the concept, two years since it was introduced, has not been further developed in the form of an official policy, special communiqué, or joint statement. There are both extrinsic and intrinsic factors which may be limiting progress and the following are just two examples.

REGIONAL CHALLENGES

One key factor posing a challenge to a new model for major power relations is the current geopolitics in Asia. Lately, China is seen as an instigator of tensions in the region, particularly in the South China Sea. Its direct neighbors—Vietnam, the Philippines, Japan, South Korea, Taiwan, and others—flatly reject Beijing’s foreign policies and territorial claims.²⁶ Given the United States’ alliances in Asia and its “rebalance to Asia”²⁷ policy, which is viewed critically in Beijing as a policy of containment, the tensions that have arisen out of all these dynamics have inevitably complicated the relationship between China and the United States. These tensions are also easily exacerbated. In a recent example, Secretary Hagel stated in a speech at the Shangri-La Dialogue in Singapore that “in recent months, China has undertaken destabilizing unilateral actions asserting its claims in the South China Sea.”²⁸ These remarks were not well received in China.²⁹ Currently, Japan is also considering a reinterpretation or revision of its constitution, which could potentially

23. Susan E. Rice, “America’s Future in Asia” (Remarks As Prepared for Delivery by National Security Advisor at Georgetown University, Washington, DC, November 20, 2013), <http://www.whitehouse.gov/the-press-office/2013/11/21/remarks-prepared-delivery-national-security-advisor-susan-e-rice>.

24. Cheryl Pellerin, “Hagel, China’s Defense Minister Build Military Relations Model,” *U.S. Department of Defense: News*, April 8, 2014, <http://www.defense.gov/news/newsarticle.aspx?id=122006>.

25. Wang Yi, “Toward a New Model of Major-Country Relations.”

26. Such as China’s 9-dash line policy and its Air Defense Identification Zone.

27. Juliet Eilperin, “During Asia trip, Obama will renew effort to ‘rebalance’ U.S. relationship with the region,” *Washington Post*, April 20, 2014, http://www.washingtonpost.com/politics/during-asia-trip-obama-seeks-to-rebalance-americas-relationship-with-the-region/2014/04/20/055e3ba0-c73c-11e3-9f37-7ce307c56815_story.html.

28. Chuck Hagel, “Secretary of Defense Speech” (speech, As Delivered by Secretary of Defense Chuck Hagel, IISS Shangri-La Dialogue, Singapore, May 31, 2014), <http://www.defense.gov/Speeches/Speech.aspx?SpeechID=1857>.

29. Xinhua News Agency, “New model of China-U.S. relations lie in respect, equality: Senior Chinese officer,” *English People Daily*, June 1, 2014, <http://english.peopledaily.com.cn/n/2014/0601/c90883-8735461.html>.

enable Japan to take a stronger military posture in the region. Such change is generally welcomed by the United States,³⁰ but it is deeply unsettling to China.³¹

Until regional tensions subside to a level that would allow for better attitudes and the continuation of more meaningful conversations, it will be difficult for China and the United States to make further progress on a new model for major power relations. Generally, there is a sense that the appropriate attitudes requisite for more constructive dialogues are absent. One analyst criticizing the Chinese position wrote, “The most problematic aspect of Beijing’s vision of a ‘new type’ of U.S.-China relationship is that it appears to require Washington to accommodate China’s interests and to do so largely on Beijing’s terms—apparently without reciprocal adjustments.”³² A new model for relations should necessarily be a framework that aims to carefully balance the interests and values of the two countries—no matter how different or asymmetric—rather than merely a platform through which countries expect the acceptance of the other’s established position. Currently, it is unrealistic to expect an evenhanded approach to dialogues while countries and allies in the region are at risk of confrontation.

INTRINSIC CHALLENGES AND GAPS

Another challenge of the new model is that the model itself has gaps and is not ready for implementation. For one thing, key issues that should be fundamental components of a new model of major power relations are missing and have yet to be developed or even introduced. A prime example of this is the topic of U.S.-China nuclear relations.

Thus far, U.S.-China nuclear dynamics have not been a significant part of discussions about a new model of major power relations. The features of the new model, which have been discussed in the literature and delivered through speeches from both Chinese and American experts, include the following:

- Deepening economic cooperation through bilateral trade and investments;
- Improving cooperation and understanding of political systems;
- Strengthening communication and relations between military establishments;
- Enhancing cyber security;
- Managing competition over resources, including energy, water, and others;
- Improving the environment;
- Improving public health;

30. “Hagel Welcomes Japan’s New Collective Self-defense Policy,” *U.S. Department of Defense News*, July 1, 2014, <http://www.defense.gov/news/newsarticle.aspx?id=122591>.

31. Ministry of Foreign Affairs of the People’s Republic of China, “Foreign Ministry Spokesperson Hong Lei’s Regular Press Conference on July 1, 2014,” July 1, 2014, http://www.fmprc.gov.cn/mfa_eng/xwfw_665399/s2510_665401/2511_665403/t1170401.shtml.

32. Chase, “China’s Search.”

- Cooperating in space exploration;
- Working together in areas of instability, like the Middle East; and
- Confronting terrorism.

Again, U.S.-China nuclear relations are missing from this list. There has been mention of U.S.-China cooperation on the denuclearization of North Korea and the resolution of the Iranian nuclear issue,³³ but nothing that focuses solely on U.S.-China nuclear dynamics. Needless to say, nuclear weapons are important assets for so-called major powers³⁴ such as China and the United States. It is unclear why nuclear weapons issues have been overlooked and excluded from such an important new framework that is supposed to guide and manage bilateral relations into the future.

Encouragingly, there are apparent efforts to develop the new model with a broader military-to-military basis. Secretary of Defense Chuck Hagel recently stated,

As I underscored in Beijing last month during my visit to China, the United States will continue to advance President Obama and President Xi's shared commitment to develop a new model of relations—a model that builds cooperation, manages competition, and avoids rivalry. To help develop this model, we are increasing our military-to-military engagement with China through our joint exercises, exchanges, and other confidence-building measures that can help improve communication and build understanding between our forces.³⁵

Developing the broader military-to-military relationship between China and the United States is an important start to a new model, and ideally nuclear dynamics may eventually follow as an area of discussion in the new framework. In fact, given the sensitivity of the issues around U.S.-China nuclear dynamics, solidifying the broader military-to-military relationship may be a prerequisite for Obama and Xi to cooperate more effectively on issues related to nuclear weapons. Nevertheless, it may be prudent to introduce the nuclear issue as a key facet of a new model of major power relations on its own sooner rather than later, especially given the current geopolitical environment in Asia.

Considerations for U.S.-China Nuclear Dynamics in a New Model of Major Power Relations

APPROPRIATENESS

As described above, the essence of a new model of major power relations between China and the United States includes the following principles: avoidance of conflict and war; deepening mutual respect; and enhancing mutually beneficial cooperation. Deeper

33. Susan E. Rice, "America's Future in Asia."

34. With exceptions: North Korea is not a major power but possesses nuclear weapons.

35. Chuck Hagel, "Secretary of Defense Speech."

cooperation over nuclear weapons naturally supports each of the principles, and thus nuclear dynamics overall seems to be an appropriate fit for a new model of major power relations.

Not only does nuclear cooperation fit a new model of major power relations, but it also supports the official position of the United States. For instance, the U.S. Department of Defense 2010 *Nuclear Posture Review Report* states, “The United States will pursue high-level, bilateral dialogues on strategic stability with both Russia and China which are aimed at fostering more stable, resilient, and transparent strategic relationships.”³⁶ The 2010 *Ballistic Missile Defense Review* states that the United States is “committed to substantive and sustained dialogue with China, with the goals of enhancing confidence, improving transparency, and reducing mistrust on strategic security issues.”³⁷ With the exception of Xi’s and Wang’s speeches on the concept of a new model for major power relations, the official written position of China regarding deeper security cooperation or nuclear cooperation with the United States is lacking.

There are additional reasons why nuclear dynamics would be an appropriate fit for inclusion in a new model. First, it is an opportunity to establish a new beginning for U.S.-China nuclear relations. It would be a chance for the two countries to turn a new leaf and update the overall direction of bilateral nuclear relations. Second, establishing a new beginning offers the opportunity to set new precedents for how China and the United States communicate about nuclear weapons.

Third, placing nuclear dynamics in a new model of major power relations would be a clear statement indicating that both China and the United States recognize that nuclear dynamics between the two are inherently different from the nuclear dynamics of others (such as U.S.-Russia nuclear relations) and therefore deserve to be placed in a context unique to them. While elements can be borrowed from the U.S.-Russia model, it cannot simply be adopted and applied to the U.S.-China context because the issues are fundamentally different. Achieving parity, for instance, is a feature of U.S.-Russia nuclear relations that would not apply to the U.S.-China context.

FEASIBILITY

One of the most important features of a new model of major power relations for U.S.-China nuclear dynamics is that there is already an acceptance and/or interest in the concept at the highest levels of government in both countries. This is beneficial because incorporating nuclear dynamics in a new model of relations would essentially elevate discussions about nuclear issues to a level where government action can be taken and policy can be implemented—a feature that has been missing from current track 1.5/2 dialogues. Furthermore,

36. U.S. Department of Defense, *Nuclear Posture Review Report*, April 2010, <http://www.defense.gov/npr/docs/2010%20nuclear%20posture%20review%20report.pdf>.

37. U.S. Department of Defense, *Ballistic Missile Defense Review Report*, February 2010, http://www.defense.gov/bmdr/docs/BMDR%20as%20of%2026JAN10%200630_for%20web.pdf.

nuclear dialogues at the newly heightened level would not need to start from scratch because they could build upon the progress of the existing track 1.5/2 dialogues.

There are, however, two main challenges for feasibility. First, while there is plenty of interest from Chinese government officials in a new model of major power relations, there is no indication that China is interested in official nuclear dialogues with the United States. As long as China maintains this position, nuclear discussions at the official level—via a new model or not—will simply not occur. The second challenge for feasibility, as mentioned above, is the current geopolitical environment in Asia. Regional tensions, driven by maritime conflicts and competing territorial claims between and among Asian countries—disputes in which China is a key stakeholder—put a strain on U.S.-China relations. Continuation of this security environment in the region would indefinitely delay overall progress of a new model of major power relations and thus limit the potential for enhanced bilateral nuclear relations.

PRACTICALITY AND USEFULNESS

Placing U.S.-China nuclear dynamics in the context of a new model of major power relations is essentially an effort to increase trust and improve predictability regarding the most destructive weapons in the world. If U.S.-China nuclear dynamics were included in the new model, would anything actually change or improve? Is it practical, or is it just another way to package nice policy ideas together?

China has far fewer nuclear weapons than the United States. In light of this difference, each country employs very different nuclear policies, which in many ways seem fundamentally incompatible. Building trust over nuclear weapons in the short term would be a significant challenge, even in the context of a new model of relations. However, given that there would be official government-to-government interactions in a new model, in the long term there would be more ways and opportunities to improve trust than are currently available.

For instance, confidence-building measures, which have been promoted by some nuclear experts in the last several years, such as Ambassador Linton F. Brooks, could potentially be implemented with greater ease. The suggestions offered thus far are practical and would be useful for improving U.S.-China nuclear dynamics, particularly in some of the more problematic topics in U.S.-China nuclear relations:³⁸

- China's misunderstanding of U.S. ballistic and missile defense systems;
- China's concern over future capabilities of U.S. conventional prompt global strike;
- U.S. concern over China's nuclear force posture;

38. Eben Lindsey, Michael Glosny, and Christopher Twomey, *US-China Strategic Dialogue, Phase VI: An NPS and Pacific Forum Conference, June 2011* (Monterey, CA: Naval Postgraduate School, November 2011), <https://www.hsdl.org/?view&did=709606>.

- U.S. concern regarding the credibility of China's no-first-use policy;
- Nuclear security;
- Nuclear test sites; and
- Nuclear operations and strategy.

For each of these problematic areas, confidence-building measures between China and the United States have been offered by experts such as Ambassador Brooks.³⁹ These measures include the following:

- Measures to conduct joint technical analyses, which would bring China some clarity on U.S. ballistic missile defense capabilities;
- Measures to develop protocols and communication regarding U.S. conventional prompt global strike launches;
- Measures to have deeper military-to-military exchanges and mutual learning opportunities regarding specific operational capabilities;
- Measures to deepen cooperation over nuclear materials security, including the sharing of best practices, etc.

A new model of major power relations could provide the vehicle through which these confidence-building measures could be executed. A challenge of the current track 1.5/2 discussions is that new questions constantly arise from the explanations and answers exchanged during discussions and dialogues, which is a very time-consuming process. In some cases, through the use of confidence-building measures, many questions can be answered more efficiently and adequately, with direct observation and participation.

Another benefit of placing nuclear dynamics in the context of a new model of major power relations is that it would bring greater public attention to U.S.-China nuclear relations. Placing nuclear issues alongside all the other important U.S.-China relations issues would speak volumes to the analytic communities in both countries, particularly in China, and encourage them to think seriously about improving bilateral nuclear cooperation. It would also put greater pressure on the administrations of both countries to act more expeditiously on these issues.

Conclusion

Placing U.S.-China nuclear dynamics in the context of a new model for major power relations has its challenges. First, the new model is simply not a mature concept. China and the United States are still seeking a clear definition, and, in light of regional tensions,

39. Linton F. Brooks, "Looking to the Future: The post-New Start world and potential Sino-U.S. confidence building measures," Appended paper at the Sixth U.S.-China Strategic Dialogue, U.S.-China Strategic Nuclear Dynamics, June 5–7, 2011, <https://www.hsdl.org/?view&did=709606>.

significant progress does not seem likely in the near future. Moreover, China generally seems outright uninterested in official nuclear discussions with the United States. However, through the new model, the opportunity is available for China and the United States to prioritize nuclear issues in the bilateral relationship and to set a new tone for building trust. Doing so would bring the unique attention that managing U.S.-China nuclear relations merits, rather than borrowing from the old lessons of U.S.-Russia nuclear relations or simply neglecting the matter at official levels, as is currently the case.

Deepening nuclear relations between China and the United States seems like a logical and appropriate fit for the principles that a new model of major power relations seeks to achieve. For the United States, advocating for the inclusion of nuclear issues in the new model as early on in the process as possible would be beneficial. In a recent roundtable discussion held at the Center for the National Interest in Washington, DC, one Asia expert asserted that if the United States is not more proactive about pushing its positions regarding the specifics of a new model for major power relations, then the default position would be established and defined by China. Before it is too late, the United States should raise the issue of including nuclear dynamics in a new model for major power relations with China.

Expanding the Scope: Setting the Stage for Future U.S.-Russian Arms Control Negotiations

*Jerry Sergei Davydov*¹

For over six decades, both the United States and the Soviet Union (later Russia) concluded that having three separate systems—heavy bombers, strategic ballistic missile submarines, and intercontinental ballistic missiles (ICBMs)—to deliver strategic nuclear weapons was instrumental to deterrence. Following massive buildups of warheads and delivery vehicles, both the United States and the Soviet Union/Russia agreed to gradually reduce the number of deployable weapons in their strategic arsenals through a series of arms control agreements. Despite the success of these treaties in putting legally binding limits on deployable strategic nuclear weapons, these treaties have not been successful in addressing the problem of nonstrategic nuclear weapons (NSNWs). As the United States and Russia continue to recapitalize and modernize their nuclear arsenals, it is necessary to develop a framework for the integration of nonstrategic nuclear weapons into the next round of U.S.-Russian arms control negotiations.

Introduction

The history of U.S.-Soviet/Russian arms control spans decades. Starting with the Strategic Arms Limitation Treaty in 1972, the United States and the Soviet Union/Russia have signed eight agreements, of which seven have been ratified and six implemented. The United States and Russia value this process for the same reasons: as a way to establish and sustain legally binding limitations on strategic nuclear forces, as a way to enhance predictability between the two sides, and as a way to ensure strategic stability. Despite the success of these treaties in putting legally binding limits on strategic nuclear weapons, these treaties

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have not been successful in addressing the problem of NSNWs, commonly referred to as tactical nuclear weapons. The latest round of arms control negotiations, culminating in New START (Strategic Arms Reduction Talks), left an unsettling taste in the mouths of arms controllers everywhere.

The issue of expanding U.S.-Russia arms control dialogue to include NSNWs has been a subject of discussion for some time. Now that deployable strategic arsenals are being reduced to the level of 1,550 warheads, it is increasingly difficult to justify the exclusion of NSNWs from arms control negotiations. Although past discussions have not produced a consensus on how to deal with NSNWs, there are a number of themes that have emerged. As tensions between the United States and Russia rise, and as both countries recapitalize and modernize their nuclear arsenals, it is necessary to identify themes for discussion in the lead-up to the next round of U.S.-Russian arms control negotiations.

The urgency of this concept was well demonstrated during the New START ratification process. When signing New START, President Obama noted that he hoped further negotiations would not only reduce strategic nuclear weapons but NSNWs as well. During the Senate debate on New START, many senators expressed concern that the treaty did not impose limits on NSNWs. In response to these concerns, the Senate attached a resolution to New START, stating that the United States should seek to initiate negotiations with Russia on an agreement to address the disparity between the NSNW stockpiles of the United States and Russia.²

Although Russia has committed to a step-by-step process aimed at reducing and ultimately eliminating nuclear weapons, it has stated that any further strategic and NSNWs reductions would have to be discussed in the larger scope of strategic security. Implicitly directed at the resolution the U.S. Senate attached to New START, the Russian Duma attached a resolution of its own to the treaty. This resolution highlighted a number of issues related to New START and future negotiations, three of which are particularly noteworthy: ballistic missile defense (BMD), strategic nonnuclear precision weapons systems (commonly referred to as conventional prompt global strike, or CPGS), and NSNW. Comments made by Foreign Minister Lavrov during discussions further elaborate the Russian position. Lavrov stated that any further reduction of nuclear arms cannot be conducted only through the lens of NSNWs; further reduction of nuclear arms will have to be considered in relation to the broader strategic context—namely, BMD and CPGS.³

After a review of the current discussions on BMD, CPGS, and NSNW, this chapter provides an overview of existing proposals that can build confidence and transparency between the United States and Russia. This work does not propose a roadmap to what a future NSNW treaty may look like but proposes a negotiating approach regarding issues that will

2. U.S. Senate, *New START Treaty Resolution of Advice and Consent to Ratification*, Washington, DC: Government Printing Office, 2011.

3. “Transcript of Remarks by Foreign Minister of the Russian Federation Sergei Lavrov at a Plenary Meeting of the State Duma of the Federal Assembly of the Russian Federation on the New START Treaty [in Russian],” *Russian Ministry of Foreign Affairs*, January 14, 2011, <http://www.mid.ru/>.

undoubtedly have to be included in discussion. Before presenting this “negotiating guide,” this chapter discusses why these negotiations are in the interest of both parties, how Russia views its strategic security, and why and how both the United States and Russia view their respective “hot button” issues.

Is Arms Control Dead?

Despite growing skepticism about the future of arms control, which some analysts have declared dead, and a divergence in views between Washington and Moscow, there are opportunities for the United States and Russia to achieve tangible nuclear arms reductions in the coming years as both sides continue to implement New START. There is concern that dialogue is stagnating, that relations between the two powers are deteriorating, and that arms control will not be possible. Many of these analysts have pointed to reluctance from Moscow to engage in future arms control negotiations. Although Russia’s current stance is to tacitly refuse any further bilateral nuclear reductions,⁴ some analysts have interpreted this as an excuse from Moscow to not engage in further arms control negotiations. Despite this interpretation, this does not mean that Russia would not be open to nuclear reductions in the future. It is important to note that even in the coldest parts of the Cold War, arms control negotiators continued discussions on future cuts.

By all indications, Russia’s reluctance to reduce the numbers of NSNWs is due to the age and makeup of its strategic nuclear deterrent. Russia’s military and political leaders have expressed anxiety about the current state of the strategic triad and Russian conventional forces as well as the ability of strategic and conventional forces to maintain parity with U.S. and North Atlantic Treaty Organization (NATO) capabilities. Given this anxiety, it is no surprise that Russia has expressed little interest in the prospect of bilateral arms control negotiations in the near future. Despite this, Russia has continued to state that one of the tools it uses to deter and prevent military conflict is to “conclude and implement agreements in the sphere of arms control and also to implement measures to strengthen mutual trust.”⁵

As Russia recapitalizes its current nuclear force and develops new strategic delivery vehicles, it is unlikely that it will be ready to negotiate and draft a legally binding arms control agreement. As the majority of these capabilities will not be developed and go into production until at least 2020,⁶ the United States and Russia have several years to prepare

4. “Лавров: сокращение СНВ придется обсуждать со всеми ядерными странами [Lavrov: Reducing Strategic Offensive Arms Will Have to Be Discussed with All Nuclear Countries],” *RIA Novosti*, July 2, 2012, http://ria.ru/defense_safety/20120207/559587903.html.

5. “Военная доктрина Российской Федерации [Military Doctrine of the Russian Federation],” *Website of the Russian President*, http://news.kremlin.ru/ref_notes/461.

6. “Восемь стратегических АПЛ поступит в ВМФ до 2020 года, заявил Путин [Eight Strategic Nuclear Submarines Will Enter the Navy by 2020, Said Putin],” *RIA Novosti*, November 27, 2013, http://ria.ru/defense_safety/20131127/980175676.html; “BBC РФ должны получить до 2020 года более 10 ракетоносцев Ту-160М [The Air Force of the Russian Federation Must Receive More than 10 Missile Carriers by 2020],” *RIA Novosti*, July 2, 2012, http://ria.ru/defense_safety/20120207/559587903.html; “Russia to keep SS-18 Satan ICBM on combat duty at least until 2020,” *Interfax: Russia & CIS Defense Industry Weekly*, October 11, 2012.

for future rounds of these negotiations by having substantive discussions on a framework that addresses U.S. and Russian concerns on the current balance of strategic security.

Gauging Interest in Future Arms Control

Future arms control negotiations hold great appeal for both the United States and Russia. They have the potential to enhance transparency and predictability and thus to allow for an increased level of strategic stability between the two sides. For Washington and Moscow, there are a number of factors each party sees as affecting strategic stability. For the United States, the key factor relates to the status of Russian NSNWs. For Russia, there are a number of issues, with particular emphasis on the status of BMD and CPGS.

In light of these priorities, a new round of arms negotiations would benefit the United States in a number of different ways. First, there is considerable uncertainty in the United States about the size of Russia's NSNW stockpile and the role those weapons play in Russia's defense planning. Negotiations on NSNWs would be instrumental in increasing transparency in this area. Second, although the exact size of Russia's NSNW stockpile is unknown, it is widely believed that Russia holds a significant numerical advantage in diversity and deployment of these weapons.⁷

An agreement on reductions of NSNWs, which would require significant Russian reductions as compared to U.S. reductions, would close the gap in the size of the two arsenals. However, this would not be possible without concessions by the United States on other perceived strategic imbalances.

Moscow's linkage of future arms control to BMD and CPGS demonstrates Russian concerns about the effect the U.S. advantage in these technologies could have on strategic stability. The Obama administration's refusal to provide Moscow with legally binding assurances on BMD and CPGS has convinced many defense experts and policymakers in Russia that these systems are being deployed against Russia. This belief is clearly demonstrated in actions Russia has undertaken in the past few years. Some examples of this concern as it is manifested in policy include the development of new heavy ICBMs to replace the SS-18 and SS-19, which Russia Strategic Rocket Forces chief lieutenant general Sergei Karakaev has said would "have enhanced capability to breach a hypothetical US missile defense system," as well as the redeployment of strategic missile trains.⁸

For Russia, engaging in arms control negotiations could provide Moscow with politically and legally binding limitations and transparency on these systems. A single or series

7. Hans Kristensen and Robert S. Norris, "U.S. nuclear forces, 2014," *Bulletin of the Atomic Scientists* 70, no. 1 (January/February 2014): 86; Hans Kristensen and Robert S. Norris, "Russian nuclear forces, 2014," *Bulletin of the Atomic Scientists* 70, no. 2 (March/April, 2014): 77.

8. "Preliminary design of Russia's new heavy ICBM ready—source," *Interfax: Russia & CIS Defense Industry Weekly*, October 19, 2012; "Россия опять решила строить 'Ракетные Поезда' [Russia decided to build 'Train Missiles' again]," *RIA Novosti*, December 27, 2012, <http://ria.ru/analytics/20121227/916455230.html>.

of agreements would go a long way in assuring Moscow that its strategic deterrent is not undermined by these systems and that strategic stability remains intact.

Naturally, preserving existing agreements and maintaining the status quo is much easier than negotiating new agreements. However, with New START expiring in 2021 (with the possibility of extension until 2026), now is the time to begin consultations with the Russians on what the nuclear reductions of the future may look like. In the lead-up to these consultations, to better understand Russia's interests and objectives it is necessary to examine the spectrum of Russian views on strategic stability.

Russia's View of Strategic Stability

Before delving into the framework for new rounds of arms control negotiations, it is necessary to examine where we are today and how we got here. In the post-Cold War world, geopolitical, technological, and economic realities have changed; accordingly, the role that nuclear weapons play in the world has also changed.

In the two decades following the dissolution of the Soviet Union, politicians, defense planners, and academics argued about fundamental questions relating to Russia's nuclear stockpile. Although Russia has seen its economic and conventional military strength wane in the past two decades, together with its share of global influence, its dominant share of the global nuclear stockpile has endowed Moscow with significant geopolitical leverage. This is to say that Russia's nuclear arsenal allows it a seat at the geopolitical table. Given this reality, Russian planners routinely accentuate the importance of strategic stability and are quick to decry any perceived behavior that can degrade its nuclear deterrent. This emphasis on strategic stability allows Russia significant leverage on a range of international issues. Russia's great power status is equated to its nuclear strength, and thus any threat to what Russia considers its strategic deterrent is judged as a threat to Moscow's ability to influence international affairs and to the very existence of the Russian state. This view, although disputed by some academics, is reinforced by many Russian political leaders, including Vladimir Putin, former prime minister and current president, who has stated, "[W]e should not tempt anyone by allowing ourselves to be weak. We will, under no circumstances, surrender our strategic deterrent capability. Indeed, we will strengthen it."⁹

Whether U.S. policymakers agree with Russia's view, it is essential that any consideration of future nuclear arms reduction be made while keeping in mind what Russia perceives as its strategic stability.

RUSSIAN MILITARY DOCTRINE

Russia's view of strategic stability is well defined in its Military Doctrine, which includes elements the United States would include in the Nuclear Posture Review (NPR). In the three

9. Vladimir Putin, "Being Strong," *Foreign Policy*, February 21, 2012, http://www.foreignpolicy.com/articles/2012/02/21/being_strong.

Military Doctrines that Russia has released since the dissolution of the Soviet Union (in 1993, 2000, and 2010), Moscow has expressed increasing concern that the United States and NATO may threaten or commence limited military action against Russia to achieve certain political goals, such as to stop Russian intervention in Ukraine. In its 2010 Military Doctrine, Russia notes that “despite the decline in the likelihood of a large-scale war involving the use of conventional means of attack and nuclear weapons being unleashed against the Russian Federation, in a number of areas military dangers to the Russian Federation are intensifying.”¹⁰

Russia’s first four “external military dangers” include (1) the geographic expansion of NATO and its military infrastructure; (2) attempts to destabilize the situation in individual countries and regions; (3) the deployment of foreign troops in territories adjacent to Russia and her allies; and (4) the deployment of BMD and CPGS systems. All four of these factors are implicitly a reference to the United States and NATO. Other concerns such as nonproliferation, noncompliance with international measures, and the spread of international terrorism are found lower on the list.

The 2010 Military Doctrine goes on to make a distinction between “military dangers” and “military threats,” both of which affect strategic stability. Russia’s “main military threats” include, *inter alia*, the impeding of the operation of systems of state and military command and control, the disruption of the functioning of its strategic nuclear forces, missile early warning systems, outer space monitoring systems, and nuclear munitions storage facilities.

The 2010 Military Doctrine further states that “the Russian Federation’s main tasks in deterring and preventing military conflicts are: . . . to maintain strategic stability and the nuclear deterrence potential at an adequate level.” Russia directly connects deterring and preventing military conflict with its nuclear weapons and the ability of those nuclear weapons to reach their targets.

This specific reference to these factors sends two important messages. First, the focus of Russia’s nuclear policy has remained ultimately unchanged since the Soviet era; Moscow still considers strategic stability and parity with the United States/NATO to be an essential element of its national security strategy. In the lead-up to New START, eager to maintain parity with the United States, Russia enthusiastically negotiated New START and was quick to sign and ratify the treaty. New START favored Moscow in that only Washington needed to make reductions, as Russian delivery vehicles and warheads were already below negotiated cuts. Furthermore, as part of New START, Russia successfully managed to avoid any reductions of its NSNWs.

Second, and perhaps more importantly, the 2010 Military Doctrine creates a dangerous vagueness in relation to BMD and CPGS systems. Russia views the development of both of

10. “Военная доктрина Российской Федерации [Military Doctrine of the Russian Federation],” *Website of the Russian President*, http://news.kremlin.ru/ref_notes/461.

these systems as a “military threat” to its national security. Utilizing the “main military threats” section, Moscow can argue that the deployment of BMD and CPGS systems impedes the operation of systems of state and military command and control and disrupts the functioning of its strategic nuclear forces, missile early warning systems, outer space monitoring systems, and nuclear munitions storage facilities, as well as putting into question the reliability of its nuclear weapons. In 2007, Deputy Defense Minister Anatoly Antonov said that Russia sees “a direct link between U.S. plans for global missile defense and the prompt global strike concept . . . [as] a means for world domination, politically and strategically. This is a rather serious factor which undermines the principles of mutual deterrence and mutual security and erodes the architecture of strategic stability.”¹¹

START “IV” Framework

From the outset, it is important to acknowledge that future arms control agreements cannot be modeled on arms control agreements of the past. In her testimony before the Senate Foreign Relations Committee, Under Secretary of State for Arms Control and International Security Rose Gottemoeller described New START as a hybrid of START I and the Strategic Offensive Reduction Treaty, or Moscow Treaty, of 2002: “[New START] contains a comprehensive verification regime as does START, to provide for predictability, but it recognizes that we are no longer in a Cold War relationship. Thus, it allows each Party to determine for itself the composition and structure of its strategic offensive arms and how reductions will be made. This flexibility is the great contribution of the Moscow Treaty, and it will be important to our national security as we move forward to further reductions.”¹²

Although this may seem like a departure from arms control of the past, this is not a new idea. In the lead-up to New START, both the United States and Russia each made compromises, both inside and outside of the New START negotiation process. Beginning with New START, both the United States and Russia have come to understand that it is necessary to address asymmetries and perceived vulnerabilities. In the post–New START era, arms control can no longer focus on tit-for-tat numerical parity in warheads and delivery vehicles. Instead, it has to take into account the broader set of issues of strategic security and asymmetries. For Washington this is NSNWs and for Moscow this is BMD and CPGS. In the lead-up to the next round of arms control negotiations, it is important for both sides to examine the role that transparency and confidence-building measures could play.

11. Anatoly Antonov, director, speaking notes at NATO-Russia Council Meeting, October 17, 2007, quoted in Eugene Miasnikov, “On the Relationship between Nuclear and Conventional Strategic Arms in the New START Treaty,” *Center for Arms Control, Energy, and Environmental Studies*, September 10, 2010, <http://www.armscontrol.ru/pubs/en/em091010.pdf>.

12. Rose Gottemoeller, “The New START Treaty,” *U.S. Department of State*, June 15, 2010, <http://www.state.gov/t/avc/rls/143159.htm>.

Nonstrategic Nuclear Weapons

According to disclosed data from the New Strategic Arms Reduction Treaty (New START), the United States has 1,654 deployed strategic warheads, while Russia has 1,480.¹³ In addition to treaty-accountable strategic warheads, the United States and Russia still possess significant numbers of NSNWs, in addition to several thousand non-deployed warheads. Following the significant reductions of NSNWs by the United States since 1991, it is thought that Russia maintains a much larger arsenal of NSNWs.¹⁴

Although this is an estimate, it is important to highlight the large imbalance between the stockpiles of the United States and Russia. This imbalance is precisely why any agreement on NSNW reductions will have to occur in the large space of strategic security for all partners involved (including other NATO countries). From the outset, it is important to acknowledge that Russia agreeing to trade its large arsenal of NSNWs for the smaller U.S. arsenal, without some sort of broader security arrangement, is not in Moscow's interest.

Attempts in the last several years to reduce numbers of NSNWs in Europe have not achieved tangible results. Moscow has repeatedly said that it will not address the problem of NSNWs until the United States removes its forward-deployed nuclear weapons from Europe, including the destruction of their associated infrastructure. In rebuttal, the United States has stated that it will not reduce further unless Russia reduces its larger inventory. Unfortunately, the two sides appear to have boxed themselves in with preconditions for reductions.

Given their range, NSNWs play little role in the U.S. homeland and thus should be observed in the larger NATO context. Immediately after the conclusion of the Cold War, U.S. forward-deployed nuclear weapons took on a new role in Europe; according to a 1991 NATO declaration, "the security challenges and risks which NATO faces are different in nature from what they were in the past. The threat of a simultaneous, full-scale attack on all of NATO's European fronts has effectively been removed and thus no longer provides the focus for Allied strategy."¹⁵ Since the 1991 declaration, the NATO Strategic Concept has repeatedly reinforced the role of nuclear weapons as a deterrent. In its 2010 Strategic Concept, NATO reiterated that "deterrence, based on an appropriate mix of nuclear and conventional capabilities, remains a core element of our overall strategy."¹⁶ It is important to note that the 2010 Strategic Concept goes on to specifically refer to strategic weapons as "the supreme guarantee of the security of the Allies" and not weapons based in Europe, as the unclassified 1999 Strategic Concept did.¹⁷

13. "New START Treaty Aggregate Numbers of Strategic Offensive Arms," *U.S. Department of State*, <http://www.state.gov/t/avc/rls/207020.htm>.

14. "Transparency in the U.S. Nuclear Weapons Stockpile," *U.S. Department of State*, <http://www.state.gov/t/avc/rls/225343.htm>.

15. "The Alliance's Strategic Concept," *North Atlantic Treaty Organization*, November 8, 1991, http://www.nato.int/cps/en/natolive/official_texts_23847.htm.

16. "Strategic Concept," *North Atlantic Treaty Organization*, November 20, 2010, http://www.nato.int/nato_static/assets/pdf/pdf_publications/20120214_strategic-concept-2010-eng.pdf.

17. "The Alliance's Strategic Concept," *North Atlantic Treaty Organization*, April 24, 1999, http://www.nato.int/cps/en/natolive/official_texts_27433.htm.

Since the collapse of the Soviet Union, Russia has paid increasing attention to its NSNW stockpile. Beginning with the abandonment of its no-first-use policy, Moscow's successive Military Doctrines have expressed a greater role for its nuclear weapons. Information on Russia's view of the role NSNWs play in its national security is not as explicit as it is with NATO; however, a rough policy can be gleaned from its 2010 Military Doctrine, which reads, "Russia reserves the right to use nuclear weapons in response to a use of nuclear or other weapons of mass destruction against her and (or) her allies, and in a case of an aggression against her with conventional weapons that would put in danger the very existence of the state."¹⁸ Although not explicitly mentioned in open publications, it is likely that Russian defense planners are as concerned about the enormous conventional superiority of China over Russia as they are with NATO.

Russia does not view its NSNWs the same way the United States does. The United States cannot assume that Russia will trade their NSNWs in return for U.S. removal and their forward-deployed nuclear weapons from Europe. The view from Moscow is that symmetrical reductions of NSNWs are unfair because of NATO's possession of superior conventional forces to Russia. Russian NSNWs provide reassurances against NATO escalation and interference in what Moscow judges to be its sphere. Furthermore, there is no experience with transparency in inspection and verification of NSNWs.

In the past, the United States and Russia have had some success in eliminating NSNWs. It is often overlooked that in the years following the end of the Cold War, both the United States and Russia made reciprocal political assurances to make deep cuts in the their respective NSNW arsenals, including the elimination of entire categories of weapons, and reducing the operational readiness of the remaining forces. However, given the current political situation in Europe, the increased desire by some NATO partners to continue the forward deployment of U.S. nuclear weapons in Europe indefinitely, and Russia's conventional inferiority, it is unlikely that the Presidential Nuclear Initiatives (PNIs) of the last century will gain traction in either Washington or Moscow.

Although in the short term these options do not seem viable, the next round of arms control may not occur for several years—a time during which there can be valuable security gains on both sides that may foster a more amiable European security environment. A series of confidence-building measures that both sides can undertake is described in greater detail below.

From the outset, given Russia's geographic location, the current state of its armed forces, and its security situation, any U.S.-Russian negotiations must allow Russia to maintain a portion of its NSNW stockpile. In the lead-up to the next round of arms control negotiations, there is a series of steps both the United States and Russia can take in order to establish greater transparency and build confidence. Before any substantive discussions between the United States and Russia begin, there must be an agreed-upon definition of

18. "Военная доктрина Российской Федерации [Military Doctrine of the Russian Federation]," *Website of the Russian President*, http://news.kremlin.ru/ref_notes/461.

what each side calls NSNWs; according to Rose Gottemoeller, “[The Russians] identify [NSNWs] differently than we do, so there are some definitional and terminology issues we have to talk to them about.”¹⁹

In the lead-up to these discussions, in order to build confidence on both sides, there should be reciprocal political declarations to remove all NSNWs to central storage at respective locations in Europe and Russia. While the political environment thaws and before negotiators work out specifics on the removal of NSNWs to central storage, both sides should first facilitate data exchange and then begin discussions on a series of joint verification exercises.

DATA EXCHANGE

Data exchange is something that has been supported by many U.S. officials, including former national security advisor Thomas Donilon, who stated, “In advance of a new treaty limiting tactical nuclear weapons . . . [a]s a first step, we would like to increase transparency on a reciprocal basis.”²⁰ Data exchange would facilitate a greater environment of trust between the United States and Russia. This sort of transparency should include:

- a PNI status declaration on reductions and eliminations from respective arsenals since 1991, including destroyed and/or converted facilities;
- information on the number of dismantled warheads, where those warheads were stored, when those warheads were removed from the stockpile, when the warheads were dismantled, and information related to the fissile material from each warhead; and,
- high-level military discussions on the role NSNWs play in the national security policy of each country, as well as the role they play in alliance management.

JOINT EXPERIMENTS AND RESEARCH

As verification of NSNWs and NSNW storage facilities is unprecedented, the two sides should develop a framework for joint experiments and research for the eventual verification of NSNWs and their storage sites. These joint experiments and research should include, but are not limited to:

- the inspection of a storage vault (perhaps using dummy warheads) hosted by each country with whatever security procedures it wants, thus allowing the other side to begin to understand what issues will arise if and when negotiations begin; and,

19. Rose Gottemoeller, “Interview with the Bulletin of Atomic Scientists,” *U.S. Department of State*, November 2, 2011, <http://www.state.gov/t/avc/rls/176555.htm>.

20. Thomas Donilon, “Keynote Speech at the Carnegie International Nuclear Policy Conference,” *Carnegie Endowment for International Peace*, Washington DC, March 29, 2011, http://carnegieendowment.org/files/Thomas_Donilon.pdf.

- on-site inspections of facilities that have been declared to have once housed NSNWs and no longer are active in order to develop verification procedures for future inspections of facilities with nuclear forces.²¹

Ballistic Missile Defense

BMD is undoubtedly the most contentious of all issues on the current U.S.-Russian security agenda and as such one of the most challenging issues to overcome. Since the Bush administration announced plans to develop a BMD system in Europe, Russian defense planners have opposed it, arguing that it will cause a breakdown in strategic stability and threaten space security. Obama's decision to curtail BMD systems in Central Europe had a positive effect on the U.S.-Russian relationship in the initial stages; however, following the announcement and formalization of plans to place ground-based BMD stations in Poland and Romania, Russian opposition has further increased. Deputy Foreign Minister Sergei Ryabkov has previously said that "the qualitative and quantitative buildup of the U.S. missile defense system, which will jeopardize Russia's strategic nuclear capability, can be regarded as an exceptional event under Article 14 of the said [New START] Treaty whereby Russia has the right to withdraw from this agreement."²²

The statement made by Ryabkov and similar statements from other senior Russian officials do not necessarily mean that Russia will withdraw from New START if BMD is expanded. Similar statements were given in reference to the 1972 Anti-Ballistic Missile (ABM) Treaty. The Soviet Union said that U.S. withdrawal from the ABM Treaty would constitute reason for Soviet withdrawal. However, when the United States withdrew from the ABM Treaty in 2002, Russia did not withdraw from START and in fact was eager to negotiate further arms control agreements.

Russia's underlying concerns about BMD stem largely from its views on the offensive-defensive interrelationship; Russia views BMD as an offensive capability. This view was articulated by President Putin in his 2013 address to the Russian Federal Assembly, when he said that "[w]e are all perfectly aware that the missile defense system is defensive in name only. In fact, it is a crucial component of strategic offensive capabilities."²³ The U.S.

21. James Acton, "Beyond Treaties: Immediate Steps to Reduce Nuclear Dangers," *Carnegie Endowment for International Peace*, <http://carnegieendowment.org/2012/10/10/beyond-treaties-immediate-steps-to-reduce-nuclear-dangers/e08j?reloadFlag=1#>; Euro-Atlantic Security Initiative Working Group on Nonstrategic Nuclear Weapons, "Addressing Nonstrategic Nuclear Forces," *Carnegie Endowment for International Peace*, <http://carnegieendowment.org/2012/02/03/addressing-nonstrategic-nuclear-forces/9cw1>; Hans Kristensen, "Non-Strategic Nuclear Weapons," *Federation of American Scientists*, http://www.fas.org/_docs/Non_Strategic_Nuclear_Weapons.pdf; Nikolai Sokov, "European Leadership Network," *NATO-Russia Interaction on Non-Strategic Nuclear Weapons*, http://www.europeanleadershipnetwork.org/nikolai-sokov-speechnato-russia-interaction-on-non-strategic-nuclear-weapons_133.html; Amy Woolf, "Nonstrategic Nuclear Weapons," *Federation of American Scientists*, <http://www.fas.org/sgp/crs/nuke/RL32572.pdf>; Miles Pomper, William Potter, and Nikolai Sokov, "Reducing and Regulating Tactical (Nonstrategic) Nuclear Weapons in Europe," *James Martin Center for Nonproliferation Studies*, http://cns.miis.edu/opapers/pdfs/tnw_europe.pdf.

22. "Russia 'disappointed' by U.S. failure to provide missile guarantees," *RIA Novosti*, May 16, 2011, <http://en.ria.ru/russia/20110516/164052008.html>.

23. "Presidential Address to the Federal Assembly," *Website of the President of the Russian Federation*, December 12, 2013, <http://eng.kremlin.ru/news/6402#sel=>.

defense doctrine, articulated by its NPRs and defense patterns over the past twenty years, indicates that Washington is slowly moving from deterrence vis-à-vis Russia toward a more defensive posture. Russia has done the opposite; in the past twenty years, Russia's successive Military Doctrines and development of several new strategic capabilities have indicated that Russia still believes its offensive capabilities will ensure its security. Given Russia's own focus on offensive capabilities, it is understandable that Moscow is concerned about BMD expansion.

In addition to its belief that BMD upsets the current balance of strategic stability, Moscow is concerned about the effect such a system may have in the future. Despite Obama administration actions that included opting for the Phased Adoptive Approach and later dropping the fourth phase that involved the most effective capabilities for defending against a Russian ICBM, as well as calls in the 2010 NATO Strategic Concept to cooperate with Russia on BMD, Russian defense planners are concerned that the current plan will establish a groundwork and that an administration down the line could deploy a more comprehensive system, which could then affect the credibility of the Russian deterrent.

In an attempt to alleviate their BMD concerns, Russia since 2011 has requested legally binding agreements with "objective criteria" in regard to BMD in future arms control agreements, something that the United States has rejected. As recently as May 1, 2014, an unnamed official from the State Department told the *Washington Free Beacon* that "the United States cannot and will not accept any obligations that limit our ability to defend ourselves, our allies, and our partners, including where we deploy our [ballistic missile defense] capable Aegis ships."²⁴

A legally binding agreement on BMD, a type of ABM 2.0, may at some point be appropriate but is not likely to be achievable in the foreseeable future. In the meantime, it would be a positive step for the United States and Russia to engage in dialogue in regard to technical and political concerns associated with BMD in order to build confidence. These discussions could comprise a number of topics, including but not limited to:

- annual declarations of U.S. BMD size, composition, deployments, and acquisition plans;
- advance notice for any changes to size, composition, and deployment;
- data exchanges and demonstrations of BMD technical capabilities through Russian inspection of BMD sites in Europe (although this is sensitive and could be politically problematic, there is precedence for such activities in earlier arms control agreements with host countries having veto power over some officials);

24. Bill Gertz, "U.S. Rejects Latest Russian Proposal to Restrict U.S. Missile Defenses," *Washington Free Beacon*, May 1, 2014, <http://freebeacon.com/national-security/u-s-rejects-latest-russian-proposal-to-restrict-u-s-missile-defenses/>.

- joint U.S./NATO-Russian missile defense exercises; and,
- sharing of early warning and tracking data.²⁵

Conventional Prompt Global Strike

Another emerging U.S. capability that is of great concern to Russia is the development and deployment of CPGS. The U.S. CPGS program aims to develop weapons capable of performing a highly precise conventional fast-strike anywhere in the world. The system is intended to be aimed at targets that need to be hit with high precision with little preparatory time, such as “Osama bin Laden in a cave, if the right one could be found; taking out a North Korean missile while it is being rolled to the launch pad; or destroying an Iranian nuclear site—all without crossing the nuclear threshold.”²⁶

Russian defense planners have expressed concern that “although Russia has not been named as a potential foe, [they do] not believe that such expensive conventional armed delivery vehicles are to be used solely against rogue nations.”²⁷ Russia has argued that the development and deployment of CPGS poses a considerable threat to strategic stability and has even gone as far as to threaten retaliation “with a nuclear strike if a new U.S. [CPGS] military strategy threatened its security.”²⁸ Russia has gone further to argue that continued development of CPGS could be a catalyst for Russia’s reconsideration of any current and future strategic nuclear arms negotiations. In his annual address to the Russian Federal Assembly, President Putin stated that “implementing all of [the CPGS] plans could have extremely negative consequences for regional and global stability. The ramping up of high-precision strategic non-nuclear systems by other countries . . . could negate all previous agreements on the limitation and reduction of strategic nuclear weapons, and disrupt the strategic balance of power.”²⁹

Although Russia frequently treats the development and deployment of CPGS as an omnibus issue, Moscow’s skepticism for CPGS can be broken down into two separate but related concerns, each with its own unique subset of issues for discussion between the United States and Russia. First, during and after the negotiation of New START, Russia had expressed reservations about CPGS mounted on ICBMs, submarine-launched ballistic missiles (SLBMs), and other future U.S. delivery vehicles such as boost glide vehicles and

25. Steven Pifer, interview by Jerry Davydov, March 24, 2014; James Acton, “Beyond Treaties: Immediate Steps to Reduce Nuclear Dangers,” *Carnegie Endowment for International Peace*, <http://carnegieendowment.org/2012/10/10/beyond-treaties-immediate-steps-to-reduce-nuclear-dangers/e08j>.

26. David Sanger and Thom Shanker, “U.S. Faces Choice on New Weapons for Fast Strikes,” *New York Times*, April 22, 2010, http://www.nytimes.com/2010/04/23/world/europe/23strike.html?_r=0.

27. Alexei Arbatov and Vladimir Dvorkin, *Outer space: weapons, diplomacy, and security* (Washington, DC: Carnegie Endowment for International Peace, 2010), 81.

28. “Russia Warns of Nuclear Response to US Global Strike Program,” *RIA Novosti*, December 11, 2013, http://en.ria.ru/military_news/20131211/185462951/Russia-Warns-of-Nuclear-Response-to-US-Global-Strike-Program.html.

29. “Presidential Address to the Federal Assembly,” *Website of the President of the Russian Federation*, December 12, 2013, <http://eng.kremlin.ru/transcripts/6402>.

hypersonic cruise missiles. Despite assurances from Washington that nuclear warheads and CPGS systems would be based separately, Moscow maintains that one can never truly know what type of warhead is loaded on the delivery vehicles, and therefore any deployment of CPGS is destabilizing. This concern was expressed by President Putin during a 2013 meeting with high level defense-policy makers and defense contractors, in which he stated, “We see that work is active around the world on developing high-precision conventional weapons systems that in their strike capabilities come close to strategic nuclear weapons.”³⁰ From Russia’s view, CPGS could be misconstrued as a first-strike nuclear attack and thus force it to commit to a launch-on-warning nuclear strike against the United States.

Second, of greater concern to Moscow is that CPGS could threaten its nuclear forces and thus create a destabilized environment. Due to CPGS’ high maneuverability and capability to hit targets around the world with high precision and little warning, Moscow is concerned that it could be used to deliver nonnuclear munitions to targets in Russia that previously required nuclear weapons or to target Russian silos as a conventional knockout first strike. Deputy Prime Minister Dmitry Rogozin has warned Washington to “bear in mind, that if we are attacked, in certain circumstances we will of course respond with nuclear weapons.”³¹ In an attempt to address this potential vulnerability, Moscow has already announced a decision to “reconsider the issue of a rail-mounted missile system given its increased survivability and the extent of our railway network.”³²

Despite the benefit of adding CPGS into the framework of a new arms control treaty, it is not immediately clear whether Russia will be willing to engage in a new round of arms control negotiations without credible assurances in the form of data exchanges and joint studies to assess the technological capability of both the CPGS system itself and its potential effect on silos. Additionally, treaty binding limits are met with hardy skepticism from many, including Deputy Defense Minister Anatoly Antonov, who has said that “if a new element emerges in strategic plans of the United States, for example implying replacement of nuclear capabilities with conventional missiles that can fulfill the same tasks as the nuclear weapons—it would be rather difficult for us to think about further reductions. Taking into account such compensation in conventional arms, the negotiations for the next treaty on nuclear disarmament would hardly be the right step to make.”³³

Because the United States has announced a plan to develop a CPGS capability, Russia has raised a number of concerns related to the program, including the possibility of deployment of these weapons on ships or submarines. As part of the next round of arms

30. “Meeting on implementing the 2011–2020 state arms procurement programme,” *Website of the President of the Russian Federation*, June 19, 2013, <http://eng.news.kremlin.ru/news/5615/print>.

31. “Russia Plans Rail-Mounted Missiles to Counter US Global Strike Program,” *RIA Novosti*, December 18, 2013, http://en.ria.ru/military_news/20131211/185462951/Russia-Warns-of-Nuclear-Response-to-US-Global-Strike-Program.html.

32. “Russia Plans Rail-Mounted Missiles to Counter US Global Strike Program,” *RIA Novosti*, December 18, 2013, http://en.ria.ru/military_news/20131218/185683711/Russia-Plans-Rail-Mounted-Missiles-to-Counter-US-Global-Strike.html.

33. “Deputy Minister Antonov on Prompt Global Strike Weapons in Geneva,” *PIR Center Press*, May 17 2013, <http://www.pircenter.org/en/news/6452-deputy-minister-antonov-on-prompt-global-strike-weapons-in-geneva>.

control negotiations, Russia wants reassurances from the United States on CPGS development and deployment. In the past they have pressed for all strategic delivery vehicles, whether they carry a nuclear or conventional payload, to be counted under the same cap for ICBMs, SLBMs, and purpose-built bombers. In the lead-up to the next round of negotiations, the United States and Russia should begin a dialogue on the technical and political concerns associated with CPGS in order to build confidence. These discussions could comprise a number of topics, including but not limited to:

- annual declarations of CPGS size, composition, deployments, and acquisition plans (note that given the expense and small number of targets, there should be a relatively small amount of these types of weapons);
- advance notice for any changes to size, composition, and deployment;
- joint studies to determine which method of verification would be best for CPGS;
- inspections of silos housing CPGS delivery vehicles to demonstrate that CPGS delivery vehicles have nonnuclear warheads;
- data exchanges and demonstrations of CPGS technical capabilities in order to develop an early warning system; and
- a joint study to determine silo vulnerability.³⁴

Conclusion

Progress on reaching any agreement on NSNWs would require resolving a number of political issues, ranging from BMD to CPGS. Undoubtedly many of these issues are more difficult from the political standpoint than from the technical standpoint. If the United States and Russia could find common ground on these political issues, they will be able to resolve technical issues associated with BMD, CPGS, and NSNWs. Although current relations between the United States and Russia are at an all-time low in the post-Cold War era, even in the coldest parts of the Cold War arms control and nonproliferation policymakers continued discussions to enhance predictability.

The existing literature and debate on steps that can be taken to build predictability and transparency on BMD, CPGS, and NSNWs provide an extensive menu of ideas both the United States and Russia can take in the lead-up to future negotiations. Many of these steps are technical in nature and can be discussed between scientists and military planners from both countries. In the past, scientist-scientist and military-military cooperation has been easier than political cooperation. For example, in the lead-up to the cleanup of plutonium at the Semipalatinsk nuclear test site in Kazakhstan, scientists from the United States,

34. Alexei Arbatov, James Acton, Dmitri Trenin, and Natalia Bubnova, “Silver Bullet? Asking the Right Questions About Conventional Prompt Global Strike,” *Carnegie Endowment for International Peace*, <http://m.ceip.org/publications/?fa=53798>; Amy Woolf, “Conventional Prompt Global Strike and Long-Range Ballistic Missiles: Background and Issues,” Congressional Research Service, <http://www.fas.org/sgp/crs/nuke/R41464.pdf>; Steven Pifer, interview by Jerry Davydov, March 24, 2014.

Russia, and Kazakhstan came together to plan plutonium cleanup and then brought these proposals to their respective political counterparts. This type of cooperation may be useful, but without political backing, even modest proposals on how to deal with threat perceptions will not be realized.

Although there are currently substantial political hurdles to cross, the failure of the United States and Russia to engage in substantive discussion on arms control poses a serious risk not only to the U.S.-Russia bilateral relationship but to a range of other issues, including European security and nonproliferation efforts in Iran and North Korea. For the United States and Russia, failure to develop a roadmap for a follow-on treaty to New START—one that is complete with the transparency and accounting mechanisms of an arms control treaty—will reduce predictability and threaten strategic stability.

The Prospects for U.S.-Russian Collaboration after Ukraine

*Matthew Fargo*¹

Events over the past year in Ukraine have demonstrated that Russia remains an aggressive regional power willing to use any means, including military force, to maintain a sphere of influence on its periphery. These events suggest that volatility will continue to exist with respect to the tripartite relationship between the United States, Russia, and NATO Europe. The uncertainties facing U.S. policymakers necessitate continued vigilance and dedication to the underlying purposes of arms control: maintaining U.S. national security interests and providing a common framework through which U.S. and Russian negotiators can maintain consistent dialogue, no matter the fluctuations in the relationship. Neither the stakes nor the methods involved in this revived conflict constitute a return to the Cold War. However, a new framework must be developed in order to pragmatically engage Russia when possible and to respond with appropriate strength to any future aggression to reassure allies and deter reckless adventurism that risks direct conflict with NATO.

Introduction

The political-military dynamics between the United States, Europe, and Russia have been highly volatile over the past twenty-five years. The dissolution of the Soviet Union presented new challenges and new opportunities for the successor governments in Russia, Eastern and central Europe, and the United States and its allies. As the sole inheritor of the Soviet Union's thousands of nuclear warheads and their means of delivery, Russia continues to benefit from their military and political power. Since the end of the Cold War, the leaders of the United States and Russia have ratified four arms control treaties, recognizing the new political, military, and economic realities since the cessation of the decades-long ideological standoff. However, outside of this subset of foreign policy, the United States has been unable or unwilling to tackle many of the underlying differences and challenges that remained after the Soviet Union had fallen.

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Compounding the difficulties in establishing a resilient policy toward Russia has been the myopic perception of the post-Soviet space by many U.S. foreign-policy makers. Despite more than four decades of U.S. foreign policy fixation regarding the Soviet Union, precious little understanding of Russian motivations or deep appreciation for Russian interests permeated the thinking of U.S. leaders during the 1990s and early 2000s.

Lacking a discernible understanding of Russian sensitivities during this period, the United States undertook numerous actions without regard to Russian interests and downplayed the potentially significant political ramifications of ignoring Russian concerns. Despite Russia's continued avoidance of an unrestrained arms buildup with the United States (while maintaining rough parity simultaneously allows Russia to continue to "punch above its weight" in international affairs) and perpetuation of influence in the former Soviet republics, U.S. pundits have been surprised by Russian actions that suit these objectives. The importance of strengthening the U.S.-Russian bilateral relationship as an end rather than as a means of pursuing other policy objectives was ignored, with serious consequences for U.S. interests and the security of many of our NATO allies.² Opportunities that seemed to exist for potential U.S.-Russian cooperation have started to disappear, shrinking the areas of mutual interest where agreements can be made to an ever-smaller subset of foreign policy issues.

Against this backdrop—and in eerie resemblance to the Russian annexation of Abkhazia and South Ossetia and invasion of Georgia in August 2008—Russia annexed the Crimean Peninsula in March 2014 and continues to provide military support to separatist groups in eastern provinces of Ukraine.³ The events unfolding in Ukraine have been cited as ushering in a new era of even fewer opportunities for the United States to work with Russia.⁴ However, these seemingly atavistic actions veer closer to the status quo than some analysts recognize, as Russia continues to hold on to the perceived former glory of a bygone era. Russia's actions, indicative of its perceived and actual weakness, are also a product of Russia's rejection of Western values and methods that has led to Russia's inability to successfully improve its position in Europe through nonaggressive means.

For years, Russia has acted in its own interests, largely without regard for opinions in Washington or Brussels and, oftentimes, as a deliberate spoiler. Events in Ukraine are a sign of consistency rather than of a shift in Russian foreign policy. Furthermore, Russian interests are as diverse as any other major power; the degree to which Russian cooperation

2. David Rohde and Arshad Mohammed, "Special Report: How the U.S. made its Putin problem worse," Reuters, April 19, 2014, <http://www.reuters.com/article/2014/04/19/us-ukraine-putin-diplomacy-special-report-idUSBREA3H00Q20140419>.

3. Andrew Kramer and Michael Gordon, "Russia Sent Tanks to Separatists in Ukraine, U.S. Says," *New York Times*, June 13, 2014, <http://www.nytimes.com/2014/06/14/world/europe/ukraine-claims-full-control-of-port-city-of-mariupol.html>.

4. Samuel Charap, "The Ukraine crisis and the search for a new normal," *International Institute for Strategic Studies*, <http://www.iiss.org/en/politics%20and%20strategy/blogsections/2014-d2de/april-bff0/ukraine-and-the-new-normal-c687>.

or passivity can be secured on issues significant to the United States will depend directly on the perceived impact of those actions on Russia.

Although Russia's actions in Ukraine serve as a reminder that U.S. and Russian interests continue to contradict each other, Russian influence in Europe remains relatively weak. The gains that Russia can realistically seek to achieve and hold through territorial expansion in the current era are exceptionally modest. Russia's purported motivation behind this annexation has been the protection of Russian minorities in eastern Ukraine. Despite the exceedingly tenuous argument that this group needed official state protection from Russia, it is a well-worn trope of Russian territorial aggression as of late. Identical claims were made prior to Russia's annexation of South Ossetia and Abkhazia, wresting these areas away from Georgian control in 2008.

However, there is also a potentially unsettling similarity between Russia's actions in Ukraine and former U.S. actions in Europe. Deeply aggrieved by U.S. action in Kosovo, Russia largely incorporated the terminology of ethnic liberation from oppression and protection of minority rights in both Ukraine and in the territories it seized from Georgia. Reactions from U.S. pundits and policymakers have largely treated these claims as spurious, instead declaiming Russian actions as part of thinly veiled aspirations to return Russia to the imperial or Soviet glory of days past. In the event that this perception is incorrect, however, the implications for the United States and NATO would be dramatic—they could even foreshadow Russian desire to carve out further ethnic Russian enclaves in Eastern Europe. This would pose an especially challenging problem in the Baltic States, which have been NATO members since 2004. In the worst case scenario, U.S. and European unwillingness to respond forcefully to Russian encroachment in Ukraine may even create the perception that Russia could get away with similar actions even in the Baltic States. This possibility may represent the most potentially serious long-term outcome of the invasion of Ukraine. In order to reassure those allies and to deter any Russian provocation, the United States has moved small numbers of additional troops to those nations in the short term.⁵ Whether a reversal of the trend away from U.S. combat troop deployments in Europe will result from Russian action remains to be seen.

Despite Russia's annexation of the Crimean Peninsula, however, events have not derailed wider strategic initiatives favored by the United States that necessitate some level of Russian support or that require acquiescence to continue. In cases such as the Iranian nuclear negotiations, the removal of Syrian chemical weapons, and the continued monitoring of existing arms control treaties with the United States, Russian interests have not been affected by events in Ukraine, and therefore no substantive change in policy would improve Russia's position. Despite analysis to the contrary, Russia has no incentive to scuttle these negotiations, as this would needlessly antagonize the other members of the process and would see Russia gain little in return.

5. Jim Miklaszewski and Courtney Kube, "U.S. Troops Bound to Bolster Baltics," *NBC News*, April 22, 2014, <http://www.nbcnews.com/storyline/ukraine-crisis/u-s-troops-bound-bolster-baltics-n86821>.

The Reset and the Past

Once the Soviet Union ceased to exist, a vacuum was created in U.S. foreign policy, and the issue of how to incorporate the Russians into the existing international structures established by the United States and its allies was incompletely addressed. In the years since the end of the Cold War, NATO expanded to the borders of Russia, eventual NATO membership was promised to additional former Soviet vassal states Ukraine and Georgia, the independence of Kosovo from Russian-backed Yugoslavia was supported with military force, and the United States withdrew from the Anti-Ballistic Missile Treaty and began to deploy missile defenses in Europe. These developments were met with trepidation from Moscow and viewed as serious challenges to Russian interests and security, limiting any perceived potential for substantive partnership with the United States in the aftermath of the Cold War. Rather than becoming a fully fledged member of the international order as envisaged by the West, Russia remains paradoxical—both excruciatingly troublesome and hesitantly cooperative on various issues of concern to the United States.

Russian leaders have sought parity with the United States but have been generally disappointed, as substantive engagement has been largely driven by the United States and has been conducted on its terms. Although Russian leaders have seen their nation as a coequal to the United States even after the fall of the Soviet Union, U.S. leaders have largely discounted Russia in foreign policy decisionmaking since 1991, frequently directly contravening Russian wishes without respect to the consequences. This presumption that Russia's weakness and inability to obstruct U.S. policies has been slow to abate, resulting in mounting animosity and disillusionment in Moscow. What has followed has been an increasingly intransigent Russia and greater opposition to U.S. interests. It would be a mistake to view such actions as merely spiteful, however. Russia's relatively scant economic and political opportunities are largely constrained by the sheer volume of the United States' international political and economic ties. It should be little wonder, then, why Russia has continued to work with countries that remain outside of U.S. favor, such as Iran and Syria. On issues that are seen to benefit or at least not to harm Russia, cooperation and agreement have been easier to obtain. Ultimately, there has been little progress or effort since 1991 to persuade Russian leaders to accept a secondary position in an international system still dominated by the United States.

Negotiations and treaties to limit the testing and deployment of nuclear weapons have been a policy mainstay since the administration of President Kennedy. Due to the frequency of arms control negotiations during this period, one could easily mistake the bilateral relationship as one of primary concern to the foreign policies of both nations. However, outside of strategic arms control, the United States consults with Russia on very few issues, and those select others that are given direct attention are often tangential to the underlying problems in the relationship that have been allowed to slowly metastasize into hardened positions and incompatible perspectives.

After taking office in 2009, the administration of President Barack Obama made a concerted effort to improve the state of U.S.-Russian bilateral relations.⁶ Indeed, many issues of mutually beneficial topics remained where progress seemed possible, including further nuclear arms reduction, engagement with Iran regarding the nature of its domestic nuclear program, and transportation corridors to U.S. bases in Central Asia. Though these issues certainly represent important aspects of U.S.-Russian bilateral relations, such opportunistic engagements with Russia continued to ignore fundamental disagreements of both parties. Using this break in overt antagonism between the United States and Russia to merely tackle superficial or simplistic conflicts did little to improve overall U.S.-Russian relations and failed to establish stronger bonds between two nations that continued to view each other with suspicion.

Despite good intentions, this reset of U.S.-Russian relations has largely floundered. While both sides feel as if they have made attempts to improve the relationship in good faith, neither has perceived that their national interests have dramatically improved as a result. After the calamitous misunderstanding that NATO would not expand into Eastern Europe was followed by the expansion of the alliance right to the borders of Russia under the administration of George W. Bush in 2004, along with the announced deployment of missile defenses there despite shrill Russian opposition, only the most dramatic actions by the Obama administration could have truly corrected Russian perceptions of U.S. encirclement, aggression, and scorn. Moscow may have also believed that the conversion to a quasi-democratic system of government would have brought greater rewards, similar to those seen in the former Soviet republics of Eastern Europe. This has further disenchanted Russian leadership from the benefits of close cooperation and coordination with the West, undermining the aggressively mediocre steps taken in the late 2000s to slow the precipitous decline in U.S.-Russian conviviality.

The underlying principles guiding U.S. and Russian foreign-policy makers remain almost as divergent as was the case during the Cold War. This divergence stems from the deeply held perception that increased security and freedom from Russian influence in Eastern European nations and in other former Soviet states diminishes Russia's security. Recent events in Ukraine illustrate the degree to which Moscow still believes that Russian security depends upon the ability to influence events in neighboring territories.

Ukraine

Pundits who would argue that recent developments in Ukraine represent a turning point in U.S.-Russian relations ignore the last two decades, where occasional Russian compliance to U.S. foreign policy never represented agreement and repeated examples of Russia acting as a spoiler to U.S. efforts on the UN Security Council and elsewhere.⁷ Russia has pursued

6. Mark Landler, "Lost in Translation: A U.S. Gift to Russia," *New York Times*, March 6, 2009, http://www.nytimes.com/2009/03/07/world/europe/07diplo.html?_r=0.

7. Walter Russell Mead, "The Return of Geopolitics: The Revenge of the Revisionist Powers," *Foreign Affairs*, 2014, <http://www.foreignaffairs.com/articles/141211/walter-russell-mead/the-return-of-geopolitics>.

its own interests without regard to the consequences or opinions of those in Washington or Brussels when its leaders have believed that Russia has more to gain than to lose. It is important to note that merely because Russian actions are unfavorable from a Western perspective does not make those actions irrational, despite frequent claims to the contrary.⁸ Indeed, the one constant in Russian foreign policy since the end of the Cold War has been the preservation of Russia's core interests—namely, the preservation of Russian influence over former Soviet satellites. Fortunately, this relative consistency should make it easier to predict how Russia will behave in forums such as the UN Security Council in the future. Moreover, the international order has never before depended on Russian cooperation or even acquiescence, as it has been a by-product of U.S. efforts originating in the wake of World War II, a time when Soviet hostility and competition dwarfed modern Russia's relatively insignificant challenges to what has become a well-established set of political and economic structures.

Russia sees itself as a major power that can pursue its own agenda with as much freedom of action as the United States enjoys. In Ukraine, for example, President Putin's calculus that the United States and Europe would only react with perfunctory sanctions and little in the way of a substantive response has, as of this writing, held true. Criticizing sanctions for merely being symbolic, however, misunderstands the usefulness of these ostensibly meager actions. Because Russia was already burdened by sanctions based primarily on the grounds of human rights, small-scale and precisely applied sanctions provide a means of demonstrating discontent without necessitating a response severe enough as to endanger other aspects of bilateral relations. Furthermore, Russia's punitive response to rumors of planned U.S. and European denials of cutting-edge oil technology export licenses reveals the paucity of Russian leverage over the United States and the asymmetry between the two nations in terms of political, economic, and technological influence. Russia's decision to cut off exports of liquid-fueled rocket engines to the United States may, in fact, simultaneously boost the burgeoning private space flight industry in the United States, while it further decreases diversity and the economic potential of Russia's few leading industries unrelated to energy exports.

Prior to the Ukraine crisis, U.S. and European policies toward Russia struggled to find a balance between fragile economic interests in the wake of a slow and difficult economic recovery and promoting human rights, democracy, and other values core to the interests of the West. Despite Russia's repeated military interventions in the nations along its periphery, the economic necessity of ties to Russia makes any dramatic shift in European policies toward Russia unlikely.

Indeed, the Russian state-controlled gas corporation Gazprom recently announced that it had increased its supply of natural gas to Europe and Turkey to the highest historical

8. Brett Logiurato, "Bill Clinton Just Gave a Grave Warning About Putin's Plan for Ukraine," *Business Insider*, May 14, 2014, <http://www.businessinsider.com/bill-clinton-putin-ukraine-russia-obama-2014-5>.

levels yet: 30 percent of total market share.⁹ Despite hopeful analyses¹⁰ that the U.S. unconventional gas boom could provide an alternative source of energy,¹¹ easing European dependence on Russian energy exports, substantial investments would be needed in the infrastructure to support liquid natural gas (LNG) exports to reduce the cost of U.S. gas shipped to Europe, thereby undercutting existing Russian natural gas pipeline revenues. Few incentives exist to develop this infrastructure, however, due to the strong economic incentives to shipping LNG to Asia, where increased demand allows it to command a higher price than in Europe.¹² Without a reduction in current LNG costs, however, Europeans similarly have no incentive to purchase more expensive LNG when cheaper Russian gas remains plentiful.

On the demand side, diminishing interest in energy subsidies throughout Europe's largest economies suggests that without a shift in the economic incentives of LNG export away from Asia that could drive the needed investment, U.S. natural gas will not solve this central issue to European energy security. The economics of energy supplied by the United States also remains strongly in favor of shipping to growth markets in Asia that command higher prices for LNG. These factors will severely limit the potential impact of domestic U.S. development of shale gas on improving the energy security of Europe.

Similarly, the chances of a domestic shale gas boom in Europe dramatically reshaping European energy flows are unlikely. Only meager geological exploration has occurred so far in Europe, with less than 100 wells drilled as of February 2014. Although it is possible that success could come eventually to unconventional gas production in Europe, those developments remain decades away and cannot diminish in the near term Russian economic influence maintained through control of large segments of European energy markets. An analysis published by the Institute for Sustainable Development and International Relations has found that even a European shale gas boom would likely account for only up to 10 percent of European energy needs, and even then this level of supply would come online only in 2030.¹³ U.S. exports of coal could help make up for energy demand in the short term in Europe, as an inexpensive and plentiful alternative to Russian energy imports.¹⁴ Whether European leaders feel this opportunity provides enough political cover to respond more strongly to Russian aggression and to hedge their bets on a speedy resolution

9. Leonid Bershidsky, "Fracking Doesn't Threaten Russian Power," *BloombergView*, February 18, 2014, <http://www.bloombergview.com/articles/2014-02-18/fracking-doesn-t-threaten-russian-power>.

10. Coral Davenport and Steven Erlanger, "U.S. Hopes Boom in Natural Gas Can Curb Putin," *New York Times*, March 5, 2014, <http://www.nytimes.com/2014/03/06/world/europe/us-seeks-to-reduce-ukraines-reliance-on-russia-for-natural-gas.html>.

11. Marvin Kalb, "Putin's Pyrrhic Victory in Crimea," *Brookings Up Front Blog*, March 7, 2014, <http://www.brookings.edu/blogs/up-front/posts/2014/03/07-russian-president-putin-crimea-kalb>.

12. International Energy Agency, "World Energy Outlook 2013," November 12, 2013, <http://www.worldenergyoutlook.org/media/weowebiste/2013/LondonNovember12.pdf>.

13. Thomas Spencer, Oliver Sartor, and Mathilde Matthieu, "Unconventional wisdom: An economic analysis of US shale gas and implications for the EU," February 14, 2014, <http://www.iddri.org/Publications/Collections/Syntheses/PB0514.pdf>.

14. "European energy security: Conscious uncoupling," *Economist*, April 5, 2014, <http://www.economist.com/news/briefing/21600111-reducing-europes-dependence-russian-gas-possible-but-it-will-take-time-money-and-sustained>.

of the issue of energy dependency remains to be seen. Just as before the Ukraine crisis, central and Eastern European leaders remain keener than their Western European counterparts to dull Russia's economic weapons through the creation of an "energy union" and greater enforcement of anticorruption legislation with respect to Russian energy firms.¹⁵

The degree to which Russia can influence European policies, even with its firm hold on energy markets, is fairly limited. Gazprom announced that it was shutting off gas supplies to Ukraine as tensions between the two governments remain high. Unlike the crisis in 2009 when gas supplies through Ukraine were shut off completely, gas will still flow through Ukraine to other customers in Europe. Should Ukraine attempt to siphon off gas that continues to transit its pipelines, Moscow could elect to stop all shipments through Ukraine at its peril. However, the lost revenues of any prolonged gas shutoff will serve as a powerful disincentive to Russia. In addition, the shock such a move would create in European energy markets would inspire greater political creativity and willingness to pursue potentially less economically favorable but more politically stable options, such as a deal with U.S. LNG exporters, a return to greater government energy subsidies, increased government funding for unconventional drilling contracts, or perhaps a combination of these options.

Whereas Europe most frequently views Russia through the lens of economic interests, the United States approaches Russia from a more political-military standpoint. Nonetheless, while U.S. military planners were forced to make nearly all decisions under the potential specter of conflict with the Soviet Union, Russia today is viewed as a near peer and negotiating partner on equal footing only in the realm of nuclear weapons. The future of greater economic integration between Russia and Europe will depend heavily on the perception of Russia as a reliable business partner—an image Russia has done a poor job of cultivating with recent events. Furthermore, the former Soviet satellites in Eastern Europe will see their suspicions of Moscow justified and strengthened with each instance of Russian aggression. Far from driving a wedge deeper between the political beliefs of Eastern Europe and economic interests of Western and central Europe, Russia's moves in Ukraine will further isolate it and will drive European interests closer together.

Arms Control as a Confidence-Building Measure

Arms control monitoring and verification has been a key component of the bilateral U.S.-Russian strategic relationship for more than four decades.¹⁶ Arms control has often been seen as an end in and of itself rather than the means through which better U.S.-Russian relations could be comprehensively pursued. Foreign policy pundits often focus their energies on discussing how or why the next arms control agreement can or cannot be reached. Far more critical, however, is what those prospects and what any potential agreements mean in a much larger framework. Arms control agreements should not be viewed

15. "Charlemagne: The eastern blockage," *Economist*, May 17, 2014, <http://www.economist.com/news/europe/21602277-new-europe-divided-about-russia-old-europe-bad-consequences-all-eastern>.

16. Amy F. Woolf, Paul K. Kerr, and Mary Beth D. Nikitin, "Arms Control and Nonproliferation: A Catalog of Treaties and Agreements," July 15, 2013, Congressional Research Service, 4.

as the ultimate objective of U.S.-Russian negotiations or relations, as this would sell short the potential for eventual longer-term cooperation and engagement on a host of wider issues.

Accordingly, at times when the prospects for a new arms control treaty seem to be especially poor, as is the case as of the writing of this chapter, reexamining past arms control agreements and developing a thorough appreciation for how arms control has been and will continue to be used as a tool for maintaining at least a base level of trust and cooperation will be an important backdrop for reformulating U.S. policy with respect to an outmoded worldview and seemingly intractable hostility from Russian leadership.

The mistrust that has permeated U.S.-Russian relations has been embodied in arms control negotiations and treaties, and domestic political debates surrounding the ratification of these treaties have revealed the degree to which suspicions remain. As a means of safeguarding the previous diplomatic successes in arms control and maintaining some means through which U.S. and Russian policymakers continue to interact, ensuring Russian compliance with bilateral arms control agreements continues to be a top priority for U.S. policymakers. Ensuring compliance, especially as Russia modernizes its nuclear forces, will remain an essential mechanism for confidence building and for promoting international security.

In order to be perceived as worthwhile policy proposals, arms control treaties must enhance U.S. national security. Beginning in November 1969, the Strategic Arms Limitation Talks marked the first formalized bilateral nuclear arms control agreements between the United States and the Soviet Union. In the face of the seemingly intractable Cold War arms race and persistent tensions, U.S. policymakers sought increased transparency regarding the composition of strategic nuclear forces to help decrease suspicion, improve relations, and pave the way for more substantive negotiations. In addition, the Strategic Arms Limitation Treaty recognized the importance of rough nuclear parity between the two superpowers in preserving deterrence, a theme that has survived in all successive arms control agreements between the United States and Russia and that will still be necessary in any future arms control frameworks.

The verification mechanisms utilized under the Strategic Arms Reduction Treaty (START I) were among the most robust in U.S.-Russian arms control agreements to date. START I provided for the use of and mandated noninterference with the use of national technical means of verification. Both the United States and Russia were also required to exchange telemetry tapes, the onboard measurements taken during every missile flight test conducted, as well as corresponding interpretative data so that the telemetry tapes could be read. Encryption of telemetry data was explicitly forbidden so that neither side could disguise the acceleration profiles, stage separations, or the throw-weight of its missiles. START I also established continuous monitoring at the final assembly facilities for intercontinental ballistic missiles (ICBMs) to check that newly produced weapons followed the established protocols of the treaty, as well as the requirements established by the

earlier Intermediate Nuclear Forces Treaty. START I had no fewer than 12 separate types of on-site inspections and exhibitions, in order to provide both sides the utmost confidence in the efficacy of the treaty. Finally, in the instance that compliance concerns were raised by either side, a Joint Compliance and Inspection Commission was created in order to deal with any potential instances of inadvertent or deliberate cheating.¹⁷ Consultations through this commission have formed the basis for continuous improvement of adherence to bilateral arms control agreements.

Despite the centrality of monitoring two arms control agreements, the provisions for verification and compliance found in New START are less intrusive and demanding than the limits placed on strategic nuclear forces in the original Strategic Arms Reduction Treaty. Although New START set a limit on deployed strategic nuclear warheads, deployed missiles and bombers, and deployed and nondeployed launchers, the agreement retained none of the limitations of START I on throw-weight or the development of new missiles that had necessitated such intrusive verification mechanisms.¹⁸ At the signing of the agreement, new strategic nuclear forces were not on the cusp of deployment, so these more stringent limitations were seen as superfluous to the negotiations. Opponents to the treaty have argued that this makes New START unsatisfactory to foreign policy and national security interests.¹⁹

Although Russia and the United States still share telemetry data from selected missile tests under New START, critics of the treaty have argued that these exchanges are too insubstantial to assist with monitoring and verification. Conversely, some critics, such as Dr. Edward Ifft of Georgetown University, have argued that exchanging telemetric data will play a smaller role in verification with deeper nuclear reductions in the future.²⁰

However, given the importance of sharing telemetric data for greater transparency and as a confidence-building measure, these exchanges may in fact become more important in the next round of U.S.-Russian arms control negotiations. Although Dr. Ifft's argument will remain the case for future rounds of warhead reduction, and this was the nature of New START, this may not be the most beneficial or probable trend in future arms control treaties.

The Russians remain extremely apprehensive about the advancement of U.S. missile defense technology. Consequently, sharing telemetric data of missile defense flight tests may serve as a means to allay Moscow's fears or at least to quiet the most outspoken hawks in Russian defense circles. Despite persistent and significant technical difficulties, there remains strong domestic political support in the United States for the continued development

17. U.S. Department of State, "START: Basic Provisions of the Treaty," July 29, 1991, <http://dosfan.lib.uic.edu/acda/factshee/wmd/nuclear/start1/strtbasi.htm>.

18. U.S. Department of State, "New START Treaty and Telemetry Fact Sheet," Bureau of Verification, Compliance, and Implementation, April 8, 2010.

19. Peter Baker, G.O.P. "Opposition Dims Hope for Arms Treaty With Russia," *New York Times*, November 16, 2010, <http://www.nytimes.com/2010/11/17/world/europe/17start.html?pagewanted=all>.

20. Dr. Edward Ifft, presentation given for the "Short Course on Nuclear Weapon Issues in the 21st Century," November 2, 2013.

of ever-more-sophisticated and capable missile defenses as a means of bolstering deterrence, providing demonstrable strategic support to regional allies, and as a hedge against failures of deterrence or against rogue missile launches.

Just as New START featured language specifically designed to include future deployments of U.S. conventional ballistic missile technology such as conventional prompt global strike, any potential follow-on to New START may need to account for the exchange of data on missile defense technologies and perhaps include on-site inspections and displays of missile defense deployments, as START I did with road-mobile and rail-mobile ICBMs and heavy bombers.

In combination with other confidence-building measures, such as Russia's inclusion as an observer to missile defense drills and other NATO military exercises, laying the foundation for the next steps in monitoring and verification of U.S. and Russian strategic nuclear forces now will help promote greater international security and will provide realistic expectations to treaty negotiators who will be responsible for identifying and reinforcing the key interests of both countries. Unfortunately, Russian negotiators have repeatedly refused U.S. entreaties of this sort. The reasons for rejecting such offers are born out of a combination of bureaucratic obduracy, conflicting technical analysis, strategic shortsightedness, and fundamentally different interpretations of world events. As a result, missile defense seems to be a symptom and not a cause of the tense political state between the United States and Russia. Although it is important to continue to engage with Russian leadership and, where possible, civil society in an effort to slowly develop greater comity between U.S. and Russian worldviews, true resolution of these issues does not appear to be a feasible near-term goal.

Although Russia's rejection of President Obama's overtures at a speech in Berlin in 2013 to continue strategic arms reductions, and Russian domestic realities make a follow-on to New START unlikely in the near term, the progress made over the past 30 years of arms control must be maintained through continued inspections, military-to-military and scientific exchanges, and other mechanisms through which communication can remain open at the operational level. Although a new agreement may not be in the offing, U.S. policymakers can still take steps to better adapt to political realities of the U.S.-Russian relationship going forward, preparing to take advantage of opportunities for cooperation if and when they present themselves. It will also be important to use the political momentum gained within Europe as a result of Russia's recent aggression.

While there may be no easier answer to working with Russia in the coming years, navigating the long-term obstacles and displaying greater willingness to apply pressure when appropriate, while recognizing the inability of concessions alone to win over Russian leaders, must become critical features of U.S. foreign policy if we are to maximize the potential available in this less-than-optimal political environment.

Future Engagement with Russia

Opportunities for key breakthroughs in U.S.-Russian relations are difficult to imagine at the present time, and severe challenges remain deeply entrenched in the psyche and political approaches of each country. Many of the policymakers and military leaders within each nation remain deeply suspicious of the other's intentions. These suspicions remain deeply embedded in the political-military structures of both the United States and Russia. However, U.S. foreign policy can better engage with Russia on a host of issues and can adopt new approaches toward more mutually beneficial consequences. There is no magic bullet to resolving the conflicts of interest between the U.S. and Russia, but that does not mean that progress cannot be made or that efforts ought not to be taken to improve the situation where possible.

Continuing to reach accord when it is achievable will play an important part in the U.S.-Russian bilateral relationship, but the mindset driving the search for such agreements ought to adapt to a longer view of events, rather than maintaining the focus on short-term gains that has dominated U.S. policy toward Russia since the end of the Cold War. The United States must better identify when it is in its long-term interests to follow courses of action unilaterally, or at least without Russian support, and when inaction and discretion designed to avoid provocation may be more valuable than immediate short-term gains that risk imperiling other U.S. interests. Deciding how best to achieve U.S. interests will require greater introspection and national debate regarding the often conflicting geopolitical and moral motivations driving U.S. foreign policy. It will also benefit long-term U.S. objectives if reaching agreements with Russia, and with other nations, is viewed as a tool of continuous constructive engagement, rather than the end goal of negotiations. Future agreements, no longer driven by near-apocalyptic necessity, will be best used as leverage to contain and focus the discussion around difficult issues of mutual concern, providing alternative structures through which the parties can express their needs and interests.²¹ The example of ongoing negotiations with Iran, for example, provides insight as to Russia's willingness to respond to potential regional crises in a way that may serve both U.S. and Russian interests.

If it is the case that U.S. foreign-policy makers begin to value the strength of the U.S.-Russian relationship as ipso facto valuable, then coming to view cooperative efforts on international issues such as Iran's nuclear program and the removal of chemical weapons from Syria will become a means to an end, rather than the primary objectives of negotiation. The response in the United States has given Russia little credit for its willingness to seek a solution to a regional problem with ramifications for international security. This lackluster welcome to an especially thorny political situation significantly reduces any ancillary benefits that solutions from regional crises may produce. The rationale for such a tepid response may reside in the preference of policymakers in the United States to view U.S.-led actions with greater inherent value than those spearheaded by Russia. It may

21. Bernard Mayer, *Staying with Conflict* (San Francisco: Jossey-Bass Publishing, 2009), 183.

also belie the underlying suspicion that any Russian action on the international scene represents a coldly calculated decision to maintain while giving up as little as possible—as though circumstance does not dictate that all nations pursuing their interests frequently act in this manner.

The overarching framework within which such agreements could be viewed as desirable might seek other wider objectives, such as a persistent de-escalation of tensions between U.S. and Russian foreign policy aims, increased communication between decision-making and policy implementing bodies in both governments, and a shift in domestic conditions so that greater economic cooperation is achievable. Continuing to exploit the few remaining areas where U.S. and Russian interests overlap and agreement can be reached will not resolve all issues between our two nations; however, the effort serves an important function nonetheless.

Unfortunately, the viability of this approach to U.S.-Russian relations is often discounted as fanciful or overly idealistic. However, the strategy being outlined, which might be termed optimistic opportunism, would be both highly pragmatic and would shield U.S. interests from Russian capriciousness.

U.S. policymakers also face a potential decision point in formulating a more coherent approach to Russia in the coming years. The Cold War has not returned. There is no ideological appeal in Russian nationalism that extends beyond the borders of the Russian Federation. Indeed, nationalism hardly enjoys unanimous support within Russia due to its continued marginalization of its ethnic minorities. Rather, the United States must come to terms with the failure of the end of the Cold War to bring about a truly substantive change in the philosophy of Russian leaders and in their perception of Russian interests as not concurrent with those of the West. Developing this rudimentary understanding of the origin of Russian political thinking and policies will serve to improve U.S. policy and will allow greater probability of success in U.S. efforts that depend upon Russian agreement or acquiescence. Treating Russia as a partner, when on those rare occasions cooperation is possible, and not resorting to recriminations or name-calling when Russia recklessly pursues its own self-interests will constitute a small but important first step in this process.

Developing a systematic approach to U.S.-Russian relations will demand a rigorous analysis of what Washington can and cannot tolerate from Russia. Russian influence in the former Soviet Union is clearly a priority in Moscow, but this interest often undermines U.S. and European efforts at democratization and wider economic integration of those nations. U.S. decisionmakers may, in fact, decide that U.S. interests do not intersect with Russia frequently enough to warrant serious concern, as has been the case in the past. However, such decisions would be made at the peril of U.S. interests and the security of our allies. Russia is not the power it once was, but neither can it be entirely discounted nor pushed aside without significant exertion. Decisions taken now that continue to embolden or anger Russia may not have the life-or-death consequences of the Cold War, but they will determine whether the United States and Russia remain adversaries beyond the reign of President Putin.

Bomber Nuclear Culture: On the Cusp of Excellence

Charles Goetz¹

Recent mistakes within the nuclear enterprise have introduced a wave of intense scrutiny and have resulted in multiple studies on shortcomings and state of forces. These studies primarily focus on the missile community. This chapter, conversely, seeks to define the current culture of the nuclear bomber force. The author conducted multiple, semistructured interviews with nuclear bomber operators at all levels. These interviews are unique because the author is recently qualified in both the B-2 and the B-52 and is not a high-ranking official. These qualities led to candid feedback. This chapter presents those interview results and proposes low-cost, immediately deliverable, leadership-based solutions to improve the climate and optimize the nuclear bomber culture.

Introduction

Culture is often overlooked in military strategic planning and diplomatic policy making because by its very nature culture is largely hidden from everyday awareness. It is nevertheless omnipresent, subconsciously guiding the behavior, choices, and interactions of its constituent members.

—Kimberly A. Crider, *Strategic Implications of Culture*²

In 2007, a crew from Barksdale Air Force Base (AFB) inadvertently transferred nuclear weapons from Minot AFB, North Dakota, to Barksdale AFB, Louisiana. This event, in conjunction with the unauthorized transfer of nuclear components to Taiwan, triggered a complete review of America's nuclear enterprise. As a result, the Air Force Nuclear Task

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2. Kimberly A. Crider, *Strategic Implications of Culture: Historical Analysis of China's Culture and Implications for United States Policy* (Maxwell AFB, AL: Air University Press, September 1999), 3.

Force report, *Reinvigorating the Air Force Nuclear Enterprise*, identified 132 separate findings detailing the erosion of nuclear preparedness. Shortly after the release of that report, Air Force Global Strike Command was activated, which implemented an overhaul of U.S. Air Force nuclear weapons safeguards and nuclear mission training. After reaching compliance with many of these sweeping changes, the country turned its attention away from the nuclear enterprise, only to be stunned again in 2013 with the decertification of 17 missile crew members in Minot AFB, based on their attitude toward the mission. An internal e-mail related to the event was subsequently published detailing a broader issue of rot in the crew force. Additionally, two top nuclear officers—the vice commander of U.S. Strategic Command (USSTRATCOM) and the 20th Air Force commander (the commander of all nuclear missile forces in the United States)—were both relieved of command for unprofessional behavior. Finally, the Air Force Office of Special Investigations began investigating a drug scandal, which uncovered a cheating scandal and led to the subsequent decertification of more than 90 missile launch officers. These unprecedented failings, especially given their close proximity to one another, have brought a wave of intense scrutiny back to the nuclear enterprise. Accordingly, the secretary of the air force and the secretary of defense commissioned multiple studies targeting the shortcomings of the enterprise and the current state of its forces.

The aforementioned issues illustrate that even in the face of substantial organizational change, a cultural problem still exists within the nuclear enterprise. The scandalous actions within the nuclear force may be reflective of a culture in need of attention, and they are definitely contrary to the stated goal of the Nuclear Posture Review of “strengthening regional deterrence and reassuring U.S. allies and partners.”³ Stewardship matters. How the nation handles nuclear weapons and how the Department of Defense (DOD) treats those entrusted with their care holds a direct correlation to how much the nation values those weapons, the perception of their utility in our national defense strategy, and the importance of the strategic umbrella we extend to our allies.

A recent bottom-up review of the nuclear missile community uncovered a cultural problem that has fostered actions and attitudes contrary to the mission of the air force nuclear enterprise and falls woefully short of the U.S. public’s expectations for those entrusted with the care and employment of these special weapons.⁴ It is appropriate, then, as a bomber pilot, to take the opportunity to turn the conversation inward and have an honest dialogue about bomber nuclear culture. This research project seeks to answer the following questions: What is the current culture among officers in the air force nuclear bomber fleet? What actions can be taken to improve the climate and potentially adjust that culture?

3. U.S. Department of Defense, *Nuclear Posture Review Report* (Washington, DC: Pentagon, April 2010).

4. Carla Pampe, “Force Improvement Program team moving forward,” *Air Force.mil*, 8 April 2014, <http://www.af.mil/News/ArticleDisplay/tabid/223/Article/478226/force-improvement-program-team-moving-forward.aspx>.

Cultural History

The Strategic Air Command (SAC) was commissioned to “conduct long range offensive operations in any part of the world, either independently or in cooperation with land and naval forces [and] provide combat units capable of intense and sustained combat operations employing the latest and most advanced weapons; train units and personnel for the maintenance of the strategic forces in all parts of the world; and perform special missions as the command general, Army Air Forces may direct.”⁵ This charter, revised and rewritten with each change of the nuclear enterprise, has remained the mission of the strategic nuclear bomber force. But while the mission remains the same, the culture of the operators who perform that mission has changed.

The culture of the air force nuclear bomber force began with rigid discipline based on strict regulatory guidance and checklist adherence. This culture was reinforced by continuous inspections with immediate and pitiless consequences. General Curtis E. LeMay, who was the commander in chief of the SAC in 1948, called this a culture of accountability and took every opportunity to hold airmen at all levels accountable. This Cold War philosophy fueled the airmen that defended the United States through nuclear deterrence. They were professional, capable, and proud. The extensive procedures and unyielding demand for absolute compliance were not overly suffocating, given the above context. SAC airmen, while definitely disgruntled at times by their superiors,⁶ were invigorated by the tremendous responsibility afforded to them by virtue of the mission. Pride stemmed from belonging to a large, elite cadre that oversaw the world’s most destructive weapons and the precarious balance of peace their stewardship brought to the world. The weakness of this culture was the intended concept of operations of centralized control, and centralized execution insidiously devolved into severe micromanagement.⁷ Few (if any) decisions were made and few actions were taken without headquarters, at multiple levels, granting permission, regardless of their significance to operations.

After the Cold War, SAC was deactivated. General McPeak, chief of staff of the air force, implemented a massive drawdown of the Air Force to make it smaller and more agile. He created a streamlined culture where headquarters played a significantly smaller role in operations, and units operated under best practices to achieve mission success: “We redistributed power inside our Air Force—shoved it down and out from the headquarters. We empowered the people who were working on the actual problem. To support this initiative, we started replacing regulations with policy guidance the ‘what and why’ of something that needs to be done. We leave the ‘how’ part to the people who know the mission best and we provide metrics to help measure operational performance.”⁸

5. Herman Wolk, *The Struggle for Air Force Independence 1943-1947* (Washington, DC: Air Force History and Museums Program, 1997).

6. Marshall L. Michel, *The Eleven Days of Christmas: America’s Last Vietnam Battle* (San Francisco: Encounter Books, 2002), 122.

7. Ibid., 5.

8. Merrill McPeak, “The Quest for Quality” (speech, First Quality Air Force Symposium, Montgomery, Alabama, 21 October 1993), in *Selected Works of the CSAF Merrill McPeak 1990–94*, 265.

This philosophy created a culture of flexibility, where adaptation and improvisation was praised and rewarded as innovation. While intended to be liberating, failure to address the unique needs of nuclear weapons, including the requirement for regimented structure, allowed this culture to degrade to one of technical ignorance hidden by increased expedience.⁹

In October 2008, the “Strategic Plan to Reinvigorate the Air Force Nuclear Enterprise” established a required “culture of: compliance, accountability, self-assessment, discipline, excellence, zero defects, reliability, rigid adherence to standards, and a culture of primacy for the nuclear deterrence mission.”¹⁰ The return to a zero-defect culture was a central focus, which was completely opposite and dramatically opposed to the current culture. The report stated, “There is no tolerance for complacency or shortcuts as we rebuild a ‘zero-defect’ culture.”¹¹ This zero-defect mandate was understandable. It must have been perceived as the only acceptable change following the illumination of such a dramatic cultural decline. To some, this change was reminiscent of the now forgotten and romanticized SAC era of operations. One senior and outspoken critic warned the military against this very culture; U.S. defense secretary William Perry stated in 1996, “Demanding such a rigid standard produces timid leaders afraid to make tough decisions in crisis, unwilling to take the risks necessary for success in military operations. This zero-defects mindset creates conditions that will lead inevitably to failure.”¹²

Finally, the most recent guidance on the culture of the nuclear enterprise came from the *Flight Plan for the Air Force Nuclear Enterprise*, released in June 2013. This reemphasized the cultural goals from 2008 with a clear focus on regaining the culture of compliance and rigorous self-inspection: “A bottom-up, internally-driven self-assessment culture that routinely uncovers deficiencies, identifies systemic weaknesses, and addresses those issues in a disciplined, accountable manner must be established.”¹³ Rather than a return to SAC, the flight plan seeks a balance between General LeMay and General McPeak’s cultural constructs. The new vector communicates the need for inspections and exercises, undertaken with the purpose of providing clear oversight and evaluating unit readiness and practices. However, the *Flight Plan* empowers the highly skilled airmen who know their units and their duties exceptionally well to implement inspections themselves on a continuous basis. This construct potentially eliminates the need for multiple inspector general visits and months of lost productivity preparing solely for these visits. It also eliminates the undesirable effect of units training to simply get through the inspection and then returning to business as usual to make things run day-to-day after the inspectors leave. The

9. Michelle Spencer, Aadina Ludin, and Heather Nelson, *The Unauthorized Movement of Nuclear Weapons and Mistaken Shipment of Classified Missile Components: An Assessment* (Maxwell AFB, AL: USAF Counterproliferation Center, Air University, January 2012), 44.

10. Laurel Gammon, *Culture Change: Is the United States Air Force Taking the Right Steps to Change the Culture of the Air Force Nuclear Enterprise?* (Maxwell AFB, AL: Air University, 2011).

11. Air Force Nuclear Task Force, *Reinvigorating the Air Force Nuclear Enterprise* (Washington, DC: Headquarters United States Air Force, 2008), 12.

12. William J. Perry, interview by Linda D. Kozaryn, *American Forces Press Service*, August 6, 1996.

13. U.S. Air Force, *Flight Plan for the Air Force Nuclear Enterprise* (Washington, DC: Headquarters U.S. Air Force, June 26, 2013), 20.

caveat to all this is that leadership must have trust in the integrity of the airmen performing the mission and the inspections. These airmen must be trusted to properly place their loyalty to the nation and the mission above their unit and peers and provide the necessary feedback when course corrections are required.

Since 1947, the air force nuclear bomber force has progressed through cultures of accountability, flexibility, zero-defect, and compliance. Some also contend that “continuous change in itself became a culture.”¹⁴ Given such numerous and substantive changes to the very fabric of operational norms and the effect those changes have on morale and operational climate of the force, it is important to critically analyze the current bomber culture.

Current Culture

In an effort to understand the current culture of the nuclear bomber force, several semistructured interviews were conducted in both the B-52 and B-2 bomber communities. The results of those conversations revealed a force that is extremely capable of accomplishing tasked missions despite frustrations with the current environment surrounding nuclear weapons. The current culture of the air force nuclear bomber aircrew can be summarized as one of competence. Officers that employ U.S. nuclear bombers are capable, well trained, and compliant with the mission requirements. That said, few officers interviewed were enthusiastic about their nuclear duties and fewer still were optimistic about their future in the air force as nuclear operators. When questioned about the nuclear mission, the airmen articulated clearly and almost unanimously their frustrations:

- No room for error in training and learning the mission;
- Constant drive for perfection creates timid commanders who drive their people into the ground preparing for inspections. Each new commander expects their people to “sprint to the finish” for him or her, but for their people there is no finish, the cycle just repeats with the next commander;¹⁵
- Little or no opportunity for career progression as a nuclear expert;
- Little or no cross talk among the bases or with headquarters;
- No opportunity for a junior officer to improve the system;
- Nonvolunteer assignments and deployments to a nonnuclear billet seemingly contradict the top priority nuclear mission;

14. Spencer, Ludin, and Nelson, *Unauthorized Movement*, 43.

15. Command tours are typically 24 months in length at the squadron level, and it is not unusual for a nuclear bomber operator to stay in the aircraft for five years on their initial assignment.

- Unlike the conventional mission, in which the force understands the mission context and is capable of making a decision in the heat of battle, there is virtually no broad understanding of the nuclear mission; and
- A belief they will never be called upon to execute the mission.

Everyone interviewed was certified as nuclear combat mission ready (CMR), current and proficient, and they were all generally frustrated. How long can we continue to excel without enthusiasm? If there is no desire to be exceptional, there is a risk of slipping back into the culture of 2007, when aircrew performed the mission to the minimum standard. They performed the least amount of work required (or perceived to be required) to avoid incident. Simply getting by always provides a false sense of security in the ability to perform. Also, operating at a level just high enough to avoid incident eliminates any factor of safety. Therefore, any mistake risks becoming an incident. This minimum required attitude combined with the resulting overconfidence proved a recipe for failure then and will again. Conversely, when culture drives crews to strive for excellence far above the minimum, the potential to fall short is greatly reduced.

A New Vision

According to Dr. John Kotter, professor of leadership at the Harvard Business School, culture changes when “a powerful person at the top, or a large enough group from anywhere in the organization, decides the old ways are not working, figures out a change vision, starts acting differently, and enlists others to act differently.”¹⁶ This is an attempt to consolidate and elevate the voice of the nuclear bomber community to present a change vision and enlist the community to act differently. That vision is a culture of excellence—excellence bounded by competent, confident airmen with a foundation of education and compliance. According to Colonel Goodwin, the 509th Bomb Wing vice commander, excellence is what we achieve with the discipline of task as the known quantity. When discipline is the minimum expectation (not a goal, but the minimum standard), we can then use leadership and judgment to execute at an even higher level of confidence than ever before.¹⁷ The first step to making forward movement toward excellence is to fully understand the requirement of compliance, as it is the foundation for everything. An interview with Mr. Keith O’Donnell from the Office of the Assistant Chief of Staff for Strategic Deterrence and Nuclear Integration (A10) within Headquarters Air Force, the office that authored the flight plan, explains that a culture of compliance is not simply complete adherence to the checklist and technical manuals without deviation or conscious consideration. At its heart, it is a culture where all operators know the

16. John Kotter, “The Key to Changing Organizational Culture,” *Forbes*, September 9, 2012, <http://www.forbes.com/sites/johnkotter/2012/09/27/the-key-to-changing-organizational-culture/>.

17. Colonel Kristen E. Goodwin (vice commander 509th Bomb Wing, Whiteman AFB, MO), interview by the author, December 2013.

regulations and understand the intent behind those regulations.¹⁸ It is critical to adhere to the technical orders and all regulations in bomber operations, but the regulations and technical manuals must be adaptable and open-ended to allow action. As one B-52 instructor pilot said, “you have to know the black and white to live in the gray.”¹⁹ Adherence to the regulations is not a replacement for sound judgment. Knowing the background and the intent behind regulations allows the operator to apply them in context to the situation and make safe decisions while employing them with maximum effectiveness. This is true compliance.

It is also important to understand that while an organization is comprised of individuals, it is the collective mentality that creates the culture. Positive actions applied to all aviators equally can dramatically improve the climate of the nuclear bomber force and over time change the culture. However, if actions are applied discriminately, a new set of problems will arise. Growing individuals is not the same as growing organizations: “A distinct [difference exists] between an organization that is merely comprised of high-performing individuals and one that produces personal excellence by emphasizing individual development and collaboration.”²⁰ *Air Force Leadership and Force Development* (2011) lists excellence as a core value and divides it into separate personal and organizational categories: “The description of personal excellence reflects its namesake, but the explanation of organizational excellence requires members to work together toward a common goal. The two ideas are not synonymous.”²¹ If commanders choose to develop only specific individuals instead of improving the entire organization by providing growth and opportunity to all, they run the risk of animus setting in and debilitating the organization by ostracizing their highest potential officers.

Culture does not stop at the end of the mission, nor end when air force instructions conclude. Culture is ever-present, establishing social norms and acceptable behaviors; therefore, to attain a culture of excellence, the crew force must attain a positive attitude with regard to nuclear weapons. Operators should view the nuclear mission as more than a high-threat, zero-defect tribulation. They should view the mission with pride, tireless motivation, unparalleled professionalism, and, if not excitement, at least profound respect. To develop these traits in the crew force, it is incumbent upon leaders in the bomber community to foster them. To achieve this, apply the simple acronym, ACE: appreciate, communicate, and educate. Appreciate your people and their sacrifices and demonstrate it. Communicate their value and role in deterrence and assurance operations. Educate on the plans and policy and the need for deterrence operations.

18. Mr. Dave O'Donnell (Chief of Assessments Headquarters Air Force A10), interview by the author, May 2014.

19. Interview with major from Air Force Global Strike Command (unattributed interview).

20. Major Matthew Burrows, *Organizational Culture in the B-2 Bomber Operational Community: A Qualitative Exploration of Culture and Mission* (December 2012), 29.

21. Ibid.

Recommendations

APPRECIATE

Theodore Roosevelt once said, “Nobody cares how much you know till they know how much you care.”²² People generally need to feel appreciated to stay motivated. Problems identified by nuclear operators stemmed from the perception that they are undervalued while executing the air force’s number one priority mission. This attitude can be curbed through some simple changes in the way leaders of the nuclear enterprise demonstrate the value of their people.

First, operators must have time to train. Bomber crews need to fly, test, succeed, and fail. The best lessons are often learned through failure. Operators practice weapons delivery in both the simulator and actual aircraft, yet the venue for practicing command and control procedures is only monthly testing. These tests are meant to stretch the envelope of the possible and expose crews to any potential situation they may encounter during mission execution, no matter how remote the possibility. These sessions are excellent ways to grow and learn, but the penalty for receiving less than a 92 percent is to have the wing commander (WG/CC) decide whether or not to decertify the crew from nuclear duty. These tests should be hard and should demand growth, but they should not be tied to consequences. Crews should be able to take these exams as training, not testing. Crews still need to be evaluated on their knowledge and ability to perform the mission during periodic inspections, but not monthly. Whiteman AFB recently implemented a policy to inform the operations group commander (OG/CC) instead of the WG/CC immediately following an unsatisfactory score and allow the OG’s discretion to determine if retraining would be so extensive that it would require WG/CC notification. This policy is a step in the right direction. This simple change demonstrates to the crew force that their leaders value them and their training. It takes the crews out of the constant pressure cooker of required perfection and gives them time build their skills without fear of being highlighted to their leadership as someone who cannot accomplish the mission.

Another clear signal from leadership to the force is who is placed in charge of overseeing the bases’ nuclear functions. In the B-52 community, those functions are the office of OSX in the Operations Support Squadron. This flight is a small team of three or four aviators and a nuclear executive manager (NEM), usually led by a U.S. Air Force Weapons School graduate. In the B-2 community, the office consists of two people, the NEM and the nuclear training officer.²³ The NEM is always a B-2 instructor pilot and the training officer is almost always an electronic warfare officer or radar navigator from the B-52. Who the leadership selects to man these positions is critical to the crew forces’ perception of the nuclear mission’s value. If these positions are manned with the sharpest, most motivated and talented warriors in the wing, it is a clear signal of their value. These positions, in turn, become a goal for young crew members. However, it is not enough to simply man the

22. Attributed to Theodore Roosevelt.

23. At all three bases, the command post plays an integral role in nuclear operations; however, this chapter’s focus is limited to rated officers and therefore will not discuss the command post in detail.

nuclear offices with the best aviators for a short time to get it into their personnel records and then shuffle them off to another position. They must be allowed to build expertise in the position. Many operators currently do not vie for these positions because of a perception that tasks such as planning current operations (conventional) or working in specialty positions like an executive officer have a better impact on one's career than nuclear operations. This perception must not continue. Nuclear expertise in one's community should be requisite to be considered a high-potential officer. This does not stop at the unit level. Sending these officers to nuclear-related fellowships and internships, including to the national capital region, for intermediate developmental education (IDE) broadens their experience base and sends a powerful signal of the skills valued by leadership.²⁴ It is imperative to demonstrate a clear correlation between nuclear expertise and career progression to attract the best talent to compete for more nuclear responsibility at every level.

Another major incentive to the bomber crew force is stability and predictability. Stability and predictability equate to time and family. While not always possible, they should be given the utmost attention because of the inherent increase in quality of life associated with stable schedules. One recommendation is to track nuclear CMR status more closely to allow Air Force Personnel Command to easily identify who is actively engaged in deterrent operations and fence them from nonnuclear related deployments. When a CMR aviator is pulled from the unit to fill a six-month or yearlong deployment working in a job unassociated with their nuclear expertise, it not only destroys stability and predictability for that member's family, it clearly communicates that the post they were filling as a CMR aviator is not as important and not valued as much as the job they are being pulled to accomplish. If the nuclear mission truly is the number one priority for the air force, logically it would not be possible for any nuclear airman to do anything more important, and therefore that airman should not be eligible for a deployment outside of the nuclear mission. It is well understood that urgency and priority are different. The air force leadership can decide to shift resources and people to any contingency operation without intending to denigrate the nuclear mission. However, the practice of pulling nuclear operators to fulfill deployment requirements based primarily on their apparent lack of involvement in current conventional operations is flawed logic and is sending the wrong message to the nuclear enterprise.

Stability should also extend to the nuclear experts who choose to remain line instructors and not pursue a career path toward leadership. Some aviators simply desire to fly and teach for the entirety of their air force careers. These aviators find special gratification in being the subject matter experts of all things related to their aircraft and its employment, beyond the expertise possibly gained in a single tour in the jet. These instructors are invaluable and should be treated as such. Colonel Goodwin stated when asked about the problem of experience loss in the nuclear enterprise, "Not everyone is a future commander and that's okay! We need a way to capture these individuals . . . individuals with energy and passion for the mission . . . keep them motivated, and let them know they are valued."²⁵

24. These opportunities are also an excellent method of communication, which is discussed later.

25. Colonel Goodwin interview.

Allowing flight instructors to remain flying for extended periods and forgo the opportunity to attend IDE and staff jobs has the potential to grow expertise in a way that is currently not possible. Continuing to send these officers to staff assignments and deployments in an attempt to develop their careers in a direction they do not desire will result in losing the opportunity to have true technical experts in the units. The nuclear enterprise may lose these officers altogether should they seek the stability they desire in the Air Force Guard and Reserve in nonnuclear units or in the airlines.

COMMUNICATE

The second major recommendation is that leaders communicate more effectively with their people. In today's geopolitical context, there simply is no existential threat to the United States, and thus the nuclear arsenal can seem dated and obsolete. Therefore, the value of nuclear weapons and those that execute the nuclear mission must be communicated clearly and often. If education is theory and history, then communication is practice and application. The best way to counter the notion that the nuclear enterprise will never be called upon to execute its mission is to communicate the fact that the nation uses nuclear weapons every day. By maintaining a credible nuclear deterrent, the nuclear enterprise allows diplomats to begin the discussion at a fundamentally different level. It is implicit in every conversation our national leaders engage in that we will protect our allies and defend ourselves and our interests with the most destructive weapons the world has ever known. These undertones do not stem from our technological prowess alone; they are derived from the uniquely survivable and executable nature of the U.S. nuclear arsenal. The burden of that execution rests with the airmen and sailors of the nuclear enterprise. Being certified as CMR, nuclear operators change the calculus of our adversaries and our allies. That is an impressive credential, though mostly lost on today's operators.

Leaders have two readily apparent avenues to communicate to their force: inspections and exercises. An inspection is an excellent time for senior leaders to address the crew force and truly communicate their value. A senior leader simply making an appearance during an inspection adds gravity to the event. After the inspection is finished, communicating the importance of its success or the consequence of its failure to the crews who participated drives home their value.

Exercises are another excellent opportunity for leaders to communicate effectively with the crew force. In this case, peer leaders should take the opportunity to be a positive influence, stamp out any negativity, and utilize the time effectively to focus on the special requirements of the nuclear mission and the value of deterrence operations. Senior leaders should again communicate the value of the exercise to the crew force. An excellent example of an exercise that presents the perfect opportunity to communicate the importance of deterrence operations was Exercise FOAL EAGLE, when two B-2s flew over the Korean peninsula during a time of tension with North Korea. This exercise highlighted the effectiveness of global strike operations executed by nuclear assets. The impact of the mission was echoed throughout the media immediately and continuously for months. Hearing from

the policymakers who leveraged this exercise to further U.S. interests provides a direct correlate to the mission and is invaluable to underscoring the worth of the nuclear enterprise.

Seminars and workshops with other agencies involved in the nuclear enterprise are other ways to connect the crew force to the bigger picture. It is important to understand that the United States has a vast array of individuals working on nuclear weapons and nuclear doctrine. The infrastructure supporting the weapons is impressive, and it remains largely unnoticed by military operators. Connecting the operator with this vast network of people and even larger network of scholars, who research and debate the best uses for the nuclear arsenal, would make tangible the enormous responsibility of executing the final step in the use of these weapons.

Communication must also include the crew force talking with each other. Cross talk among bases and platforms is critical in understanding individual roles in operations, identifying gaps in training, and implementing best practices to elevate our standards. It is also critical to establish an avenue of communication with senior leadership and USSTRATCOM so the aviators who implement the nuclear mission can recommend changes to improve the entire system. One idea presented during interviews was the establishment of a joint NEM working group to create a direct line of communication among all legs of the triad at the junior officer level. This type of interaction allows for sharing expertise across the entire enterprise and provides the opportunity to intermingle cultures. This group could also be responsible for elevating crew force improvement recommendations to senior leadership.

EDUCATE

Simon Sinek's book, *"Start with Why,"* articulates the requirement for people to understand why something matters before they can be invested in how to accomplish it.²⁶ "The lack of understanding of nuclear deterrence, a core air force mission, is at the heart of the problem. . . . [T]he service needs to educate airmen on this mission and its criticality to the nation. . . . In addition the air force needs to educate personnel at all levels in order to influence the attitudes and actions of personnel."²⁷ Sinek describes the need to comprehend the relevance of the mission. Teaching the history of nuclear weapons is the first step toward understanding their worth. Only by understanding the sacrifices made by the United States to create these weapons and the unimaginable burden of their first use can the significance of the Cold War be understood. Studying the evolution of deterrence theory can illuminate the precarious balance sought to maintain stability in a bipolar world. Fundamental questions to study include these: Why are nuclear weapons a big deal? Why do we still have them? What are deterrence and assurance? Why do they matter? Are these theories relevant today? To comprehend the "why" of the nuclear enterprise is to under-

26. Simon Sinek, *Start with Why: How Great Leaders Inspire Everyone to Take Action* (New York: Penguin Group, 2009).

27. Spencer, Ludin, and Nelson, *Unauthorized Movement*, 8.

stand and be able to articulate the requirement for deterrence and the value of assurance. Start with the recommendation of the *Secretary of Defense Task Force on DoD Nuclear Weapons Management* (the Schlesinger report) from September 2008. The nuclear enterprise “should examine the offerings of other professional military and civilian academic institutions, other agencies such as the Defense Threat Reduction Agency, the National Nuclear Security Administration, and Federally Funded Research and Development Centers, as well as the educational approaches employed by allies for nuclear policy.”²⁸ Attending courses at these institutions or having these courses taught by visiting professors at the bases themselves would be especially effective if taught as part of a standard curriculum to every nuclear-certified officer during their training. Furthermore, encouraging participation in professional groups such as the Project on Nuclear Issues exposes the crew force to others who have chosen careers in nuclear matters at all levels of government and provides more opportunity to grow and mature as nuclear experts.

Summary

The nuclear bomber aviator’s perspective of force culture identified shortcomings. Yet, low-cost, immediately deliverable leadership solutions to improve the culture exist. This chapter recommends that leaders in the bomber communities at all levels follow the acronym ACE: appreciate their people, communicate their value to them, and educate them on the importance of their mission. It is also important to note the requirement to implement changes consistently and universally. Any changes implemented only to a small, targeted audience or applied inconsistently run the risk of the perception of change simply for the sake of change and will be poorly received.

Encouragingly, the air force has been listening to its personnel and is currently conducting similar research on a large scale. Since the research for this chapter began in October of 2013, both the 60-day review and the Force Improvement Plan have been implemented. Both are top-level acknowledgements of the possibility of the need for cultural change and an attempt to make an informed decision on what the change vision should be prior to establishing any new policies. These initiatives are encouraging because, by their very existence, they empower the operator to think critically and to openly critique the system. This manner of welcoming honest feedback resonates with operators who are very comfortable with candid critiques as part of their daily lives via mission debrief. The more input operators have in establishing the new culture, the more potential courses of action will arise and the greater the buy-in will be to the new system. This will both expedite and solidify implementation of the new vision.

The air force nuclear bomber culture is on the cusp of excellence. All the ingredients for success are in place. It is incumbent on junior officers to know their job without hesitation, critically analyze mission execution, and provide candid feedback to senior leaders.

28. James R. Schlesinger, *Report of the Task Force on DoD Nuclear Weapons Management, Phase I: The Air Force’s Nuclear Mission* (Arlington, VA: Secretary of Defense, September 2008), 45.

All this must be done while maintaining perspective on the importance of the mission and a positive attitude regardless of mission requirements. It is essential that senior leaders trust their people, demonstrate an understanding of and appreciation for their skills, endlessly communicate to their people their immense value to the country, and develop them through the multitude of educational opportunities available. Leaders at all levels implementing ACE solutions could prove to be the thrust required to turn the corner from competence to excellence.

Deception in Covert Nuclear Development

Brian Gordon¹

*C*overt nuclear development programs have ranked among governments' most secret efforts. The security of early programs rested with the denial of information to those who would seek to discover them. But more recent development programs have faced a security challenge that is significantly more complex. These programs must evade export control efforts, avoid detection by technologically advanced intelligence agencies, and circumvent inspections by international watchdogs. It is therefore no longer possible for a government to covertly develop nuclear weapons capability while only exercising denial of information about its intent; modern programs must deceive. For states pursuing these programs, effective deception may mean the difference between time to develop nuclear weapons and sanctions or military action. For the U.S. intelligence community (IC), it may mean the difference between timely detection and unwanted surprise.

Introduction

The development of the capacity for nuclear weapons production has been conducted in the utmost secrecy by every state that has pursued it. In the early period of development programs, great power countries pursued nuclear weapons capabilities in an attempt to impact the outcome of World War II. In the United States, nuclear facilities were constructed far from population centers, and workers were housed in manufactured towns where their activity could be shielded from any observation by foreign powers. The security challenge in this era was largely centered on denial of information—the concealing of what was happening within laboratories and facilities from adversaries who wanted to discover it.

In the decades following the war, the capability to conduct nuclear research became more attainable. The diffusion of knowledge, the discovery of natural resources, and the increasing need for energy enabled many states to seriously consider pursuing an

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indigenous or shared nuclear development effort. The argument that such development may also address the state's perceived security threats was logical and inevitable. Each state that had the capability and desire to embark on nuclear research made a decision, or series of decisions, over time that dictated the extent to which that research was applied to a weapons program.

As the Cold War progressed and states such as South Africa, India, Iraq, and Israel pursued nuclear weapons capability, the security challenge of development programs had radically changed. The evolution of nonproliferation agreements and export control regimes, combined with the expansion of intelligence technology and capabilities, created a space in which simply denying the existence of a nuclear development program was impractical and unlikely to be effective. Faced with more legal restrictions and increased scrutiny, states embarking on a development program that would draw criticism or sanctions were compelled to utilize deception to mask their actions.

Nuclear research and development (R&D) efforts are complex enterprises that span scientific, industrial, military, and diplomatic lines of effort. The concealment and detection of such programs are equally complex. Bureaucracies on each side—both of the state pursuing the program and of the adversary attempting to detect it—enable the allocation of resources and communication but also inhibit coordination between internal groups. Though it is essential in order for the state pursuing a nuclear program to achieve its goals, deception is but one part of an effort that includes others such as budgeting or testing—both activities that may be easier for an intelligence agency to examine than an intricate deception plan.

Why focus on deception analysis rather than just advise analysts to bear it in mind? In his seminal work on military deception, Dr. Barton Whaley argues that one problem with intelligence analysis is that it often “seeks to expose camouflage, not analyze it for its own sake.”² For the discrete military actions with which Dr. Whaley was focused, the analysis of deception may yield insight that makes victory likely. But for a long-term R&D enterprise of which deception is a critical part, the identification of deceptive measures is crucial for detecting and evaluating the effort. Writing in 2002, a former Central Intelligence Agency (CIA) analyst argued that “[q]ualitative and quantitative analyses of historical [denial and deception (D&D)] cases potentially can help both in the detection of foreign D&D and the reduction of [U.S.] susceptibilities.”³

This chapter is concerned with “strategic deception,” the deception that is targeted at the highest levels of government and has as its end goal the influence of policymakers. It focuses on two cases of covert nuclear development where the deception effort itself is informative—South Africa and India—and addresses deception challenges from the point of view of the U.S. government and IC. The intent of this research is not to claim that D&D is

2. Barton Whaley, *Strategem* (Boston: Artech House, 2006), 77–78.

3. Paul Rossa, “The Denial and Deception Challenge to Intelligence,” in *Strategic Denial and Deception: The Twenty-First Century Challenge*, ed. Roy Godson and James J. Wirtz (New Brunswick, NJ: Transaction Publishers, 2002), 227.

the only marker to analyze when attempting to ascertain the extent of a country's nuclear development but to argue that the likelihood of D&D in a nuclear research program should not be ignored. Additionally, this chapter seeks to begin the formulation of ways in which deception activities can be analyzed.

Denial and Deception

Denial and deception are often combined, but the two are distinct concepts. Though denial is an integral part of any deception scheme, each requires separate actions and has a different intended effect. In the case of nuclear development efforts, D&D requires the meticulous shielding and masking of what can be very recognizable steps toward development.

DENIAL

Denial is the concealing of fact from the adversary. More specifically, it is “those measures designed to hinder or deny the enemy the knowledge of an object, by hiding or disrupting the means of observation.”⁴ The practice of denial is a familiar one to many who have been involved in government or security work. The requirement for security clearances, restricted areas on military installations, and compartmentalized programs are all examples of the denial of information to an adversary. In the early days of U.S. nuclear development, denial was conducted in part by the location of facilities. An individual without proper authorization would have found it extremely difficult to approach Los Alamos, New Mexico, in early 1944. With no airborne or space assets available, an adversary's only ability to see through denial was to have a collection asset with access to the denied information.

Effective denial of information is also an integral part of deception. Selecting the information that is shared with the adversary in such a way as to be manipulative requires confidence that no additional information is revealed. Without the ability to control key information, the deception cannot be conducted. Thus, while an effort in its own right, the concealing of fact through denial is also an important part of a deception plan.

DECEPTION

If denial is the withholding of information so the adversary cannot draw a conclusion, deception is the revealing of information that supplies a wrong one. Bennett and Waltz define deception as “those measures designed to mislead the enemy by manipulation, distortion, or falsification of evidence to induce him to react in a manner prejudicial to his interests.”⁵ History has numerous examples of deception operations. These include the Japanese masking of fleet movements prior to Pearl Harbor and the Allied effort to convince the German High Command that the real D-Day landings would take place at Pas

4. Michael Bennett and Edward Waltz, *Counterdeception Principles and Applications for National Security* (Boston: Artech House, 2007), 5.

5. Ibid.

de Calais. Both of these deceptions were successful, but they were military operations with finite time spans that were targeted to specific command and intelligence staffs. An R&D effort spanning years and possibly involving thousands of people requires a deception that can be sustained for a longer period over multiple lines of effort.

Strategic deception is the deception practiced against the most senior levels of government that attempts to influence national-level decisionmaking.⁶ It involves the construction of a coherent story across the entire enterprise of government. The Prussian military theorist Carl von Clausewitz was skeptical of deception on this level, stating that deception was a concept that is tactical in nature and that strategic surprise rarely works, as it “approaches the higher levels of policy.”⁷ Today, many theorists believe deception to be solely tactical in nature as well. But in his research, Whaley is more optimistic. Though he acknowledges the complex nature of the military (and government) bureaucracy and its impact on deception, he also argues that deception can be built upon the inevitable disclosures of information by bureaucracy.⁸ The coordination of deception measures across the bureaucracy defines strategic deception.⁹ It is this coordination across the bureaucracy on which the case studies will focus.

Methodology

Several times in the description of D&D, the concepts of revealing and concealing facts and fiction have been referenced. These concepts provide a simple but useful framework for categorizing actions taken as part of a deception plan. Bennett and Waltz summarized these concepts in a “deception methods matrix,” a modified version of which appears in Table 1.¹⁰

Of particular note in this table is the “Conceal Fiction” block. This block is a key to analysis of the strategic deception aspects of a long-term R&D program. In each of the other blocks, the efforts are largely directed at the adversary. However, “Conceal Fiction” actions are internal actions with external effects. They are intended to both reveal information to the adversary and protect the deception plan itself. Thus, they require a coordinating entity. For example, to give false information to an official in one’s own government protects the development program and provides false information to the deception target through that official’s interactions. But the one who provides this misinformation must be aware both of the true nature of the program and the fictitious one that is being shown to the deception target. Additionally, this person must be senior enough that the government official in question will readily accept the talking points provided. It is these internal actions that we will consider “concealing fiction.”

6. Abram Shulsky, “Elements of Strategic Denial and Deception,” in *Strategic Denial and Deception: The Twenty-First Century Challenge*, ed. Roy Godson and James J. Wirtz (New Brunswick, NJ: Transaction Publishers, 2002), 17.

7. Carl von Clausewitz, *On War*, trans. Michael Eliot Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1989), 198.

8. Whaley, *Strategem*, 71.

9. Shulsky, “Elements,” 29.

10. Bennett and Waltz, *Counterdeception*, 52.

Table 1. Deception Methods Matrix Modified for Research and Development Programs

Reveal fact • Information: ◦ Release true information that benefits the deceiver • Physical: ◦ Display real equipment or facilities	Conceal facts (dissimulation) • Information: ◦ Secrecy (clearance programs, physical security) ◦ Selective withholding of information • Physical: ◦ Camouflage, signal reduction
Reveal fiction (simulation) • Information: ◦ Disinformation (lying, dazzling with large volumes of communication) • Physical: ◦ Decoys, diversions	Conceal fiction • Information: ◦ Issuing of false information to own government officials and press • Physical: ◦ Additional restrictions for personnel involved in the deception program ◦ Monitoring of involved personnel

CASE STUDIES

To consider this framework, two case studies of covert nuclear development are examined: the Republic of South Africa (RSA) and India. Both embarked on nuclear development with considerable concern that the United States might discover the program. Both employed deception in their program, but to different extents. Several other similarities and differences had significant impacts on the deception practiced and are worthy of mention.

Both the RSA and India were nonaligned in the context of the Cold War, and this helped spur their interest in nuclear weapons. India was nonaligned by choice and was a leader of the nonaligned movement. However, it faced significant security threats from two powerful neighbors: China and Pakistan. Its nuclear program was seen by many Indians as both a source of pride and a “force equalizer.” Following a visit to Hiroshima, Atal Vajpayee, who would be prime minister during India’s 1998 nuclear test, stated that “Hiroshima convinced me that the world respects only the strong and has no patience for the weak.”¹¹ In contrast, the RSA’s nonalignment was involuntary. By the early 1970s, the RSA government faced international condemnation due to apartheid. It also faced newly independent states and Soviet-backed insurgencies in neighboring countries and did not believe the West would offer support if a communist overthrow of the government was imminent.¹²

11. Raj Chengappa, *Weapons of Peace: The Secret Story of India’s Quest to be a Nuclear Power* (New Delhi: Harper Collins Publishers, 2000), 7.

12. Thomas C. Reed and Danny B. Stillman, *The Nuclear Express: A Political History of the Bomb and Its Proliferation* (Minneapolis: Zenith Press, 2009), 171.

The second area in which the RSA and India differed is closely related to the context of their nonalignment. Each country's relationship to the United States and their perception of the impact of having a nuclear weapon on that relationship was very different. The RSA government saw their weapons as "a political bluff intended to blackmail the United States or other Western powers into coming to South Africa's assistance."¹³ In effect, they saw the possession of a nuclear device as bridging the diplomatic gap with the United States at the critical moment. The Indians had no such desire or belief. They were fully aware that the United States would react strongly and negatively to the revelation that Indian nuclear research had led to construction of a weapon. The Indian government certainly considered the impact of economic sanctions, but it also entertained the possibility that the United States might conduct a preventative strike on their nuclear installations.¹⁴

The final notable difference between the two cases is not about the countries themselves but rather the U.S. IC's evaluation of the programs. In a 1984 assessment of the RSA program, the IC issued projections regarding the total number of devices manufactured, the RSA's annual capacity for enriching uranium, and the possibility that nuclear capabilities had been folded into South African military strategy. The assessment also stated a belief that the RSA was unlikely to test a weapon unless there was a specific event that compelled it.¹⁵ Each of these projections was close enough to reality to give policymakers a sense of the South African program. By contrast, the Indian nuclear test in May 1998 caught the U.S. government completely unaware, despite numerous signs that in hindsight indicated India might be preparing for such a step. Senator Richard Shelby, chairman of the Senate Select Committee on Intelligence, called the failure to predict the Indian test "a colossal failure of our intelligence-gathering system, perhaps the greatest failure in a decade."¹⁶ There are likely many factors that contribute to this difference in the IC's evaluations, but the approach and execution of a consistent D&D program is one that warrants closer examination.

South Africa

The RSA nuclear program had received assistance from abroad, including from the United States, throughout the 1950s and 1960s. By the time a weapons program was seriously considered, there was substantial "nuclear knowledge" within the country.¹⁷ Originally focused on nuclear explosives for mining, the effort was redirected to weapons by Prime Minister John Vorster's government in the early 1970s. Though the RSA possessed considerable natural resources and space to conduct testing and evaluation, its status as a pariah state limited its research progress. Nonetheless, it found one willing partner in the govern-

13. David Albright, "South Africa and the Affordable Bomb," *Bulletin of Atomic Scientists* 50, no. 4 (1994): 38.

14. Chengappa, *Weapons*, 11.

15. U.S. CIA, "Trends in South Africa's Nuclear Security Policies and Programs," *National Intelligence Estimate* 73/5-84/CX, October 5, 1984 (declassified), FOIA case F-1992-00809, April 27, 1997.

16. Robin Wright, "U.S. Intelligence Failed to Warn of India's Atom Tests," *Los Angeles Times*, May 13, 1998, <http://articles.latimes.com/1998/may/13/news/mn-49267>.

17. Albright, *South Africa*, 39.

ment of Israel. A series of defense and cooperation pacts in the mid-1970s is believed to have provided South Africa with technical information and the Israelis with vital materials and testing space.¹⁸

In 1977, the RSA prepared to conduct some form of test at a remote site in the Kalahari Desert and learned the inadequacy of solely practicing denial. The preparations were spotted by a Soviet satellite, and the Western governments were promptly informed. Under international pressure, the test was canceled. Additionally, the UN Security Council passed a total arms embargo on the RSA later that year. However, the program continued, and by the end of 1978 the RSA's entirely indigenous Helikon jet-nozzles were enriching uranium up to 80 percent and in quantities sufficient for one gun-type weapon to be produced each year.¹⁹ The Armaments Corporation of South Africa (ARMSCOR) did in fact produce weapons at this rate, and by the time the RSA decided to dismantle the program a handful of gun-type weapons had been manufactured.

REVEAL FACT

In line with their intention to reveal their nuclear capability in a crisis, the RSA was somewhat open about their capacity to build and their willingness to consider nuclear weapons. The jet-nozzle enrichment process that was conducted in plants at Velindaba was well known throughout the world, and the RSA government leaked several details in order to diffuse speculation about the plants' uses.²⁰ On the diplomatic front, the RSA government was forthright about its openness to weaponization. Foreign Minister Pik Botha stated in 1988 that "South Africa has the capability to make a nuclear weapon should we want to," but he did not provide any details, leaving the actual status of development ambiguous.²¹

One additional and revealing piece of information was released by the RSA. The South African Air Force publicly announced that as early as 1976, Buccaneer bombers had been used to practice the delivery of nuclear devices.²² This revelation was extraordinary because it not only revealed the consideration (and possibility) of weapons development but also of the possible role of nuclear weapons in RSA defense doctrine and the method of delivery.

CONCEAL FACT

Though a goal of the RSA program seemed to be to suggest the presence of weapons to U.S. and Soviet analysts, it also relied heavily on the denial of information. The facility where ARMSCOR assembled the weapons, eventually known as Advena, was a completely

18. Reed and Stillman, *Nuclear Express*, 175.

19. *Ibid.*, 176.

20. Robert E. Kelley, "The Iraqi and South African Nuclear Weapon Programs: The Importance of Management," *Security Dialogue* 27, no. 1 (1996): 33.

21. Roy E. Horton III, *Out of (South) Africa: Pretoria's Nuclear Weapons Experience* (Colorado Springs: U.S. Air Force Academy Institute for National Security Studies, 1999), 15.

22. U.S. CIA, *South Africa*, 17.

nondescript facility located within a vehicle testing area.²³ Within it were few and simple machines. Though it significantly slowed the manufacturing process, the RSA government did not want to be discovered acquiring more advanced machinery.²⁴

In the 1980s, when the RSA government considered conducting a test at the same Kalahari facility where preparations had been detected in 1977, they undertook several denial measures. Buildings were constructed over the test shafts to disguise preparations. When water was discovered within the shafts, it was not pumped into the ground as that would create a detectable change in the color of the terrain. Instead it was poured into large containers and moved by truck each night.²⁵

Diplomatically, the RSA engaged in concealment even after the program was dismantled. The March 1993 admission of a nuclear program by President F. W. de Klerk included a statement to the effect that South Africa had not collaborated with any foreign governments in their nuclear weapons development program. Given their agreements with the Israeli government and the extent to which their respective industries and scientists interacted, this statement is unlikely to be true.²⁶

REVEAL FICTION

The RSA engaged in both short-term and long-term simulation measures during their nuclear program. During preparations for the 1977 Kalahari test, a new conventional rocket was tested at a nearby facility in an attempt to mask the reason for activity in such a remote location.²⁷ This simulation was repeated during preparations in the mid-1980s, when army units conducted open exercises in the area of the test site to mask the actual activity.²⁸

The long-term revealing of fiction is perhaps the most notable measure of the RSA's deception activities. Following the discovery of the 1977 test, the RSA government transferred responsibility for weapons production to ARMSCOR. The semiprivate corporation did not alter the physics package but focused on production of safe and reliable weapons. However, scientists at the Atomic Energy Corporation (AEC), which had originally designed the weapons, continued their plodding research on implosion devices and other advanced designs. The activity of the AEC was not relevant to RSA plans but left more intelligence indicators than the actual production at ARMSCOR, and thus it was very misleading for analysts.²⁹

23. Albright, *South Africa*, 43.

24. Ibid., 45.

25. Ibid.

26. Reed and Stillman, *Nuclear Express*, 183.

27. Thomas Graham Jr. and Keith Hansen, *Preventing Catastrophe: The Use and Misuse of Intelligence Efforts to Halt the Proliferation of Weapons of Mass Destruction* (Stanford, CA: Stanford Security Studies, 2009): 51.

28. Albright, *South Africa*, 45.

29. Kelley, *Management*, 37.

Table 2. Deception Methods Matrix (South Africa)

Reveal fact • Information: ◦ Exercises for delivery of nuclear weapons by Buccaneer bombers • Physical: ◦ Enrichment capabilities at Velindaba	Conceal facts (dissimulation) • Information: ◦ Denial for foreign collaboration • Physical: ◦ Preps at Kalahari site (water removal) ◦ Advena facility
Reveal fiction (simulation) • Information: ◦ AEC advanced weapons research that was not the actual main effort • Physical: ◦ Nearby military exercises during test preparations	Conceal fiction • Information: ◦ Nuclear deterrent strategy calling for selective release of information to U.S. and West

CONCEAL FICTION

Despite the rollback of the RSA nuclear weapons program and the government's subsequent admission of its existence, there is scarce evidence of a coordinated deception plan within the successive RSA governments that oversaw the effort. What is known is that the RSA's nuclear deterrent strategy had three phases, ranging from denial of the weapons' existence to covert revelation of their existence to an underground test.³⁰ The public disclosures of military training and statements about capability, coupled with the intense secrecy of the weapons production facility, indicate that some decisionmaking process was in place to selectively release information at various times. But without a more in-depth examination of the RSA program, it cannot be confirmed that a long-term and coordinated effort across the bureaucracy was prominent within the program.

India

The relationship of the United States with India in the 1990s was certainly closer than that with the RSA in the 1970s. Despite India's nonaligned status, the two countries agreed on many significant issues, but nuclear development was not one of them. Numerous high-level discussions were held on the benefits of extension of the Non-Proliferation Treaty and adoption of the Comprehensive Test Ban Treaty (CTBT), but by 1998 Indian politicians were becoming increasingly convinced that the United States' real goal was to block the current nonnuclear states from conducting beneficial research indefinitely.

U.S. officials were or should have been aware that they did not have a complete understanding of the Indian perceptions of threat. A U.S. ambassador in the early 1990s recalled

30. Horton, *Pretoria's Nuclear Weapons Experience*, 24.

not understanding the Indian missile program despite numerous discussions with counterparts on the issue. He believed there to be a “degree of inarticulateness among policy makers and the military” on these issues.³¹ Additionally, the threats of China and Pakistan were very real to the Indian government, and there were public clues to the seriousness with which these issues were considered. A *Times of India* editorial around the time of the 1998 nuclear test stated, “A drowning man will grasp even a thermonuclear device to stay alive. And he isn’t going to think of the consequences.”³²

Three times (in 1982, 1995, and 1996) the United States detected activity at India’s Pokharan nuclear test site and pressured India to cease test preparations. Each time, the Indians learned how they had been detected and what not to do in future preparations.

REVEAL FACT

India had conducted a “peaceful nuclear explosion” in 1974, and it was well understood that they had the scientific know-how to embark on nuclear research with more military applications. But there is one overt action that stands out. On July 20, 1996, the Indian representative to the UN Conference on Disarmament announced his country’s reversal of position on the CTBT. This was the strongest diplomatic indication that the Indian government was still considering a nuclear test.³³ The sudden change in attitude and policy must certainly not have been lost on U.S. officials, and this makes it all the more puzzling why the 1998 test was so unforeseen.

CONCEAL FACT

The Indians employed an extensive denial effort to protect their nuclear development program. From the standpoint of organizations, they masked interactions they felt would be “red flags” to foreign intelligence agencies. Any collaboration between the AEC and the Defence Research and Development Organization was highly classified due to fears of discovery.³⁴ Scientists were issued military uniforms and given false names when visiting the test site and other defense facilities.³⁵

A significant portion of India’s concealment of fact for the 1998 test came from the 58th Engineer Battalion, the army unit placed in charge of the test site. Their preparations were meticulous, including carefully replacing vegetation as cables were laid to ensure there would be no sign the earth had been moved. Additionally, they ensured that sand mounds created from digging were uneven and oriented to match the prevailing winds, thus creating the appearance that they had been formed naturally.³⁶

31. Chengappa, *Weapons*, 375.

32. George Perkovich, *India’s Nuclear Bomb: The Impact on Global Proliferation* (Berkeley: University of California Press, 2001), 422.

33. Reed and Stillman, *Nuclear Express*, 240.

34. Chengappa, *Weapons*, 23.

35. *Ibid.*, 21.

36. *Ibid.*, 426.

The scientists involved in the 1998 test also practiced concealment. The test was not one device, but three devices set off simultaneously. This had the effect of masking the specific yields of any one of the devices and was done intentionally to inhibit the ability of observers to make calculated guesses.³⁷

REVEAL FICTION

The Indian government had a significant diplomatic element to its deception plan for the 1998 test. Following the election of the new government in March, several officials informed their U.S. counterparts that India would be beginning a review of nuclear security policy and no tests would be conducted until that was complete.³⁸ This position was specifically communicated to Secretary of Energy Bill Richardson during an April visit.³⁹

The 58th Engineers were also engaged in simulations. In past test preparations, a considerable amount of fencing was placed around the test shafts, and this fencing had been noticed by satellites. In preparation for the 1998 test, the engineers did not erect fencing but instead placed signs such as “Danger—Mined Area” and “Dozer Cadre Training” to mask the actual reason for their activity.⁴⁰ Additionally, they constructed a soccer field adjacent to one test shaft where nightly games were played, thus creating an impression that this was a garrison with little happening in the immediate vicinity.⁴¹

CONCEAL FICTION

Unlike the RSA, the Indians instituted several measures within their own system to protect the deception plan. Seismic and meteorological personnel throughout the country, who were not part of the test in any way, were advised to monitor their equipment for possible Pakistani tests in the near future.⁴² This provided Indian officials with additional test data without the risk of alerting additional personnel to the test.

Additionally, the Indian officials announced that they were taking steps to protect the public from nuclear exposure in April as part of a civil defense program. This was possibly due to the upcoming test in May and the knowledge that the public would have questions and concerns when it was announced.⁴³

But perhaps the most significant protective measure was the defense minister’s statement in March 1998. Minister Fernandes stated that India would not be testing and had no need to test in the immediate future.⁴⁴ This measure is not “reveal fiction” because the defense minister was not informed of the decision to test until after the event had taken

37. Perkovich, *India’s Nuclear Bomb*, 426.

38. Graham and Hansen, *Preventing Catastrophe*, 45.

39. Chengappa, 31.

40. *Ibid.*, 404.

41. *Ibid.*, 20.

42. *Ibid.*, 423.

43. Perkovich, *India’s Nuclear Bomb*, 414.

44. “No Immediate Nuclear Tests, Says Fernandes,” *Times of India*, March 21, 1998, 1.

Table 3. Deception Methods Matrix (India)

Reveal fact	Conceal facts (dissimulation)
• Information: ◦ Reversal of CTBT position	• Information: ◦ Collaboration between civilian and defense organizations • Physical: ◦ Preparations at site (cables, sand mounds,) ◦ Testing three devices simultaneously
Reveal fiction (simulation)	Conceal fiction
• Information: ◦ Fictitious nuclear review process • Physical: ◦ Soccer fields and signs for alternate uses of the land	• Information: ◦ Defense minister statements about no testing • Physical: ◦ Preparations for mitigating civilian nuclear exposure

place.⁴⁵ His statement was accurate to the best of his knowledge, but in fact he was an unwitting accomplice to a coordinated deception plan.⁴⁶

Conclusion

The South Africans developed a nuclear strategy that employed the selective revealing of fact as needed. They allowed research efforts to be seen while protecting production efforts and maintained diplomatic ambiguity as to their intentions to acquire and use nuclear weapons. These efforts amounted to a deception that was meant to provide deniability but insinuate that the weapons existed or could be produced in a short time. The Indian desire was to develop a functioning weapon to counter their nuclear-armed adversaries. The Indian government conducted an elaborate diplomatic deception by both witting and unwitting officials, as well as meticulous measures employed by the 58th Engineers to disguise operations at the test site. Their goal was to remain undetected until a successful nuclear test would announce to the world that India had achieved nuclear weapons capability.

India pursued a deception plan to mask its nuclear program that was significantly more complex than the South African effort. This is not to argue that the RSA did not deceive nor that the Indian deception could not have been detected. Rather, the nature of the deception plan in each case was a conscious decision that was unique and based on that country's perceptions of both the threats it faced and the reactions of the United States when the

45. Perkovich, *India's Nuclear Bomb*, 408.

46. Despite the robust nature of the Indian deception, the potential for detection still existed. U.S. satellites had incontrovertible proof of an impending test six hours before the event. But the CIA analysts were not looking because they were not on alert for such an event (Ibid., 418).

extent of the program was discovered. Each plan could be judged a success. U.S. intelligence officials were aware of the South African program but unsure as to the specifics throughout the 1970s and 1980s. When India tested in 1998, the U.S. was completely unaware until the test itself was detected.

This study was limited by the depth to which the cases could be explored and by the necessity of relying on secondary sources for case development. A more extensive review of the Indian and South African deception programs would no doubt enrich the data, and explorations of other cases would be beneficial as well. But the underlying results are unlikely to change. Deception efforts, like the nuclear research efforts themselves, are unique to the state and the time. However, the presence of deception is a common attribute.

There are several implications to this conclusion. First, both policymakers and analysts must be aware that a coordinated deception will, to some extent, be present in each case where nuclear development that is detrimental to relations with the United States is taking place. Policymakers must be aware that they are the targets of strategic deception and analysts must employ techniques such as analysis of competing alternatives to mitigate the “clear answer” provided by deception. Second, analysts should be aware that if deception can be detected, it may provide some of the best evidence that a program exists. Long-term analysis on South African research on implosion devices would have revealed that very little progress was being made by the AEC, and yet the research program continued and was well funded. Closer inspection of the Indian test site would have revealed individuals dressed as soldiers but who had long white hair or electrical generators placed close to a site where seemingly only bulldozer training was being conducted.

In attempting to detect covert nuclear development, there is a benefit to analyzing the camouflage for its own sake. Deception complicates the analysis of what is usually a large and intricate R&D enterprise. But it may also be the element that is present regardless of the state’s particular development path. The way in which it is pursued is an indicator of the state’s perceptions of its security risks and its relationship with the United States. Though it is only one facet of a covert nuclear development program, it is one that intelligence analysts should not ignore.

Rethinking the Origins of North Korea's Nuclear Program

Joeeun Kim¹

After three nuclear tests, North Korea is a de facto nuclear state. While the recent nuclear tests and the processes of developing a nuclear weapons capability since the first nuclear crisis in 1993 receive much more attention from policy circles, this chapter aims to bring the attention back to the origins of North Korea's efforts to develop nuclear weapons. As it is unlikely that North Korea will disarm in the near future, it is more important to understand why North Korea first became interested in developing a nuclear deterrent while it was under the nuclear umbrella of the Soviet Union and, later, China. The United States, which provides a nuclear umbrella to cover its East Asian allies, could learn lessons from the North Korean proliferation. While it is true that North Korea faced external threats from the United States and South Korea, this chapter argues that North Korea first explored its nuclear program decades ago due to the unreliability of the extended deterrence of its ally.

Introduction

In March 1993, North Korea (officially the Democratic People's Republic of Korea or DPRK), one of the last bastions of unreformed communism following the collapse of the Soviet bloc, declared its intent to withdraw from the Nuclear Non-Proliferation Treaty (NPT), sending the signal that it was moving forward in developing an indigenous nuclear program.² This set the stage for what is commonly referred to as the first nuclear crisis. Pyongyang later suspended its withdrawal and entered into an agreement with Washington that was intended to pave the way to normalization of relations between the two states. The "Agreed Framework" broke down, and in 2003 North Korea actually carried out its threat to withdraw from the NPT—making it the first state to do so. In 2006, North Korea became

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2. For example, "N Korea withdraws from nuclear pact," *BBC News*, January 10, 2003, <http://news.bbc.co.uk/2/hi/asia-pacific/2644593.stm>; "North Korea leaves nuclear pact," *CNN*, January 10, 2003, <http://www.cnn.com/2003/WORLD/asiapcf/east/01/10/nkorea.treaty/index.html?s=PM:asiapcf>; "North Korea Assailed for Withdrawing from Arms Treaty," *New York Times*, http://www.nytimes.com/2003/01/10/international/10CND_KORE.html.

the ninth country to obtain nuclear weapons.³ Today, North Korea is an isolated, impoverished nation that possesses nuclear weapons. It is this nexus of nuclear weapons and impoverishment, along with the concern that the cash-strapped regime may sell weapons to irresponsible states or even terrorist groups, that have pushed North Korea to the top of the U.S. foreign policy agenda.⁴

Many scholars and policy analysts who write about the motivations for North Korea's nuclear program overemphasize the importance of the external environmental security threats to which North Korea was exposed after the collapse of its patron ally, the Soviet Union.⁵ However, newly declassified Soviet documents from September 1991 (before the collapse of the Soviet Union) demonstrate that Soviet officials already held serious concerns about a North Korean nuclear program for several years. In a meeting between Soviet Foreign Ministry officials and the North Korean ambassador, Son Seong-Pil, Soviet officials pressured North Korea to sign the safeguard agreement with the International Atomic Energy Agency, threatening to terminate nuclear power plant construction assistance, halt the supply of fuel resources, and end all military assistance.⁶

Long before the end of the Cold War, in the early 1960s, and three decades before the isolated North Korean regime used the threat of developing an indigenous nuclear weapons program as leverage over the United States, the DPRK sought a nuclear deterrent. North Korea pursued nuclear weapons despite being protected by the nuclear arsenals of its allies: the Soviet Union—which possessed a nuclear arsenal—and China, which by 1964 had detonated its own device.⁷ Using newly obtained and translated primary source documents from the archives of North Korea's present and former communist allies, this chapter aims to go beyond the conventional explanation of nuclear proliferation in North Korea—that is, the deterioration of external security environment as the trigger of the program.⁸ Rather, this chapter attempts to show that the unreliability of the Soviet

3. There is still some debate about whether the first test was a success, as the explosion yield was low.

4. See Robert S. Litwak, *Outlier States: American Strategies to Change, Contain, or Engage Regimes* (Washington, DC: Woodrow Wilson Center Press, 2012): 138.

5. For example, David Kang argues, "Although during the cold war the North was the aggressor, this shift in power put it on the defensive. It was only when the balance began to turn against the North that it began to pursue a nuclear weapons program." Victor Cha and David Kang, *Nuclear North Korea: A Debate on Engagement Strategies* (New York: Columbia University Press, 2003), 45; Similarly, Victor Cha, when analyzing the purpose of a weapons program, claims, "At a minimum, one could posit that a primary political goal of the DPRK regime and its *juche* strategy is state survival and protection of national sovereignty, given the deteriorating domestic and geostrategic condition since the end of the cold war." Victor Cha, "North Korea's Weapons of Mass Destruction: Badges, Shields, or Swords?," *Political Science Quarterly* 117, no. 2 (2002): 214.

6. *Record of Conversation between F.G. Kunadze and Son Seong-Pil* (State Archive of the Russian Federation [GARF], 20 September 1991), fond 10026, opis 4, delo 2803, listy 1–3.

7. While North Korea enjoyed alliances with two great powers, I only focus on its alliance with the superpower ally, the Soviet Union, because I only treat the inception stage of North Korea's nuclear program.

8. There are some examples that used the primary documents and analyzed the motivation behind North Korea's nuclear weapons program. However, recently, more documents have been uncovered, and we can more definitely trace the thinking of North Korean leadership. For recent examples, see Jonathan D. Pollack, *No Exit: North Korea, Nuclear Weapons and International Security* (New York: Routledge, 2011); Balazs Szalontai and Sergey Radchenko, *North Korea's Efforts to Acquire Nuclear Technology and Nuclear Weapons: Evidence from Russian and Hungarian Archives* (working paper, Washington, DC: Cold War International History Project, Woodrow Wilson International Center for Scholars, August 2006).

nuclear umbrella—and, after 1964, the Chinese umbrella as well—contributed to North Korea’s initial decision to fortify its national security by developing an indigenous nuclear weapons program.

While other scholars⁹ have identified Moscow’s perceived unreliability as a motivating factor in the evolution of North Korea’s thinking about an indigenous nuclear deterrent, this chapter utilizes new Russian and Chinese documents, including recently obtained conversations with North Korean leader Kim Il Sung, to confirm and reinforce this argument. These newly obtained archival documents describe a process of hypermilitarization of North Korea starting in December 1962 under the so-called Byungjin Line (*byungjin rosun*), which called for the simultaneous development of heavy industry and national defense capabilities. As the documents reveal, a critical component of the buildup of national defense capabilities was the development of an indigenous nuclear weapons program, though this was not to be achieved for another four decades.

The remainder of this chapter proceeds as follows. In the following section, the existing literature on why states proliferate in relation to North Korea’s case is discussed to see how the case could be better understood. In the next section, the inception stage of North Korea’s nuclear program is investigated, as well as the reasons why the unreliability of its Soviet alliance compelled North Korea to develop nuclear weapons using Soviet nuclear technology. In the final section, policy recommendations for current nuclear umbrellas in the context of future East Asian nuclear proliferation are presented.

Alliance Dynamics and Proliferation

Threats to national security are thought to be the major motivation for states to seek nuclear weapons.¹⁰ However, in case of junior allies, who are heavily dependent on patron allies for their national security, threat perception can be swayed by alliance dilemmas and patron ally’s extended deterrence guarantees.¹¹ Moreover, the fear of “abandonment,” resulting from a junior ally’s perception that a patron ally’s conventional and nuclear security guarantees are reduced or absent, can trigger junior allies’ pursuit of a nuclear weapons program.

9. See, for example, Alexandre Mansourov, “The Origins, Evolution, and Current Politics of the North Korean Nuclear Program,” *Nonproliferation Review* (spring-summer 1995); Michael J. Mazarr, *North Korea and the Bomb: A Case Study in Nonproliferation* (New York: St. Martin’s Press, 1995); Pollack, *No Exit*.

10. Scott D. Sagan, “Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb,” *International Security* 21, no. 3 (winter 1996–1997): 54–86. Sagan also published this article in revised form as “Rethinking the Causes of Nuclear Proliferation: Three Models in Search of a Bomb,” in *The Coming Crisis: Nuclear Proliferation, US Interests, and World Order*, ed. Victor A. Utgoff (Cambridge, MA: MIT Press, 2000); Kenneth Waltz, “Nuclear Myths and Political Realities,” *American Political Science Review* 84, no. 3 (September 1990): 731–745; Kenneth N. Waltz, “More May Be Better,” in *The Spread of Nuclear Weapons: A Debate*, eds. Scott D. Sagan and Kenneth N. Waltz (New York/London: W. W. Norton, 1995).

11. On alliance dilemmas, see Glenn H. Snyder, *Alliance Politics* (Ithaca, NY: Cornell University Press, 2007).

Recent research on nuclear proliferation takes this alliance dynamic into consideration. Political scientist Avery Goldstein argues that three second-ranking powers—Britain, China, and France—did not value the security guarantee provided by their superpower partners, the United States and the Soviet Union, leading to those countries’ decisions to proliferate.¹² For example, Britain and France, even with NATO security guarantees, did not fully trust that the United States would come to their aid in the case of a confrontation with the Soviet Union.¹³ However, Goldstein’s analysis is limited to second-ranking powers’ decision and does not account for what made the patron allies unreliable. While it is important to analyze great powers’ and second-tier powers’ security policies, if the conflicts in the post–Cold War international system are caused by small states such as North Korea and Iran, it is also important to study those states’ histories and policies.

International relations scholar Etel Solingen also argued that the security threat cannot be the main reason behind North Korea’s nuclear development.¹⁴ First, North Korea was under the nuclear umbrellas of two great power allies (following the 1964 detonation of the Chinese bomb) through mutual defense treaties signed in 1961. The rationale behind this argument is that, even if you have enemies such as the United States and South Korea, due to the extended deterrence provided by major power allies the security threat should be reduced. Also, when North Korea started to develop the weapons program in the 1960s, the United States, the greatest threat to North Korea, was focused on the war in Vietnam. North Korea understood that the United States would not want to open another front in Asia and start the second Korean War.¹⁵ However, Solingen does not trace the history of why North Korea had to develop their nuclear program to defend against the superpower threat while under the Soviet and Chinese nuclear umbrellas.¹⁶

In the following section, using primary source documents, the history of North Korea’s weapons program as part of its hypermilitarization under the Byungjin Line will be explored in order to shed light on the relations with its superpower ally and the unreliability of its nuclear umbrella.

12. Avery Goldstein, “Discounting the free ride: alliance and security in the postwar world,” *International Organization* 49, no. 1 (winter 1995): 39–71; Avery Goldstein, *Deterrence and Security in the 21st Century: China, Britain, France, and the Enduring Legacy of the Nuclear Revolution* (Redwood City, CA: Stanford University Press, 2000).

13. Also, for a similar argument on Britain, see Kenneth N. Waltz, *Peace, Stability, and Nuclear Weapons* (policy paper, San Diego, CA: University of California Institute on Global Conflict and Cooperation, August 1995): 5.

14. Etel Solingen, *Nuclear logics: Contrasting paths in East Asia and the Middle East* (Princeton, NJ: Princeton University Press, 2009): 119.

15. Richard Rosecrance, *The Dispersion of Nuclear Weapons: Strategy and Politics* (New York: Columbia University Press, 1964), 301, as quoted in Solingen, *Nuclear logics*.

16. Solingen also mentions that South Korea’s nuclear program did not start until the 1970s; therefore the “reactive proliferation” argument is also not sufficient. See Solingen, *Nuclear logics*. However, Michael Mazarr gives a contrasting view on South Korea’s role in North Korea’s nuclear motivation. See Michael J. Mazarr, “Going Just a Little Nuclear: Nonproliferation Lessons from North Korea,” *International Security* 20, no. 2 (fall 1995): 100.

History of North Korea's Mistrust and Longing for Autonomy

While it is difficult to get into the minds of leaders, one can easily surmise that North Korea's Kim Il Sung had an appreciation for the power of nuclear weapons dating back to 1945. Despite Korean attempts to achieve national liberation through nearly fifteen years of guerrilla warfare against Japan, it was two U.S. bombs dropped on Hiroshima and Nagasaki that brought an end to Japanese colonial rule over Korea.¹⁷

In the years following the establishment of the DPRK in 1948, Kim Il Sung, who had come to power with Soviet backing, maintained close relations with Moscow, which had become a nuclear power in 1949. Following the establishment of the People's Republic of China in 1949, Kim also developed strong relations with Beijing. North Korea benefited tremendously from these two alliance relationships during the 1950–1953 Korean War. Moscow provided military equipment and Beijing dispatched several hundred thousand “volunteers” that prevented North Korea from being wiped off the map. Yet, it was during this period that tensions and doubts also began to emerge in Pyongyang's relations with its two patron allies. Soviet leader Joseph Stalin's refusal to directly commit troops following the September 1950 Incheon landing, which resulted in a complete rout of North Korean forces, and Chinese commander Peng Dehuai's heavy-handed treatment of Kim Il Sung, led to tensions that lingered on even after the July 1953 armistice.¹⁸

Despite tensions, North Korea maintained close relations with the Soviet Union and China, partly because of the tremendous role the two patron allies played in the reconstruction of the war-torn country throughout the 1950s but also to gain access to advanced technologies, particularly from Moscow and its Eastern and central European satellite states. This included nuclear technology. In 1956, the Soviets signed an agreement to train North Korean technicians in peaceful uses of nuclear technology at Soviet nuclear research facilities.¹⁹ In 1959, the Soviets signed another deal with the North Koreans to provide them with a research reactor, which was completed in 1965.²⁰

While China was incapable of providing the advanced technology North Korea desired, tens of thousands of Chinese “volunteers” remained in North Korea after the war to help with reconstruction. The lingering tensions after the 1956 incident in which Chinese and Soviet officials interfered in an internal North Korea dispute and the desire to limit the influence of Pyongyang's patron allies over North Korean politics led Kim Il Sung, in 1957,

17. Mansourov, “Origins, Evolution and Current Politics,” 28.

18. See, for example, “Information on the Situation in the DPRK,” April 1955, History and Public Policy Program Digital Archive, Woodrow Wilson International Center for Scholars, <http://digitalarchive.wilsoncenter.org/document/114590>.

19. See, for example, “Journal of Soviet Ambassador in the DPRK A. M. Puzanov for 17 May 1958,” May 17, 1958, History and Public Policy Program Digital Archive, Woodrow Wilson International Center for Scholars, <http://digitalarchive.wilsoncenter.org/document/116144>.

20. Alexander Zhebin, “A Political History of Soviet-North Korean Nuclear Cooperation,” in *The North Korean Nuclear Program: Security, Strategy, and New Perspectives from Russia*, eds. James Clay Moltz and Alexandre Y. Mansourov (New York: Routledge, 2000), 28–30.

to propose the withdrawal of the remaining Chinese forces from the country.²¹ This pullout was carried out in the fall of 1958, over seven years after Chinese forces entered Korea. By coincidence, as Chinese troops withdrew from Korea, the United States began to introduce “new weapons” to South Korea. Specifically, the United States deployed Honest John missiles and 280-mm atomic cannons to the peninsula.²² North Korea was well aware of U.S. nuclear capabilities and the consequences they would bring for the peninsula. Therefore, in this period, North Korea began to discuss the prospect of nuclear weapons.²³

With the introduction of nuclear weapons to South Korea, the importance of Pyongyang’s military alliances, particularly with the more technologically advanced and nuclear-armed Moscow, became more important. While traveling to Moscow in late January 1959 to attend the Communist Party of the Soviet Union’s (CPSU) 21st Congress, Kim proposed signing a mutual cooperation treaty with the Soviet Union. Though Khrushchev consented and also agreed to visit Pyongyang later that year to sign the agreement, for over two years the Kremlin leader found reasons to postpone his trip to the North Korean capital. Khrushchev was scheduled to travel to Pyongyang in the fall of 1959 but canceled, suggesting that it would be inadvisable to sign such an agreement with North Korea in the wake of his trip to Washington.²⁴ The trip was rescheduled for September of 1960, though it was again postponed because he was allegedly too busy preparing for the CPSU’s 22nd Congress later in October. In the spring of 1961, Khrushchev again explained that it would be difficult to travel to North Korea. After two previous cancellations, however, Khrushchev had become aware that Kim Il Sung was growing impatient and believed the cancellations to be connected to the Soviet leader’s desire to improve relations with the United States.²⁵

On the southern half of the peninsula, Major General Park Chung Hee seized power through a military coup on May 16, 1961. As newly obtained and translated Chinese records reveal, the alarming events in Seoul put Pyongyang in crisis mode. Two days after the coup, the North Korean leadership abandoned plans for economic reform and instead proposed shifting expenditures toward national defense industries.²⁶

21. See “Journal of Soviet Ambassador to the DPRK A.M. Puzanov for 4 June 1957,” June 04, 1957, History and Public Policy Program Digital Archive, Woodrow Wilson International Center for Scholars, <http://digitalarchive.wilsoncenter.org/document/115623>; and “Minutes of Conversation between Zhou Enlai and Soviet Ambassador Yudin (Excerpt),” January 08, 1958, History and Public Policy Program Digital Archive, Woodrow Wilson International Center for Scholars, <http://digitalarchive.wilsoncenter.org/document/114173>.

22. See National Archives and Records Administration, “Records of the Department of State Internal Affairs of Korea, 1955-1959,” Decimal File 795, .00/7-157 to .00/2-2458, Roll #6.

23. Pollack, *No Exit*, 47.

24. See “Report, Embassy of the Hungarian People’s Republic in the DPRK to the Ministry of Foreign Affairs of Hungary,” March 16, 1961, History and Public Policy Program Digital Archive, Woodrow Wilson International Center for Scholars, <http://digitalarchive.wilsoncenter.org/document/113387>.

25. “Memorandum of Conversation between N.S. Khrushchev and Kim Gwanghyeop, March 1961,” from the personal archive of V. P. Tkachenko, cited in *Koreiskii Poluoostrov i interesi Rossii* [The Korean Peninsula and Russia’s Interests] (Moscow: Vostochnaya Literatura, 2000), 20–21.

26. “Contents of the May 18th North Korean Party Central Standing Committee Meeting,” May 21, 1961, History and Public Policy Program Digital Archive, Woodrow Wilson International Center for Scholars, <http://digitalarchive.wilsoncenter.org/document/110055>.

In late May, Khrushchev dispatched First Deputy Premier Alexei Kosygin to Pyongyang. Kosygin, perhaps as a response to the troubling developments in South Korea, invited Kim Il Sung to visit Moscow to sign the agreement. In late June, barely six weeks after the Park Chung Hee coup, Kim departed for the Soviet capital. During his visit, he and Khrushchev finally signed the agreement. Days later, Kim traveled to Beijing, where he signed a nearly identical agreement with China, which, having fallen out with the Soviets, sought to win the allegiance of the North Koreans. It is not clear from the documentary evidence how valuable Kim believed the Sino-DPRK treaty to be, as Beijing had not yet detonated its first nuclear device and did not have as advanced a weapons industry as Moscow.

While Kim Il Sung must have been relieved to finally have a security guarantee from Moscow after the introduction of nuclear weapons to Seoul and the Park Chung Hee coup, the difficulties he encountered in signing the agreement likely left him with the impression that Khrushchev did not fully appreciate Kim's security concerns, leading to doubts about Moscow's commitment to North Korea's security.

By October 1962, Kim, already full of doubts, had his suspicions confirmed after the Cuban Missile Crisis, when Khrushchev "betrayed Cuba."²⁷ North Korean vice premier Kim Il later explained to Alexei Kosygin that as a result of the Cuban Missile Crisis, the North Korean leadership felt that it "could not count that the Soviet government would keep the obligations related to the defense of Korea it assumed in the Treaty of Friendship, Cooperation and Mutual Assistance."²⁸ What the North Koreans viewed as Soviet capitulation in the face of pressure from the Kennedy administration demonstrated that Khrushchev was more concerned about peaceful coexistence than he was in aiding smaller socialist countries vulnerable to being picked off, one by one, by the United States.²⁹

27. "Embassy of Hungary in North Korea to the Hungarian Foreign Ministry, 8 January 1965," MOL, XIX-J-1-j Korea, 1965, 73, doboz, IV-100, 001819/1965. In the recent H-Diplo debate, Matthew Fuhrmann, Matthew Kroenig, and Todd S. Sechser argued against Frank Gavin, claiming that Gavin does not provide the criteria for an important case of nuclear deterrence and coercion when arguing that the 1958–1962 case is critical in understanding nuclear weapons. They also argue that by no means would policymakers go back to this case in the past in order to derive policy implications for the cases of Iran and North Korea. However, while I do not dispute their claim that focusing on just one case is not enough for generalization and policy implications of nuclear issues, we need to understand for North Korea's case that the Cuban Missile Crisis changed alliance dynamics with the Soviet Union and the Soviet nuclear umbrella's credibility. See Matthew Fuhrmann, Matthew Kroenig, and Todd S. Sechser, "Response: 'The Case for Using Statistics to Study Nuclear Security,'" H-Diplo/ISSF Forum, 2014.

28. "Record of a conversation with the Soviet Ambassador in the DPRK Comrade V.P. Moskovsky about the negotiations between the Soviet delegation, led by the USSR Council of Ministers Chairman Kosygin, and the governing body of the Korean Workers Party," February 16, 1965, Czech Foreign Ministry Archive. Similarly, according to Wolf Mendl, the French nuclear armament can be justified by events surrounding the war in Indochina and Suez Crisis in 1956: "Both these incidents provide a basis for the theory that in conditions of nuclear stalemate between the super-powers a nation cannot rely upon its ally for protection when the issue is not of vital interest to that ally." Wolf Mendl, *Deterrence and Persuasion* (London: Faber and Faber, 1970).

29. "Record of a conversation with the Soviet Ambassador."

North Korea's *Rodong Sinmun* published an editorial on October 29, 1962, harshly criticizing Khrushchev for capitulating to the United States.³⁰ Moreover, as newly obtained Soviet records reveal, Kim Il Sung informed Soviet ambassador Moskovsky that after “new American equipment” was introduced in South Korea, North Korea's decision on strengthening the DPRK's battle readiness and defense forces was no longer sufficient. Therefore, Kim asked for permission to send a delegation to Moscow to discuss military aid.³¹ Kim requested that the Soviet Union deliver—“free of charge”—over 100 million rubles in military aid to North Korea. Specifically, to enhance coastal defenses, he asked for submarines, and for the defense of cities he requested an unspecified number of MiG-21s and 12 surface-to-air missile batteries. Kim played up the threat not just to North Korea but also to the Soviet Union if North Korea, which borders the Soviet Far East, were to fall to the imperialists. Kim slyly remarked, “I know that [First Secretary Khrushchev and Second Secretary Frol Kozlov] are no less concerned than I about the defense of the Far Eastern forward post. . . . It provides a convenient platform for the enemy's landing.”³² After receiving word through Ambassador Moskovsky that the Soviet leadership was prepared to receive a North Korean delegation to discuss military assistance, Kim dispatched Deputy Premier Kim Gwanghyeop to Moscow in late November to work out the terms of the military aid to the DPRK. Yet, the visit to Moscow ended in failure. Kim Il Sung's government could not pay for this vital military assistance; Moscow would sell the weapons to Pyongyang but not give them for free or even on credit.³³

This certainly reinforced Pyongyang's mistrust of the Soviet leadership. One week after the delegation returned from Moscow, the Fifth Plenum of the Fourth Central Committee of the ruling Korean Worker's Party was held in secret, an unusual move even by North Korean standards. The North Koreans were so frustrated by the perceived Soviet betrayal that they did not even bother to inform the embassy of the December Plenum, which had been a standard practice.³⁴ The plenum formally adopted the Byungjin Line, or the “equal emphasis policy,” which called for simultaneous development of heavy industry and defense capabilities. The plenum also declared Four Military Guidelines (*sadae kunsanoseon*): to arm the entire population; to fortify the entire country; to train the entire army as a “cadre army”; and to modernize weaponry, doctrine, and tactics under the principle of self-reliance in national defense.³⁵ The party also revived the wartime Military Committee (*kunsa wiweonhoe*).³⁶ These measures resulted in a hypermilitarization of North Korean society.

30. Yonhap News Agency, *North Korea Handbook* (Seoul: East Gate, 2002): 948. Also see James F. Person, “North Korea and the Cuban Missile Crisis,” Wilson Center, <http://www.wilsoncenter.org/publication/north-korea-and-the-cuban-missile-crisis>

31. “Memorandum of Conversation between Soviet Ambassador to North Korea Vasily Moskovsky and Kim Il Sung,” November 1, 1962.

32. Ibid.

33. See Balazs Szalontai, *Kim Il Sung in the Khrushchev Era, Soviet-DPRK Relations and the Roots of North Korean Despotism, 1953-1964* (Redwood City, CA: Stanford University Press, 2006), 192.

34. “Memorandum of Conversation between Soviet Ambassador to North Korea Vasily Moskovsky and North Korean Foreign Minister Pak Seongcheol,” December 29, 1962.

35. “Report, Embassy of Hungary in North Korea to the Hungarian Foreign Ministry,” February 15, 1963.

36. As Daesook Suh writes, the Supreme People's Assembly had established the Military Committee during the Korean War. The Party revived it under the auspices of the Central Committee in 1962. See Daesook Suh, *Kim Il Sung: The North Korea Leader* (New York: Columbia University Press, 1988), 215.

It is important to note just how extreme a measure this was for North Korea, which had recently completed a highly successful Five-Year Plan. While Chinese documents reveal that the Standing Committee of the Korean Worker's Party Central Committee had recommended modifying the Seven-Year Plan in the wake of the May 1961 military coup in South Korea, that plan was suspended and the plan was launched as originally conceived, perhaps after signing agreements with both Moscow and Beijing. The Seven-Year Plan, by December 1962 already completing its first year, was slated to de-emphasize heavy industry and focus—after eight years of intense heavy industry centered development—on the improvement of living conditions through the development of light industry and consumer goods. Thus, changing the Seven-Year Plan at this stage was an extreme measure signaling a complete change in North Korean planning.

North Korea took immediate measures to enhance defense capabilities and began the construction of fortifications in mountains throughout the country.³⁷ As Soviet and Hungarian records reveal, in addition to these measures, North Korea also sought to obtain the technology to develop an indigenous nuclear weapons program. This pursuit of a nuclear deterrent became clear through a sudden and keen interest in nuclear technology from the spring of 1963. In the early 1960s, Soviet specialists were in the DPRK conducting tests on uranium ore found on the northern half of the peninsula. Alarm bells were set off in the Soviet embassy when North Korean officials suddenly began to make inquiries about how they might develop the mining of uranium ore on a broad scale. The Soviet specialists explained that such an operation would be very costly. Moreover, they informed the North Koreans that Korean uranium ore was “not rich” and “very scarce.”³⁸ This did not deter those making the inquiries, who only days later asked about Korea's prospects for building their own atomic bomb. Attempting to discourage his interlocutors, the specialist insisted that “the economy of the DPRK cannot cope with the creation of nuclear weapons.” Again undeterred, the North Korean retorted that “it would cost much less in the DPRK than in other countries. If we tell our workers, . . . they will agree to work free of charge for several years.” The Soviet embassy gave explicit instructions to the specialists to avoid all further discussions about uranium and weapons with North Koreans.³⁹

North Korea would not develop an indigenous nuclear weapons program for another fifty years. However, lack of faith in the Soviet extended deterrent, coupled with an unfavorable status quo following the introduction of nuclear weapons to South Korea and the presence of an anticommunist military junta in Seoul, led to North Korea's initial decision to seek a nuclear deterrent of its own. As a result of Moscow's lack of credibility, the course of North Korean economic and military planning was forever altered. This had a transformative effect on the country, which became hypermilitarized under the Byungjin Line. North Korea began to make a multidecade and extremely costly

37. “Report, Embassy of Hungary in North Korea to the Hungarian Foreign Ministry,” May 27, 1963.

38. “Conversation between Soviet Ambassador in North Korea Vasily Moskovsky and Soviet specialists in North Korea,” September 27, 1963.

39. *Ibid.*, October 16, 1963.

investment in science and technology in pursuit of its national defense goals. By 1965, the share of national defense to the total national budget had risen to over 30 percent, representing 1.2 billion won, from a mere 4.3 percent less than a decade before.⁴⁰ The goal of this costly program was to maximize indigenous production and minimize reliance on foreign suppliers. This did not mean that Pyongyang was unwilling to assimilate foreign science and technology. This was particularly the case with nuclear weapons technology. The DPRK even asked China, once relations were restored in the mid-1970s following a Sino-Korean split during the Cultural Revolution, to train North Korean specialists in the development of nuclear weapons. Even until the 1980s, North Korea showed an effort to receive civilian nuclear assistance from the Soviet Union and other Eastern European allies.⁴¹

Conclusion

While there are several motivations behind a state's pursuit of nuclear weapons, for junior allies, the unreliability of its patron ally's nuclear umbrella could be the biggest motivating factor. For North Korea, the difficulty of receiving a written assurance and the way the Soviet Union handled the Cuban Missile Crisis made North Korea realize that the Soviet Union was not trustworthy, and these issues dramatically shifted Pyongyang's domestic policy to fortify the country from December 1962. This was a monumental shift in North Korean planning that, in part, likely led to the country's economic slowdown by the 1970s and eventual and dramatic collapse in the 1990s.

Tracing the origins of North Korea's nuclear weapons does not indicate how those weapons changed—or did not change—the state's strategic calculus. However, understanding why they first explored the weapons helps to understand why small states might seek nuclear weapons while under a nuclear umbrella. While there are many arguments that bilateral security guarantees of U.S.-South Korea and U.S.-Japan have been the main reason why the two junior allies have not developed their own nuclear weapons, it is less commonly thought that North Korea might have wanted the weapon early on due to the fact that the Soviet nuclear umbrella was less credible. Rather than treating North Korea as a rogue regime, it is advisable to try to understand the reasons for its conduct.

Even with allies, and even with one (and later two) nuclear umbrella(s), North Korea sought its own deterrent through the development of an indigenous nuclear weapons program. On February 12, 2013, two decades since the first nuclear crisis, North Korea

40. "Record of a conversation with the Soviet Ambassador, in the DPRK Comrade V.P. Moskovskiy about the negotiations between the Soviet delegation, led by the USSR Council of Ministers Chairman Kosygin, and the governing body of the Korean Workers Party, which took place at the USSR Embassy in the DPRK on February 16, 1965," Central Committee of the Communist Party of Czechoslovakia.

41. Hymans argues that the DPRK sought to obtain nuclear weapons due to a combination of security and prestige purposes. Because of this, his argument is, "therefore, they resolved to block its attempt to gain the expertise and equipment necessary for the bomb." However, while North Korea sought autonomy through nuclear weapons acquisition, they certainly sought its allies' assistance. See Jacques Hymans, "Assessing North Korean nuclear intentions and capacities: A new approach," *Journal of East Asian Studies* 8, no. 2 (2008): 271.

conducted its third underground nuclear test, the first under the new leadership of Kim Jong-un. North Korea is not likely to give up its nuclear capabilities.⁴² Indeed, one month after the third nuclear test, North Korea reintroduced the Byungjin Line, but the 2013 version calls for the simultaneous development of the nuclear program and improvements to living conditions. While the term used is the same, Byungjin of 1962 and its 2013 version are fundamentally different in that the recent program's aim seems to be to reduce expenditures on conventional military forces and focus on the nuclear deterrent so that the country can at long last improve living conditions, a goal that had been scuttled after the 1962 change to the Seven-Year Plan. To be realistic, this makes it less likely that North Korea will be willing to disarm. The international community can reduce the possibility of potential nuclear standoff in the region by learning from the sources of North Korean conduct and apply it to other cases.⁴³ If a nuclear-armed patron ally does not want to see further proliferation in East Asia or in the world in general, the nuclear umbrella has to be credible. North Korea's case demonstrates that even if junior allies enjoy formal alliances with patron allies, if the nuclear umbrella is not credible, they can seek their own nuclear deterrent. With a February 2013 South Korean poll revealing a high level of support for a domestic nuclear program, the more urgent task for the United States as a patron ally may not be a speedy resolution to North Korea's disarmament—which, given its history, will likely not be carried out voluntarily—but to credibly project its nuclear umbrella so that both South Korea and Japan see no need to develop their own weapons programs.⁴⁴ A statement by former Japanese prime minister Morihiro Hosokawa summarizes the importance of the U.S. nuclear umbrella very well: “It is in the interest of the United States, so long as it does not wish to see Japan withdraw from the [NPT] and develop its own nuclear deterrent, to maintain its alliance with Japan and continue to provide a nuclear umbrella.”⁴⁵

There was debate about whether the United States and other countries should engage or contain North Korea during negotiations in the 1990s and early 2000s.⁴⁶ The issue of whether or not the United States should have engaged with North Korea is not covered in this chapter. But whether or not a bomb was a goal all along for North Korea, it is clear that the possession of nuclear weapons by the DPRK or other small countries in the future does not help the United States because it limits U.S. freedom of action.⁴⁷ The United States has to

42. Mazarr, *North Korea and the Bomb*, 101.

43. Mark Hibbs, senior associate at the Carnegie Endowment for International Peace, believes that because nuclear technology is easier to achieve even as an isolated country such as North Korea, “nuclear proliferation has to be countered through addressing the complex political factors underlying it.” Export control is not effective as providing protection, because the technology can be obtained through illicit networks. Armin Rosen, “How North Korea Built Its Nuclear Program,” *Atlantic*, April 10, 2013, <http://www.theatlantic.com/international/archive/2013/04/how-north-korea-built-its-nuclear-program/274830/>.

44. See Asan Institute, “The Fallout: South Korean Public Opinion Following North Korea's Third Nuclear Test” (issue brief, February 24, 2013), <http://en.asaninst.org/issue-brief-no-46-the-fallout-south-korean-public-opinion-following-north-koreas-third-nuclear-test/>.

45. See Morihiro Hosokawa, “Are U.S. Troops in Japan Needed? Reforming the Alliance,” *Foreign Affairs* 77, no. 4 (July/August 1998), 5.

46. The most representative scholarly work is by Cha and Kang.

47. Kenneth Waltz, “Peace, Stability and Nuclear Weapons,” 11; Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Ithaca, NY: Cornell University Press, 2010).

take into consideration the possibility of North Korea's nuclear retaliation against U.S. cities or allied territory when taking action against North Korea. The United States can learn a lesson from the North Korean case and better understand why having a credible nuclear umbrella is essential to prevent allies from going nuclear in the future and consequently limiting its freedom of action.

Don't Make Me a Target: Alliance Management, Threat, and Forward Deployments

Alexander Lanoszka¹

*C*hina's nuclear modernization program will likely provoke insecurity among U.S. friends and allies in East Asia. To understand the implications of these developments for alliance politics, this chapter draws on international relations theory and evidence from two narrow case studies. Major power patrons like the United States and their weaker allies are bound to perceive an adversarial threat differently. Though an unsurprising by-product of geography and other structural conditions, these differences in turn produce divergent assessments as to what strategic posture the patron should adopt in order to deter the adversary. The resulting intra-alliance bargaining shapes how the patron forward deploys its forces. To understand the intra-alliance bargaining process, this chapter examines how U.S. allies in Western Europe responded to significant improvements in Soviet ballistic missile capabilities in the late 1950s and again in the late 1970s. The chapter then concludes with a discussion of how interalliance bargaining can be expected to affect contemporary security dynamics in East Asia.

Introduction

Arguably, the most significant strategic development currently taking place in East Asia is China's nuclear modernization program. Upon its completion, China's expanded, more survivable nuclear arsenal and improved missile systems will render the country's second-strike capability against the United States more secure.² However, from the point of view of the United States, this nuclear modernization program might be a good thing.³ After all, a

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2. M. Taylor Fravel and Evan S. Medeiros, "China's Search for Assured Retaliation: the Evolution of Chinese Nuclear Strategy and Force Structure," *International Security* 35, no. 2 (fall 2010): 48–87.

3. Robert S. Ross, "Navigating the Taiwan Strait: Deterrence, Escalation Dominance, and U.S.-China," *International Security* 27, no. 2 (2002): 48–85.

condition of mutual deterrence—whereby both the United States and China can inflict unacceptable costs on each other with neither side fearing a disabling first strike—could produce strategic stability.⁴ Yet some observers argue that such optimism is misplaced. Chinese leaders could become more assertive in conventional crises involving the United States because of their improved ability to neutralize U.S. nuclear threats. Though its military remains relatively inferior, China will be better able to engage U.S. conventional forces in East Asia. Accordingly, the firebreak between conventional and nuclear war with China could lose its clarity, making dangerous crisis escalation more likely.⁵ Moreover, China’s nuclear modernization affects not only the United States but also regional friends and allies who depend on U.S. security assurances. What possible significance could this development have for alliance politics in East Asia?

If history is any guide, alliance discord is probable because the United States and its regional security partners will reach different conclusions as to what military basis is sufficient for U.S. extended deterrence in the region. Two episodes from the Cold War support this claim. The first is the controversy that ensued when the Soviet Union launched Sputnik and dramatically improved its ballistic missile capability. Western European allies pushed the United States to support a nuclear-sharing arrangement, a move that U.S. decisionmakers saw as strategically undesirable but necessary for placating tensions within the North Atlantic Treaty Organization (NATO). The second is the “dual-track decision” reached in the late 1970s, in which the United States agreed to deploy intermediate-range nuclear forces in Western Europe while simultaneously pushing the Soviet Union to negotiate an arms control agreement banning said forces. Although the Carter administration did not feel that the Soviet SS-20 (an intermediate-range ballistic missile) changed the balance of power, they felt obliged to meet European demands for security. In both episodes, U.S. decisionmakers believed that the U.S. nuclear deterrent remained strong, while allied governments perceived new gaps in U.S. security guarantees. Based on this historical pattern, it is likely that U.S. security partners will not passively observe China’s nuclear modernization, especially amid its newfound assertiveness in regional maritime disputes.⁶ At minimum, they are more likely to press the United States into strengthening its own military capabilities in the region so as to bolster extended deterrence.

This chapter proceeds as follows. First, international relations theory is used as a lens to discuss how major powers and their weaker allies comprehend adversarial threats. Differences in these threat perceptions are an unsurprising by-product of geography and other structural conditions. These differences in turn produce divergent assessments as to what strategic posture can reliably deter the adversary. This chapter analyzes these dynamics in the cases of the nuclear-sharing arrangements of the 1950s and the 1979 dual-track decision. Finally, the chapter concludes with a discussion of the implications of this study for understanding contemporary security dynamics in East Asia.

4. Patrick M. Morgan, *Deterrence Now* (New York: Cambridge University Press, 2003).

5. Thomas J. Christensen, “The Meaning of the Nuclear Evolution: China’s Strategic Modernization and U.S.-China Security Relations,” *Journal of Strategic Studies* 35, no. 4 (2012): 447–487.

6. Alastair Iain Johnston, “How New and Assertive Is China’s New Assertiveness?,” *International Security* 37, no. 4 (2013): 7–48.

Threat Assessments and Forward Deployment

Diverse factors affect whether and to what extent a state feels threatened by another. According to structural realism, which posits that states find themselves in an anarchic international system, differences in material capabilities explain threat.⁷ Other versions of this theory examine the interaction of material capabilities and intentions.⁸ Stephen M. Walt describes threat as a composite of different variables: capabilities, intentions, geography, domestic political institutions, and external support.⁹ Scholars often invoke these explanations of threat to understand which alliances form and why. Nevertheless, these explanations also shed light on the politics of alliances *following* their formation.

Consider Glenn H. Snyder's description of the alliance dilemma.¹⁰ In choosing what level of commitment it should allocate to its weaker ally, the major power patron (e.g., the United States) has to consider the dual problem of abandonment and entrapment. By extending only a weak commitment, as when it offers only verbal pledges of support, the patron risks engendering fears of abandonment in its weaker ally. Such fears can result in either its defection from the patron or measures to bolster its own defenses (e.g., nuclear weapons acquisition).¹¹ However, by extending a strong commitment, as in the instance of establishing a defense pact, the patron risks emboldening the ally. Confident of the patron's support, the ally engages in a risky foreign policy that could drag the patron into a war it prefers to avoid.¹²

Attenuating this dilemma is whether the patron and its ally agree on the threat posed by the adversary, as well as the best strategy for dealing with it. In cases where the patron and the ally converge in their threat assessments and strategies, the alliance dilemma is minor. However, the alliance dilemma grows the more that threat assessments and preferred strategies diverge. One of the factors contributing to this divergence is geography. Patrons and allies may be more likely to disagree on these points when they are geographically separated and have different capabilities. For example, an ally that is geographically proximate to the adversary will be relatively more insecure than a patron that is geographically distant. This insecurity increases when the ally has no nuclear weapons arsenal but both its patron and its adversary do. The weaker ally not only needs to believe in the

7. Kenneth Waltz, *Theory of International Politics* (New York: McGraw-Hill, 1979); and John J. Mearsheimer, *The Tragedy of Great Power Politics* (New York: W. W. Norton, 2001).

8. Robert Jervis, "Cooperation Under the Security Dilemma," *World Politics* 30, no. 2 (1978): 167–214; and Charles L. Glaser, "The Security Dilemma Revisited," *World Politics* 50, no. 1 (1997): 171–201.

9. Stephen M. Walt, *The Origin of Alliances* (Ithaca, NY: Cornell University Press, 1987). Nonrealist explanations of threat emphasize differences in preferences that may be manifest in either regime type or ideology. Mark L. Haas, *The Ideological Origins of Great Power Politics, 1789–1989* (Ithaca, NY: Cornell University Press, 2005); and Andrew Moravcsik, "Taking Preferences Seriously: A Liberal Theory of International Politics," *International Organization* 51, no. 4 (1997): 513–553.

10. Glenn Snyder, *Alliance Politics* (Ithaca, NY: Cornell University Press, 1997).

11. Alexander Lanoszka, *Protection States Trust? Major Power Patronage, Nuclear Behavior, and Alliance Dynamics* (Princeton University: PhD dissertation, 2014); and Avery Goldstein, *Deterrence and Security in the 21st Century: China, Britain, France, and the Enduring Legacy of the Nuclear Proliferation* (Stanford, CA: Stanford University Press, 2000).

12. States design their commitments strategically so as to mitigate these problems. TongFi Kim, "Why Alliances Entangle but Seldom Entrap States," *Security Studies* 20, no. 3 (2011): 350–377.

credibility of the nuclear security guarantee so as to feel secure, it also needs assurances that a stable nuclear balance between its patron and the adversary does not come at its own expense.¹³

Yet another difference exists between the patron and the weaker ally that is worth considering. Being geographically proximate to the adversary, the weaker ally faces its threats relatively more directly but with less complexity than that of the patron.¹⁴ By contrast, with geographical distance, the patron faces its threats relatively more indirectly but with greater complexity than that of the weaker ally. After all, the patron—as in the example of post-1945 United States—has commitments that span the world.

With its commitments global but its resources ultimately finite, the patron would prefer to invest in a deterrent capability that optimizes between cost and effectiveness. Nuclear weapons help obviate high levels of military spending, particularly when it comes to conventional military deployments, because they neutralize an adversarial threat at high levels of violence. Nevertheless, the patron cannot rely exclusively on nuclear weapons for all of its military needs. It must retain a conventional military in order to be able to wage conventional wars (and even deter adversaries conventionally), secure borders, project land and sea power, and support diverse operations.

Because of differing threat assessments, however, the weaker ally might be dissatisfied with what could constitute minimal but sufficient deterrence for the patron. For example, the weaker ally may worry that stability at higher levels of violence (i.e., where nuclear weapons would be used) between the patron and the adversary could come at its expense at lower levels of violence. The adversary might still use its conventional military to encroach upon the interests and security of the weaker ally, knowing that the patron will shy away from crisis escalation and the threat of nuclear war. One solution available to the patron is to provide a conventional deterrent against the adversary. Unfortunately, this solution is costly and negates the savings reaped from having a nuclear weapons arsenal.¹⁵ Another solution is to place military assets, both conventional and nuclear, on the territory of its ally, thereby making crisis escalation more likely through the “threat that leaves something to chance.”¹⁶ Any conflict, even at lower levels of violence, risks inviting the participation of the patron and nuclear war through accident or misperception.¹⁷

Such is the strategic situation facing the patron. It wants to effectively deter an adversary but at as low a cost as possible. Its weaker ally will feel the threat of that adversary

13. I discuss the stability-instability paradox below. For a discussion, see Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca, NY: Cornell University Press, 1989), 19–22.

14. Thus is meant as complexity in terms of the information needed to manage commitments in light of the threats states face. Major powers are more likely to face complex environments than their weaker allies because their interests are diffuse and span more geographical regions.

15. For additional critiques, see Robert Jervis, *The Illogic of American Nuclear Strategy* (Ithaca, NY: Cornell University Press, 1984).

16. Thomas C. Schelling, *The Strategy of Conflict* (Cambridge, MA: Harvard University Press, 1980), 203.

17. Robert Powell, “Crisis Bargaining, Escalation, and MAD,” *American Political Science Review* 81, no. 3 (1987): 717–736.

more acutely both because of its relative lack of power and its proximity to the adversary. The patron and the weaker ally have their own preferences regarding the composition of the forward deployment of the patron's forces. The ally wants more forward-deployed assets, whereas the patron wants to provide less. Alliance politics thus consists of each side bargaining with each other so as to shape the forward deployment in a way that more closely resembles their distinct preferences.

Several conclusions flow from this analysis. First, the patron's threat assessments do not fully account for the forward deployment of its forces. Second, intra-alliance bargaining will produce a forward deployment that exceeds the deterrent that is minimally necessary against the adversary. Ironically, this alliance-induced forward deployment risks antagonizing the adversary, thereby complicating the deterrence task that forward deployment was intended to do. A likely result is strategic instability, something that both the patron and the ally would have preferred to avoid in the first place.

Case Study Analysis

This analysis seeks to explain changes in the patron's forward deployment of military assets. If the hypothesis is correct, there should be (1) differing threat perceptions; (2) the patron initially disagreeing with its allies regarding how its forces should be forward deployed; and (3) the patron ultimately accepting a greater level of forward deployment so as to reassure its allies despite its original assessments. The hypothesis is proven wrong if allies and patrons agree on the threat and, by extension, how the patron's forces should be forward deployed. It would also be wrong if the patron unilaterally selects the structure of its forces.

Two cases help determine the plausibility of this argument. They center on internal NATO debates regarding how to respond to (1) the Soviet Union's acquisition of an intercontinental missile capability in the late 1950s; and (2) the Soviet Union's development (and subsequent deployment) of the SS-20, an intermediate-range ballistic missile, in Western Europe. Both cases involve the same patron, the same Western European allies, the same adversary, and that same adversary achieving a major increase in its military capabilities.

SOVIET MISSILES AND NATO NUCLEAR-SHARING ARRANGEMENTS, 1957–1964

The launching of Sputnik in 1957 appeared to be a major change in the East-West balance of power. Beforehand, the Soviet Union was much like the United States insofar as it could deliver its nuclear weapons only using bombers. After Sputnik, however, the already conventionally superior Soviet Union appeared to be technologically outpacing the United States, with the added benefit of being able to mount its nuclear weapons on its intercontinental ballistic missiles. The consequences seemed dire. Domestically, the Eisenhower administration faced strong criticism from opposing Democrats that the United States was

on the losing end of a “missile gap.”¹⁸ Internationally, Western European allies began pressuring the Eisenhower administration into allowing them a greater role in the nuclear defense of Europe.¹⁹

The United States had already deployed tactical nuclear weapons in Europe with a two-key system in place.²⁰ Under this system, the United States had custody of the nuclear weapons, while Western European hosts had custody of the missiles. The Supreme Headquarters Allied Powers Europe, under the leadership of U.S. general Lauris Norstad, began fearing that this system was inadequate, especially with the Soviet Union’s growing stockpile of medium-range ballistic missiles (MRBMs). U.S. decisionmakers resisted placing the United States’ newly developed MRBMs under a similar arrangement to the two-key system, but they recognized that they had to address Western European concerns.²¹

Much was at stake. Excluding Western European allies from NATO nuclear decision-making could provoke fears of abandonment and spur them to seek their own nuclear weapons. After all, it was unclear to them whether the United States would sacrifice its cities for the defense of Europe in a nuclear exchange with the Soviet Union. Tensions within NATO already reflected these anxieties; West Germany, Italy, and France had already secretly entered into a trilateral initiative to develop an independent European nuclear capability.²² Even though French president Charles de Gaulle terminated this project shortly after returning to power in 1958, his country continued to produce its own nuclear weapons arsenal. Still, allies warned that a serious weakness in the U.S. nuclear deterrent had emerged, the remedy for which demanded a major recasting of the decision-making structures undergirding NATO.²³

U.S. decisionmakers assessed the strategic situation differently than their Western European counterparts. For one, the missile gap was exaggerated, and the launching of Sputnik did not radically change the threat environment. The Eisenhower administration believed that Western European governments should have access to nuclear weapons—but not yet. Indeed, when the Kennedy administration came into office, these attitudes remained unchanged. Despite Kennedy’s criticisms during the 1960 presidential campaign about the missile gap, the administration knew that none existed.²⁴ Moreover, the Kennedy

18. Yanek Mieczkowski, *Eisenhower’s Sputnik Moment: The Race for Space and World Prestige* (Ithaca, NY: Cornell University Press, 2013): 244–247.

19. Marc Trachtenberg, *A Constructed Peace: The Making of the European Settlement, 1945–1963* (Princeton, NJ: Princeton University Press, 1999).

20. Robert A. Wampler, “Eisenhower, NATO, and Nuclear Weapons: The Strategy and Political Economy of Alliance Security,” in *Eisenhower: A Centenary Assessment*, ed. Gunter Bischof and Stephen E. Ambrose (Baton Rouge: Louisiana State University Press, 1995).

21. James B. Solomon, *The Multilateral Force: America’s Nuclear Solution for NATO, 1960–1965*, U.S. NA Trident Scholar Project Report No. 269 (Annapolis, MD: U.S. Naval Academy, 1999).

22. Colette Barbier, “Les négociations franco-germano-italiennes en vue to l’établissement d’une coopération militaire nucléaire au cours des années 1956–1958,” *Revue d’histoire diplomatique* 104, no. 3 (1990): 81–113.

23. Keith W. Baum, “Treating the Allies Properly: The Eisenhower Administration, NATO, and the Multilateral Force,” *Presidential Studies Quarterly* 13, no. 1 (1983): 85–97.

24. Dwight Eisenhower tried to refute the existence of a missile gap, but John F. Kennedy cynically exploited the rhetoric for electoral gain. See Christopher A. Preble, “Who Ever Believed in the ‘Missile Gap’? John F. Kennedy and the Politics of National Security,” *Presidential Studies Quarterly* 33, no. 4 (2003): 802.

administration had a more hostile attitude than its predecessor toward the notion that Western European allies should have their own nuclear weapons programs. Finally, the Eisenhower administration believed that the threat of nuclear punishment was sufficient to deter the conventionally superior Soviet Union, a view that its New Look policy embodied. Conventional forces in Europe were not only unnecessary but also expensive.²⁵ The Kennedy (and later Johnson) administration agreed, despite their alleged adoption of “flexible response” that called for the ability to muster both conventional and nuclear military power so as to respond to different gradations of Soviet aggression.²⁶

Consequently, the United States and its Western European allies differed in their views as to how to deter the Soviet Union most effectively. U.S. officials believed that their nuclear forces were qualitatively superior to those of the Soviets. By contrast, Western European officials saw their countries as being exposed to the conventional military threat of the Soviet Union. They did not want to be overrun by the Red Army when the United States appeared to be raising the nuclear threshold with flexible response. The nuclear balance deepened their fears because the United States had incentives not to escalate when only European vital interests (and not American ones) were affected.

U.S. decisionmakers proposed a compromise that they felt would reassure allies and permit them a greater role in nuclear decisionmaking: the Multilateral Force (MLF). This initiative called for the members of NATO to contribute their forces to mixed-manned warships and submarines that would be fitted with nuclear-armed Polaris ballistic missiles. U.S. officials from the Eisenhower through the Johnson administrations believed that this nuclear-sharing arrangement would address Western European concerns that the United States had a disproportionate share in the nuclear defense of Europe. It would preserve NATO’s second-strike capability and lower the incentives of other countries—especially West Germany—to want their own nuclear weapons. Nevertheless, the MLF would not surrender U.S. control of such arms.

Though the initiative had its origins in the Eisenhower administration, debate over the MLF intensified during the Johnson administration. This debate produced two effects, neither of which was stabilizing or beneficial to the United States.

The first was that it deepened rather than soothed alliance discord. Western European governments expressed concerns over the mounting costs of the program. Nor did they accept the reasoning put forward by U.S. officials that the MLF would augment NATO’s deterrent capability in a manner that was commensurate with those costs. The British and the French had their own misgivings. The British interpreted the MLF as an effort by the United States to render their nuclear deterrent fully dependent on U.S. technology.²⁷ Simi-

25. Saki Dockrill, *Eisenhower’s New-Look National Security Policy, 1953–61* (New York, NY: St. Martin’s Press, 1996).

26. Francis J. Gavin, “The Myth of Flexible Response: United States Strategy in Europe during the 1960s,” *International History Review* 23, no. 1 (2001): 847–865.

27. John W. Young, “Killing the MLF? The Wilson Government and Nuclear Sharing in Western Europe, 1964–1966,” *Diplomatic and Statecraft* 14, no. 2 (2003): 295–324.

larly, the French—that is, Charles de Gaulle—saw the MLF as a tool for the United States to preserve its power and influence over Europe.²⁸ Only West Germany supported the program, but other allies were not entirely convinced that the MLF would fully discourage Bonn from seeking its own nuclear weapons in the future.²⁹

The second was that the MLF alarmed members of the Soviet bloc. They saw the initiative as a backdoor means to supply West Germany with nuclear weapons. Memories of World War II and Nazism were still fresh at this time, and members of the Eastern bloc understood Cold War politics through the prism of their interwar experience. Any hint that the West German government wanted to rearm recalled the militarist 1930s. Thus, Soviet apprehensions over nuclear-sharing arrangements within NATO stymied negotiations for an international treaty against nuclear proliferation.³⁰

Ultimately, the United States abandoned the MLF proposal. After China first detonated a nuclear weapon in October 1964, U.S. decisionmakers felt it urgent to reach an accord with the Soviet Union to prevent further dissemination of nuclear weapons. Gaining Soviet cooperation to draft a nondiffusion treaty, however, required making stronger pledges to prevent West Germany from acquiring nuclear weapons. These pledges in turn required canceling nuclear-sharing arrangements like the MLF but permitted the Nuclear Planning Group (NPG) to coordinate nuclear policy in NATO.³¹ The United States also retained its conventional military forces in West Germany and Europe.

SOVIET MISSILES AND THE NATO DUAL-TRACK DECISION, 1977–1979

In the late 1970s, the Soviet Union again seemed poised to develop a superior missile capability to that of the United States. Specifically, it deployed in central Eastern Europe a new intermediate range ballistic missile armed with nuclear weapons called the SS-20. Earlier models of this missile had a range from 600 kilometers to 5,000 kilometers. Later models increased the range and could incorporate multiple warheads. It was an in-theater nuclear weapon that threatened Western European allies more than the United States, especially because NATO had no in-theater counter.³²

Western European leaders recognized these dangers. In a speech delivered at the International Institute for Strategic Studies in October 1978, West German chancellor

28. Colette Barbier, “La France et la Force multilatérale (MLF),” in *La France et l’OTAN*, ed. Maurice Vaïsse et al. (BE: Complexe, 1996). See also Michael Middeke, “Anglo-American Nuclear Weapons Cooperation after the Nassau Conference: The British Policy of Independence,” *Journal of Cold War Studies* 2, no. 2 (2000): 69–96.

29. Research Memorandum to Dean Rusk, October 28, 1964, folder “Multilateral Force, General Vol. 2 [3 of 3],” National Security File, Subject File, Box 23, Lyndon Baines Johnson Library (LBJL). See also MLF Congressional Presentation, June 1, 1964, folder “Multi-lateral Force, General Vol. 1 [1 of 3],” National Security File, Subject File, Box 22a, LBJL.

30. Douglas Selva, “The Warsaw Pact and Nuclear Non-Proliferation, 1963–1965, Working Paper 32” (Washington, DC: Woodrow Wilson International Center for Scholars, 2001).

31. Hal Brands, “Non-Proliferation and the Dynamics of the Middle Cold War: The Superpowers, the MLF, and the NPT,” *Cold War History* 7, no. 3 (2007): 389–423.

32. Raymond L. Garthoff, “The Soviet SS-20 Decision,” *Survival* 25, no. 3 (1983): 110–119.

Helmut Schmidt warned that a serious weakness had emerged in the U.S. nuclear deterrent capability. Western Europe had become vulnerable to an increasing parity between U.S. and Soviet conventional and tactical nuclear forces that benefited the Soviet Union.³³ If the Soviets did achieve parity with the United States, then the latter might become reluctant to defend Western European allies due to the costs involved. U.S. decisionmakers were alert to these concerns. A member of the National Security Council later observed that “Western strategic analysts believed that in Soviet eyes, strategic parity would reduce U.S. willingness to use its strategic nuclear forces in contingencies short of nuclear attack on the United States itself, therefore sharply reducing the credibility of the American nuclear umbrella over Europe.”³⁴

U.S. decisionmakers did not share their allies’ assessments of the strategic situation, however.³⁵ President Jimmy Carter had already declared his interest in nuclear disarmament, a goal at odds with Western European demands that the United States increase its regional MRBM deployments. Indeed, he decided in 1978 to postpone production of the neutron bomb despite Soviet efforts to continue manufacturing them.³⁶ Reflecting on his time as U.S. national security adviser in the Carter administration, Zbigniew Brzezinski claims to have not seen improvements in Soviet nuclear capabilities as indicating an interest to fight wars. An interview with him notes that

Brzezinski felt that the Soviets would not use nuclear weapons first and might be restrained even if they had superiority in nuclear weapons. If we employed nuclear arms, the Soviets probably would match us or maybe escalate. They would respond to U.S. tactical nuclear use with tactical preemption, in the context of on-going hostilities. Brzezinski doubted that during a theater war, the USSR would strike preemptively at U.S. strategic forces in the continental U.S.³⁷

33. Helmut Schmidt, “The 1977 Alastair Buchan Memorial Lecture,” *Survival* 20, no. 1 (1978): 2–10.

34. James A. Thomson, “The LRTNF Decision: Evolution of U.S. Theater Nuclear Policy, 1975–1979,” *International Affairs* 60, no. 4 (1984): 602.

35. Raymond L. Garthoff, “The NATO Decision on Theater Nuclear Forces,” *Political Science Quarterly* 98, no. 2 (1983): 198. Some members of the Carter administration recognized this discrepancy. As one memorandum observed, “Because their interests are not identical to ours, our allies do not necessarily see the problem as we do. . . . The Germans are concerned with the adequacy of the NATO deterrent in light of strategic parity. They also feel that the U.S. is preoccupied with the homeland-homeland strategic balance at the expense of those aspects of the strategic balance that impact more directly on European security.” Memorandum to Vice President et al. from National Security Council Staff Secretary Christine Dodson, “SCC [Special Coordinating Committee] Meeting, PRM-38, Tuesday, August 22, 1978,” August 18, 1978, enclosing final draft of response to PRM/NSC-38 [Section I missing from FOIA release], Top Secret, Excised Copy. Available at <http://www2.gwu.edu/~nsarchiv/nukevault/ebb301/>.

36. This decision was partly in response to the growing antinuclear movement in Western Europe that saw the neutron bomb—which destroys organic matter but leaves physical structures intact—as morally egregious. The leftist antinuclear movement in West Germany was a strong opponent of any potential forward deployment of U.S. neutron bombs. See Kristina Spohr Readman, “Germany and the Politics of the Neutron Bomb, 1975–1979,” *Diplomacy and Statecraft* 21, no. 2 (2010): 259–285. Still, Schmidt sought the production and deployment of the neutron bomb so as to have a bargaining chip against the Soviets. Readman, “Conflict and Cooperation in Intra-Alliance Nuclear Politics: Western Europe, the United States, and the Genesis of NATO’s Dual-Track Decision, 1977–1979,” *Journal of Cold War Studies* 13, no. 2 (2011): 49–50.

37. John G. Hines interview with Zbigniew Brzezinski, November 20, 1991. Available at <http://www2.gwu.edu/~nsarchiv/nukevault/ebb285/>.

Thus, even Brzezinski—often seen as the most anti-Soviet and hawkish member of Carter’s foreign policy team—saw Soviet leaders as believing in and practicing nuclear deterrence. Apparent boosts to their ability to fight nuclear wars were really preparations for those contingencies in which deterrence failed. A State Department briefing memo asserted that “in military terms, the SS-20 has not so much undermined NATO doctrine.”³⁸ Western Europeans disagreed and so retained their interest in seeing the United States adopt a posture that would negate the perceived Soviet advantage.

An effort to build allied consensus continued after Carter’s neutron bomb decision. British and West German defense planners had already agreed that NATO’s nuclear forces in Europe should move away from its battlefield orientation—an orientation preferred by their U.S. counterparts—so as to be able to attack the support lines of a Warsaw Pact offensive.³⁹ In other words, they wanted to improve in-theater long-range theater nuclear forces and thus remained adamant that the United States close gaps in its deterrent capability against the Soviet Union. Moreover, they believed that such deployments should come in tandem with a new arms control initiative to reduce both U.S. and Soviet long-range theater nuclear forces from Europe. This contradictory linkage was necessary because West German chancellor Schmidt needed to preserve *détente* and *Ostpolitik* (“Eastern Policy”) and make the deployment politically palatable for his coalition, which included the liberal Free Democratic Party.⁴⁰

Ultimately, U.S. defense planners relented and agreed that some strategic solution was necessary, largely to overcome concerns over U.S. credibility.⁴¹ Moreover, they even accepted the proposed linkage between deployments and arms control efforts for use as bargaining leverage against the Soviets. Thus, NATO deployed 572 ground-launched cruise missiles and Pershing II missiles in Western Europe. As historian Kristina Spohr Readman writes, this change to NATO’s nuclear deterrent was the result of alliance politics: “Western European defense experts were the ones who had pushed for the modernization of longer-range theater nuclear forces that could strike Soviet territory. The United States neither pressured nor predominated. Rather, to the chagrin of Europeans, the Carter adminis-

38. Briefing Memo, “SCC Meeting on PRM-38, August 23,” August 16, 1978, <http://www2.gwu.edu/~nsarchiv/nukevault/ebb301/doc02.pdf>.

39. British strategists spoke of improving NATO’s conventional deterrent and theater nuclear forces, whereas the West Germans emphasized medium-range systems. Readman, “Conflict and Cooperation,” 51–53.

40. *Ibid.*, 69–71. On the complex origins of *Ostpolitik*, see Mary Elise Sarotte. *Dealing with the Devil: East Germany, Détente, and Ostpolitik, 1969–1973* (Chapel Hill: University of North Carolina Press, 2001). Some members of the U.S. government recognized these motivations for West German policy proposals. As one briefing memo indicated, “if the Alliance decides ultimately to make long-range [theater nuclear force] deployments, then they would have to be accompanied by a strong arms control effort, and that both these tracks would be guided by an integrated.” It added that West Germany accepted an arms control effort so as to have a political “cover” for the deployment. See footnote 31. Emphasis in original document.

41. Brian J. Auten, *Carter’s Conversion: The Hardening of American Defense Policy* (Columbia: University of Missouri Press, 2008); Keren Yarhi-Milo, *Knowing the Adversary: Leaders, Intelligence, and Assessment of Intentions in International Relations* (Princeton, NJ: Princeton University Press, 2014), 126–157.

tration seemed for a long time to be ambivalent about European concerns . . . and at crucial moments to lack the ability or desire to lead.”⁴²

Had the United States had its way, these deployments would likely not have taken place and the deterrent capability that was hitherto in place would have remained the same.

It is unclear how this initiative to reassure allies affected the Soviet Union. Certainly, its leadership did not feel more secure.⁴³ Shortly after the deployment, the Soviet Union invaded Afghanistan. This action likely reflected a desire to support a puppet regime and signal strength to other restive Muslim populations in Central Asia. Still, the concurrence of the dual-track decision and the invasion of Afghanistan indicated that détente was over. Both the United States and the Soviet Union resumed an arms race, one that their leaders soon realized was dangerous and needed regulation.⁴⁴

Discussion and Concluding Remarks

The two cases explored above contain several important similarities. First, a major uptick in Soviet military capabilities precipitated tense disagreements between the United States and its NATO partners over what form the U.S. strategic posture should take in deterring the Soviet Union. Second, in each instance the United States ended up adopting a nuclear strategy or posture that it initially saw as unnecessary. The MLF was essentially a half-hearted U.S. counterproliferation strategy that satisfied no one, including most NATO members. Having emerged primarily from Western European strategic debates, the dual-track decision had at least broader appeal within NATO. Still, U.S. decisionmakers had misgivings when allies first mooted it. Left unmentioned in the cases is that both initiatives helped renew U.S.-Soviet tensions. Emerging documentary evidence suggests that concerns over NATO nuclear-sharing arrangements and a nuclear-armed West Germany ended a thaw in superpower relations and spurred Soviet leader Nikita Khrushchev to issue ultimatums over the status of Berlin.⁴⁵ And although détente was already becoming fragile, the dual-track decision and the Soviet invasion of Afghanistan signaled that the Cold War entered a new, more dangerous phase.

42. Readman, “Conflict and Cooperation,” 88. She is responding to a historiography that emphasizes the primacy of the United States in determining this change in NATO’s nuclear policy. Advocates of this older perspective include, inter alia, Garthoff, “The NATO Decision.”

43. According to the website of the National Security Archive’s Nuclear Vault, recent Russian-language historiography alleges that the dual-track decision influenced the Soviet approach to Afghanistan. In particular, see Alexander Lyakhovsky, *Tragedia i doblest Afgana* [Tragedy and Valor of Afghanistan] (Moscow: Eksmo, 2009), 282.

44. The Intermediate-Range Nuclear Forces (INF) Treaty was the result, which removed from Europe nuclear and conventional ground-launched ballistic missiles with ranges between 500 and 5,000 kilometers. This treaty signified an easing of tensions that presaged the end of the Cold War and the collapse of the Soviet Union. For a critical view of the relationship between NATO nuclear deterrence and the INF treaty, see Thomas Risse-Kappen, “Did ‘Peace Through Strength’ End the Cold War? Lessons from INF,” *International Security* 16, no. 1 (1991): 162–188.

45. Trachtenberg, *A Constructed Peace*. On the relationship between the Berlin and Cuban Missile Crises, see Marc Trachtenberg, “The Influence of Nuclear Weapons in the Cuban Missile Crisis,” *International Security* 10, no. 1 (1985): 137–163.

The implications that these cases suggest for contemporary security dynamics in East Asia are worrisome. Chinese nuclear modernization could represent a quick but significant increase in Chinese military capabilities that might incite allies to demand a forward deployment posture that U.S. decisionmakers believe exceeds the requirements of deterrence. However, in the interests of reassuring worried allies, the United States might find itself drawn into making commitments that it would rather not make. The result could be a flare-up in Sino-American tensions that could further destabilize the region.

Still, several counterarguments to this point are possible. One is that such Cold War cases have little relevance for East Asia today because the military technology that undergirds extended deterrence today is too different from that of the past. Accentuating this difference is the United States' conventional and unconventional superiority over China. By contrast, during the Cold War, it was the United States' conventional inferiority that led it to forward deploy its conventional forces, tactical weapons, and theater nuclear weapons in Western Europe. Yet the military asymmetry that favors the United States today is a double-edged sword. On the one hand, U.S. security partners prefer the United States to be much stronger than their adversaries. On the other hand, U.S. decisionmakers might be overly confident in their ability to project military power (especially from offshore) and thus become insensitive to the particular security needs of their weaker allies. Simply put, a leviathan that stands too tall with its head in the clouds might fail to see the little problems at its feet. Alliance discord can still ensue despite differences in technology and the balance of power between the Cold War and today.

A more powerful counterargument is that the hub-and-spoke alliance system in East Asia would generate different security dynamics than those observed in NATO. Being a multilateral alliance with a centralized command structure, information flowed relatively easily in NATO, thereby facilitating cooperation.⁴⁶ In East Asia, alliance structures are constructed differently so as to favor the United States. Not only does the bilateralism that characterizes U.S. security partnerships in East Asia impede such cooperation, but historical animosities and antagonism also permeate relations between South Korea and Japan. According to this argument, major U.S. allies in East Asia face serious obstacles that would keep them from coordinating a unified position regarding the regional provision of U.S. extended deterrence.

Yet an irony of ROK-Japanese relations is that these major U.S. allies cooperate with each other best when they both fear U.S. abandonment.⁴⁷ This observation suggests that Japan and South Korea could coordinate more closely with each other and jointly call for the United States to bolster its security presence if they feel too deprived of those security

46. For an institutionalist argument in this vein, see Celeste A. Wallander, "Institutional Assets and Adaptability: NATO After the Cold War," *International Organization* 54, no. 4 (2000): 705–735. On why the absence of a NATO-like alliance in East Asia, see G. John Ikenberry, "American Hegemony and East Asian Order," *Australian Journal of International Affairs* 58, no. 3 (2004): 353–367. For an alternative account, see Christopher Hemmer and Peter J. Katzenstein, "Why is There No NATO in Asia? Collective Identity, Regionalism, and the Origins of Multilateralism," *International Organization* 56, no. 3 (2002): 575–607.

47. Victor D. Cha, *Alignment Despite Antagonism: The United States-Korea-Japan Security Triangle* (Stanford, CA: Stanford University Press, 1999).

goods that they deem vital for their security. Because China has become more assertive in maritime disputes that do not directly involve U.S. interests, their sense of vulnerability might intensify once China finalizes its modernization program.

U.S. decisionmakers can avoid the errors of the past by taking several steps. First, maintaining regular consultations and open dialogue with friends and allies helps build empathy and understanding. One of the worst impressions that the United States could convey to its allies is that it is indifferent to their security interests. Disagreements over threat perceptions and strategies are to be expected, particularly when the United States enjoys the security that comes with two oceans and peaceful neighbors to its north and south. But talking through these disagreements can allay concerns that the United States is aloof or fails to appreciate their security concerns. Second, U.S. defense planners would do well to consider the broad effects of any reductions in its military forces or forward deployment beyond merely a budgetary perspective. Though the cases examined concerned large-scale increases in the adversary's military capabilities, it is possible that similar dynamics could ensue following large-scale decreases in U.S. military capabilities. Both actions affect the vulnerability of the allies. As U.S. defense spending will likely fall, planners should try to soften the impact these cuts would have on friends and allies.

Chinese Views of Japanese Nuclear Capabilities and Ambitions

Bonny Lin¹

The years 2013 and 2014 were rough for China-Japan relations. Mirroring the tense bilateral relations were heightened Chinese suspicions of Japanese nuclear capabilities and ambitions. While there is no indication the Chinese government believes that Japan is manufacturing nuclear weapons, there is concern that Japan is keeping more sensitive nuclear material than necessary for domestic energy use. There is also concern that Japanese leaders may be gradually clearing the obstacles preventing Japan from fully embracing the nuclear option. Though Chinese views of Japanese nuclear direction are driven by their analyses of specific developments within Japan as well as tensions in bilateral relations, recent Chinese assessments could be more balanced to include discussions of potential Japanese nuclear strategies and potential negative ramifications for Japan should it decide to acquire nuclear weapons.

Introduction

The years 2013 and 2014 were rough ones for China-Japan relations, as tensions between the two countries escalated, particularly in the East China Sea. Mirroring the tense bilateral relations were heightened Chinese suspicions of Japanese nuclear capabilities and ambitions. Before the thawing of China-Japan relations in late 2014, a number of Chinese publications expressed greater concern over Japan's current nuclear direction than Japanese nuclear policies a decade ago. While there is no indication the Chinese government believes that Japan is manufacturing nuclear weapons, there is concern that Japan is keeping more sensitive nuclear material than necessary for domestic energy use. Throughout much of 2013 and 2014, Chinese experts worried that Japanese leaders were clearing the obstacles preventing Japan from acquiring nuclear weapons and that they were also challenging and altering key international and internal factors discouraging Japan from seeking nuclear weapons.

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This chapter reviews Japan's latent nuclear capabilities and then draws on Chinese language resources to delve into Chinese perceptions of international, internal, and technical and strategic drivers of Japanese nuclear capability. Chinese strategists see few technical barriers to Japanese nuclearization and view international and internal constraints preventing Japan from seeking nuclear weapons as weakening. While recent Chinese assessments focus on specific developments within Japan, they largely omit discussions of potential Japanese nuclear strategies and potential negative ramifications for Japan should it decide to acquire nuclear weapons.

Japan's Latent Nuclear Capabilities

Chinese concerns about Japan are based on the understanding that Japan has sufficient nuclear material and technological capabilities to produce nuclear weapons and their associated delivery vehicles. It is widely recognized that Japan's nuclear energy program provides a solid foundation for any potential nuclear weapons program.² Japan is committed to completing the nuclear fuel cycle and reprocesses nuclear spent fuel to separate uranium and plutonium from other nuclear waste. Separated reactor-grade plutonium can fuel nuclear reactors or, if diverted in sufficient quantities, can be used to make nuclear weapons.³ Japan's controversial Rokkasho nuclear facility also possesses sophisticated centrifuges that, should the facility come online, could provide Japan with the capability to enrich uranium for nuclear weapons.⁴

As of 2012, Japan had 9.3 tons of separated reactor-grade plutonium⁵ and 159 tons of plutonium in spent fuel held within Japan and 35 tons of separated reactor-grade plutonium located abroad.⁶ Japan also has 1.2 tons of enriched uranium scattered within the country.⁷ Japanese nuclear materials are under International Atomic Energy Agency

2. For example, see Yin Xiaoliang, "Japan has nuclear weapons capability," *China Daily*, March 24, 2014, http://www.chinadaily.com.cn/world/2014xivisiteu/2014-03/24/content_17373447.htm.

3. Though it is difficult to use reactor-grade plutonium to make nuclear weapons, it was proven possible by a 1962 test. See Richard L. Garwin, "Reactor-Grade Plutonium Can be Used to Make Powerful and Reliable Nuclear Weapons," August 1998, <http://www.fas.org/rlg/980826-pu.htm>.

4. Richard J. Samuels and James L. Schoff, "Japan's Nuclear Hedge: Beyond 'Allergy' and Breakout," in *Strategic Asia 2013-2014: Asia in the Second Nuclear Age*, ed. Ashley J. Tellis, Abraham M. Denmark, and Travis Tanner (Seattle: National Bureau of Asian Research, 2013), 233–265.

5. Japan misreported its plutonium stockpile in its two most recent reports to the IAEA about the status of its stockpile in December 2011 and December 2012. Japanese reports failed to include 640 kilograms of fresh MOX fuel. However, in order to encourage better accounting of its nuclear materials and prevent terrorists from acquiring them, Japan pledged to return to the United States more than 300 kilograms of weapons-grade plutonium as well as quantities of highly enriched uranium. See Pavel Podvig, "How fissile material falls through the cracks," *Bulletin of Atomic Scientists*, July 7, 2014, <http://thebulletin.org/how-fissile-material-falls-through-cracks7296>; Juergen Baetz and Toby Sterling, "Japan, U.S. announce landmark deal," *Huffington Post*, March 24, 2014, http://www.huffingtonpost.com/2014/03/24/japan-us-nuclear-deal_n_5020554.html.

6. The most recent data available are from 2012. Data from Japan Atomic Energy Commission, "Current Situation of Plutonium Management in Japan," various years (2001–2013), http://www.aec.go.jp/jicst/NC/iinkai/teirei/plutonium_management.htm.

7. Zachary Keck, "Japan and China's dispute goes nuclear," *Diplomat*, March 18, 2014, <http://thediplomat.com/2014/03/japan-and-chinas-dispute-goes-nuclear/>.

(IAEA) safeguard. Should Japanese nuclear policies change significantly, the country might be able to use its nuclear materials to build a thousand or more nuclear weapons.⁸

Japan's space program provides potential nuclear weapons delivery platforms. Its solid-fuel rocket technology, particularly its 1.8-ton payload M-V space launch vehicle, could be converted to missiles capable of delivering nuclear weapons. The M-V's successor, the Epsilon rocket, was successfully launched into space in late 2013.⁹ Since at least 1994, Japan has experimented with technology that will enable its rockets to reenter the atmosphere. Japan also has access to U.S. missile defense technologies and has been working on space technologies to improve precision targeting.¹⁰

There is little consensus, however, over how long it would take Japan to produce a nuclear weapon. Estimates range from several months to less than two years.¹¹ Moreover, some argue that even if Japan is able to produce one or two nuclear bombs in a span of months, it would take much longer to establish a credible and survivable nuclear deterrent. Chinese analysts argue that Japan lacks expertise on "bomb and warhead design, reliable delivery vehicles, intelligence and counterintelligence capabilities designed to protect and hide assets from a potential first strike, a comprehensive command-and-control system, and infrastructure to safely test weapons."¹² It is unclear whether China holds a similar and rather sanguine view that a Japan with a couple of bombs may be less worrisome than a Japan with a more robust nuclear capability.¹³ Chinese articles tend to note that a nuclear Japan would increase the potential for a Sino-Japanese clash as well as regional nuclear proliferation. Thus far, there are few articles written by Chinese scholars or even translated into Chinese that question this dominant view.¹⁴

8. Samuels and Schoff, "Japan's Nuclear Hedge," 241.

9. "Japan's 1st Epsilon Rocket Launches into Space on Maiden Voyage," Space.com, September 14, 2013, <http://www.space.com/22806-japan-launches-epsilon-rocket.html>.

10. Samuels and Schoff, "Japan's Nuclear Hedge," 241–242.

11. For this range, see Robert Windrem, "Japan has nuclear 'bomb in the basement' and China isn't happy," *NBC Special Report*, March 11, 2012, 2014, <http://www.nbcnews.com/storyline/fukushima-anniversary/japan-has-nuclear-bomb-basement-china-isnt-happy-n48976>. Chinese sources, however, reiterate Japanese estimates of 183 days for Japan to make a nuclear bomb. See Heng Zhao, "Japanese nuclear policy's past and future (Ribei hezhengce de huigu yu qianyan)," *Northeast Asia Forum (Dongbeiyu luntan)* 4 (2003): 47.

12. Samuels and Schoff, "Japan's Nuclear Hedge," 242. See also James R. Holmes, "Japan: Joining the nuclear weapons club? It could," *Diplomat*, October 22, 2012, <http://thediplomat.com/2012/10/japan-joining-the-nuclear-weapons-club-it-could/>.

13. For example, see Zhao, "Japanese nuclear policy's past," 47.

14. One of the few exceptions is a 2010 article by an Australian scholar translated into Chinese. The article noted that a number of Chinese scholars hold a pessimistic view of a nuclear Japan because these scholars fail to take into account the larger geopolitical context of China-Japan relations and what principles and strategies a nuclear Japan may embrace. See Huili Shao, trans., "Sino-Japanese Strategic Relations: Will Competition Lead to Confrontation? (Zhongri zhanlue guanxi: jingzheng hui dao zhi duikang ma?)," *Foreign Theoretical Trends (Guowai lilun dongtai)* 6 (2010): 53–57, http://www.cctb.net/llyj/lltd/hwzg/201007/t20100706_247956.htm.

Chinese Assessment of Drivers of Japan's Nuclear Capability

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International factors are crucial to Japanese nuclear decision-making, in the view of Chinese analysts. China perceives that Japan is focusing more on China as a potential threat and that the U.S.-Japan alliance has a mixed influence on Japan's interest in acquiring nuclear weapons. Recent Chinese articles do not devote substantial attention to the potential international costs and damages Japan might suffer if it were to seek nuclear weapons.

Greater Japanese Strategic Focus on China as a Potential Threat

Chinese analysts assess that Japan focuses on China as its main potential security threat. According to the authoritative Chinese military text, *Science of Military Strategy* (2013 edition), countries that Japan traditionally viewed as potential adversaries in the post-Cold War era (ranked in order of threat) are North Korea, China, and Russia. In recent years, the text writes, Japan is increasingly focused on China's growing power and military capabilities.¹⁵

Chinese articles from 2010 to mid-2014 repeatedly criticize Japan for adopting a zero-sum mentality that identifies China as a threat to the existing order and status quo in Asia. From Prime Minister Abe Shinzo's return to power in late 2012 onward, Chinese analysts have argued that he "frequently label[s] China as a troublemaker and an obstacle to a rising Japan."¹⁶ Chinese observers also tend to argue that Japan exaggerates threats from China to boost its defense spending.¹⁷ This Chinese perception of increased Japanese strategic focus on China is also reflected in Chinese views of Japanese nuclear policies. Chinese articles on Japanese nuclear policy written before 2010 tend to be less passionate: most note that Japan is unlikely to seek nuclear weapons in the near future; others discuss Japanese interest in nuclear capabilities vis-à-vis North Korea, and some focus on the negative effects of Japan's accumulation of nuclear materials on the Nuclear Non-Proliferation Treaty (NPT).¹⁸ In contrast, from around 2010 to 2014, Chinese articles

15. Xiaosong Shou et al., *The Science of Military Strategy (Zhanlue xue)* (Beijing, China: Academy of Military Science Press, 2013), 63.

16. Zhang Yunbi, "Antiquated ideas source of Abe strategy," *China Daily*, October 29, 2013, http://usa.chinadaily.com.cn/world/2013-10/29/content_17064708.htm. See also Wu Huaizhong, "Japan's grand Asia-Pacific strategy," *China Daily*, January 18, 2013, http://europe.chinadaily.com.cn/opinion/2013-01/18/content_16136029.htm.

17. *China Daily*, "Japan under fire for 'China threat theory,'" August 5, 2011, http://www.china.org.cn/world/2011-08/05/content_23147990.htm.

18. For examples of earlier Chinese articles, see Xiaojun Luo, Donghan Ding and, Zongwen Su, "Preliminary assessments of Japan's latent nuclear capability and the direction of Japanese government's nuclear policy (Ribei de heqianli ji riben zhengfu hezhengce zouxiang chutan)," *International Observer (Guoji Guancha)* 2 (2002): 49–52; Zhao, "Japanese nuclear policy's past," 45–58; Xuping Hu, "Should Japan nuclearize? (Ribei gai wuzhuang)," *Contemporary International Relations (Xiandai Guoji Guanxi)* 9 (2003): 42–43; Dahui Huang, "On Japan's Non Nuclear Policies (Lun riben de wuhehua zhengce)," *Arms Control and Security (Junbei kongzhi yu anquan)* 3 (2006): 6–21; Liping Xia, "On Japan's nuclear policy trend and influence (Lun riben hezhengce de zouxiang yu yingxiang)," *International Observer (Guoji Dongcha)* 4 (2008): 9–15; Xiangli Sun, Jun Wu, and

tend to assume a greater Japanese interest in nuclear weapons and tend to attribute this to a desire to deter China. Sun Xiangli, a nuclear weapons expert and director of the Arms Control Research Division at the Chinese Academy of Engineering Physics, labeled a greater Japanese stockpile of sensitive nuclear material as a “major latent threat” to East Asia.¹⁹

Mixed Assessment of the U.S.-Japan Alliance on Preventing Japanese Nuclearization

Chinese experts have historically regarded international factors, particularly the U.S.-Japan alliance, as important to Japanese nuclear decisionmaking. The current mainstream view carried in a number of more official channels is that the United States does not support Japanese development of nuclear weapons but does support Japan’s use of nuclear energy for peaceful purposes. Therefore, Japanese nuclearization could strain the U.S.-Japan alliance.

Chinese sources, however, worry that Japan is becoming more of an equal partner, instead of a junior partner, in the U.S.-Japan alliance.²⁰ Unlike in the Cold War environment, where Japan closely followed the United States for its own security and survival,²¹ Chinese strategists are concerned that Washington has less influence over Tokyo now. Some fear that U.S. desire for Japanese cooperation may put Washington in compromising situations. Others question whether the United States may be turning a blind eye to Japanese nuclearization in order to use Japan to challenge China.²² Wu Huaizhong, director of the Japanese Politics Research Office at the Institute of Japanese Studies under the Chinese Academy of Social Sciences, argues that the United States will not allow Japan to become a completely normal military power, and this is most evidenced in U.S. opposition to Japanese nuclearization. However, the United States faces a bigger challenge of dealing with the “contradictions” of a rising China. U.S.-Japan contradictions are of secondary importance,

Side Hu, “Japan’s plutonium problem and international concern (Ribei buwenji ji qiguoji guanqie),” *Contemporary International Relations (Xiandai guoji guanxi)* 3 (2006): 16–20; Wansheng Xu and Zhengnan Fu, “Direction of Japanese nuclear policy (Ribei hezhengce dongxiang),” *Contemporary International Relations (Xiandai Guoji Guanxi)* 4 (2008): 22–25, 42; He Qin, “The effect of the North Korean issue on Japan’s nuclear policy (Chaoxian wenti dui ribei hezhengce de yingxiang),” *International Politics Quarterly (Guoji Zhengzhi Yanjiu)* 2 (2009): 160–170.

19. Jun Wu and Xiangli Sun, “Japan’s accumulation of nuclear material causes concerns for East Asian security (Ribei lei ji hecailiao ling dongya anquan mengyou),” *Xinhua News*, February 21, 2014, http://news.xinhuanet.com/world/2014-02/21/c_126170211.htm.

20. Shou, *Science of Military Strategy*, 63.

21. According to one article, during the Cold War, Japanese leaders recognized that developing nuclear weapons would lead to a rupture in U.S.-Japan relations. Given Japan’s small geographic size and lack of strategic depth, Japan would not have been able to withstand a Soviet nuclear attack without a U.S. nuclear umbrella. Japan was thus forced to shelve its nuclear design. See Jiangang Huo, “Why is Japan accumulating nuclear material (riben tunji hecailiao shi he juxin),” *Liao Wang*, February 25, 2014, <http://www.lwgcw.com/NewsShow.aspx?newsId=34539>.

22. Zhejun Guo, “U.S. may allow Japan to acquire nuclear weapons to challenge China (Mei huo zongrong ribei yonghe tiaozhan zhongguo),” *China National Defense News (Zhongguo Guofang Bao)*, February 11, 2014. The article, but with its title slightly modified, is also carried at <http://www.globalview.cn/ReadNews.asp?NewsID=36362>.

and Washington may relax its control over Tokyo in order to obtain Japanese cooperation in policies toward China.²³

Chinese articles published in 2013 and 2014 portray U.S. extended nuclear deterrence as having a mixed influence on Japanese nuclearization. On the one hand, Chinese experts recognize that U.S. extended deterrence may dampen Japanese desire for nuclear weapons. U.S. extended deterrence is viewed as a more cost-effective option for Japan to deter nuclear adversaries than developing its own nuclear weapons. Relying on U.S. extended deterrence also allows Japan to maintain its international standing. Chinese articles qualify the positive effects of U.S. extended nuclear deterrence by noting that Japan does not completely trust U.S. nuclear assurances. Japanese experts are uncertain that the United States will engage in nuclear retaliation if a country were to strike Japan with a nuclear weapon, and Washington has not provided an explicit promise to do so.²⁴

On the other hand, Chinese experts are concerned that U.S. extended nuclear deterrence undermines part of Japan's Three Non-Nuclear Principles (1967), a Japanese parliamentary resolution that forbids Japan from producing, possessing, or introducing nuclear weapons. Chinese articles note that Tokyo signed a secret nuclear agreement with Washington in 1960 specifying that the United States can temporarily allow its nuclear submarines to stop at Japanese ports. Japan further reached an agreement with then U.S. president Nixon to allow the United States to introduce nuclear weapons into Japan in 1969.²⁵

For Chinese viewers, Japanese desire to rely on the U.S. nuclear umbrella reflects Japan's complex and contradictory attitudes toward nuclear weapons and could create a slippery slope situation that leads to further challenges to its nonnuclear principles. Chinese articles recognize that some in Japan call for allowing U.S. strategic bombers to pass through Japanese airspace and U.S. military forces to use Japanese military bases to deal with contingencies on the Korean peninsula. Such advocates have pushed for creating exemptions in Japan's Three Non-Nuclear Principles. Some even argue for an updated "2.5 version" of the nonnuclear principles.²⁶ In response to questions about Japanese efforts toward nuclear disarmament, the Chinese Foreign Ministry has publicly urged "certain countries" to give up their nuclear umbrella and nuclear-sharing agreements.²⁷

23. *People's Daily*, "Be wary of Japan taking off its 'feathers of peace' (Global observer) (Jingtí riben tuoqu 'heping de yumao' [guoji shidian])" April 1, 2014.

24. *Global Times*, "Japanese media questions reliability of U.S. nuclear umbrella, urges government to explore nuclear strategy (rimei zhiyi meihebaohusan kekaoxing huyu zhengfu taolun hezhanlue)," April 15, 2014, <http://world.huanqiu.com/exclusive/2014-04/4971681.html>.

25. *People's Daily*, "'Secret nuclear agreement' leads to embarrassment (international forum) ('hemiyue' yinchu de cankui [guoji tanlun])," April 23, 2010.

26. *Ibid.*

27. "Foreign Ministry spokesperson: Certain countries should give up their nuclear umbrella and nuclear-sharing policies (waijiaobu fanyanren: youguan guojia yinggai fangqi hebaohusan he hegongxiang deng zhengce)," *Xinhua News*, April 14, 2014, http://news.xinhuanet.com/world/2014-04/14/c_1110235242.htm.

Less Chinese Discussion of Negative International Ramifications of Japanese Nuclearization

Along with U.S.-Japan relations, Chinese experts before 2010 also reasoned that negative international ramifications would be another major reason why Japan may not seek nuclear weapons. If it developed nuclear weapons, Japan would likely be cast as an international pariah, seriously damaging relationships with neighboring countries. One article further notes that Japanese trade with its neighbors could be impacted and, ultimately, economic development brings tangible benefits to Japanese citizens, whereas nuclear weapons do not.²⁸ Japan would also likely have to leave the NPT, which would end its access to nuclear materials for peaceful purposes.²⁹

These factors are less emphasized in present-day Chinese articles. Instead, some articles have raised the possibility that Japan may follow in Israel's footsteps to secretly develop nuclear weapons while deflecting international pressure and criticism.³⁰ The articles do not discuss Japanese trade or loss of access to nuclear material for peaceful purposes as a constraint on nuclear development. Before the 2011 Fukushima disaster, Japan depended on nuclear energy for a significant portion of its domestic energy; one 2008 Chinese article measured this portion at 33 percent.³¹ Since the disaster, Japan has depended less on nuclear as an energy source.

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Along with international variables, Chinese analysts also pay attention to national factors within Japan. Whereas articles published in earlier years emphasized Japanese domestic constraints and occasionally noted some erosion of such constraints, recent articles are more seriously concerned that such barriers may be breaking down: they caution that Japan is led by right-wing leaders and is remilitarizing; the influence of the antinuclear Japanese public may be waning; and Japanese legal constraints against nuclear weapons are already modified or under pressure.

Concern That Right-Wing Japanese Leaders and Remilitarization May Open the Door for Nuclearization

China is wary of recent Japanese moves to revise or reinterpret its pacific constitution and augment its military capabilities to become a normal military power. Chinese experts link such Japanese moves with "throw[ing] away the label of 'defeated country' in World War II."³² China's official Xinhua News Agency states that revising Japan's constitu-

28. Zhao, "Japan's nuclear policy past," 47.

29. Xia, "On Japan's nuclear policy," 12.

30. "Experts: Japan may seek to emulate Israel and secretly research and develop nuclear weapons (Zhuanjia: riben huo xiaofang yiselie qiaoqiao yan hewu mimi yonghe)," July 3, 2012, <http://big5.huaxia.com/thjq/jswz/2012/07/2909566.html>.

31. Xia, "On Japan's nuclear policy," 12.

32. "Japan aims to abandon label of 'defeated country,'" *China Military Online*, December 20, 2013, republished by Chinese Ministry of National Defense, the People's Republic of China, http://eng.mod.gov.cn/Opinion/2013-12/20/content_4480185.htm.

tion and rebuilding its military are dangerous and threaten regional stability if Japan does not fully recognize its war crimes.³³

Chinese articles worry that remilitarization will open the door to allow pronuclear Japanese leaders to push for the nuclear option. Chinese articles characterize Japanese views of nuclear weapons as split between two extremes: a large population (including the Japanese public) came to believe that Japan should never seek nuclear weapons, while a portion of Japanese leaders were convinced that the island state needed them.³⁴

According to some Chinese analysts, this latter group of “rightist” Japanese politicians believed that the only way Japan could control its own destiny would be by having powerful and destructive nuclear bombs. These leaders were never fully confident of U.S. extended nuclear deterrence, but they saw that the strategic, domestic, or technical circumstances were not yet ripe for Japan to develop nuclear weapons. Instead, these leaders rapidly expanded Japan’s use of nuclear energy to provide the foundation to develop nuclear weapons.³⁵ Chinese articles note repeated Japanese studies of the feasibility of developing nuclear weapons (such as in 1968, 1970, 1981, and 1995)³⁶ and rhetoric from Japanese leaders in support of nuclear weapons.³⁷

Chinese articles in 2013 and 2014 portray Prime Minister Shinzo Abe as harboring “rightist” views, given his visit to the Yasukuni Shrine (and sending of symbolic gifts on a number of occasions), his stance on the Senkaku/Diaoyu Islands, and his push to modify Japan’s pacifist constitution. They point out that Abe and former prime minister Fukuda Yasuo proclaimed that possessing nuclear weapons would be constitutional in 2002. In September 2006, Abe (in an earlier term as prime minister) called for Japan to move beyond a strict interpretation of the Three Non-Nuclear Principles.³⁸ A February 2014 article from *PLA Daily*, the official Chinese military newspaper, writes that after Abe came back to

33. “China ‘vigilant’ over Japan’s military moves,” *Xinhua News*, May 16, 2014, republished by the Chinese Ministry of National Defense, the People’s Republic of China, http://eng.mod.gov.cn/Opinion/2014-05/16/content_4509102.htm.

34. “When Japan acquires nuclear weapons, the U.S. will not be able to control it (yidan riben yonghe, meiguo bian guanbuliao ta),” *People’s Daily*, February 25, 2014.

35. “International observer: Japan’s ulterior motives for accumulating nuclear material (guoji guancha: riben tunji hecailiao juxinpoce),” *Xinhua News*, February 20, 2014, http://news.xinhuanet.com/world/2014-02/20/c_119431887.htm.

36. Huang, “On Japan’s Non Nuclear Policies,” 17–18.

37. Recent articles, for example, note pronuclear comments from retired Major General Yoshiaki Yano of the Ground Self-Defense Force, Foreign Minister Fumio Kishida, former Tokyo governor Shintaro Ishihara, and the late former finance minister Shoichi Nakagawa. See “Retired Japanese General Urges Developing of Nuclear Weapons to Deter China (Ri tuiyi jiangling guchui kaifa hewu weishe zhongguo),” *Xinhua News*, July 20, 2012, http://news.xinhuanet.com/world/2012-07/20/c_123436060.htm; Fengpo Zhang, “How big is Japan’s ‘nuclear’ ambition? (riben ‘he’ yexin you duoda),” *PLA Daily*, February 24, 2013, 3; “Japanese major general states that if Japan has enough nuclear materials, can acquire nuclear weapons within a year (ri shaojiang cheng ruo cailiao chongzu riben kezai yinian nei yongyou hewu),” *Sina News* reprint of Xinhua Web, February 19, 2014, <http://mil.news.sina.com.cn/2014-02-19/0910764939.html>.

38. Meng Lubin and Wu Yiping, “Changes from Japan’s Non-Nuclear Principles: Examining Development Trends in Japan’s Nuclear Weapons Policy (Cong riben wuhehua zhengce yanbian: kan riben hewuqi fazhan Dongxiang),” *Modern Military (Xiandai Junshi)* 3 (2009): 26–29.

power in 2012, Japan's political leadership took a rightward turn, and one politician stated that Japan could develop nuclear weapons within three months.³⁹

Abe is also seen as closely linked to proponents of Japanese nuclearization. A March 2014 *People's Daily* article, for example, characterizes Abe's maternal grandfather, former Japanese prime minister Nobusuke Kishi,⁴⁰ as one of the first Japanese to oppose Article 9 of the Japanese constitution, an article that is frequently interpreted as forbidding Japan from possessing armed forces, much less developing offensive arms such as nuclear weapons.⁴¹

Worries about Waning Influence of Antinuclear Japanese Public

In line with Chinese suspicions of select Japanese leaders, Chinese articles stress the importance of internal Japanese political and legal constraints that check the ambitions of its pronuclear leaders. Chinese analysts frequently praise the antinuclear sentiment exhibited by the Japanese public and civil society. Having suffered the devastating consequences of a nuclear attack, the majority of the Japanese public, as well as Japanese scholars and experts, vehemently oppose nuclear weapons and have formed strong antinuclear movements.⁴² These movements are seen by Chinese sources to have led to, for example, the 1975 resolution passed by the Kobe municipality that requires all foreign vessels to certify that no nuclear weapons are on board before entering its ports.⁴³

Despite their historic influence, Chinese experts are worried that the public's influence may be waning and it may not be able to constrain Japanese leaders. Chinese commentaries point out a number of instances, some mentioned above, in which Japanese leaders have privately and secretly taken stances and have sometimes taken actions that contradicted their public policies. According to a February 2014 article carried by both Xinhua and *PLA Daily*, Abe is paving the way to potentially allow Japan to secretly produce nuclear weapons by passing the State Secrets Law in late 2013 and establishing a National Security Council (NSC) in early 2014.⁴⁴ Chinese experts are concerned that these two new developments in Japan afford Abe more control over Japanese defense and diplomacy and could limit the availability of government information to the Japanese public.⁴⁵

39. Yanghao Wu, "'Nuclear Weapon Dream' will bring Japan disaster ('Hewumeng' jiang gei riben dailai zainan)," *PLA Daily*, February 28, 2014, 7.

40. *Japan Times* characterizes Abe's conservatism as influenced by his family and upbringing and writes that Abe views Kishi as his role model. See "Formed in childhood, roots of Abe's conservatism go deep," *Japan Times*, December 26, 2012, <http://www.japantimes.co.jp/news/2012/12/26/national/formed-in-childhood-roots-of-abes-conservatism-go-deep/#.U49u8ELfbIY>.

41. Xu and Fu, "Direction of Japanese nuclear policy," 25.

42. Huang, "On Japan's Non Nuclear Policies," 6–7.

43. "'Secret nuclear agreement' leads to embarrassment (international forum) ('hemiyue' yinchu de cankui [guoji tanlun])," *People's Daily*, April 23, 2010.

44. Zhang, "How big is Japan's 'nuclear' ambition?," 3.

45. *Xinhua News* carried a short description of the State Secrets Law and repeated Japanese concerns that the law "infringed on the public's right to know and freedom of the media" and lacked a regulator body to keep it institutionally in check. It also mentioned that the law designated information related to national defense, foreign policy, intelligence, and counterterrorism as "special state secrets" and the law will allow Japan to withhold information on "weapons, munitions, as well as aircraft." See "Japan's governing party forced

Viewing Japan's Legal Constraints against Nuclear Weapons as under Pressure or Modified

Along with antinuclear public sentiment, China sees Japan's Three Non-Nuclear Principles (1968) and its Atomic Energy Basic Law (1955) as two pillars supporting Japanese peaceful use of nuclear energy and opposition to nuclear weapons.⁴⁶ The Three Non-Nuclear Principles, as mentioned earlier, prohibit Japan from producing, possessing, or introducing nuclear weapons. The Atomic Energy Basic Law prevents Japan from using nuclear energy for nonpeaceful purposes.

Chinese articles question if Japanese commitment to the Three Non-Nuclear Principles is firm. Articles are repeatedly suspicious of behaviors of previous Japanese leaders. For example, articles note that Abe's great uncle, former prime minister Eisaku Sato, told then U.S. president Lyndon B. Johnson that Japan needs nuclear weapons. The articles then characterize Sato as putting on a "different face" in public by signing the Three Non-Nuclear Principles in 1967 but privately dismissing them as "nonsense."⁴⁷

In June 2012, Japan modified its Atomic Energy Basic Law to include a phrase that nuclear energy should also contribute to Japan's "national security." Chinese media included Japanese explanations that the amendments were made to prevent nuclear proliferation and prevent the use of nuclear material for military purposes.⁴⁸ Chinese news outlets also reprinted a South Korean article that cited a South Korean Foreign Ministry official as stating that the Japanese amendment was aimed at countering China.⁴⁹ A March 2014 *Xinhua* article further described this change, as well as Abe's push to restart the country's idled nuclear reactors as indications of Japanese nuclear ambiguity. The modification was viewed as opening the possibility for Japan to develop nuclear weapons.⁵⁰

through State Secrets Law (Ribei zhizhengdang qiangxing biaojuetongguo baomi fa'an)," *Xinhua News*, December 7, 2013, http://news.xinhuanet.com/photo/2013-12/07/c_125821943.htm. Similarly, according to Kenji Yamagishi, head of the Japan Federation of Bar Associations, "the scope of the information [the State Secrets Law] intends to cover is wide-ranging and unclear, and there is concern the government could designate [state secrets] arbitrarily." See Alexander Martin, "Japan to Form Own National Security Council," *Wall Street Journal*, November 21, 2013, <http://online.wsj.com/news/articles/SB10001424052702303653004579210881381219784>; Martin Fackler, "Secrecy bill could distance Japan from its postwar pacifism," *New York Times*, November 28, 2013, <http://www.nytimes.com/2013/11/29/world/asia/secracy-bill-could-distance-japan-from-its-postwar-pacifism.html>.

46. Xia, "On Japan's nuclear policy," 12.

47. "Threats from Japanese nuclear designs (international forum) (Ribei heqitu de weixiexing [guoji tanlun])," *People's Daily*, March 14, 2014. The article is based on *People's Daily* staff interview with U.S. historian Peter Kuznick.

48. "Japan amends 'Atomic Energy Basic Law' and states that international community should not be worried about military use (ri xiugai 'yuanzineng jiben fa' cheng waijie wuqu danxin qi junyong)," China.com, June 26, 2012, http://www.china.com.cn/military/txt/2012-06/26/content_25742890.htm.

49. "South Korean media: Japan amends Atomic Energy Basic Law to counter China," *Cankao Xiaoxi*, June 24, 2012, <http://mil.cankaoxiaoxi.com/2012/0624/53149.shtml>.

50. "Restarting nuclear reactors, what is Japan trying to do? (chongqi hedianzhan, ribei yu hewei?)," *Xinhua News*, March 20, 2013, 2014, http://news.xinhuanet.com/world/2014-03/20/c_119851169.htm; "'National Security' amendment to nuclear law raises fears of military use," *Asahi Shimbun*, June 21, 2012, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201206210061>.

TECHNICAL AND STRATEGIC DRIVERS

Compared to international or internal constraints, recent Chinese articles spend less ink weighing technical and strategic factors on Japan's nuclear capabilities. China views Japan as facing few difficult technical hurdles to manufacturing nuclear weapons, and its growing nuclear stockpile may make it easier for Japan to divert nuclear material covertly. There has been very little recent Chinese discussion on possible Japanese nuclear strategies.

Concern That Larger Japanese Nuclear Stockpile Makes Covert Diversion Easier

Previously, Chinese scholars noted that Japan is a relatively transparent country and it would be difficult for Japan to secretly divert nuclear material for nuclear weapons.⁵¹ They worry that Japan's newly passed State Secrets Law as well as consolidation of national security in its NSC may provide some cover for Japan to move forward on nuclear weapons.

More problematic from the Chinese perspective is that, as Japan's stockpile of nuclear material grows in size and there is an imbalance between nuclear energy use and nuclear supply, there may be greater potential to divert nuclear material undetected. Though this was an issue for China before 2010,⁵² it has grown in prominence given Japan's expanding nuclear stockpile and likely soon-to-be in operation Rokkasho facility. In December 2010, *People's Daily* drew from declassified German documents on conversations between Japan and West Germany in 1969 on developing nuclear weapons. According to the Chinese article, Japanese diplomats mentioned to West Germany that there may be unexpected circumstances in the next 10 to 15 years that could cause Japan to leave the NPT. The Japanese diplomats also suggested that even if Japan were to abide by strict NPT international safeguards, it would still be able to divert approximately 5 percent of its nuclear material.⁵³

Japan's Rokkasho reprocessing facility, which could commence operations in 2016, is an example of a large facility that poses significant challenges for IAEA monitoring. Experts and scientists recognize that even a 1 percent in uncertainty over materials at Rokkasho, a facility with "an annual throughput of 800 tons of spent fuel containing about one percent plutonium," or 8,000 kg of plutonium, "translates into an overall measurement uncertainty of 80 kilograms plutonium."⁵⁴ This is ten "significant quantities" of plutonium: the IAEA defines a significant quantity of plutonium as the quantity by which the possibility of manufacturing a nuclear device cannot be excluded. The IAEA does not yet have high

51. For example, see Xia, "On Japan's nuclear policy," 12. Sun Xiangli and others did note that should Rokkasho commence operations, diverting nuclear materials will not be difficult given the uncertainty and potential measurement error in IAEA safeguards; see Sun, Wu, and Hu, "Japan's plutonium problem," 18.

52. Ibid.

53. Qing Yu, "Japan had discussed obtaining nuclear weapons with West Germany (riben ceng yu lian-bang deguo taolun yonghe)," *People's Daily*, December 1, 2010.

54. Alan J. Kuperman, David Sokolow, and Edwin S. Lyman, *Can the IAEA Safeguard Fuel-Cycle Facilities?* (Austin: Nuclear Proliferation Prevention Project at University of Texas at Austin, March 18, 2014), 22, <http://blogs.utexas.edu/nppp/files/2014/03/NPPP-working-paper-2-2014-Mar-18.pdf>.

confidence in timely detection of potential diversion of nuclear materials from the Rokkasho facility.

Little Chinese Discussion of Potential Japanese Nuclear Strategies and Relevant Constraints

Recent Chinese articles largely fail to address how Japan may use nuclear weapons and what type of doctrine a nuclear Japan might embrace. Earlier articles mention that Japan's small geographic size may limit its nuclear ambitions; it causes Japan to lack strategic depth, prevents Japan from testing nuclear weapons underground, and limits Japan's ability to withstand a nuclear second strike.⁵⁵ Recent Chinese articles barely mention this constraint, or they mention the constraint in passing when talking about Japanese thinking during the Cold War.⁵⁶

An exception is an April 2014 article published in *Phoenix Weekly*, a Hong Kong-based media outlet. The article criticizes recent Chinese articles as focusing too much on rhetoric and moves by Japan's right-wing politicians. It argues that Chinese articles do not give enough consideration to Japan's interests and international strategy. The article rehashes most of the constraints described above (but does not address the Chinese counterarguments) and states that it would be difficult for Japan to publicly declare a nuclear capability. Even if Japan were to follow Israel's path, Japan may maintain a nuclear strategy based on self-defense and nuclear retaliation. As long as Tokyo abides by the NPT, Washington might be able to accept a hidden Japanese nuclear capability. It advocates that China should not be too concerned that Japan will produce "hundreds or over a thousand" nuclear weapons.⁵⁷

China is well aware that Japan is technically capable of manufacturing nuclear weapons and associated delivery vehicles. China's official news agency, CCTV, broadcast a news segment on March 6, 2014, that described Japan as possessing a capability to manufacture nuclear weapons. The news segment, among other Chinese sources, countered that Japan's small geographic size does not limit its technical ability to test nuclear weapons. Japan has advanced computer modeling and simulation capabilities that can "test" nuclear weapons without physically detonating a device.⁵⁸ The news segment pronounced that should Japan decide to develop nuclear weapons, it could quickly become the world's third-largest nuclear power.

Finally, whereas earlier Chinese articles differentiated between an ability to produce a few nuclear bombs versus an ability to establish a credible and survivable nuclear deterrent, most recent articles do not clearly spell out and analyze the difference.⁵⁹

55. Hu, "Should Japan nuclearize?," 42–43.

56. See Huo, "Why is Japan accumulating," for an example of the discussion of Japanese nuclear constraints during the Cold War.

57. Ge Wu, "Will Japan take the step of nuclear weaponization? (Ribei hui maichu 'you hewu' zhebuma?)," *Phoenix Weekly*, April 27, 2014, <http://www.ifengweekly.com/display.php?newsId=7835>.

58. "Japan's 'nuclear weapon' puzzle (riben 'hewu' miju)," CCTV channel 13, March 6, 2014, <http://tv.cntv.cn/video/C10313/6e6a48ace31b43818ef666c8b6fe6507>.

59. For an earlier article discussing such constraint, see Xia, "On Japan's nuclear policy," 11–12.

Table 1. Chinese Views of Constraints on Japanese Nuclearization

	<i>Identified constraints</i>	<i>Recent Chinese counter-arguments</i>
International	U.S. extended deterrence and opposition to Japanese nuclearization will discourage Japan. Japanese nuclearization would seriously strain U.S.-Japan relations.	Japan is becoming a more equal partner, instead of junior partner, to the United States. Japanese nuclearization would strain U.S.-Japan relations, but that may be secondary to U.S. need to work with Japan on policies toward China.
	Nuclearization would damage Japan's international standing and Japan would have to leave the NPT and would be an international pariah.	Japan could emulate Israel and secretly develop a bomb-in-the-basement option.
Internal	Antinuclear sentiment among the Japanese public hinders nuclearization.	Antinuclear public sentiment may not be able to constrain Japanese leaders, especially given Japan's new State Secrets Law and National Security Council.
	Japan's Three Non-Nuclear Principles disavows nuclearization.	Its Three Non-Nuclear Principles are eroding and were not always firmly held.
Technical/ strategic	Japan's Atomic Energy Law prevents Japan from using nuclear energy for nonpeaceful purposes.	Japan has modified its Atomic Energy Law to allow nuclear energy to be used for "national security" purposes.
	Japanese transparency and adherence to IAEA safeguards make it difficult to secretly seek nuclear weapons.	With a large civilian nuclear stockpile, diversion may not be easily detected.
	Given its small geographic size and dense population concentration, Japan would not be able to withstand a nuclear first strike.	
	Japan would not have a place to test nuclear bombs.	Japan can use computer simulations and may not need to test.
	Ability to produce nuclear bombs is different from having the capability to use them for war fighting.	

SUMMARY OF CHINESE VIEW OF JAPANESE CONSTRAINTS

Table 1 summarizes Chinese views of constraints on Japanese nuclearization. The first column lists constraints that Chinese articles and reports have identified since 2000. The second column captures recent (mainly late 2013 and early 2014) Chinese counterarguments. To the extent possible, this column relies on the most authoritative Chinese sources and does not represent the range of Chinese views. Blanks in this column indicate that no strong or well-accepted Chinese counterargument was identified from Chinese sources.

Conclusion

Overall, in 2013 and 2014 China was suspicious that Japan was continuously using small actions and steps to chip away barriers preventing its nuclearization.⁶⁰ Pursuing this strategy would not attract Japan much international criticism because no single step would elicit substantial international concern. From the Chinese perspective, looking at all Japanese moves together raised concerns and questions regarding their motives and direction.

China has been more vocal and critical of nuclear developments in Japan in recent years than before 2010. While tensions in the East China Sea and strong anti-Japanese sentiment in China help explain a portion of the change, they do not account for everything. China is also responding to specific developments occurring within Japan. These include Japanese moves to reinterpret its constitution to allow Japan to have a more “normal” set of national security policies, modification of its Atomic Energy Basic Law, passage of a State Secrets Law that limits public knowledge of information related to national defense, greater accumulation of sensitive nuclear material, and continued interest in the Rokkasho nuclear reprocessing plant.

The increased Chinese criticism of Japanese actions is also a reflection of incomplete Chinese assessments: recent articles largely omit discussions of possible Japanese nuclear strategies and negative ramifications for Japan if it were to seek nuclear weapons. They focus their attention on what Japan might be doing to augment its nuclear potential but not on whether acquiring nuclear weapons will benefit or harm Japanese geopolitical or economic interests. The articles also tend not to differentiate between Japan possessing one or a couple of nuclear bombs and establishing a credible and survivable independent nuclear deterrent. It underexamines what Japan’s nuclear strategy and doctrine might be if Japan were to acquire a few or substantially more nuclear weapons. Chinese discussions of Japan’s nuclear ambitions would be enriched if Chinese strategists could more explicitly detail their logic and thinking on these issues.

60. *PLA Daily*, “Nuclear weapons dream,” 7.

Maintaining the Nuclear Security Complex for Non-Stockpile Research and Development as the United States Pursues Global Zero

*Jonathan Moore*¹

The United States is taking concrete steps toward eliminating all nuclear weapons. Pursuing such an aim could prove dangerous, as other nuclear but non-stockpile programs rely on experimental capabilities provided by the National Nuclear Security Administration's (NNSA) Defense Programs. As the United States strives toward a world without nuclear weapons, the experimental capabilities and facilities provided solely by the National Laboratories would degrade and eventually be eliminated without Defense Programs to maintain them. Now is the time to make sure this does not happen. Even in a world without nuclear weapons, the United States must protect against proliferation and nuclear terrorism to prevent states from pursuing a clandestine nuclear program and to safeguard sensitive materials from misuse by terrorists.

Introduction

In the post–Cold War era, the United States has drastically reduced its number of nuclear weapons and undertaken a number of measures to demonstrate that it no longer relies on nuclear weapons as the primary purveyors of national security. These measures include becoming a signatory to the Comprehensive Test Ban Treaty, the refusal to use nuclear weapons on nonnuclear countries in compliance with their Nuclear Non-Proliferation Treaty obligations, and the refusal to develop any new nuclear weapons.² Since the early

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2. David E. Sanger and Peter Baker, “Obama Limits When U.S. Would Use Nuclear Arms,” *New York Times*, April 5, 2010, http://www.nytimes.com/2010/04/06/world/06arms.html?_r=1&.

1990s, when certain treaty obligations restricted nuclear testing,³ it has become necessary for the United States to implement a sophisticated science campaign to ensure that its stockpile remains safe, secure, and reliable. Stockpile Stewardship, as this campaign maintained by the NNSA came to be known, created and continues to use a variety of sophisticated experimental and computational facilities.

Regarding nuclear security issues, U.S. policies now prioritize countering nuclear terrorism and preventing nuclear proliferation rather than the maintenance of a large nuclear stockpile to counter the nuclear threat of the Soviet Union. Indeed, on multiple occasions President Barack Obama has called for concrete steps toward eliminating nuclear weapons globally. This pursuit is referred to in this chapter as Global Zero. As U.S. nuclear security priorities shift from the maintenance of a large nuclear stockpile to protecting against terrorism and proliferation, non-stockpile activities have leveraged the innovative experimental and modeling capabilities and facilities ushered in by the age of Stockpile Stewardship.

NNSA experimental capabilities, however, are not managed with enough flexibility to allow the nuclear security complex to adequately adapt to unforeseen threats, particularly if a policy of Global Zero is pursued. It stands to reason that, in a world without nuclear weapons, stockpile stewardship and NNSA Defense Programs will no longer be needed, and their vast experimental capabilities will degrade or eventually be eliminated. Should this occur, non-stockpile programs—in particular nonproliferation and counterterrorism programs—will lose vital capabilities that were once leveraged from Defense Programs. This is troublesome because even in a nuclear weapons-free world, nonproliferation and counterterrorism will continue to be important. For instance, it is possible that a state could cheat under a Global Zero regime and pursue a clandestine nuclear weapons capability. Therefore, it is vital that the United States maintain the necessary technological capabilities to prevent states from attempting to cheat in a Global Zero regime. Also, it is reasonable that not all of the nuclear material that would be attractive to terrorists would be eliminated in a Global Zero regime, and the capabilities to prevent and respond to nuclear terrorism must also be maintained.

Even if one does not believe that the United States would ever completely eliminate its reliance on nuclear weapons, there is evidence that the reduced focus on maintaining the stockpile has already negatively affected the ability of non-stockpile programs to leverage the Defense Programs' experimental capabilities. Currently, other NNSA programs—as well as other departments and agencies—pay NNSA Defense Programs for use of their facilities and capabilities. In this arrangement, non-stockpile programs cannot fulfill their missions due to lack of funding and lack of access to necessary facilities. In effect, Defense Programs owns the vineyards of experimental capabilities, and non-stockpile programs are drinking wine by the glass—a terribly inefficient business arrangement.

3. Nevada National Security Site, "Stockpile Stewardship Program," August 2013, <http://www2.nstec.com/Documents/Fact%20Sheets/Stockpile%20Stewardship.pdf>.

Experimental facilities at the weapons labs used for stockpile work are vital for nuclear nonproliferation and counterterrorism (i.e., non-stockpile) research. Non-stockpile activities will become more important as stockpiles are reduced in a move toward Global Zero. The non-stockpile programs in NNSA already have difficulty using those facilities, in part because the stockpile programs get priority. Furthermore, if the United States reduces its support for the stockpile, those facilities themselves will be in jeopardy. For these reasons, governance of those facilities should be restructured to ensure their long-term availability for non-stockpile work. It is imperative that the United States maintain experimental capability and expertise in the nuclear weapons complex to maintain its ability to perform high-priority nonproliferation and to counter nuclear terrorism objectives as the United States prepares to reduce and eventually eliminate its reliance on nuclear weapons.

Sample of Capabilities and Facilities Leveraged by Non-Stockpile Programs

The Department of Energy and NNSA maintain a wide variety of experimental capabilities in the national laboratory system. The national laboratories not only address nuclear security issues but also, according to the Department of Energy, “tackle the critical scientific challenges of our time—from combating climate change to discovering the origins of our universe—and possess unique instruments and facilities, many of which are found nowhere else in the world.”⁴ They also “address large scale, complex R&D challenges with a multidisciplinary approach that places an emphasis on translating basic science to innovation.”⁵ Although the Department of Energy maintains many national labs, the three weapons labs—Sandia National Laboratories (SNL), Lawrence Livermore National Laboratory (LLNL), and Los Alamos National Laboratory (LANL)—possess vital facilities, capabilities, and expertise in nuclear weapons technology that are vital to non-stockpile research.

These capabilities make it possible for non-stockpile programs to conduct vital research and innovative experiments that would otherwise be impossible. These capabilities directly influence the U.S. government’s ability to combat the threat of nuclear proliferation and nuclear terrorism with scientifically informed policy solutions and technological innovation. For example, as explained by its website, NNSA’s Office of Defense Nuclear Nonproliferation “develops and tests new technologies to advance U.S. capabilities to monitor nonproliferation and arms control treaty and agreement implementation, provides unique training and capacity-building programs, and engages internationally to promote nonproliferation norms and best practices through bilateral and multilateral work.”⁶ All of these efforts are made possible by the unique capabilities provided by the national

4. U.S. Department of Energy, “About the National Labs,” <http://energy.gov/about-national-labs>.

5. Ibid.

6. National Nuclear Security Administration, “Our Programs: Nonproliferation,” <http://nnsa.energy.gov/aboutus/ourprograms/nonproliferation-0>.

laboratories and NNSA's Defense Programs. However, the current arrangement prevents effective collaboration.

LANL, LLNL, and SNL all maintain capabilities that are essential to protecting against nuclear proliferation and terrorism and are all managed through NNSA's Defense Programs. For example, TA-55 at LANL performs a wide variety of nonproliferation and counterterrorism activities. According to LANL, "TA-55 supports a wide range of national security programs that involve stockpile stewardship, plutonium processing, nuclear materials stabilization, materials disposition, nuclear forensics, nuclear counter-terrorism, and nuclear energy."⁷ Nuclear forensics, counterterrorism, and nuclear energy research is conducted by organizations other than Defense Programs that must leverage these outside capabilities when possible.

The work conducted at the national labs addressing counterterrorism and nonproliferation goals serves not only NNSA but a variety of agencies and organizations as well, such as the Department of Homeland Security, the Department of Defense, and the intelligence community. For example, researchers at LLNL are working to produce handheld isotopic identification tools "that can distinguish between innocuous and suspicious radiation sources for use at airports, border crossings, and seaports" for use by the Department of Homeland Security.⁸

The research conducted on the Z machine at SNL displays perhaps one of the most visible examples of how Defense Program facilities are leveraged by other organizations. A part of SNL's Pulsed Power program, "Sandia's Z machine is the world's most powerful and efficient laboratory radiation source." The Z machine "uses high magnetic fields associated with high electrical currents to produce high temperatures, high pressures, and powerful X-rays for research in high energy density science." Capabilities offered by the Z machine allow researchers from other national security agencies and academia to harness a unique capability. For instance, its immensely powerful capability allowed researchers to examine nuclear materials under conditions similar to a detonation of a nuclear weapon. Further, these experiments allow researchers to validate computer-simulated weapons models."⁹ However, the Z machine is still primarily a Defense Program capability.

The NNSA Defense Program's Office of Research, Development, Test, and Evaluation maintains the experimental facilities and capabilities leveraged by non-stockpile programs. According to the NNSA website, the office "directs research, development, computer simulation, and inertial confinement fusion activities."¹⁰ Figure 1 lists a variety of

7. Los Alamos National Laboratory, "TA-55 PF-4 LANL Plutonium-Processing Facilities Fact Sheet," http://www.lanl.gov/about/_assets/docs/fact-sheets/ta-55-factsheet.pdf.

8. Lawrence Livermore National Laboratory, "Hand-held Isotope Identification," <https://missions.llnl.gov/counterterrorism/hand-held-isotope-identification>.

9. Sandia National Laboratories, "Z Pulsed Power Facility," <http://www.sandia.gov/z-machine/>.

10. National Nuclear Security Administration (NNSA), "Research, Development, Test, and Evaluation," <http://nnsa.energy.gov/aboutus/ourprograms/defenseprograms/stockpilestewardship>.

Figure 1. Stockpile Stewardship Program Experimental Capabilities

Science capabilities	Location	Description
Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility	LANL	DARHT captures high-resolution images of moving, nonnuclear weapon assemblies. Experiments are used to obtain information critical to certifying weapons performance in the absence of underground testing. DARHT captures images from two views and at multiple times.
Contained Firing Facility (CFF)	LLNL	CFF capabilities include high-resolution imaging and high-fidelity velocity measurements of moving, nonnuclear weapon assemblies. Experiments are used to obtain information critical to certifying weapons performance in the absence of underground testing. A single image and many velocity measurements are captured per experiment. CFF has a substantially larger field of view than DARHT.
National Ignition Facility (NIF)	LLNL	NIF provides a platform to investigate fundamental properties of material, plasma, radiation, fusion ignition, and thermonuclear burn at temperatures and pressures relevant to those obtained in a nuclear weapon. In the absence of underground testing, these conditions are not possible on any other experimental platform.
Z-Machine	SNL	The Z-Machine provides a platform to investigate fundamental properties of material, plasma, and radiation and effects of radiation on electronics. Certain advanced certification concepts in parameter regimes of interest have used data acquired on Z. Note: Pu experiments for Q1 and Q2 were delayed due to PF-4 stand-down at LANL.
Omega	UR-LLE	Omega provides a platform to investigate HED material properties, plasmas, inertial confinement fusion, and radiation, as well as for the development of targets, diagnostics, and experimental platforms for the NIF. Omega is uniquely accessible to universities through the National Laser Users Facility. Targets are millimeters in diameter.
High Explosive Application Facility (HEAF)	LLNL	HEAF provides a platform to investigate fundamental properties and reactions of chemical explosives, as well as gas guns to study materials. Experiments are focused on continually improving the safety of our stockpile.
The Joint Actinide Shock Physics Experimental Research (JASPER) Facility	NNSS	JASPER provides a platform to investigate the properties of metals, including plutonium, at high shock pressures, temperatures, and strain rates. JASPER and TA-55 each cover unique areas of material phase space, with some overlap.
Los Alamos High Explosives Facilities	LANL	The Los Alamos High Explosive Facilities consist of both indoor and outdoor firing sites, boom boxes, and a suite of six gas guns (single and two-stage) that are used to investigate fundamental properties and reactions of chemical explosives, detonators, and to conduct studies on materials in order to continue to improve the surety, reliability, and performance of our nuclear stockpile.
Proton Radiography (pRad)	LANL	pRad is a beam line and proton optics capability that uses protons to study fundamental material properties. pRad uses the LANSCE accelerator to produce protons for radiography of static and dynamic materials.
Big Explosives Experimental Facility (BEEF)	NNSS	BEEF is an experimental facility that allows the study and investigation of materials as they are merged together by high-explosive detonations.
TA-55	LANL	TA-55 provides several platforms to investigate the properties of metals, including plutonium, at high shock pressures, temperatures, and strain rates. The TA-55 gas gun is located in a Category 2 nuclear facility but is limited to Category 3 quantities.

experimental capabilities central to the Stockpile Stewardship program, which can be leveraged by non-stockpile activities.¹¹

In addition to the aforementioned capabilities, the national labs also maintain some of the most sophisticated supercomputers in the world as part of their Advanced Simulation

11. NNSA, “Summary of Experiments Conducted in Support of Stockpile Stewardship, June 2014,” June 2014.

and Computing (ASC) campaign. As of November 2011, NNSA Laboratories possessed 4 of the top 10 fastest supercomputers in the world.¹² The ASC website explains that ASC “provides NNSA with leading edge, high-end simulation capabilities,” which “helps NNSA to meet nuclear weapons assessment and certification requirements, including: weapon codes, weapon science, computing platforms, and supporting infrastructure.”¹³ In addition to their use for Stockpile Stewardship programs, these immense computer simulation capabilities provide the backbone to non-stockpile predictive capabilities.

Policy Drivers Threatening the Loss of Experimental Capabilities

Shortly after he was inaugurated in 2009, President Obama declared his vision for a world free of nuclear weapons in his speech in Prague.¹⁴ This speech set into motion many of the administration’s policies intended to reduce the United States’ reliance on nuclear weapons. Both the National Security Strategy¹⁵ and the Nuclear Posture Review (NPR) released in 2010 prioritized protecting against nuclear terrorism as well as reducing the role nuclear weapons play in U.S. security policy. The Obama administration has not only called for a reduced reliance on nuclear weapons but also their elimination altogether. The president reiterated these goals speaking in Berlin in June of 2013, where he proclaimed, “Peace with justice means pursuing the security of a world without nuclear weapons—no matter how distant that dream may be.”¹⁶ The administration has already made concrete steps in the dramatic reduction of the U.S. nuclear stockpile.¹⁷

The sample of national laboratory capabilities listed above, among many others, would be at risk in a Global Zero regime because they are managed by NNSA’s Defense Programs. If the management structure is not updated to accommodate a world devoid of nuclear weapons, Defense Programs’ capabilities may not be maintained. However, the need for such capabilities will remain just as relevant for nonproliferation and counterterrorism research and development (R&D) in order to prevent states from developing a clandestine nuclear weapons capability, as well as preventing terrorists from accessing remaining nuclear materials. Spread of technology and know-how in an ever-interconnected world would make it easier for states to cheat in a Global Zero environment and for terrorists to

12. Top500, “Supercomputer Sites,” November 2011, <http://www.top500.org/lists/2011/11/>.

13. NNSA, “Advanced Simulation and Computing and Institutional R&D Programs,” <http://nnsa.energy.gov/asc>.

14. “Remarks by President Barack Obama Hradcany Square Prague, Czech Republic,” *White House*, April 5, 2009, http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered.

15. “National Security Strategy: May 2010,” *White House*, May 2010, http://www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf.

16. “Remarks by President Obama at the Brandenburg Gate—Berlin, Germany,” *White House*, June 19, 2013, <http://www.whitehouse.gov/the-press-office/2013/06/19/remarks-president-obama-brandenburg-gate-berlin-germany>.

17. *Ibid.*

obtain radioactive materials, and experimental capabilities must be agile enough to adapt to a rapidly changing security environment.

VITAL CAPABILITIES ARE AT RISK BEFORE GLOBAL ZERO

Predictions of Global Zero are often met with skepticism; many observers do not believe that the United States will ever completely eliminate its reliance on nuclear weapons. However, many gains have been made in terms of nuclear reductions that were previously unimaginable. About 10 years ago, there was widespread skepticism that the United States would be able to reduce its stockpile to 1,000 weapons; today, the United States is actively working toward these low levels. The current stated goal of the U.S. government is the achievement of a nuclear weapons-free world, and consequently we must be prepared for that possibility. However, vital capabilities will begin to be at risk even before Global Zero is reached.

Immediately after the Cold War ended, the United States began making great strides in reducing the role of nuclear weapons in U.S. security policy. The Strategic Arms Reduction Treaty (START I), entered into force under the George H. W. Bush administration in 1991, reduced U.S. warheads from 10,000 to roughly 6,000. Earlier, President Reagan, in his 1985 inaugural address, had proclaimed, “We seek the total elimination one day of nuclear weapons from the face of the Earth.”¹⁸ Indeed, Figure 2, released by the Department of Defense as a transparency measure in 2010, shows just how much the United States has reduced its nuclear stockpile.¹⁹ With these reductions has come the gradual degradation of the nuclear security enterprise. Even now, many are skeptical that NNSA can properly manage the life extension plans currently underway.

The Union of Concerned Scientists published a report in March 2014 detailing many recommendations to increase efficiencies in the National Security Complex. The recommendations of this report demonstrate that the National Security Complex cannot even currently meet demands of Defense Programs alone, much less non-stockpile programs. The report also suggests many closures of facilities that it sees as duplicative. It warns that current needs of the Stockpile Stewardship program have made some facilities and capabilities unnecessary. Furthermore, the report mentions that failure to achieve ignition at the National Ignition Facility most likely means that NNSA will not be able to make drastic changes in nuclear weapons design, which in turn will likely lead to cost- and time-saving efforts that reduce experimental facilities and expertise. The report also claims that supercomputing advancements are not necessary for Stockpile Stewardship programs. However, even if they are right with regard to stockpile purposes, advancements in supercomputing can be vital in intelligence, nonproliferation, and counterterrorism research.

18. “The Reagan Vision,” 2014, <http://www.thereaganvision.org/>.

19. U.S. Department of Defense, “Fact Sheet: Increasing Transparency in the U.S. Nuclear Weapons Stockpile,” May 3, 2010, http://www.defense.gov/npr/docs/10-05-03_fact_sheet_us_nuclear_transparency_final_w_date.pdf.

Figure 2. U.S. Nuclear Weapons Stockpile, 1945–2009



If these recommendations for modifications to the Stockpile Stewardship program are to be implemented by NNSA, non-stockpile programs will be directly harmed by the reduced capacity. This is a prime example of how the current management structure of the unique experimental capabilities is insufficient and hinders the progress of important nonproliferation and counterterrorism research.

Conclusions: NNSA Priorities Are Not Aligned with National Goals

Norman Augustine and Admiral Richard Miles, coauthors of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, reported to Congress in March of 2014 several interim findings. They found that “the existing governance structures and practices are most certainly inefficient and in some instances ineffective, putting the entire Enterprise at risk over the long term.”²⁰ They continue,

Simply stated, there is no plan for success with available resources. NNSA is on a trajectory towards crisis unless strong leadership arrests the current course and reorients its governance to better focus on mission priorities and deliverables.

At the root of the challenges are complacency and the loss of focus on the nuclear mission by the nation and its leadership following the end of the Cold War.

20. Norman Augustine and Admiral Richard Miles, U.S. Navy (Retired), “Interim Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise,” Subcommittee on Strategic Forces, Testimony before the House Armed Services Committee, March 26, 2014.

Although the national leadership has provided strong policy statements and substantial sums of money to the enterprise, it is evident that follow-through has been insufficient.²¹

Augustine and Miles explain that, even in the current environment, NNSA priorities do not align with national goals, causing inefficiencies across the enterprise. Unfortunately, NNSA goals and priorities are not aligned within the organization either.

In the 2010 NPR, the administration outlines its nuclear security objectives. They are as follows:

1. Preventing nuclear proliferation and nuclear terrorism;
2. Reducing the role of U.S. nuclear weapons in U.S. national security strategy;
3. Maintaining strategic deterrence and stability at reduced nuclear force levels;
4. Strengthening regional deterrence and reassuring U.S. allies and partners; and
5. Sustaining a safe, secure, and effective nuclear arsenal.²²

It is important to note that the top priority in the NPR is nonproliferation and counterterrorism, while maintaining the nuclear arsenal is at the bottom of the list. The 2011 NNSA Strategic Plan also aligns with the NPR and the National Security Strategy mentioned above. The plan states, “The NNSA is truly moving from a nuclear weapons complex to a 21st century Nuclear Security Enterprise, addressing the nuclear and national security challenges of the 21st century.”²³ However, looking at the 2014 Stockpile Stewardship and Management Plan (SSMP), this does not seem to be the case.

The Stockpile Stewardship Management Plan still claims that Defense Programs is “central to the Nuclear Security Enterprise.”²⁴ This statement is in direct conflict with every strategic document that addresses nuclear weapons of the current administration, and it is a sign that NNSA Defense Programs management structure is not aligned with the goals of the Nuclear Security Enterprise. As long as weapons activities are thought of as the center of the Nuclear Security Enterprise, non-stockpile R&D will always be lagging behind trying to catch up to requirements and gaps. NNSA’s organization—when it comes to science, technology, and engineering, and R&D—is completely incompatible with the president’s priorities. Even though the SSMP claims that the president’s National Security Strategy, NPR, and ratification of New START have provided a *clear path forward* for NNSA management,²⁵ NNSA’s primary approach is contradictory to these policies, which prioritize nonproliferation and counterterrorism.

21. Ibid.

22. Department of Defense, *Nuclear Posture Review Report*, April 2010, 2.

23. NNSA, “Strategic Plan,” May 2011, 1, http://nnsa.energy.gov/sites/default/files/nnsa/inlinefiles/2011_NNSA_Strat_Plan.pdf.

24. National Nuclear Security Administration, “Stockpile Stewardship and Management Plan 2014,” June 2013, 1, http://nnsa.energy.gov/sites/default/files/nnsa/06-13-inlinefiles/FY14SSMP_2.pdf.

25. Ibid.

Even though budgets are not being dramatically reduced at this time, it is easy to see that the deemphasis on nuclear weapons will present challenges in the future. It is not out of the question that this deemphasis will lead to reduced funding and reduced capabilities. The current structure in which science and technology capabilities are centrally located and managed by Defense Programs hinders national priorities of preventing nuclear proliferation and terrorism. These issues will become more urgent with the passage of time. Even though the United States is unlikely to give up its nuclear weapons anytime soon, now is the time to think of new ways to structure the immense experimental capabilities of NNSA's Defense Programs so that non-stockpile programs will not lose these unique capabilities.

China's Modernization: How Improved Technologies Could Enable Changes in Nuclear Policy

Carolyn Mullen¹

This chapter analyzes how China's improvement of early warning capabilities, interest in developing multiple independently targetable reentry vehicles (MIRVs), and construction of a sea-based nuclear deterrent could enable it, from a technological and operational perspective, to change its established nuclear policies. The chapter finds that each capability could create tensions or inconsistencies with current doctrine, posture, and practices. Most interestingly, the development of early warning capabilities could enable China to alter its posture from one of absorbing a first strike before retaliating to "launch on warning" (LOW). However, despite multiple possible points of tension, the chapter ultimately concludes that Beijing's interest in and development of these three capabilities does not necessarily indicate a shift in long-standing nuclear doctrine and policy.

Introduction

In the last two decades, U.S. predictions about the trajectory of China's nuclear weapons program have consistently proven to be inflated. Whereas many analysts believed that China would greatly increase the number of nuclear weapons in its arsenal, the evidence available suggests that Beijing's pace of quantitative weapons development has been slow relative to the growth of its economic capacity and conventional military capability. Rather than having "sprinted to parity" to match the United States and Russian strategic forces, the current Chinese nuclear arsenal still appears small and, some would argue, vulnerable. Still, despite an apparent commitment to a relatively restrained nuclear posture and a pledge to a no-first-use (NFU) policy, Beijing is indeed in the process of modernizing its strategic forces.

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This chapter seeks to contribute to the discussion by examining how three elements of China's nuclear modernization program—the improvement of its early warning capabilities, indications of interest in developing MIRVs, and the beginning of the construction of a viable submarine-based deterrent—may or may not create tensions that might lead to a change in Beijing's nuclear doctrine and posture. This examination reveals larger lessons to be learned, which should be considered when discussing China's nuclear program.

The Status of the Program

A BIRD'S-EYE VIEW

While the exact numbers remain unclear, it is estimated that China has approximately 250 warheads in its stockpile and around 150 nuclear-capable land-based ballistic missiles of mainly short and medium ranges. The number of China's long-range nuclear-capable missiles is increasing, as well as the proportion of warheads assigned to these delivery systems.² The country is slowly expanding its nuclear warhead stockpile, but China's limited stocks of military-grade fissile materials may constrain how much it could expand its arsenal without restarting plutonium or highly enriched uranium production.³

China's nuclear and missile modernization programs were initiated in the early 1980s and were designed with the purpose of replacing older, liquid-fuelled, and less accurate land-based ballistic missiles with solid-fuelled, more precise, longer-range road-mobile missiles.⁴ The most important consequence of this modernization has been increased missile mobility, which has increased survivability and thus helped to secure a second-strike capability. China has begun to replace the older DF-3 medium-range ballistic missiles (MRBMs) and the DF-4 and DF-5 intercontinental ballistic missiles (ICBMs) with the newer DF-21 MRBMs and the DF-31 and DF-31A ICBMs. Beijing has also recently fielded a new intermediate-range ballistic missile, the DF-26c,⁵ and may be developing additional missiles, including a new MRBM (CSS-X-11) and a new ICBM (DF-41).⁶ While the pace of development of these missiles has been slow, as the project has been underway for more than 30 years,⁷ it is also true that China has the largest and most active ballistic missile

2. Hans M. Kristensen and Robert S. Norris, "Chinese Nuclear Forces, 2013," *Bulletin of the Atomic Scientists* 69 (November/December 2013): 81.

3. Without official knowledge from China, estimates of China's fissile material stocks will have uncertainties. For a more in-depth exploration of the subject, see Hui Zhang, "China's HEU and Plutonium Production and Stocks," *Science & Global Security* 19, no. 1 (January-April 2011): 68–89.

4. Paul H. B. Godwin, "Potential Chinese Responses to US Ballistic Missile Defense," (Report 43, presented to the Stimson/CNA NMD-China Project, January 17, 2002), 63.

5. Bill Gertz, "China Fields New Intermediate-Range Nuclear Missile," *Free Beacon*, March 3, 2014, <http://freebeacon.com/national-security/china-fields-new-intermediate-range-nuclear-missile/>.

6. Jeffrey G. Lewis, "China's Nuclear Modernization: Surprise, Restraint, and Uncertainty," in *Strategic Asia 2013-2014*, ed. Ashley J. Tellis, Abraham M. Denmark, and Travis Tanner (Seattle: National Bureau of Asian Research, 2013), 76.

7. Gregory Kulacki, *China's Nuclear Arsenal: Status and Evolution* (Cambridge, MA: Union of Concerned Scientists, October 2011), 4, <http://www.ucsusa.org/assets/documents/nwgs/UCS-Chinese-nuclear-modernization.pdf>.

program in the world.⁸ China is also developing the CJ-20, an air-launched land-attack nuclear-capable cruise missile, for delivery by modified H6 bombers.⁹ The CJ-20 is believed to be an air-launched version of the ground-launched CJ-10, which has a range of more than 1,500 kilometers, with either a conventional or a nuclear warhead.¹⁰

U.S. PREDICTIONS OF CHINESE NUCLEAR WEAPONS

China's first nuclear test in 1964 and subsequent fielding of ballistic missiles by the early 1970s surprised the U.S. intelligence community. In the decades since, U.S. predictions of Chinese nuclear weapons and delivery systems have been exaggerated: estimates about the size of the Chinese nuclear arsenal have been inflated, and timelines for fielding new systems have almost always been too early.¹¹ The tendency to misestimate is a factor of U.S. bureaucratic behavior that favors overestimating, assuming the worst, and mirror imaging, as well as China's ability to practice opacity with regard to its capabilities.

The inclination to exaggerate China's nuclear forces remains present today. Take, for example, U.S. intelligence predictions of China's ICBM force. In 2001, the Central Intelligence Agency (CIA) predicted that China's nuclear missile force would include between 75 and 100 ICBMs deployed primarily against the United States.¹² The 2013 Department of Defense's (DOD) *Annual Report to Congress, Military and Security Developments Involving the People's Republic of China* estimated that China possessed 50 to 75 ICBMs.¹³ The DOD's annual reports for 2012 and 2011 estimated the same and included the caveat that less than 50 of the missiles were capable of reaching the continental United States. Interestingly, the 2014 report includes a description of the types of Chinese ICBMs but omits an estimate of the number of ICBMs China possesses. Still, analysts note that if the current trend has continued, it seems highly unlikely for China's nuclear ICBM arsenal to reach the numbers estimated by the CIA back in 2001.¹⁴

EARLY WARNING CAPABILITIES

Beijing's interest in developing early warning capabilities is known. An integral part of China's missile early warning includes large phased array radar (LPAR). Chinese work on

8. *Ballistic and Cruise Missile Threat* (Wright-Patterson AFB, OH: National Air and Space Intelligence Center, 2013), 3.

9. James M Kowalski, "Air Force Global Strike Command," May 7, 2013, <http://www.fas.org/programs/ssp/nukes/nuclearweapons/AFGSC-CommandBrief-May2013.pdf>.

10. Hans M. Kristensen, "Air Force Briefing Shows Nuclear Modernizations But Ignores US and UK Programs," *Federation of American Scientists Strategic Security Blog*, May 29, 2013, <http://fas.org/blogs/security/2013/05/afgsc-brief2013/>.

11. Hans M. Kristensen, Robert S. Norris, Matthew G. McKinzie, *Chinese Nuclear Forces and U.S. Nuclear War Planning* (Washington, DC: Federation of American Scientists and Natural Resources Defense Council, November 2006), 3–4.

12. *Foreign Missile Developments and the Ballistic Missile Threat Through 2015* (Washington, DC: National Intelligence Council, December 2001).

13. Office of the Secretary of Defense, *Annual Report to Congress, Military and Security Developments Involving the People's Republic of China 2013* (Washington, DC: U.S. Department of Defense, 2013).

14. Hans Kristensen summarizes nicely and explores this more in-depth in "Chinese ICBM Force Leveling Out?," *Federation of American Scientists Strategic Security Blog*, April 19, 2013; and "Chinese Nuclear Modernization: Smaller and Later," *Federation of American Scientists Strategic Security Blog*, February 24, 2012.

LPARs began in 1970. Their development was intended to catalogue space targets and to provide early warning of missile attacks.¹⁵ The International Institute for Strategic Studies' (IISS) *Military Balance* has in previous years asserted that China possesses a phased array radar complex for ballistic missile early warning,¹⁶ though more recent publications indicate that China has only "some phased array radar; some detection and tracking radars."¹⁷ The U.S. DOD has hinted, however, that China has recently upgraded its ballistic missile early warning capability. In its 2011 Annual Report to Congress on China's military and security developments, the DOD explains that "Given China's nuclear policy of 'no first use' and until recently its limited ballistic missile early warning capability, Beijing had assumed it might have to absorb an initial nuclear blow prior to engaging in 'nuclear counterattack.'"¹⁸ Here, it is the phrase "until recently its limited ballistic missile early warning capability" that is particularly telling, in that it suggests that China has recently and significantly improved its early warning capabilities.

More significantly, some evidence suggests that China is developing space-based ballistic missile early warning satellites. Such satellites, which are equipped with infrared sensors, are used to detect hot plumes from, among other heat sources, ballistic missiles. A broad survey of People's Liberation Army (PLA) and defense literature from 2002 indicates consistent support for missile early warning satellites.¹⁹ In a 2012 report prepared for the U.S.-China Economic and Security Review Commission, Mark Stokes and Dean Cheng argue that "a technical foundation [for developing early warning satellites] exists: for example, with infrared sensors associated with the FY weather satellite program."²⁰ According to these experts, the SJ-7 satellite, launched in July of 2005, has been cited as an experimental platform to test infrared sensor arrays.²¹ Furthermore, a recent survey of the Chinese defense literature, reported by Kyodo news, described ongoing work into space-based infrared sensors for missile early warning and quoted an unnamed PLA analyst who stated that this has "become the most pressing mission in terms of (the Chinese military's) missile defense strategy preparation."²²

MIRVs

A multiple reentry vehicle (MRV) missile has the capability to deliver multiple warheads to different targets, increasing the destructive potential of a single missile. In September 1981, China successfully delivered three satellites with a single launch vehicle, reportedly

15. Mark A. Stokes, *China's Strategic Modernization: Implications for the United States* (Carlisle, PA: Strategic Studies Institute, U.S. Army War College, September 1999), 41.

16. This statement is present in *The Military Balance* in editions from at least 1991 to 2005.

17. International Institute for Strategic Studies, *The Military Balance 2014* (London: Routledge, February 2014).

18. Office of the Secretary of Defense, *Annual Report to Congress 2011*, 36.

19. Mark A. Stokes, *China's Strategic Modernization*, 32.

20. Mark A. Stokes with Dean Cheng, *China's Evolving Space Capabilities: Implications for U.S. Interests* (Arlington, VA: Project 2049 Institute, April 26, 2012), 35.

21. Ibid.

22. "China Seen Readying Space-Based Warning Sensor," *Global Security Newswire*, July 25, 2013, <http://www.nti.org/gsn/article/china-seen-readying-space-based-warning-sensor/>.

giving it a nascent multiple-warhead capability.²³ Since the mid-1980s, China has reportedly conducted missile flight tests involving MRVs, and in May 1995 it flight-tested the DF-31 missile equipped with MRVs. MRVs differ from MIRVs in that they are unable to deliver warheads to multiple targets and instead deploy multiple warheads in a pattern against a single target, but the development of MRV technology could be and often is a significant step to developing an MIRV capability.

For more than a decade, the Pentagon has estimated that China has the capability to develop MIRVs for its silo-based missiles. In 2000, IISS indicated in its annual *Military Balance* that China had tested a version of the DF-5 ICBM with an MIRV capability.²⁴ Though detail was omitted in subsequent publications, the U.S. intelligence community is currently asserting that China may be developing a new road-mobile ICBM, possibly MIRV-capable.²⁵ Other observers speculate that China is developing a new fleet of ICBMs and is ensuring that it will be MIRV-capable.²⁶ Despite these observations and speculations, the U.S. intelligence community has consistently assessed all of the missiles in China's current arsenal to be single-warhead weapons. Thus, it appears that China has the capability to develop MRV and MIRVs but has not yet chosen to deploy the system on its missiles. Still, this assessment does not obviate Beijing's apparent interest in developing the technology nor the possibility of its future deployment.

NUCLEAR-POWERED BALLISTIC MISSILE SUBMARINES

China has two types of submarine-launched ballistic missiles (SLBMs), the JL-1 and the JL-2, which have been developed for two types of nuclear-powered strategic ballistic missile submarines (SSBNs).²⁷ The JL-1 entered service in the late 1980s for an old Xia-class (type 092) submarine, which was based at the North Fleet Base near Qingdao. Eight years ago, the submarine underwent a lengthy shipyard overhaul, but it has stayed in port since. It is not considered to be operational and is expected to be retired soon.²⁸

China is currently developing a new SSBN, the Jin-class type-094, as well as a new SLBM, the JL-2.²⁹ The JL-2 was successfully test-launched in 2012, and the Defense Intelligence Agency predicted operational capability to be attained sometime in 2014.³⁰ China currently has three Jin-class submarines in service, though without missiles onboard. Each submarine contains 12 missile launch tubes, meaning that the three boats together

23. "Nuclear Warhead Modernization: Multiple Reentry Vehicle (MRV)/Multiple Independently Targetable Reentry Vehicle (MIRV) Modernization/Warhead Miniaturization," Monterey Institute of International Studies, Center for Nonproliferation Studies, 1998, http://cns.miis.edu/archive/country_china/coxrep/wwhmdat.htm.

24. The International Institute for Strategic Studies, *The Military Balance 1999-2000* (Oxford, UK: Oxford University Press, 2000), 186.

25. "Nuclear Warhead Modernization," Monterey Institute of International Studies.

26. For example, Rebecca Heinrichs, "China's Strategic Capabilities and Intent" (Heritage Foundation Issue Brief No. 4111, December 18, 2013).

27. Kristensen and Norris, "Chinese Nuclear Forces, 2013," 82.

28. Ibid.

29. Lewis, "China's Nuclear Modernization," 76.

30. Kristensen and Norris, "Chinese Nuclear Forces, 2013," 82, 84.

could carry 36 missiles.³¹ According to various sources, Beijing plans to build between four and six Jin-class submarines by 2015,³² which would increase the total number of missiles carried to up to 72. In 2013, the Defense Department asserted that the weapons system will “give the PLA Navy its first credible sea-based nuclear capability.”³³

China’s Nuclear Doctrine, Posture, and Practices

Public pronouncements regarding nuclear doctrine are limited to three facets: (1) China will not use nuclear weapons first; (2) China will not use nuclear weapons against non-nuclear weapons states; and (3) China deploys a small number of nuclear weapons as a credible retaliatory force, which could respond after absorbing a first strike.³⁴

The best known of these tenets is China’s declaration of an NFU policy, which states that China will not, at any time or under any circumstances, use nuclear weapons first, and that it will absorb a first nuclear strike before retaliating. Beijing argues that its NFU declaration reflects a doctrinal decision that nuclear weapons are purely defensive in nature. The Chinese also believe that maintaining a policy of NFU allows China to command higher moral authority in the international community.³⁵ Further, Chinese scholars maintain that China’s NFU pledge encourages nuclear disarmament and nonproliferation because it deemphasizes the role and efficacy of nuclear weapons in international relations.³⁶

Many in the United States remain skeptical as to the credibility of China’s NFU pledge. U.S. policymakers believe that because the pledge is neither binding nor verifiable, it may not be indicative of actual and operational Chinese nuclear policy.³⁷ Furthermore, the pledge to “not be the first to use nuclear weapons at any time and in any circumstances” would mean that even if an adversary invaded China and threatened the very survival of the state, the country’s nuclear forces would remain unused so long as the invader did not use nuclear weapons; to some Western analysts, this is “hardly a credible policy.”³⁸

In 2013, some Western analysts questioned the implications of China’s omission of its no-first-use statement in an annual defense white paper. James Acton of the Carnegie Endowment for International Peace quickly pointed out the omission, arguing that the

31. Ibid., 83.

32. Thomas M. Skypek, “China’s Sea-Based Nuclear Deterrent in 2020: Four Alternative Futures for China’s SSBN Fleet,” in *A Collection of Papers from the 2010 Nuclear Scholars Initiative* (Washington, DC: Center for Strategic and International Studies, 2010), 108.

33. Office of the Secretary of Defense, *Annual Report to Congress, 2013*, 6.

34. Godwin, “Potential Chinese Responses,” 1.

35. Xia Liping, *Impacts of China’s Nuclear Doctrine on International Nuclear Disarmament* (presented at the PIIC Beijing Seminar on International Security, Beijing, China, November 2012).

36. Hui Zhang, “China’s No-First-Use Policy Promotes Nuclear Disarmament,” *Diplomat*, May 22, 2013, <http://thediplomat.com/2013/05/chinas-no-first-use-policy-promotes-nuclear-disarmament/>.

37. Stephanie Spies, “China’s Nuclear Policy: (No) First Use?,” *PONI Debates the Issues Blog*, October 20, 2011, <http://csis.org/blog/chinas-nuclear-policy-no-first-use>.

38. Hans M. Kristensen, “China Defense White Paper Describes Nuclear Escalation,” *Federation of American Scientists Strategic Security Blog*, January 23, 2009, <http://fas.org/blogs/security/2009/01/chinapaper/>.

absence of the NFU pledge may reflect ambiguity in China's nuclear thinking by not ruling out the use of nuclear weapons other than in response to a nuclear attack.³⁹ Among others, Major General Yao Yunzhu of China's Academy of Military Science was quick to respond and reassert Beijing's commitment to its NFU pledge, explaining that its omission in the white paper was due to a change in structure and substance of the document, rather than a change in doctrine.⁴⁰ Still, and not insignificantly, some research has found that most of China's nuclear experts agree that Beijing should adopt a flexible approach to the NFU policies and a more offensive-oriented nuclear strategy.⁴¹ Some Chinese sources indicate that high-powered conventional attacks on nuclear forces could prompt a nuclear response from China, though technically China would be the first party in this scenario to use nuclear weapons.⁴²

There exists a debate about how to characterize China's nuclear strategy. Some observers believe that China pursues a "minimum deterrence" doctrine, whereas others believe the country pursues one of "limited deterrence." According to the Committee on the U.S.-Chinese Glossary of Nuclear Security Terms, "minimum deterrence" refers to "threatening the lowest level of damage necessary to prevent attack, with the fewest number of nuclear weapons possible." Limited deterrence, on the other hand, "requires a limited war-fighting capability to inflict costly damage on the adversary at every run on the escalation ladder, thus denying the adversary victory in a nuclear war."⁴³ Some experts find little utility in the minimum versus limited deterrence debate, asserting that the distinctions between the two are neither clearly articulated nor adequately understood. Semantics notwithstanding, most observers agree that Beijing's logic of deterrence is based upon the principle that a sufficient percentage of its nuclear forces must survive a first strike in order to be able to retaliate and inflict a high level of damage, and this is most often referred to as minimum deterrence.⁴⁴ The most important thing to note is that this issue factors into a long-running debate about whether China, in modernizing its nuclear forces, desires to shift from a defensive nuclear strategy to a more offensive one.

China's nuclear posture is marked by the notable attribute of maintaining nuclear warheads de-mated from their missiles but stored at a low level of alert in central facilities under the control of the Central Military Commission. Should China need to retaliate to a nuclear attack, its nuclear weapons would be released to the Second Artillery Corps to

39. James M. Acton, "Is China Changing Its Position on Nuclear Weapons?," *New York Times*, April 18, 2013.

40. Yao Yunzhu, "China Will Not Change Its Nuclear Policy," *China US Focus*, April 22, 2013.

41. According to the research conducted by Baohui Zhang, an associate professor of political science at Lingnan University, and highlighted by Stephanie Spies in "China's Nuclear Policy."

42. Peng Guangqian and Rong Yu, "Nuclear No-First-Use Revisited," *China Security* 5, no. 1 (winter 2009), 82–85.

43. The Chinese Scientists Group on Arms Control (CSGAC) of the Chinese People's Association for Peace and Disarmament and the Committee on International Security and Arms Control (CISAC) of the U.S. National Academy of Sciences have jointly produced a Chinese-English glossary on nuclear security terms. The glossary of approximately 1,000 terms is built on 20 years of joint discussions. See Committee on the U.S.-Chinese Glossary of Nuclear Security Terms, *English-Chinese, Chinese-English Nuclear Security Glossary* (Washington, DC: National Academies Press, 2008), 33–36.

44. Godwin, "Potential Chinese Responses," 61–62.

enable missile brigades to prepare to retaliate.⁴⁵ This practice makes sense for multiple reasons. First, from a safety standpoint, keeping nuclear warheads separate from their delivery systems ensures that even if a missile launched, it would not deliver a nuclear payload. Second, from a command point of view, because of the time-consuming process necessary to mate a missile to its warhead, the practice of keeping the two separate components provides an extra step to prevent an unauthorized, rash, or unintended launch. Finally, from an ideological perspective, China's de-mating practice symbolizes the country's belief that nuclear weapons are not a means for fighting or winning wars and have utility that is limited to deterring nuclear attacks and countering nuclear coercion. It is likely that China considers all of these as valid reasons to de-mate warheads and believes that ultimately the consequences of an accidental or unauthorized launch are much more serious than costs of suffering a deliberative first strike.⁴⁶

Finally, Beijing practices a high degree of deliberate ambiguity with regard to its nuclear doctrine and posture. Whereas for the most part, Western strategists believe that transparency is a measure that can be used to bolster strategic stability, their Chinese counterparts believe that a high degree of opacity is a necessary element to maintain deterrence given their lower numbers of nuclear weapons. In recent years, however, China has made what appears to be at least a small effort to increase transparency: for example, the 2009 *China Defense White Paper* details for the first time the several stages of nuclear alert. Some analysts postulate that as China continues to modernize its deterrent—the shortcomings of which previously provided some incentive to practice nuclear opacity—the country may be willing to adopt a more transparent disposition.⁴⁷ However, due to cultural and political considerations, Beijing is likely to remain tight lipped about anything nuclear related.

Old Policies and New Technologies

Of the three technologies examined in this chapter, the development of early warning capabilities is the most interesting with regard to established doctrine and posture. With the development of early warning capabilities, China could consider changing its posture from one of absorbing a first strike before retaliating to LOW. Indeed, early warning capabilities would be of little value if China did not adopt LOW. To make LOW consistent with its traditional doctrinal commitments, Beijing would argue that it is not a violation of NFU, as launching on warning would be a defensive action taken in response to a confirmed attack. LOW might be attractive to those Chinese analysts who closely follow Mao's principles of war, as it removes the doctrinal obligation to absorb a first strike before responding, which is considered to be a "passive" posture and therefore a weaker defensive military posture.⁴⁸ From this perspective, LOW would not only be consistent with a

45. Kristensen and Norris, "Chinese Nuclear Forces, 2013," 84.

46. Conversations held with Li Bin of the Carnegie Endowment for International Peace, June 19, 2014.

47. Nicolas Giacometti, "China's Nuclear Modernization and the End of Nuclear Opacity," *Diplomat*, April 10, 2014, <http://thediplomat.com/2014/04/chinas-nuclear-modernization-and-the-end-of-nuclear-opacity/>.

48. Godwin, "Potential Chinese Responses," 69.

NFU doctrine, but it would more closely resemble the traditional Chinese military concept of “active defense.”

The Chinese conception of “active defense” permits preemption where conventional weapons are concerned. As U.S. rear admiral Michael McDevitt explains, “They don’t have to wait and take the first shot. . . . China claims ‘if you act *diplomatically* to challenge our sovereignty . . . we have the right to preemptively attack as part of our active defense strategy.’”⁴⁹ Some in the United States are therefore worried that a shift toward LOW could give China the option to use nuclear weapons preemptively. However, Chinese nuclear scholars and experts consistently maintain that the country will continue to adhere to its NFU policy.

In a 2009 defense white paper, the Chinese government described for the first time how the Second Artillery Corps would change the operational status of the nuclear forces to meet different levels of crisis.⁵⁰ Three levels of escalation were described: “peacetime,” “nuclear crisis,” and “nuclear attack.” In “peacetime,” China’s missiles are “not aimed at any country.” Hans Kristensen points out that this phrase seems to be borrowed from the U.S. terminology that refers to the absence of targeting data in a missile’s guidance system, rather than the actual alert level of the weapon itself.⁵¹ As mentioned above, it is widely assumed that China’s warheads under normal circumstances are not mounted to their missiles, meaning that “aiming” the weapons would be fruitless anyway. During “nuclear crisis,” the Second Artillery Corps and nuclear missile force “will go into a state of alert, and get ready for a nuclear counterattack.”⁵² It is during this phase that road mobile missiles would be dispersed, nuclear warheads would be mated, and presumably the weapons would be aimed. During “nuclear attack,” the Second Artillery Corps will “use nuclear missiles to launch a resolute counterattack against the enemy.”⁵³ This could either be independently or with the navy (SSBNs) or air force (bombers).⁵⁴

As it stands currently—with China’s missiles not fully in their “nuclear crisis” status—it would take too long for China to prepare its nuclear missiles for launch before absorbing a first strike. Though retaliating after a first strike has been absorbed is a known tenet of China’s nuclear doctrine, in order to maintain a credible LOW posture and to take full advantage of an early warning capability China would be required to maintain its nuclear weapons in a higher alert status than it currently does. One way that China could elevate the alert status of its weapons is by changing the practice of de-mating warheads from their delivery systems, a measure in which it seems uninterested. Should Chinese officials eventually change their mind and decide to maintain warheads mated to their delivery systems, the United States would likely consider the move worrying.

49. Michael McDevitt, “China’s Maritime Strategy in the East China Sea” (presentation at Wilson Center Asia Program Event, Washington, DC, 24 September 2013).

50. Information Office of the State Council of the People’s Republic of China, *China’s National Defense in 2008* (Beijing: January 2009), http://english.gov.cn/official/2009-01/20/content_1210227_9.htm.

51. Kristensen, “China Defense White Paper.”

52. Information Office, *China’s National Defense*.

53. Ibid.

54. Kristensen, “China Defense White Paper.”

Though a more developed early warning constellation would allow China the option to seek a LOW posture, its fleet of SSBNs would decrease the strategic need for LOW; the submarines are capable of hiding in the ocean during an attack, thus ensuring that a second strike can be made even if China is unable to launch a land-based counterstrike. In this way, an SSBN fleet could be seen as complementary to China's current nuclear doctrine. This does not mean that a LOW posture and an active SSBN fleet necessarily serve opposing nuclear purposes, but it does mean that the two are not dependent on each other, nor are they necessarily being developed in the pursuit of a single, discernable, established nuclear strategy.

Though an SSBN fleet would be complementary to China's current nuclear doctrine and desires for a secure second-strike capability, it may lead the country to change its long-standing policy of de-mating. Should Beijing decide to deploy SSBNs continuously at sea but with their warheads stored on land, they would have to return to port—and hence become highly vulnerable—if the decision were taken to alert their missiles. It would therefore make logistical sense for ballistic missiles to be stored already mated with their nuclear payloads. Furthermore, maintaining a sea-based deterrent would likely present operational issues to China, including questions of command and control, as the country has no previous experience in maintaining nuclear deterrence patrols on the open seas. Notwithstanding these growing pains, and beyond the likely exception to the country's de-mating policy, the development of an SSBN fleet will likely not create tension with China's current nuclear doctrine.

Chinese strategists fear that efforts by the United States to improve and expand its ballistic missile defense (BMD) system may diminish China's nuclear deterrent, and U.S. assurances that its BMD program is not directed at China do not alleviate Beijing's distrust of long-term U.S. intentions.⁵⁵ However, U.S. BMD has shortcomings that leave the United States vulnerable to some kinds of long-range strikes, including those that employ MIRVs. It thus has been speculated that China would choose to employ MIRVs in a response to the buildup of U.S. BMD, with the ultimate goal to maintain its current nuclear minimum deterrence posture.⁵⁶

Some experts have observed that if the motivation for China to develop the mobile missile is simply to have a secure second-strike capability, then MIRV technology may not be necessary or even desirable for a second-strike capability. Because missiles with MIRV capabilities have an increased value, they would be more likely to be targeted in a foreign preemptive strike.⁵⁷ Analysts explain that this, along with the fact that just a single nuclear warhead could destroy all the warheads on a MIRV, creates a "use them or lose them" scenario—an incentive to strike first in a time of crisis or otherwise suffer a first strike

55. Godwin, "Potential Chinese Responses," 61.

56. Ibid., 65; Baohui Zhang, "US Missile defense and China's nuclear posture: changing dynamics of an offence-defence arms race," *International Affairs* 87, no. 3 (2011): 562.

57. Richard L. Garwin, "Why China Won't Build U.S. Warheads," *Arms Control Today*, April/May 1999.

that disproportionately damages retaliation capabilities.⁵⁸ Thus, even if China's NFU doctrine in principle remains intact, MIRVs could create incentives to strike first in a time of crisis.

Larger Lessons

In light of the discussion above, it is apparent that, in numerous ways, technological changes could allow China to change its established nuclear policies. However, the question must be asked: Do the technological changes to China's force structure necessarily signal a change in doctrine, posture, or practices? With regard to the three specific capabilities examined in this chapter, the answer is: not necessarily.

Early warning capabilities would allow China to adopt LOW, but China's interest in developing a robust early warning system does not indicate that the country will necessarily move to LOW. And, even if adopted, LOW does not necessarily depart from China's NFU principle, nor does it violate China's current posture of minimum deterrence. Similarly, MIRVs may be seen as creating a first-use incentive during a nuclear crisis, but their development does not necessarily represent a shift from no-first-use. Rather, it may represent Beijing's desire to strengthen a nuclear deterrent it perceives has been diminished by the introduction of new U.S. capabilities. While it might require a modification to its de-mating policy and demand an improvement to command and control, China's modest SSBN fleet currently appears to complement its NFU doctrine and minimum deterrence posture.

Though Beijing's exploration and development of new technological capabilities do not yet indicate a shift in nuclear ideological cornerstones, possessing these capabilities would not be disadvantageous for China if it decided to depart from its NFU doctrine or shift away from its posture of minimum deterrence. As it stands, there exists burgeoning literature exploring China's objectives in modernizing and expanding its nuclear arsenal, much of which postulates a multitude of nefarious intentions China holds for the future. While monitoring China's technological developments is an important task in its own right, it is equally as important to understand how the Chinese view their own technological developments and to appreciate that new capabilities by themselves give little insight into intentions. Simply put, technology on its own does not indicate intent. Instead, its purpose is unique according to that which Beijing specifically assigns to the technologies. These purposes are rarely clear-cut or simple—rather, they are the complicated accumulation of unique historical, technical, and bureaucratic considerations. Thus, while worried Western observers attempt to ascribe a certain purpose and trajectory for new nuclear developments and point to technological innovations and developments to indicate intent, the true purpose and trajectory may very well be a totally different and much more complicated reality.

58. Eryn MacDonald, "The End of MIRVs for U.S. ICBMs," *All Things Nuclear*, Union of Concern Scientists, June 27, 2014.

As Jeffrey Lewis has aptly stated, “If the history of the United States’ understanding of China’s nuclear capabilities and force development could be summarized in one word, it would be ‘surprise.’”⁵⁹ From China’s very first nuclear test in 1964 to modern-day predictions, Western analysis of China has proven to be consistently incorrect. This is due to combination of the inability to appreciate the sum of China’s historical experiences, to comprehend (or trust) China’s ideologies, and to surmount intentional opacity. The goal of this chapter is not to transcend these difficulties and determine what China’s true intentions are but rather to emphasize the importance of maintaining sober analysis. Simply stated, the development of any of the above technologies is not indicative of a wicked intent. While it is likely that predictions of China will continue to be incorrect, a humble appreciation of our own limitations might help improve our understanding of a complicated subject.

59. Lewis, “China’s Nuclear Modernization,” 67.

Ghosts of the Nonaligned Past: Debate on U.S. Compliance with NPT's Article VI

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*A*nalysis of the negotiation process of the Nuclear Non-Proliferation Treaty (NPT) exposes a stark contrast between the Article VI text ratified by the Conference of Parties and the expectation of the nonaligned states. The United States has based the argument for its compliance on a strict interpretation of Article VI. Conversely, critics have incorporated context and the drafters' intent to argue that the United States underestimated the depth of its commitments. Nonnuclear-weapon states (NNWS) have based their allegations of U.S. noncompliance on the fact that it defied the purpose of the NPT, which includes the conclusion of two other arms control negotiations in the form of the Comprehensive Test Ban Treaty (CTBT) and the Fissile Material Cut-off Treaty (FMCT).

Introduction

At the start of a promising negotiating session with Premier Mikhail Gorbachev in Reykjavik in 1986, President Ronald Reagan's signature charm was on full display. The two leaders, who controlled over 90 percent of the world's nuclear weapons and whose countries have faced the threat of nuclear annihilation since 1949, were on the precipice of a landmark agreement on the total disarmament of their strategic nuclear weapons within 10 years. Reagan was so optimistic that he mused that the two leaders would return to Reykjavik in 10 years' time to "destroy" their last remaining nuclear missiles. Had the two men overcome a fatal impasse in the eleventh hour over President Reagan's Strategic Defense Initiative, the nuclear-weapon states (NWS) would have met their ultimate mandate under Article VI of the NPT. Instead, the collapse of the negotiations at Reykjavik was a harbinger for the inauspicious future of the NPT, from its near extinction at the 1995

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Review Conference to perennial charges that the United States has failed to fully honor the “grand bargain” on which the NPT’s endurance has relied.

Senator John F. Kennedy predicted in 1960 that absent an international treaty, the number of states possessing nuclear weapons could balloon from five to twenty-five by 1970.² However, the entry into force of the NPT in 1970 prevented Kennedy’s worst fears from being realized. More than four decades after President Kennedy’s commencement address at American University in 1963, President Barack Obama reiterated Kennedy’s goal of total nuclear abolition in Prague.³ Both leaders’ speeches were given on the eve of major arms control treaty signings. President Kennedy’s speech was intended to build momentum for a Limited Test Ban Treaty with the Soviet Union and for an NPT being negotiated between eighteen states in Geneva. Similarly, President Obama announced his intention to sign the New Strategic Arms Reduction Treaty (New START) and to pursue ratification of the CTBT. While President Kennedy sought to create an international framework that would support nuclear disarmament toward the goal of zero, Obama’s call for “a world free of nuclear weapons” was not merely aspirational; its achievement was a binding obligation on the United States under Article VI of the NPT. Both presidents were quick to note that general and complete disarmament was preconditioned on fulfillment of certain security guarantees.

An analysis of the NPT negotiation history exposes differences between the literal text and intent of the NPT. Since the NPT’s entry into force, the depth of obligation of Article VI has stood as a major point of contention between the NWS and the nonaligned movement. The United States has made undeniable progress in reducing the size of its nuclear weapons and their role in national security strategy. While the United States unfairly receives the brunt of criticism from NNWS for the perceived glacial pace in nuclear reductions, some of its actions have failed to live up to the full spirit of the NPT. The debate resurfaces every five years during the NPT Review Conference, the one institutional forum that allows NNWS to grade NWS on their progress. With the 2015 NPT Review Conference approaching, this historic schism will once again require the United States to exercise diplomatic jujitsu. At stake for the United States is its ability to induce other states to accede to or comply with arms control treaties and agreements.

The NPT’s Original Intent

The NPT negotiation record exposes a stark contrast between the Article VI text ratified by the Conference of Parties and the expectation of the nonaligned states. Since its inception, the United States has based the argument for its compliance on a strict interpretation of Article VI. Conversely, critics have incorporated context and the drafters’ intent to argue

2. Proliferation Analysis, “JFK on Nuclear Weapons and Non-Proliferation,” *Carnegie Endowment for International Peace*, November 27, 2003, <http://carnegieendowment.org/2003/11/17/jfk-on-nuclear-weapons-and-non-proliferation/3zcu>.

3. Barack Obama, “Remarks of the President” (remarks in Prague, Czech Republic, April 5, 2009), http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered.

that the United States underestimated the depth of its commitments. The differing interpretation among these parties can be found by reviewing negotiation minutes from the 1962–1969 Eighteen Nation Disarmament Committee (ENDC) in Geneva.

These negotiations provide the historical context to answer the core question of this study—whether the United States has complied with its three binding obligations under the text and spirit of Article VI. Theoretically, the United States could be in good standing with its textual commitments under Article VI while in noncompliance with the intent or purpose of the treaty. While the vagueness of responsibilities has sheltered the United States from a persuasive legal challenge, this low threshold is not consistent with the ultimate goal of “general and complete disarmament.” The strength of the NPT is derived from the near universal ascension to the treaty. Achieving that universality was predicated on the United States, the United Kingdom, and the Soviet Union agreeing not only to the aspiration of disarmament but also to concrete steps for its realization.

The ENDC negotiations demonstrate an enthusiasm gap between the United States and NNWS on the issue of disarmament. The nonaligned states fought in Geneva to raise their grievances about the arms race and absence of the resolve of the Cold War powers to move toward disarmament. The desire of the NNWS to tie disarmament to nonproliferation was not satisfied through the negotiated inclusion of Article VI. At every successive NPT Review Conference, the NNWS have tried to clarify the ambiguity of Article VI that has given the United States free reign to selectively interpret its obligations. The United States has continually rebuffed such attempts to bind itself to specific measures such as the CTBT. However, the United States also recognized that the prospects for universal ascension to the NPT in the late 1960s would be threatened without forging a compromise on what was to become the second pillar of the treaty.

From the outset of the nonproliferation negotiations, the concept of disarmament was completely divorced from the more urgent concern relating to the transfer and receipt of nuclear weapons. The U.S. security interest in generating broad agreement on nonproliferation principles without binding itself to disarmament was clearly identified by the U.S. delegation lead, William Foster, in the early proceedings of the ENDC in 1962: “Let us therefore start from that point by freezing the situation where it is.”⁴ Ambassador Foster’s statement strongly articulated the U.S. realist policy of capping the nuclear fraternity at five states and mirrored the Irish-sponsored 1961 UN General Assembly Resolution dealing with the global concern of nonacquisition. The mutual interest of the great powers in dodging disarmament was spelled out by future treaty drafts circulated at the ENDC. The Czechoslovakian representative would later define U.S. static policy of maintaining the nuclear status quo as “non-armament.”⁵

4. “Final verbatim record of the Conference of the Eighteen-Nation Committee on Disarmament [Meeting 120],” *University of Michigan Digital Library*, <http://quod.lib.umich.edu/cgi/t/text/text-idx?c=endc;idno=4918260.0120.001>.

5. “Final verbatim record of the Conference of the Eighteen-Nation Committee on Disarmament [Meeting 250],” *University of Michigan Digital Library*, <http://quod.lib.umich.edu/e/endc/4918260.0250.001?view=toc>.

The United States' and Soviet Union's joint draft of the NPT in 1965 addressed the issue of nonproliferation and outlined what was to become Articles I, II, and III; however, there was no explicit reference to disarmament outside a general aspiration in the preamble.⁶

The Burmese representative, U Maung Maung Gyi, articulated the nonaligned states' expectation on disarmament: "The eight delegations are convinced that measures to prohibit the spread of nuclear weapons should, therefore, be coupled with or followed by tangible steps to halt the nuclear arms race and to limit, reduce and eliminate the stocks of nuclear weapons and the means of their delivery."⁷ India's representative to the ENDC, V. C. Trivedi, summed up the sentiment of the nonaligned eight, alleging that the United States was shortsighted for refusing to address disarmament while compelling others to foreswear the pursuit of nuclear weapons. Trivedi humorously referenced a seventeenth-century Indian emperor, who "himself was a drunkard, but he prohibited drinking in his empire."⁸

Codifying their objections to the ENDC negotiations, the nonaligned states passed General Assembly Resolution 2028 in 1965, which declared their firm negotiating position. This position was that "the treaty should embody an acceptable balance of responsibility," and more centrally, it "should be a step towards . . . general and complete disarmament," and "there should be acceptable and workable provisions to ensure the effectiveness of the treaty."⁹

Members of the ENDC introduced a vast array of proposals to satisfy the nonaligned states' desire to tie nonproliferation commitments to progress on disarmament. Western-aligned states including Germany and Italy also played a key role in extracting a price, or less cynically, a bargain, with NWS in exchange for support of nonacquisition principles. Italy's representative, Amantori Fanfani, advocated linkage between nonacquisition and disarmament by the great powers. He argued that NNWS should consent to a moratorium only on receipt of nuclear weapons if the NWS complied with specific disarmament measures "in a (specified) time limit."¹⁰ Fanfani argued that this would induce the United States and the Soviet Union to hasten disarmament for fear of breaking the moratorium and denying the United States its principle goal of the treaty. The British floated a compromise that would have created an incentive for the NWS to pursue disarmament measures in earnest. The British proposal would have given the NNWS the right to withdraw from the NPT if the NWS failed to implement their obligations under Article VI in a timely manner.¹¹ The nonaligned eight ultimately abandoned their earlier desire to make their ascension to

6. Glenn T. Seaborg and Benjamin S. Loeb, *Stemming the Tide: Arms Control in the Johnson Years* (Lexington, MA: Lexington Books, 1971).

7. "Final verbatim record of the Conference of the Eighteen-Nation Committee on Disarmament [Meeting 158]," *University of Michigan Digital Library*, <http://quod.lib.umich.edu/e/endc/4918260.0158.001?view=toc>.

8. Seaborg and Loeb, *Stemming the Tide*, 162.

9. *Ibid.*, 167.

10. "Final verbatim record of the Conference of the Eighteen-Nation Committee on Disarmament [Meeting 219]," *University of Michigan Digital Library*, <http://quod.lib.umich.edu/e/endc/4918260.0219.001?view=toc>.

11. George Bunn and Ronald Timerbaev, *Nuclear Disarmament: How Much Have the Five Nuclear Powers Promised in the Non-Proliferation Treaty?* (August 2009), <http://www.cdi.org/laws/nuclear-disarmament.pdf>.

the NPT dependent upon the NWS demonstrating in deed their sincerity to disarm; as referenced earlier, some of the proposals included directly linking CTBT negotiations to the NPT and a cutoff in fissile material production.

The fact that negotiations on these two treaties have yet to conclude or enter into force helps explain the common perception among the NNWS that the P5 (the five nuclear-weapon states) have not complied with the intent behind the NPT. While the compromise language of Article VI earned the critical support of most of the nonaligned states, India and Burma continued to advocate for specific measures that would require the NWS to reduce nuclear weapon vehicles.¹² Outside of Article VI, the nonaligned states were able to extract significant concessions from the NWS. Most notably, the NPT would be in force for only twenty-five years, not ad infinitum as the NWS had preferred. Dependence of the NWS on NNWS for the indefinite renewal of the NPT in 1995 was an immense bargaining chip to compel the NWS to fulfill the preambular goal of negotiations on the CTBT.¹³ This, coupled with mandatory review conferences every five years, has provided the NNWS with a platform to interpret the future progress of the NWS on disarmament obligations.

Despite these modest overtures, however, the Article VI language of “pursuing negotiations in good faith” does not amount to the depth of obligation sought by the sponsors of UN Resolution 2028, calling for “acceptable and workable provisions to ensure the effectiveness of the treaty.”¹⁴ The NWS were secure knowing that their membership on the Security Council would thwart any attempt to find them in breach of Article VI. Underscoring the perceived inequality of the NPT, there remains no institutional avenue for an NNWS to invoke sanctions or repercussions against a noncompliant NWS.

Object and Purpose Test of the NPT

The main debate over Article VI is premised on whether simply pursuing negotiations toward the three obligations is sufficient to demonstrate compliance. While this is certainly a legal question, the mere perception that the United States and the NWS have not fulfilled their commitments to the satisfaction of the NNWS threatens the legitimacy of the regime. The debate over Article VI compliance pits former U.S. nonproliferation negotiators, such as Christopher Ford, against select legal scholars and prodismament interest groups who argue that the obligations require action beyond aspirational goals. The Managerial School of treaty compliance, led by Abram and Antonia Chayes, argues that ambiguity in treaty language is a key source of noncompliance.¹⁵ Since the treaty does not bind the NWS to specific policies that would demonstrate “good faith” efforts, Article VI has been

12. “Final verbatim record of the Conference of the Eighteen-Nation Committee on Disarmament [Meeting 198],” *University of Michigan Digital Library*, <http://quod.lib.umich.edu/e/endc/4918260.0198.001?view=toc>.

13. “Comprehensive Nuclear Test Ban Treaty,” *Inventory of International Nonproliferation Organizations and Regimes*, *Center for Nonproliferation Studies*, <http://cns.miis.edu/inventory/pdfs/ctbt.pdf>.

14. “UN General Council Resolution 2028,” <http://daccess-dds-ny.un.org/doc/RESOLUTION/GEN/NR0/217/91/IMG/NR021791.pdf?OpenElement>.

15. Abram Chayes and Antonia Handler Chayes, “On Compliance,” *International Organization* 47, no. 2 (1993): 175–205.

subject to varying interpretations. While most concede that the United States has made commendable progress toward negotiating and concluding negotiations on disarmament treaties, it remains unclear under what conditions the NWS must pursue “general and complete” disarmament.

In 1994, the UN General Assembly petitioned the International Court of Justice (ICJ) to render an advisory opinion on the legality of the use of nuclear weapons. While the General Assembly did not seek a comprehensive review of NPT, the ICJ expanded its 1996 advisory opinion to include a reinterpretation of Article VI. The ICJ’s unanimous ruling lent credence to the expansive interpretation that nonaligned states had articulated since the ENDC: that the literal text of Article VI should incorporate the stated end of the treaty. The ICJ opinion stated, “There exists an obligation to pursue in good faith and bring to a conclusion negotiations leading to nuclear disarmament in all its aspects under strict and effective international control.”¹⁶

Elizabeth Shafer of the International Association of Lawyers Against Nuclear Arms cites ICJ precedent to argue that intent is legally binding. The ICJ’s 1997 advisory opinion on the Gabčíkovo-Nagymaros Project led to a reinterpretation of the obligations under Article 26 of the Vienna Convention on Treaties.¹⁷ Article 26 of the Vienna Convention states that treaties are “binding upon the parties and must be performed by them in good faith.”¹⁸ The court, in turn, found in its 1997 opinion that “it is the purpose of the Treaty, and the intentions of the parties in concluding it, which should prevail over its literal application.”¹⁹ The ramifications of the 1996 ICJ ruling requiring conclusion to negotiations and the 1997 case pertaining to Article 26 of the Vienna Convention are far reaching. By the court’s definition, the United States has not complied with Article VI because “general and complete disarmament” must be concluded. Additionally, given that many of the parties concluding the NPT stated their clear desire for action on the CTBT and the FMCT, the absence of entry into force of these agreements signals that the United States has failed to meet the purpose of the treaty.

Christopher Ford challenged the validity of the ICJ’s findings, saying that it interjected itself into a legal issue beyond its powers or *ultra vires*.²⁰ The ICJ’s legal argument departs from the literal text of Article VI and the preamble, neither of which binds states to conclude agreements. However, the court’s opinion that actions should reflect the purpose of the treaty is a sound policy argument, if not a legal one. The ICJ’s expansive ruling created a new threshold from which the U.S. commitment to fulfilling Article VI could be evaluated.

16. “Legality of the Use or Threat of Nuclear Weapons.” *International Court of Justice Advisory Opinion*, July 8, 1996, <http://www.icj-cij.org/docket/files/95/7495.pdf>.

17. Elizabeth J. Shafer, “Good Faith Negotiation, the Nuclear Disarmament Obligation of Article VI of the NPT, and Return to the International Court of Justice” (paper presented at International Seminar on Abolition of Nuclear Weapons, War and Armed Forces, San Jose, Costa Rica, January 26, 2008).

18. *Ibid.*

19. *Ibid.*

20. Christopher Ford, “Debating Disarmament: Interpreting Article VI of the Treaty on the Non-Proliferation of Nuclear Weapons,” *Nonproliferation Review* 14, no. 3 (2007): 402.

There is a chief difference between the two preamble paragraphs addressing disarmament and the language of Article VI itself. The three obligations unique to the NWS pronounced both in the NPT preamble and text of Article VI are the “cessation of the nuclear weapons arms race,” “disarmament,” and “general and complete disarmament.” The major question to pursue, which is central to evaluating U.S. compliance with Article VI, is the extent to which the nuclear-weapon states’ obligation to pursue “general and complete disarmament” must occur in isolation to other events. Bunn and Timerbaev argue that complete disarmament of the U.S. stockpile is not an unconditional obligation under NPT. Several factors—such as a corresponding reduction in the Soviet Union, near or full elimination of conventional arms, and strengthened resolve of the United Nations Security Council to enforce their Chapter 7 “peace and security” powers—are among the preconditions to trigger obligations.²¹ Ford also referenced the preamble, which states, “desiring to further the easing of international tension and the strengthening of trust between states” to facilitate disarmament and general and complete disarmament.

The ICJ opinion makes complete disarmament an unconditional obligation, whereas the preamble and Article VI itself do not; rather, it is an obligation that should be undertaken subsequent to efforts that breed an environment that eases the risks of disarmament. However, since global peace and stability will never be fully obtained, adopting a narrow interpretation of Article VI means that the goal of zero nuclear weapons will never be accomplished.

Evaluating Compliance

Previous sections covered the genesis of the NPT, with attention to the diverging emphases between the United States and the nonaligned states of the ENDC. While the United States was not antithetical to the aspiration of disarmament, it opposed attempts by the non-aligned states to create a reciprocal exchange—their pledge to never acquire nuclear weapons would be tied to the NWS progress on disarmament. Mounting a successful legal challenge against the United States for its alleged violations of Article VI is nearly impossible given the soft language of the treaty. NPT Review Conferences held every five years since 1975 are the best example of how even the perception of NWS compliance matters. The 1980 Review Conference failed to issue a consensus document over the objections of nonaligned states that criticized the NWS for their delay in negotiating the CTBT. The 1985 Review Conference reached consensus, but the document called upon the NWS to “intensify their efforts” to implement Article VI and reiterated their urgent desire for CTBT negotiations to commence.²² Reaction to the laggard action on CTBT and disarmament was most pronounced at the 1990 Review Conference. Mexico, with the support of a few other nonaligned states, made their consent to a final document contingent on its referencing the P5’s pledge to commence negotiations on CTBT.²³ The United States rejected Mexico’s pro-

21. Bunn and Timerbaev, *Nuclear Disarmament*, 21.

22. “History of the NPT: 1975–1995,” *Reaching Critical Will*, <http://www.reachingcriticalwill.org/disarmament-fora/npt/history-of-the-npt-1975-1995>.

23. *Ibid.*

posal, preferring instead to keep CTBT negotiations separate from the NPT. Ambassador Bosch's maneuver signaled the perilous future ahead at the 1995 Review Conference.

The alleged failed promises and deliverables brought the NPT to the brink of extinction at the 1995 Review Conference. In what was a concession to NNWS, Article X gives parties to the NPT the discretion to determine the future fate of the treaty—either to discontinue it, extend it for a fixed length of time, or extend it indefinitely.²⁴ Again, the same criticisms leveled at the ENDC—namely, the lack of finality on CTBT, FMCT negotiations, and meaningful disarmament—were rehashed by NNWS in 1995. The key difference between the 1995 Review Conference and the preceding conferences was that for the first time, the proponents of expanding the NWS' binding commitments had bargaining leverage. For a regime that has been plagued by accusations that it perpetuates “nuclear apartheid,” the reliance of the NWS on the NNWS for adherence shifted the power dynamic, albeit momentarily. This discussion exposes the fundamental argument of this study: the United States acting in good faith to fulfill their international legal obligations is secondary to whether their policy actions are to the satisfaction of the NNWS.

The U.S. aim of indefinite extension was secured through the consensus final agreement that called for the conclusion of CTBT negotiations by 1996, conclusion of FMCT negotiations, and meaningful multilateral nuclear reductions more significant than those to date.²⁵ Although not legally binding, the final document marks the first instance where all parties to the NPT embraced the idea that concluding agreements was the standard of compliance. Disarmament proponents have argued that the final document constitutes a legal redefinition of Article VI requirements. Shafer cited Article 31 of the Vienna Convention on Treaties that requires states to honor “any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions.”²⁶ Regardless of the legal merit, the 1995 Conference participants articulated their clear expectation that negotiations must lead to implementation in order to satisfy the “good faith” test.

The 1995 Review Conference accomplished the previously elusive goal of the NNWS. Since their first recommendations in Geneva and before the General Assembly in the mid-1960s, the NNWS had campaigned to tie conclusion of specific policy aims to their contractual NPT obligation of nonacquisition. An important caveat is the fact that even though the principles were unanimously agreed to, they are at most an interpretation, not an obligation, of what defines compliance with Article VI. Nevertheless, a successful conclusion of negotiations on the three principles of CTBT, FMCT, and eventual disarmament is consistent with the well-documented intent of the NPT drafters. Moreover, the principles created a useful barometer to evaluate U.S. and P5 compliance.

Negotiators to the ENDC repeatedly argued that the entry into force of the CTBT was critical to bring about the “cessation of the nuclear arms race.” Along with disarmament,

24. Ibid.

25. Ibid.

26. Elizabeth J. Shafer, “Good Faith Negotiation.”

the pursuit of good-faith negotiations toward this end was one of two unconditional obligations of states under Article VI. When the ENDC negotiated preambular language on the CTBT in parallel with the NPT, they would have likely interpreted conclusion of negotiations to mean “entry into force” of the treaty. The preamble articulates the aspiration of the NPT parties to “seek to achieve the discontinuance of all test explosions of nuclear weapons.” Negotiations on the CTBT successfully concluded in 1996, in accordance with the 1995 principles and with support from two-thirds of the countries.

Even with the successful conclusion of negotiations and signing of the CTBT, this has not meant the entry into force of its provisions. The United States remains one of eight Annex 1 countries whose nonratification has prevented the CTBT from taking effect.²⁷ While the United States signed CTBT under President Clinton, the high bar of U.S. Senate ratification has prevented U.S. accession to the treaty. President Clinton’s desire to ratify the CTBT faced stiff opposition from Republicans who argued that the safe, secure, and effective U.S. nuclear deterrent could not be guaranteed in the absence of underground testing.

The Republican-controlled Senate rejected President Clinton’s desire for consideration of the CTBT for two full years. Senate Majority Leader Trent Lott (R-MS) finally brought the CTBT up for floor debate in 1999. This reversal caught the administration by surprise, and knowing they were well short of a super majority, they implored the GOP to delay the vote. Senator Lott replied that “this is what they have been clamoring for.”²⁸ With their victory assured, the GOP’s maneuver to suddenly bring the CTBT to a floor vote shows that the Senate, an institution of the state, failed to “pursue negotiations in good faith.” The neorealist unitary state does not accurately characterize a two-step U.S. adherence model where the executive negotiates a treaty and the U.S. Senate wields advice and consent powers. One interesting possible conclusion from the CTBT debate is that the obligation for states to enter into negotiations in good faith could be both complied with and breached by two different branches of the government.

On the second unconditional obligation of NWS, disarmament, the United States has generally complied with the text and spirit of the NPT. The greatest nuclear disarmament efforts have been bilateral agreements between the United States and Russia. The most obvious reason for this is that the vast majority of the world’s warheads and bombs reside with the former Cold War rivals. Every bilateral disarmament treaty with Russia has used the preamble to prominently proclaim that the action undertaken is mindful of their obligations under Article VI.²⁹ From the first Strategic Arms Limitation Treaty to the two START treaties, the former rivals have acknowledged their binding commitment to disarmament. Paragraph 5 of New START’s preamble states that through the limitation in de-

27. “Comprehensive Nuclear Test Ban Treaty,” *Inventory of International Nonproliferation Organizations and Regimes*, Center for Nonproliferation Studies.

28. Oliver Know, “U.S. Senate debate on nuclear test ban set for October 8,” *Agence France Presse*, October 2, 1999.

29. “Interim Agreement between the United States of America and the Union of Soviet Socialist Republics on Certain Measures with Respect to the Limitation of Strategic Offensive Arms,” *Federation of American Scientists*, <http://www.fas.org/nuke/control/salt1/text/salt1.htm>.

ployed warheads and delivery systems, the United States and Russia are “committed to the fulfillment of their obligations under Article VI.”³⁰

While the United States has made commendable progress toward reducing its nuclear posture from the Cold War heights, the last two U.S. presidents have approached the issue in contrasting ways. Less than four years removed from the 9/11 terrorist attacks, the Bush administration emphasized the nonproliferation pillar over its disarmament obligations at the 2005 NPT Review Conference. For instance, at the 2003 Preparatory Committee, the deputy U.S. representative articulated a literal interpretation of Article VI that does not bind the United States to “milestones.”³¹ This position was best evidenced by the U.S. effort to purge mention of one of the thirteen steps for Article VI implementation that were adopted at the 2000 Review Conference. Step 6 called for the “unequivocal undertaking by the nuclear-weapon States to accomplish the total elimination of their nuclear arsenals leading to nuclear disarmament to which all the States parties are committed under Article VI.”³² The Bush administration opposed their completion of the FMCT and CTBT, the two major policy aims commonly associated with Article VI compliance.³³ Negotiations on the FMCT at the Conference on Disarmament stalled when the administration objected to proposed on-site verification measures. And on the CTBT, President Bush stuck to his campaign position and chose to not resubmit the treaty to the Senate for ratification.³⁴

President Obama’s rhetorical support for disarmament is a clear departure from his predecessor. Obama reaffirmed the U.S. commitment to a “world without nuclear weapons” and signed the New START Treaty with Russia that reduced U.S. strategically deployed nuclear weapons to 1,550 from 2,100.³⁵ Coinciding with the 2010 NPT Review Conference, the Obama administration also made the unprecedented move to declassify the number of active nuclear weapons in the U.S. stockpile.³⁶ However, a series of unforeseen events have short-circuited President Obama’s Prague agenda. First, implementation of the New START Treaty has fallen prey to the Republican opposition, which argues that President Obama reneged on his pledge to fund the nuclear weapons complex at the level agreed to in the 1251 Report of the 2010 National Defense Authorization Act (NDAA). Second, Russia’s invasion of Crimea heightened fears of a reawakening of the Cold War and made strategic dialogue politically unworkable. The House of Representatives reacted with language in the FY 2015 NDAA that

30. “Treaty between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms [New START Treaty],” *U.S. Department of State*, <http://www.state.gov/documents/organization/140035.pdf>.

31. J. Sherwood McGinnis, “Remarks to the Second Session of the Preparatory Committee for the 2005 NPT Review Conference,” May 1, 2003, <http://www.State.gov/t/isn/npt/122735.htm>.

32. “2000 NPT Review Conference Final Document,” *Arms Control Association*, http://www.armscontrol.org/act/2000_06/docjun.

33. Wade Boese, “Bush Shifts Fissile Material Ban Policy,” *Arms Control Today*, September 2004, http://www.armscontrol.org/act/2004_09/FMCT.

34. “1992–2002: The United States and the CTBT,” *CTBTO Preparatory Committee Website*, <http://www.ctbto.org/the-treaty/developments-after-1996/1999-2002-the-united-states-and-the-ctbt/page-3-1999-2002-the-united-states-and-the-ctbt>.

35. “New START Treaty,” *U.S. Department of State*.

36. A conference call between senior Energy, State, and Defense Department officials occurred in May 2010 immediately following the April Nuclear Security Summit in Washington. The specific quantities of each warhead/bomb type remaining had not been declassified as of June 2014.

would restrict funds for the reductions mandated by the New START Treaty until Russia withdrew from Crimea, ceased its alleged violations of the Intermediate Nuclear Forces Treaty and implemented the Conventional Forces in Europe Treaty.³⁷ This episode is another instance of how Congress can complicate the “good-faith efforts” of the executive branch in meeting the “object and purpose” test of Article VI. The Nuclear Posture Review Implementation Study, released in July 2013, states that the United States could safely reduce its deployed stockpile to around 1,100 warheads.³⁸ However, Russia’s territorial ambitions and a U.S. Congress wary of unilateral actions mean that the United States may have a dearth of policy victories to highlight ahead of the 2015 NPT Review Conference.

Adding to the pessimism, the nonaligned movement has opened another front on disarmament through two conferences on the Humanitarian Consequences of Nuclear War. Born out of the 2010 Consensus Final Document that acknowledged “catastrophic humanitarian consequences that would result from the use of nuclear weapons,” the issue entered into the debate at the 2014 NPT Preparatory Committee setting the stage for a showdown in New York at next year’s Review Conference. Armed with no procedural tool to compel the P5 to hasten disarmament, the nonaligned movement has shifted the debate in order to delegitimize nuclear possession and use. They point to the fact that deliberate or inadvertent use makes nuclear weapons inconsistent with international humanitarian law’s *jus in bello* principles.³⁹ The United States and P5 boycotted the 2013 and 2014 conferences in Norway and Mexico, fearing they would shine an unhelpful spotlight on a “treaty on general and complete disarmament.” The nonaligned movement’s effort to devise new means to promote disarmament could exacerbate existing tensions with the P5. To offset this, the United States can take unilateral steps to show substantive progress on Article VI. First, the Obama administration should accelerate dismantlement of the approximately 2,500 retired warheads, which would come at relatively little political and financial cost.⁴⁰ Second, the Obama administration can formally axe plans to field the Long-Range Standoff Weapon. The U.S. Air Force is set to field the weapon on two stealth nuclear-capable bombers—the B-2 and the planned long-range strike bomber.⁴¹ As bombers are or will be designed to penetrate within an enemy’s defenses, a nuclear standoff weapon is not required, especially after the recent life extension of the air-launched cruise missile that will keep it in service until 2030.⁴² Canceling an expensive weapon system would serve as a

37. Congressman Doug Lamborn, “Protecting Military Religious Freedom, Prohibiting Funding for the New START Treaty, and more NDAA Amendments” (press release, May 22, 2014), <http://lamborn.house.gov/2014-press-releases/protecting-military-religious-freedom-prohibiting-funding-for-the-new-start-treaty-and-more-ndaa-amendments/>.

38. “FACT SHEET: Nuclear Weapons Employment Strategy of the United States,” *White House Fact Sheet*, June 19, 2013, <http://www.whitehouse.gov/the-press-office/2013/06/19/fact-sheet-nuclear-weapons-employment-strategy-united-states>.

39. Jenny Nielsen, “Jenny Nielsen: Nuclear disarmament—the humanitarian dimension,” *IISS Voices*, February 18, 2014, <http://www.iiss.org/en/iiss%20voices/blogsections/iiss-voices-2014-b4d9/february-72f2/humanitarian-disarmament-5ec5>.

40. Kristiansen and Norris, “US nuclear forces, 2014,” 85–93.

41. Jon Hemmerdinger, “USAF’s LRSO missile may reach IOC around 2030,” *FlightGlobal.com*, January 7, 2014, <http://www.flightglobal.com/news/articles/usaf39s-lrso-missile-may-reach-ioc-around-2030-394622>.

42. *Ibid.*

modest signal to NPT parties that the United States is reticent to add *new* nuclear capabilities and missions as part of its future modernization efforts.

Conclusion

Determining whether the United States has complied with Article VI of the NPT hinges upon how one characterizes those obligations. Adopting a strict interpretation of the NPT that disregards the ENDC negotiation records, the United States has met their unconditional commitments of pursuing good-faith negotiation on the “cessation of the nuclear arms race” and on disarmament. However, despite rhetoric to the opposite effect, the United States has not actively worked to fulfill what most scholars define as their conditional obligation, pursuing a treaty on “general and complete disarmament.” NNWS and critics of the U.S. “good faith” on disarmament believe that the intent behind the NPT Article VI, through observable metrics, should be factored into the compliance equation. NNWS have based their allegations of U.S. noncompliance on the fact that it defied the purpose of the NPT, which included the conclusion of the CTBT and the FMCT negotiations. The 1995 Principles Document rejected the narrow aspirational interpretation of Article VI.

Even in the absence of legal challenges, the United States has strong policy incentives to embrace the disarmament pillar. U.S. compliance with observable metrics in support of Article VI may not dissuade a state actor from developing a nuclear weapons program. However, the United States can build multilateral consensus against noncompliant states and defang attacks from NNWS by adopting a more expansive interpretation of their Article VI obligations. Negotiations on the alleged weapons dimensions of Iran’s nuclear program prove the enduring appeal of the “grand bargain” after forty-five years. First, a web of coercive United Nations Security Council and European Union sanctions leveled against Iran were assembled after President Obama’s rhetorical commitment to the disarmament pillar of the NPT in his first term. The hypothetical conclusion of a comprehensive solution between the P5+1 and Iran will show the linkage between the varied obligations of the NWS and the NNWS. In exchange for adoption of intrusive safeguards that would make a nuclear breakout more detectable and deterrable, an agreement will likely permit peaceful uranium enrichment activities and other assistance to a civilian program. Such an agreement would serve as a case study in how multilateral pressure can alter a state’s pursuit of a nuclear weapons capability and help unlock domestic opposition to further reductions. Conversely, a collapse of negotiations could result in the very cascade of proliferation President Kennedy predicted fifty years ago and make fulfillment of the NPT unobtainable. The global nuclear weapon stockpile may never dwindle to zero, but the NPT remains the most effective vehicle for such disarmament to occur.

Employment of Hypersonic Glide Vehicles: Proposed Criteria for Use

*Abel Olguin*¹

Hypersonic glide vehicles (HGVs) are a type of reentry vehicle that couples the high speed of ballistic missiles with the maneuverability of aircraft. The HGV has been in development since the 1970s, and its technology falls under the category of Conventional Prompt Global Strike (CPGS) weapons. As noted by James M. Acton, a senior associate in the Nuclear Policy Program at Carnegie Endowment, CPGS is a “missile in search of a mission.” With the introduction of any significant new military capability, a doctrine for use—including specifics regarding how, when, and where it would be used, as well as tactics, training, and procedures—must be clearly defined and understood by policymakers, military commanders, and planners. In this chapter, the benefits and limitations of the HGV are presented. Furthermore, proposed criteria and scenarios illustrate a possible method for assessing when the use of an HGV would be appropriate.

Introduction

HGVs, also known as boost-glide vehicles, are the next generation of conventional, long-range weapons. They are a type of reentry vehicle that couples the high speed of ballistic missiles with the maneuverability of aircraft.² The HGV has been in development since the 1970s, and its technology is one of many considered for CPGS weapons. As noted by

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2. Harry Kazianis, “The real military game-changer: Hypersonic weapons 101,” *Interpreter*, March 14, 2014, <http://www.lowyinterpreter.org/post/2014/03/14/Hypersonic-weapons-101.aspx>.

James M. Acton, a senior associate in the Nuclear Policy Program at Carnegie Endowment, CPGS is a “missile in search of a mission.”³

This chapter briefly describes the HGV development and its characteristics, and then presents the criteria from the literature as a possible method for determining conditions for the use of the HGV as a weapon are presented and augmented. Four scenarios illustrate possible HGV uses and associated issues.

Background on Hypersonic Glide Vehicles

As a reentry vehicle, an HGV is capable of aerodynamic lift and gliding to change the trajectory from ballistic to nonballistic, increase its range on reentry into the atmosphere,⁴ and provide it with the ability to maneuver. These vehicles are referred to as hypersonic because they can travel in the range of speeds labeled as hypersonic by the National Aeronautics and Space Administration (NASA): greater than Mach 5 but less than Mach 25.⁵ The HGV is considered a glide vehicle because after a rocket accelerates it to a desired speed, the rocket and HGV separate, and then the HGV travels unpowered to its target. The HGV is not a powered vehicle and thus cannot maintain a level flight at a constant speed and altitude; a glider in steady gliding flight is always descending relative to the air around it, thus exchanging altitude for maintenance of velocity.⁶

Two long-range HGVs have been under development since the early 2000s: the Hypersonic Technology Vehicle (HTV-2) and the Advanced Hypersonic Weapon (AHW). For the HTV-2, the range is 10,000 miles,⁷ the cross-range is about 3,300 miles,⁸ accuracy is a few meters (assuming GPS/INS navigation),⁹ and speed is Mach 20-plus.¹⁰ For the AHW, the range is 3,500 to 5,000 miles¹¹ (a 2014 flight test is scheduled for 4,000 miles),¹² the cross-

3. James M. Acton, *Silver Bullet? Asking the Right Questions about Conventional Prompt Global Strike* (Washington, DC: Carnegie Endowment for International Peace, 2013), 9, <http://carnegieendowment.org/2013/09/03/silver-bullet-asking-right-questions-about-conventional-prompt-global-strike/gkmp>.

4. “Boost-glide vehicle,” Answers.com, *McGraw-Hill Dictionary of Scientific and Technical Terms*, McGraw-Hill Companies, Inc., 2003, <http://www.answers.com/topic/boost-glide-vehicle>.

5. Kazianis, “Military game-changer: Hypersonic weapons.”

6. Thomas E. Beach, *TR-4 Model Rocket Technical Report Boost Gliders* (Penrose, CA: Estes-Cox Corp., 2012), http://www2.estesrockets.com/pdf/2266_TR-4_Boost_Gliders.pdf.

7. Acton, *Silver Bullet?*, 43.

8. Design dependent assumes a 3/1 ratio for range to cross-range; Jess Sponable, “Reusable Space Systems: 21st Century Technology Challenges,” (presentation, Defense Advanced Research Projects Agency, June 17, 2009), <http://nia-cms.nianet.org/getattachment/resources/Education/Continuining-Education/Seminars-and-Colloquia/Seminars-2009/Reusable-Space-Systems,-LaRC,-17-Jun-09.pptx.aspx>.

9. National Research Council, *U.S. Conventional Prompt Global Strike Issues for 2008 and Beyond* (Washington DC: National Academies Press, 2008), 7.

10. Guy Norris, “Review Board Sets Up to Probe HTV-2 Loss,” *AviationWeek*, August 11, 2011. <http://aviationweek.com/awin/review-board-sets-probe-htv-2-loss-0>.

11. Gunnar Arbman and Charles Thornton, “Russia’s Tactical Nuclear Weapons Part I: Background and Policy Issues,” (FOI-R—1057—SE), *Swedish Defence Research Agency* (November 2003), http://www.foi.se/ReportFiles/foir_1057.pdf.

12. Kisaq, LLC, *Advanced Hypersonic Weapon Flight Test 2 Environmental Assessment* (U.S. Army Space and Missile Defense Command, April 2014): 2–6, http://ahw-ft2-htt-ea.info/documents/HTT_FT02_Final%20EA_FONSI.pdf.

Table 1. General Characteristics of Hypersonic Glide Vehicles

<i>Hypersonic glide vehicle</i>	<i>Range</i>	<i>Cross-range</i>	<i>Accuracy</i>	<i>Speed</i>
Hypersonic Technology Vehicle (HTV)-2	16,000 km (10,000 mi)	5,300 km (3,300 mi)	Few meters	Mach 20-plus
Advanced Hypersonic Weapon (AHW)	5,600–8,000 km (3,500–5,000 mi)	1,900–2,700 km (1,200–1,700 mi)	< 10 meters	Mach 8

Sources and data for the HTV-2 are as follows: range: Acton, *Silver Bullet?* 43; cross-range: design dependent, assumes a 3/1 ratio for range to cross-range; Jess Sponable, “Reusable Space Systems: 21st Century Technology Challenges” (presentation, Defense Advanced Research Projects Agency, June 17, 2009), <http://nia-cms.nianet.org/getattachment/resources/Education/Continuining-Education/Seminars-and-Colloquia/Seminars-2009/Reusable-Space-Systems,-LaRC,-17-Jun-09.pptx.aspx>; accuracy: National Research Council, *U.S. Conventional Prompt Global Strike Issues for 2008 and Beyond* (Washington, DC: National Academies Press, 2008), 7; speed: Guy Norris, “Review Board Sets Up to Probe HTV-2 Loss,” *AviationWeek*, August 11, 2011, <http://aviationweek.com/awin/review-board-sets-probe-htv-2-loss-0>.

Sources and data for the AHW are as follows: range: Gunnar Arbman and Charles Thornton, “Russia’s Tactical Nuclear Weapons Part I: Background and Policy Issues,” (FOI-R—1057—SE), *Swedish Defence Research Agency* (November 2003), http://www.foi.se/ReportFiles/foir_1057.pdf; cross-range: same as HTV-2; accuracy: “Advanced Hypersonic Weapon (AHW),” *GlobalSecurity.org*, last modified November 17, 2011, <http://www.globalsecurity.org/military/systems/munitions/ahw.htm>; speed: Noah Shachtman, “2,400 Miles in Minutes? No Sweat! Hypersonic Weapon Passes Easy Test,” *Wired*, November 27, 2011, <http://www.wired.com/2011/11/2400-miles-in-minutes-hypersonic-weapon-passes-easy-test/>.

range is about 1,200 to 1,700 miles,¹³ accuracy is less than 10 meters,¹⁴ and speed is Mach 8.¹⁵ For a summary of these characteristics and their sources, see Table 1.

HYPERSONIC TECHNOLOGY VEHICLE

The vehicle known as HTV-2 was the primary focus of the HGV effort from 2003 until 2012.¹⁶ In 2004, the initial version of the HTV was known as the Common Aero Vehicle (CAV); the program was funded under the National Defense Authorization Act for FY2004.¹⁷ Two years later, the CAV program was restructured and redesignated as the HTV because of a congressional concern that other states might misinterpret the CAV as a nonconventional launch.¹⁸

Design flaws were discovered in the HTV in 2007. Its successor—HTV-2—was developed and then flight-tested twice in 2010–2011. The HTV-2 successfully separated from its booster in both tests, but the flights were terminated prematurely by the onboard flight-termination system. Though the main objective of reaching the target was not met, the tests were not considered total failures because valuable flight-test data was collected up to the point of flight termination. However, because of those two early flight terminations, the

13. Design dependent (see Footnote 8 of this chapter).

14. “Advanced Hypersonic Weapon (AHW),” *GlobalSecurity.org*, last modified November 17, 2011, <http://www.globalsecurity.org/military/systems/munitions/ahw.htm>.

15. Noah Shachtman, “2,400 Miles in Minutes? No Sweat! Hypersonic Weapon Passes Easy Test,” *Wired*, November 27, 2011, <http://www.wired.com/2011/11/2400-miles-in-minutes-hypersonic-weapon-passes-easy-test/>.

16. Acton, *Silver Bullet?*, 39–41.

17. Amy F. Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles*, 7-5700, R41464 (Washington, DC: Congressional Research Service, April 26, 2013), 20, <http://www.hsdl.org/?view&did=735886>.

18. *Ibid.*, 21.

HTV-2 program was restructured to a “risk reduction/technology maturation/test campaign program,” and funding shifted to the AHW program.¹⁹

ADVANCED HYPERSONIC WEAPON

The AHW, now the main focus of U.S. HGV development efforts, is a direct descendant and a scaled-up version of a previously tested system, the Sandia Winged Energetic Reentry Vehicle Experiment,²⁰ which was successfully tested three times between 1979 and 1985.²¹ Funding for the AHW increased from \$1.5 million in 2006, when it was considered as a risk-mitigation project, to approximately \$42 million in 2013,²² when it became the primary focus of U.S. HGV efforts. A successful test flight was launched in November 2011, by a Strategic Targets System booster from the Pacific Missile Range Facility in Hawaii; it impacted on the Reagan Test Site in Kwajalein Atoll about 2,500 miles away. A second AHW test, scheduled to take place in FY2014, will launch from the Kodiak Launch Complex in Alaska with an impact point at the Reagan Test Site, a distance of approximately 4,000 miles.

Trajectory Differences between Ballistic Weapons and Hypersonic Glide Vehicles

The trajectory of a ballistic weapon is fairly predictable after its powered phase because its movement is controlled by the laws of classic physics. An HGV, in contrast, is aerodynamically guided and can maneuver almost continually during its gliding phase, though any maneuvering reduces its range. Thus, while a ballistic weapon’s point of impact can easily be calculated after its powered phase, an HGV’s impact can be anywhere within its range. Figure 1 provides a comparison of the possible trajectories for a ballistic weapon and an HGV.

HGV Benefits and Limitations as Military Weapon

BENEFITS: SPEED AND MANEUVERABILITY

An HGV’s primary benefit is speed. Traveling at many times the speed of sound allows an HGV to reach any target within its range in under an hour. Its velocity also makes it extremely difficult to intercept, which greatly increases the chances of penetration of air defenses, even when an adversary is able to detect the launch and/or track it during flight.

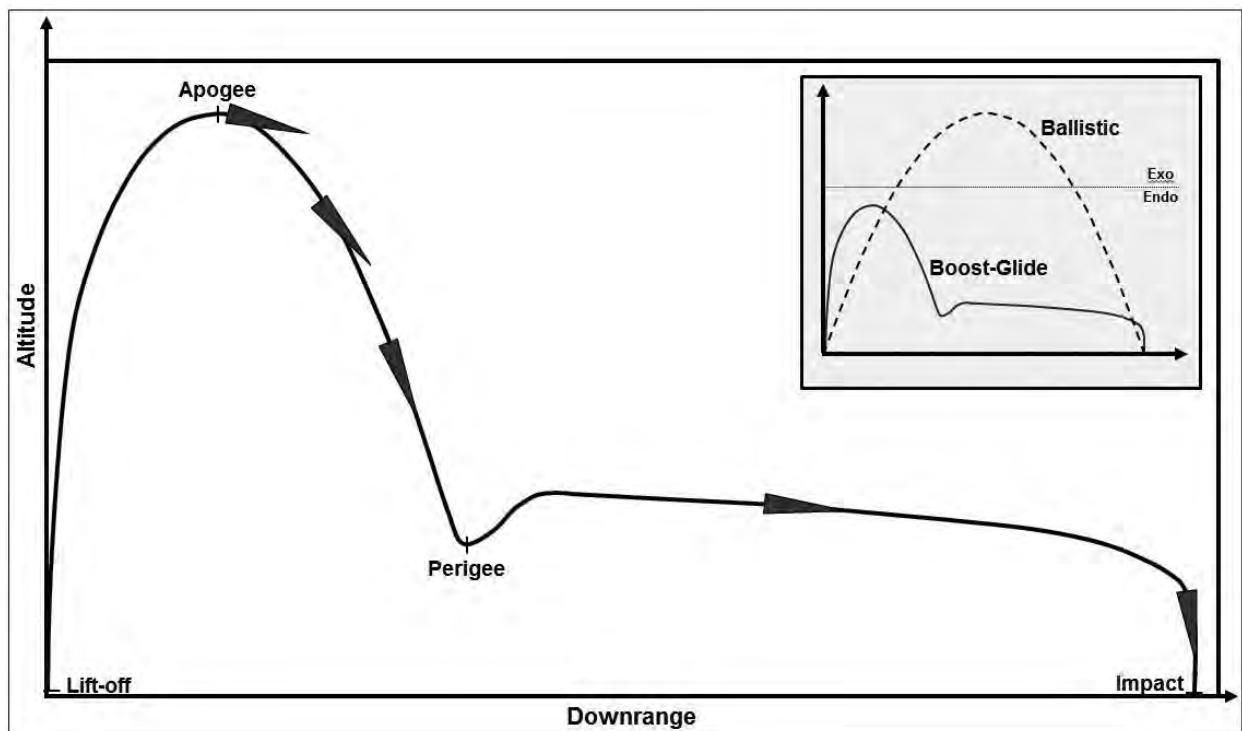
19. Acton, *Silver Bullet?*, 40.

20. *Ibid.*, 39–40, 47.

21. Kenneth W. Iliff and Mary F. Shafer, *A Comparison of Hypersonic Vehicle Flight and Prediction Results*, NASA Technical Memorandum 104313 (Edwards, CA: National Aeronautics and Space Administration, 1995), 7, <http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19960003513.pdf>.

22. Woolf, “Conventional Prompt Global Strike,” 19.

Figure 1. Comparison of Trajectories for Ballistic Weapon and HGV



Source: Debra G. Wymer, “Advanced Hypersonic Weapon Flight Test Overview to the Space & Missile Defense Conference” (presentation at Space & Missile Defense Conference, Huntsville, AL, August 2012), <http://www.smdc.army.mil/TechCenter/2013/PowerPoint/FINALAHWBriefToSMDConference081312.pptx>.

An HGV’s speed also compresses an adversary’s reaction time, assuming the launch is detected.

Another HGV benefit is maneuverability. Studies suggest that an HGV’s unpredictable maneuvering, like its speed, would help it penetrate advanced air defenses.²³ Even the U.S. antiballistic missile defense system, arguably the most advanced in the world given its overall success rate (80 percent as of October 2013),²⁴ has never been shown to hit a maneuvering target. A relatively safe conclusion, therefore, is that no nation at present could destroy a maneuvering HGV and likely would not be able to in the near future.

LIMITATIONS: TECHNOLOGY, NUMBERS, AND COST

The major technological limitation with respect to the HGV as a military weapon lies with material development related to extreme heat. At its travel speed, an HGV is subjected to extremely high temperatures—about 1,930°C (3,500°F).²⁵ To mitigate temperature effects,

23. National Research Council, *U.S. Conventional Prompt Global Strike Issues for 2008*.

24. Missile Defense Agency, *Ballistic Missile Defense Intercept Flight Test Record* (fact sheet, Fort Belvoir, VA: October 4, 2013), <http://www.mda.mil/global/documents/pdf/testrecord.pdf>.

25. Tariq Malik, “Death of DARPA’s Superfast Hypersonic Glider Explained,” *Space.com*, April 23, 2013, <http://www.space.com/15388-darpa-hypersonic-glider-demise-explained.html>.

customized high technology and expensive materials are required, which greatly increase the cost of the HGV. Assuming that the HGV can be developed to sufficiently withstand the heat throughout its attack path, other technical issues that must be considered include range, payload, accuracy, and guidance systems.

The small number of expected HGVs and the costs associated with them are also limitations. According to Acton, U.S. officials consider that the HGV and CPGS in general will be a niche capability,²⁶ and so the deployed numbers will remain relatively low (i.e., tens of units rather than hundreds). Two reasons explain these expectations. The first is strategic stability. Russia has expressed concerns about the CPGS program,²⁷ including a fear that it would provide the United States with the capability to launch a disarming first strike without crossing the nuclear threshold.²⁸ The second reason is cost. According to the Congressional Budget Office, AHW and HTV-2 are predicted to cost about \$26 million and \$36 million (in 2006 dollars) per unit respectively, not including development costs.²⁹

Proposed Criteria Regarding HGV Targets

Generally, when the use of the HGV is considered, the discussion focuses on limited scenarios or missions, such as counterterrorism, preemptive strikes, or retaliatory strikes. To broaden the focus, Amy Woolf of the Congressional Research Service has proposed basic criteria in the form of questions about weapon applicability that could be asked with respect to any scenario or mission instead of limiting the discussion to the scenarios noted above.³⁰ In concert with this approach, Woolf's questions are presented below, along with two additional questions: one proposed solely by the author and another proposed by the author in collaboration with James Acton.

1. Speed (promptness)

One reason cited frequently regarding the need for HGV development is that an HGV can reach any target in less than an hour if the target is within an HGV's range. This criterion specifically questions the necessity for such speed. For example: Is speed necessary? Is there a mobile target that will be temporarily stopped (e.g., a mobile missile preparing to launch)? Is there a terrorist target at a certain location for a limited period of time? Is it necessary to eliminate an enemy's offensive enablers before the enemy orders an attack against radars or Command and Control (C2) centers or before the enemy attacks assets to degrade U.S. war-fighting abilities (e.g., antisatellite weaponry)? Are there other reasons why the United States would require the speed of an HGV instead of using an alternate capability?

26. Acton, *Silver Bullet?* 49.

27. Woolf, "Conventional Prompt Global Strike," 29.

28. The Russians will still have a second-strike capability via their submarine-launched ballistic missiles. See Oscar Rickett, "We Asked a Military Expert How to Invade and Conquer Russia," *Vice.com*, March 4, 2014, http://www.vice.com/en_uk/read/we-asked-a-military-expert-how-to-invade-and-conquer-russia.

29. Congressional Budget Office, *Alternatives for Long-Range Ground-Attack Systems* (Washington, DC: March 2006), xv, <http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/71xx/doc7112/03-31-strikeforce.pdf>.

30. Amy Woolf, pers. comm.

2. Foresight

Some potential HGV targets must be attacked with as little warning as possible because of the potential for the target to be moved or launched (if it is a weapon). This possibility could be a concern with states that can detect launches or track missiles in flight, or when the United States believes the enemy may be warned of an incoming attack in time to move the target. In considering this criterion, the analysts would question whether the element of surprise would mean an adversary would not have time to move its potential assets or, if the target has an offensive capability, to use the weapon before being destroyed.

3. Enabling capabilities

Enabling any attack requires target detection, accurate target location information, appropriate weapon selection (depending on the goal), and battle damage assessment. Decisions regarding the use of a particular weapon are based on such variables. Target detection and accurate locations (including altitude, weather, lighting, and surrounding structures) are crucial.

The use of long-range missiles to deliver conventional weapons accurately enough to damage targets requires information that is more detailed than that needed for nuclear weapons or for conventional weapons delivered by aircraft or short-range missiles. The primary issues are related to the following: (1) C2 that reserves decisions to the National Command Authority, while delivering information to the weapon system quickly for a short overall execution time; (2) the provision of the information necessary for accurate weapon delivery to a specified aim point; (3) the accurate location of aim points; and (4) target detection.³¹

What type of enabling capabilities would be required when deciding to attack a particular target? What kinds of C2 capabilities are available? Will the decision to attack be made at the regional/local level, or must it come from the president? Who has the final say to launch the attack, and will he or she be available when needed? Will intelligence, surveillance, and reconnaissance assets/capabilities be in place and available to make the attack possible? What type of damage assessment is required, and how will it be accomplished (local human assets, satellite imagery, aerial photos, etc.)?

4. Alternative means

Four primary areas would affect whether an HGV or an alternative would be used for an attack: (1) target type (soft target, mobile target, hard and deeply buried target, etc.); (2) penetration of enemy airspace; (3) range; and (4) cost. When choosing to attack a target, the U.S. military must select the right tool for the job. Depending on final technical specifications, an HGV may—or may not—be able to follow a moving target, have enough energy to destroy the target (e.g., a hardened target), result in acceptable collateral damage, given the circumstances, or have the ability

31. National Research Council, *U.S. Conventional Prompt Global Strike Issues for 2008*, 51.

to penetrate the enemy's airspace because of air defenses. Another factor that must be taken into account is target location. If the target is too far inland or too far away from certain U.S. capabilities, an alternate attack mode must be chosen. And, as stated earlier, HGVs are likely to be niche weapons with a high unit procurement cost.³² This expense is expected to vastly limit their use only to scenarios that require an HGV's specific capabilities.

Alternative means of attacking a target could include drones, bombers, short-range systems, or special forces:

- *Drones.* Is there a drone in the area? Does a drone's payload have enough firepower to take the target out?

One of the most popular counterterrorism attack systems are unmanned aerial vehicles, commonly called drones. Since the war in Afghanistan started in 2001, drones have been heavily employed by the U.S. military, mainly for counterterrorism. Drones have the advantage of being able to loiter and look around the target's area. When a drone is used to attack a target, it can use onboard sensors and cameras for damage assessment and possibly launch a follow-on attack if the first one was not successful. Is there a drone nearby that could be used to attack the target? Would it be preferable to use a drone, whose attack can be seen by its operator, or use an HGV from up to thousands of miles away? Would the drone's firepower be sufficient to destroy the target, or would a larger weapon be needed to do the job?

- *Bombers.* Is a bomber close enough to be timely? Can it penetrate airspace (is a suppression package needed)? Can the attack wait until the bomber gets there?

Bombers can carry powerful bombs, and with aerial refueling they have virtually unlimited range. However, a bomber must fly over the target to drop its munitions and also is often too far away to be used at a moment's notice. If it is a time-sensitive target, it may take too long to get a bomber from as far away as Missouri to the target in time. Will the bomber be able to penetrate the airspace where the target is located or would a suppression package be needed if a bomber is chosen? Countries with some minor air defense capability may be able to shoot down a B-52, but it is more difficult to shoot down a B-1 or B-2 bomber.

- *Short-range systems.* Are there forces in the area? Can we use shorter-range systems such as cruise missiles or short-range missiles?

Does the United States have shorter-range weapons such as Tomahawk cruise missiles or army tactical missile systems in the area? Are they accurate enough to destroy the targets?

- *Special Forces.* Can we use special forces or other boots on the ground?

The United States has multiple military units trained for high risk missions, such as the Navy SEALs, which can be sent in to destroy targets. Typically, putting

32. Acton, *Silver Bullet?*, 49.

“boots on the ground” is a last resort for the United States because of the high risk of casualties.

5. Political enabling capabilities

If an HGV is considered a niche weapon, its use would likely be approved by presidential authorization only.³³ Thus, this question concerns the issues, especially political concerns, that the president would need to consider before ordering the launch of an HGV. For example, would a majority of the public support the attack? Will launching the attack be the opening salvo of a larger conflict? Because of its speed, will the shorter flight time of an HGV give the president more time to make a decision?

Four Potential Scenarios

This section provides four common attack scenarios to illustrate a method of determining whether to use an HGV or an alternate weapon. For every scenario, a brief response to each question posed above is presented. These responses are a simplified version of what would likely be a lengthy discussion regarding HGV use in an attack scenario and are presented only as examples.

SCENARIO 1: TERRORISM/COUNTERTERRORISM

Terrorism is typically the first mission that comes to mind when talking about potential CPGS and HGV usage scenarios. According to James Acton, terrorism was the easy thing to say publicly, but it is not the most important mission for CPGS.³⁴ One typical terrorist scenario might include a meeting of several terrorist leaders (or the knowledge of where a high-value leader will be), with the timing and location unknown until the last minute. Would this scenario be a good candidate for using HGVs?

1. Speed (promptness)

In a scenario in which the United States learns the location of a high-value terrorist or a meeting of terrorist leaders, speed may be required for various reasons. First, if the location and time are unknown until the target is in place, then the United States would want the attack to occur as soon as possible after the information becomes known. Terrorist meetings would be only as long as necessary, because terrorists understand that they are actively pursued and any gathering would be considered a target. Before an attack could be launched and assuming a relatively short meeting (an hour or less), the United States would need time to plot the location, verify the intelligence, assess the target, make the decision to attack, and provide enough time for commander authorization. The speed of an HGV potentially allows more time for

33. National Research Council, *U.S. Conventional Prompt Global Strike Issues*, 65; for a larger campaign or full-scale war, presidential authorization would likely be delegated to a local combatant commander.

34. James M. Acton, pers. comm.

the preliminary actions while still being able to attack the intended target before the meeting ends. In this scenario, weapon speed would be an advantage.

2. Foresight

A surprise attack is necessary with regard to targeting a terrorist meeting. HGVs would be a good fit for this situation because few states can detect an HGV launch and therefore would be unable to warn any terrorist group with which they are aligned of the pending attack, thus increasing the potential for surprise. If the attack is not a surprise, the terrorist(s) may move or cancel the meeting to thwart the attack.

3. Enabling capabilities

Where there is a large U.S. military presence, such as the Middle East or Afghanistan, enabling capabilities may already be in place or located nearby. In other parts of the globe, the required enabling capabilities may not be available. The answer to this question may be the deciding factor as to which weapon to utilize.

4. Alternative means

Similar to the response to enabling capabilities, the United States will likely have an alternative means to attack the target if it is located in a region with a large U.S. military presence.

- *Drones.* The U.S. military operates drones in many parts of the world; it is likely a drone would be near the target site. If the drone has sufficient firepower to achieve the goal (e.g., destroy the target), it would be preferable to an HGV because it can loiter in the area, gather intelligence, and possibly also assess battle damage.
- *Bombers.* Unless bombers are positioned nearby, they likely are not an option for attacking a time-critical target. On the other hand, terrorist groups tend to have a large presence in lawless areas or areas with little to no government control, so terrorist targets are not likely to be located in an area with a heavily defended airspace. Therefore, it may be possible to position the bomber near the target, if it were chosen.
- *Short-range systems.* If short-range systems are in the area, their use would be preferable to using an HGV because they are likely to be much cheaper and already have enabling capabilities located nearby.
- *Special forces.* Unless the target is extremely valuable, special forces or similar forces are not likely to be used because of the high risk of casualties. Osama bin Laden is the prime example of an extremely valuable target; the United States may have sent special forces to ensure proof of bin Laden's capture or death since an air strike would have destroyed that evidence.

5. Political enabling capabilities

The U.S. public historically has strongly supported an attack against terrorists when located, as have other states. Political fallout would occur only if the attack were to

cause widespread collateral damage, kill many civilians, or be a large and secretive operation.

As seen in the bin Laden raid, violating another nation's borders/sovereignty is highly politically sensitive. The United States has repeatedly crossed into other nations' territories (on the ground or in the air) to attack terrorist targets (Pakistan, Afghanistan, Yemen, Somalia, etc.). These actions have had the effect of straining relationships with some of these countries and negatively influencing the perception of the United States by those nations' citizens. Attacking terrorists within these nations' borders through the air (drones, cruise missiles, etc.) appears to have fewer political repercussions than putting U.S. boots on the ground. The United States has historically chosen to accept these consequences in order to destroy the target because these nations typically are not close allies, are adversaries, or the political fallout is expected to be minimal.

Conclusion to Scenario 1

HGVs are not expected to be used against terrorist targets because alternative means are generally available in this scenario. Also, if the target is moving (such as in a vehicle), HGVs are unlikely to be able to track and destroy it.

SCENARIO 2: A ROGUE NATION THREATENS TO USE WEAPONS OF MASS DESTRUCTION AGAINST THE UNITED STATES

In this scenario, a rogue state is threatening to use weapons of mass destruction (WMDs) against the United States or the United States believes that WMD use is imminent.³⁵ In response, the United States decides to strike preemptively. The attack options are to either attack the WMD source directly, given a known location, or choose to render the country's leadership or C2 powerless to launch the attack.

1. Speed (promptness)

If the United States believed that a WMD launch were imminent, an attack would be required as quickly as possible so the rogue nation would be unable to launch its weapon. If the United States needs to locate the target, the speed of an HGV also potentially allows more time for target location and the decisionmaking process. In this scenario, weapon speed would be an advantage.

2. Foresight

Preemption of a rogue state's launch must be a surprise. Without surprise, the WMD could be moved or hastily launched. If the attack in this scenario were against the rogue state's leadership, the attack must be a surprise to prevent its leadership from dispersing or hiding.

35. Woolf, "Conventional Prompt Global Strike," 65; Acton, *Silver Bullet?*, 26.

3. Necessary enabling capabilities

At present, North Korea and states in the Middle East are considered to be rogue states. The United States has a heavy presence in South Korea and the Middle East, so the enabling capabilities currently are near the likely targets.

4. Alternative means

Similar to the response to enabling capabilities, the United States will likely have an alternative means to attack the target if it is located in an area with a large U.S. military presence.

- *Drones.* Most, if not all, countries that possess WMDs have operational air defense systems. Drones are usually highly susceptible to being shot down and so would likely not be a viable alternative to an HGV.³⁶
- *Bomber.* A nonstealth bomber (e.g., B-52) would be susceptible to the same air defense systems as a drone unless defense suppression operations were also conducted. The problem is that the element of surprise would be lost unless the suppression operations and the actual attack occurred in quick succession. Also there would be the need to confirm a clear path for the bomber or risk having it shot down. The B-2 (stealth) bomber fleet, stationed in Missouri, would likely be too far for a timely operation in this time-critical scenario.
- *Short-range systems.* Depending on target location, short-range systems might be preferable to an HGV. A cruise missile can be an attractive alternative if the target location is known and because it is harder to detect given its low flying altitude. On the other hand, short-range systems may be too far away to be effective.
- *Special forces.* It is possible, though very unlikely, that special forces would be used in this scenario if the evidence was indisputable and there was no other way to reach the target in time. Because using special forces would be extremely risky, with a high potential for casualties, and because the target is likely well defended/protected, their use is not likely.

5. Political enabling capabilities

Nearly indisputable evidence of an imminent WMD launch would likely be required before the U.S. public would accept a U.S. attack for fear of getting entangled in a new conflict. Given relatively recent history—such as the 1998 cruise missile attack on the Al-Shifa pharmaceutical factory in Somalia thought to be producing chemical weapons³⁷ or the United Nations' inability to find WMDs prior to the 2003 Iraq war³⁸—and the current political landscape, political enablement would likely not be

36. A. Rafay, comment on Abdul Q. Khan, "U.S. drone can be shot down by Hamza missile: Dr. A. Q. Khan," Pakistan Defence (Forum), June 7, 2012, <http://defence.pk/threads/us-drone-can-be-shot-down-with-hamza-missile-dr-aq-khan.185526/>.

37. Michael Barletta, "Chemical Weapons In the Sudan: Allegations and Evidence," *Nonproliferation Review* 6, no. 1 (fall 1998): 115–136, <http://cns.miis.edu/npr/pdfs/barlet61.pdf>.

38. Walter Pincus and R. Jeffrey Smith, "Official's Key Report on Iraq Is Faulted," *Washington Post*, February 9, 2007, <http://www.washingtonpost.com/wp-dyn/content/article/2007/02/08/AR2007020802387.html>.

available now or in the near future. However, these conditions may be different when HGVs are fielded in the early to mid-2020s.³⁹ According to General Michael Hayden, former director of the Central Intelligence Agency (CIA), the CPGS mission will “require ‘very convincing intelligence’ before any attacks occur.”⁴⁰

Conclusion to Scenario 2

The potential to use HGVs depends highly on the details of the situation and also if alternatives such as short-range systems or special forces are more attractive. Political repercussions would also have to be weighed in any decision to use HGVs against rogue nations, given recent history.

SCENARIO 3: ANTI-ACCESS/AREA DENIAL CAPABILITIES

Anti-access and area denial (A2/AD) are modern terms referring to war-fighting strategies intended to prevent an opponent from operating military forces near or in a contested region.⁴¹ Examples of A2/AD systems range from past war systems, such as trenches and land mines, to modern capabilities such as antiship or cruise missiles designed to keep a fleet far from a country’s coast.

In this scenario, an attack on A2/AD capabilities would be a preemptive strike from afar (out of the range of the target nation’s A2/AD systems) with the goal of subduing the enemy’s defenses. Attacking an enemy’s A2/AD capabilities would likely be the leading edge of a much larger attack and also would signal involvement in a larger conflict. Many states, including China, Russia, Syria, Iran, North Korea, Pakistan, and others, possess or will likely have A2/AD systems in the near future, as well as a reasonably high probability of military conflict with the United States.

1. Speed (promptness)

Attacking an enemy’s A2/AD capabilities quickly is necessary so the enemy does not have time to react to the attack. Slower systems, such as cruise missiles, could be detected well before reaching the target, giving the enemy a chance to either launch its attack/counterattack or try to destroy the incoming missiles. An HGV’s speed would be valuable should an enemy possess sophisticated air defenses; interception of an HGV attack would be nearly impossible, even if detected.⁴² Assuming detection, the enemy would have less than 30 minutes to assess the incoming attack and respond, which can be a time-consuming process in a military system with a multilayered chain of command.

39. Acton, *Silver Bullet?*, 50.

40. Woolf, “Conventional Prompt Global Strike,” 4.

41. Sam J. Tangredi, “A2/AD and Wars of Necessity,” *National Interest Blog*, December 8, 2013, <http://nationalinterest.org/commentary/a2-ad-wars-necessity-9524>.

42. Aaron Mehta, “USAF Sees Speed as Part of the A2/AD Solution,” *AirForceTimes.com*, September 19, 2013, <http://www.airforcetimes.com/article/20130919/NEWS04/309190023/USAF-Sees-Speed-Part-A2-AD-Solution>.

2. Foresight

A surprise attack is valuable especially if the situation is escalating and the conflict has not yet begun. A surprise attack could be the leading edge of a larger attack. Without the element of surprise, the enemy could launch its systems before being hit or, when possible, move them. If the conflict were already well under way, the enemy would likely assume its A2/AD capability would be targeted and respond accordingly.

3. Necessary enabling capabilities

An effective A2/AD system would likely push the necessary enabling capabilities hundreds of miles offshore or away from the engagement zone, thus keeping the enabling capabilities from being available for the initial attack.

4. Alternative means

An A2/AD system by definition is meant to keep enemies at a distance. Area penetration may be difficult if the adversary's A2/AD capabilities keep U.S. weaponry farther out than its range.

- *Drones.* Even assuming a drone is stationed nearby, it would have difficulty penetrating the airspace around an A2/AD target; also, it likely would not have enough firepower to sufficiently destroy the target. While the loitering of a drone is an advantage for a terrorist target, it is a disadvantage against an enemy with sophisticated air defenses.
- *Bombers.* Adversaries with A2/AD systems likely have robust air defense systems, either as part of the A2/AD capabilities or as a separate system. These conditions make penetration by plane difficult. To get a bomber close enough, the United States would have to destroy air defenses on its path and around the target. A bomber could also use standoff weapons, such as cruise missiles, to stay out of air defense range, but the range of such weapons may not be sufficient to reach the intended target.
- *Short-range systems.* These systems are likely not an option because A2/AD systems would keep U.S. forces out of range, at least at the beginning of a conflict.
- *Special forces.* Special forces or similar forces are not likely to be used because of the high risk of casualties. Also, in recent U.S. wars and conflicts, a heavy bombing campaign has preceded putting large numbers of boots on the ground.

5. Political enabling capabilities

For political enablement to launch an attack that would likely lead to a war, the target nation has to have harmed the United States, its interests, or its people sufficiently to necessitate a war. A mutual defense agreement may not be enough to get the public's approval because of U.S. exhaustion after over 10 years of continuous war.

Conclusion to Scenario 3

HGVs have a high likelihood to be used against A2/AD targets because in many places, other weapon systems cannot be used without significant risk of loss of life or risk of losing the element of surprise.

SCENARIO 4: ANTI-SATELLITE WEAPONRY

Anti-satellite (ASAT) weapons are designed to disable or destroy satellites, typically for military purposes. The United States relies heavily on satellites to enable its war-fighting capabilities; they are attractive targets for an enemy who wants to degrade U.S. ability to conduct wars. The United States, China, Russia, India, and Israel are known to have attempted to develop or acquire an ASAT system.⁴³ In this scenario, HGVs would be used against ASATs either as a preemptive strike to prevent an enemy from destroying a U.S. satellite or as a retaliatory strike after an enemy has already destroyed a satellite and to prevent the adversary from damaging or destroying more satellites.

1. Speed (promptness)

In both preemptive and retaliatory strike scenarios, speed would be required. If the attack is preventive, speed is necessary to destroy as many enemy ASAT assets as possible before they can be utilized. Should an enemy detect the launch of the HGV, it has 30 minutes or less to activate, target, and launch its ASAT systems. If the HGV attack is retaliatory, speed is necessary to destroy ASAT systems that have not yet been launched to prevent further ASAT attacks. For countries such as China that likely have—or will have—located its ASAT weapons deep within its borders, an HGV would be the best method. Alternate weapons, such as cruise missiles, would take hours to get there, giving the target nation time to launch its weapons.⁴⁴

2. Foresight

This scenario requires a surprise attack, especially given a preemptive strike. In an escalating situation in which the United States believes war cannot be averted, a surprise preemptive strike could be launched to ensure the enemy cannot destroy critical U.S. satellites. Without the element of surprise, the enemy could decide to launch or move/reposition its ASAT weapons before the United States can destroy them.

43. United States: “US missile hits ‘toxic satellite,’” *BBC News*, February 21, 2008, <http://news.bbc.co.uk/2/hi/science/nature/7254540.stm>; China: Marc Kaufman and Dafna Linzer, “China Criticized for Anti-Satellite Missile Test,” *Washington Post*, January 19, 2007, <http://www.washingtonpost.com/wp-dyn/content/article/2007/01/18/AR2007011801029.html>; Russia: Michail Fomichev, “Russian officer says developing new weapon for space defense,” *RIA Novosti*, May 15, 2010, <http://en.ria.ru/russia/20100515/159029349.html>; India: Peter J. Brown, “India targets China’s satellites,” *Asia Times*, January 22, 2010, http://www.atimes.com/atimes/South_Asia/LA22Df01.html; Israel: Barbara Opall-Rome, “Arrow-3 Could Be Adapted for Anti-Satellite Role,” *Space News International* 20, no. 44 (2009): 16.

44. Phillip C. Saunders and Charles D. Lutes, “China’s ASAT Test Motivations and Implications,” *Joint Force Quarterly* 46, no. 3 (2007): 39–45.

3. Necessary enabling capabilities

In an ASAT attack, the availability of enabling capabilities will depend on target location. For nations with a large landmass, such as Russia and China, the ASAT assets would be positioned far inside their borders, so local enabling capabilities will likely be too far to support alternative means of attacks.

4. Alternative means

When considering an attack of ASAT capabilities in Russia and China, range is a very important factor because the ASATs are likely to be located far inland. Alternative means of attacking an ASAT target may not be feasible, as described below.

- *Drones.* Drones would probably have difficulty penetrating an enemy's ASAT weapon airspace, and they may not have enough firepower onboard to incapacitate or destroy the target. For Chinese or Russian targets, drones likely will not have the range necessary.
- *Bombers.* An enemy with robust air defenses and ASAT capabilities will likely keep bombers out of its airspace, so bombers would not be effective. Weapon range may be an issue for standoff weapons, especially if the ASAT weapons are located deep within a country's boundaries.
- *Short-range systems.* Short-range systems may be an option against geographically small nations but would not have the necessary range against countries such as China or Russia that could deploy ASAT weapons deep within their borders.
- *Special forces.* Special forces or similar forces are not likely to be used, at least until the risk of loss of life is reduced. In the past, the United States has preceded large-scale deployment of ground forces with a heavy bombing campaign.

5. Political enabling capabilities

Similar to the A2/AD scenario, political enablement will only occur if the target nation has harmed the United States, its interests, or its people sufficiently to necessitate a war. A mutual defense agreement may not be enough to gain approval from the public.

Conclusion to Scenario 4

An HGV is likely to be used against ASAT targets. It may be the only means to attack in many cases, especially when outside the range of a cruise missile or shorter-range systems. HGV use would also benefit when air defense penetration is difficult or not assured.

Summary

HGVs are the next generation of conventional, long-range weapons. Under development since the 1970s, advances in HGVs are currently being pursued under two separate programs: HTV and AHW. Since late 2012, the AHW has been the main focus of U.S. HGV

Table 2. Summary of Responses per Example Scenarios

<i>Criteria</i>	<i>Scenario</i>			
	<i>Terrorism/ counterterrorism</i>	<i>Rogue nations</i>	<i>A2/AD capabilities</i>	<i>Anti-satellite weaponry</i>
Speed (promptness)	Yes	Yes	Yes	Yes
Foresight	Yes	Yes	Yes	Yes
Enabling capabilities	Depends on target location	Likely yes	Not available	Depends on target location
Alternative means	Yes	Likely yes	Not available	Likely no
Political enabling means	Yes, unless widespread collateral damage, etc.	Nearly indisputable evidence of WMD required	War	War
Conclusion	Not likely	Case-by-case	Likely	Likely

development efforts, with HTV-2 restructured into a risk-reduction and technology-maturation program.

HGVs are different from current long-range conventional weapons because they combine the speed of ballistic missiles with the maneuverability of aircraft, which gives them unparalleled speed, agility, and range. These combined traits greatly increase the likelihood of an HGV penetrating enemy air defenses. Limitations of HGVs include technological issues (materials, range, payload, accuracy, and guidance), small production numbers (tens of units), and cost (\$26–\$36 million per unit in 2006 dollars, not including development costs).

Five criteria are considered in this chapter as a method of assessing whether an attack scenario would be a good candidate for the use of an HGV. The criteria are applied to four common scenarios. As seen in Table 2, HGV use would be likely in an attack against A2/AD capabilities or ASAT weapons, given its capabilities and the undesirability of other options. Use of an HGV against rogue nations would depend on scenario specifics; an HGV would likely not be used to attack a terrorist target. Based on these examples, the proposed methodology can provide guidance regarding appropriate use of an HGV.

With the introduction of any significant new military capability, a doctrine for use should be defined and understood. The proposed criteria and four scenarios illustrate a possible method for assessing when to use an HGV. Although HGV targeting initially may be limited, such as with A2/AD and ASAT targets, the method can be applied to future consideration of additional scenarios that might benefit from the HGV's unique combination of speed, range, and maneuverability.

A Perfect Record: Assessing Risk and the Human Factor in Avoiding Nuclear Catastrophe

*Elise Rowan*¹

Despite a number of close calls and accidents involving nuclear weapons and warheads throughout the nuclear age, there has never been an accidental detonation of a nuclear warhead or an unauthorized, accidental, or miscalculated launch of a nuclear weapon. Robust safety and security technologies, policies, and procedures have been developed and refined over time to prevent such a catastrophic event, but the risk can never be fully eliminated. Risk assessment techniques are used to certify that U.S. nuclear weapon systems meet a set of qualitative and quantitative criteria, supporting their continued deployment. There are a number of challenges to assessing the risk of an event that has never before happened, including a limited pool of data to draw from, the difficulty of considering all possible failure scenarios, and the fact that risk assessments are subjective. The complicated “human factor”—the role of human error, performance, and judgment—may not be adequately considered in U.S. nuclear weapon risk assessments. The information available on U.S. risk assessments is limited, reflecting the sensitive nature of nuclear weapon-related information and provides limited assurance available to the public that the risk of a catastrophic nuclear weapons incident is low.

Introduction

In the 70 years since the beginning of the nuclear age, a nuclear warhead has never accidentally detonated or been launched without authorization, by accident, or as a result of miscalculation, despite a number of close calls.

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Catastrophic nuclear weapon incidents are considered to be low-probability, high-consequence events. Despite an impressive safety record and the implementation and refinement of safety and security protocols over time, the risk of an incident can never be completely eliminated. Indeed, there is a first time for every event.² Can this extraordinary record hold, or is it just a matter of time before human or system error gives way to catastrophe? And how sure can we be that we understand the risk effectively enough to mitigate it?

A former U.S. Air Force chief of staff once said, “The possibility of a launch of an ICBM [intercontinental ballistic missile] without the president’s authorization is as close to zero as anything I can imagine.”³ On the other hand, former secretary of defense Robert McNamara and one of his successors, William J. Perry, have both highlighted the role of luck in the history of nuclear nonuse since 1945.⁴

This chapter provides a definition of risk and focuses on strategies used to assess the risk of catastrophic incidents involving nuclear weapons in the United States, including probabilistic risk assessment (PRA). Special attention is paid to the human factor—the role of human error, performance, and judgment—in the nuclear weapons enterprise. Finally, the broad outlines of U.S. risk assessment practices are described, with a particular focus on how the United States incorporates the human factor in its nuclear weapon risk assessments. Recent personnel issues and safety and security lapses within the U.S. Air Force’s ICBM and bomber forces illustrate why the human factor should not be overlooked.

Information about nuclear weapon safety assessments, procedures, and practices is extremely sensitive, and most information about these details in the United States is classified. A number of sources have suggested that the practices followed to assess civil nuclear risk mirror those on the weapons side, making civilian nuclear risk assessments—for which there is more publicly available information—a useful proxy.⁵ Valuable insights are also drawn from expertise and experience in other high-risk fields that use similar risk assessment techniques.

Catastrophic Nuclear Weapon Incidents: A Proposed Definition

This analysis focuses on the range of potential scenarios leading to nuclear yield not ordered by the requisite authority or ordered on the basis of inaccurate or misinterpreted

2. Scott D. Sagan, *The Limits of Safety: Organizations, Accidents, and Nuclear Weapons* (Princeton, NJ: Princeton University Press, 1993), 12.

3. *Ibid.*, 248.

4. *The Fog of War*, directed by Errol Morris (Culver City, CA: Columbia TriStar Home Entertainment, 2004), DVD; William J. Perry, interview by Ben Goddard, January 26, 2008.

5. Christopher Stubbs, “The Interplay between Civilian and Military Nuclear Risk Assessment, and Sobering Lessons from Fukushima and the Space Shuttle,” in *The Nuclear Enterprise: High-Consequence Accidents: How to Enhance Safety and Minimize Risks in Nuclear Weapons and Reactors*, ed. George P. Shultz and Sidney D. Drell (Stanford: Hoover Institution Press, 2012); Stacey Hendrickson and Stacey Durham, Sandia National Laboratories, telephone interview by Elise Rowan, July 30, 2014.

information. This includes an accidental detonation of a nuclear warhead, an unauthorized launch, an accidental launch, or an authorized launch based on miscalculation (e.g., a false warning of an attack). This list of potential incidents is based largely on accounts of “near misses” that did not result in nuclear yield but could have under slightly different circumstances. These categories cut across a range of possible safety- and security-based failure scenarios. The section below describes the range of potential incidents considered and brief historical anecdotes or notional examples of each.

ACCIDENTAL DETONATION

An accidental detonation is the detonation of a warhead due to warhead component malfunction. The warhead may be mated with a delivery vehicle or separate, and it occurs without the input signals required to arm, fuse, and fire a nuclear warhead.⁶ This can be classified as a failure of one or more safety features, perhaps due to exposure to “extreme environmental insult,” including fire, crush, or shock or to conditions that imitate deployment.⁷ In the United States, the range of the potential environments to which a nuclear weapon might be exposed is detailed for each weapon system in a classified stockpile-to-target sequence (STS) document.

Almost all historical examples of close calls in this category occurred in the early decades of the nuclear age, when concerns in the United States about the weapons’ effectiveness under deployment trumped safety. In 1961, a B-52 bomber flying airborne alert broke apart in midair and dropped two hydrogen bombs over Goldsboro, North Carolina. One of the bombs sustained nominal damage. On the other bomb, one safety switch broke during the crash and two became incapacitated when the aircraft broke apart. There were four switches total. A single safety switch prevented the bomb from detonating.⁸ In the late 1960s, after a series of additional plane crashes involving nuclear weapons, the United States abandoned “Continuous Airborne Alert,” a doctrine that kept U.S. nuclear weapons ready to launch from the air for 29 years.⁹

UNAUTHORIZED LAUNCH

An unauthorized launch refers to “deliberate launching or releasing of a nuclear missile or bomb (except jettisoning) before execution of an emergency war order.”¹⁰ An unauthorized launch might occur at the hands of an insider from the nuclear weapons establishment who does not have the proper authority to execute an order to launch a nuclear weapon, or

6. R. E. Kidder, *Report to U.S. Congress: Assessment of the Safety of U.S. Nuclear Weapons and Related Nuclear Test Requirements* (Livermore, CA: Lawrence Livermore National Laboratory, 1991), D-2, <http://www.fas.org/resource/08062004142243.pdf>.

7. David W. Plummer and William H. Greenwood, “The History of Nuclear Weapon Safety Devices” (paper submitted at Joint Propulsion Conference, American Institute of Aeronautics and Astronautics, 1998), 1.

8. Ed Pilkington, “US nearly detonated atomic bomb over north carolina—secret document,” *Guardian*, September 20, 2013, <http://www.theguardian.com/world/2013/sep/20/usaf-atomic-bomb-north-carolina-1961>.

9. “SAC Airborne Alert,” *National Museum of the United States Air Force*, <http://web.archive.org/web/20090114035353/http://www.nationalmuseum.af.mil/factsheets/factsheet.asp?id=1851>.

10. *Department of Defense Nuclear Weapon System Safety Manual*, U.S. Department of Defense, Number 3150.02, January 31, 2014, <http://www.dtic.mil/whs/directives/corres/pdf/315002m.pdf>.

it could be the result of an external actor. An unauthorized launch is initiated by intent and may stem from malfeasance.

There are no known examples of close calls in this category, though there have been cases involving the so-called insider threat in the area of nuclear materials security. A *Worst Practices Guide to Insider Threats* by Matthew Bunn and Scott Sagan, illustrates a number of dangerous assumptions that can be applied to a nuclear weapons context, including the beliefs that background checks are foolproof and organizational culture and employee disgruntlement will not negatively impact the mission.¹¹

ACCIDENTAL LAUNCH

Also called an “inadvertent launch,” an accidental launch is probably the most unlikely of the potential incidents considered and would most likely happen by way of nature, human error, or system or component failure.

The 1980 incident at Damascus, Arkansas, profiled in detail in *Command and Control* by Eric Schlosser, illustrates a variation of this incident type. Though not technically a launch, the accident happened when a technician dropped a wrench that punctured a liquid-fueled Titan II missile. The missile was ejected from its silo, and the warhead landed on a nearby roadside.¹² Fortunately, the weapon did not detonate.

MISCALCULATED LAUNCH

A miscalculated launch may be ordered rationally and follow procedure perfectly but is ultimately deemed a mistake. In this case, an order to launch could be based on misinformation, misinterpretation, or misjudgment, perhaps due to rushed decisionmaking as a result of the limited time available for the president (in the case of the United States) to respond to indications of a nuclear first strike.

Had events unfolded differently, a 1979 incident in which a training tape was mistaken for a massive incoming Soviet attack and a 1980 close call in which a computer chip malfunctioned and showed incoming Soviet missiles would have fallen into this category.¹³

A miscalculated launch could also take place as a result of a confluence of events in a tense political environment. Events during the Cuban Missile Crisis illustrate the potential for miscalculation. Throughout the 13-day crisis, when tensions between the United States and the Soviet Union were at an all-time high, a number of provocative events took place that could have led either side to believe its adversary was escalating or even launching a nuclear war. A planned test of an ICBM at Vandenberg Air Force Base took place as

11. Matthew Bunn and Scott D. Sagan, *A Worst Practices Guide to Insider Threats: Lessons from Past Mistakes* (Cambridge, MA: American Academy of Arts and Sciences, 2014).

12. Eric Schlosser, *Command and Control* (New York: Penguin Press, 2013).

13. For more on these incidents and other close calls, see Patricia Lewis et al., *Too Close for Comfort: Cases of Near Nuclear Use and Options for Policy* (London: Royal Institute of International Affairs, 2014), <http://www.chathamhouse.org/publications/papers/view/199200>; and Schlosser, *Command and Control*.

scheduled. A series of false warnings from radars detected indications of Soviet nuclear weapons launched from Cuba, and a U.S. U-2 spy plane mistakenly crossed from Alaska into Soviet airspace, resulting in a 300-mile chase by Soviet fighter planes. Coincidentally, the Alaskan U-2 incident occurred the same day another U.S. U-2 was shot down over Cuba, a move not ordered by centralized leadership in Moscow or Havana.¹⁴ These incidents illustrate the array of actors, aside from the central leadership in Washington, who have responsibility over nuclear weapons in some capacity in the United States.

Defining and Measuring Risk

Before we can conceptualize the risk of a catastrophic nuclear weapon incident, it is essential to first understand what is meant by “risk.” According to scholars Stanley Kaplan and B. John Garrick, risk is the probability of a scenario occurring combined with the consequences of that scenario. It involves both uncertainty and the possibility of damage or loss.¹⁵ Three fundamental questions are used to assess risk:¹⁶

1. What can happen? (i.e., What can go wrong?)
2. How likely is it that it will happen?
3. If it does happen, what are the consequences?

To assess these questions and measure risk in complex systems where the data pool of events is small or even zero, such as with nuclear weapons, PRA is useful. PRA breaks down a complex system into subsystems and components for which there are data (or data can be extrapolated from models when data does not exist) to estimate the occurrence of a range of potential failures that could lead to an accident. PRA combines those scenarios to form an overall judgment about the integrity of a system.¹⁷ Data from subsystems may come from component tests or judgments about the likelihood of an operator following a procedure according to protocol. Fault trees break down components, tasks, or procedures into a diagram, using data to assign a statistical probability to each possible outcome. A fault tree begins with an overall outcome—either a successful operation or failure—and elements that contribute to that outcome are shown underneath to demonstrate how a particular outcome might happen.¹⁸ Event trees are also used in PRA to profile the potential consequences of an initiating event, and possible outcomes and consequences are recorded based on a variety of potential intervening actions listed within the pyramid.

14. Sagan, *Limits of Safety*, 78–80, 122–134, 135–140.

15. Stanley Kaplan and B. John Garrick, “On the Quantitative Definition of Risk,” *Risk Analysis* 1 (1981): 12–13.

16. Ibid.

17. Vicki M. Bier, “Challenges to the Acceptability of Probabilistic Risk Assessment,” *Risk Analysis* 19 (1999): 704.

18. James Reason and Michael Maddox, “Chapter 14: Human Error,” in *Human Factors Guide for Aviation Maintenance*, ed. Michael Maddox (Washington, DC: Federal Aviation Administration, 1998).

Conventional or Gaussian statistical methods cannot meaningfully model the risk of catastrophic events for which there is little to no data. Conventional statistics employ the standard bell curve to represent event frequency, but for rare events the focus is on the extreme ends or “tails” of the curve. Thus, PRA is represented by a family of curves representing components of the system and, ultimately, by a cumulative probability curve that shows confidence measures for the risk assessment.

CHALLENGES TO RISK ASSESSMENTS

There are a number of challenges relevant to assessing nuclear weapon risks that shed light on the fallibility and potential shortcomings of these assessments.

Completing the Scenario List

Risk assessors must identify all the potential hazards, risky components, and ways in which a system could fail and lead to an accident, a process that is subjective and not absolute. As Christopher Stubbs writes, “What about situations that we weren’t clever enough to incorporate into our probabilistic risk models?”¹⁹ Omitting a crucial scenario from a model can impact the assessment’s accuracy.

Narrow Base of Experience

PRA deals with events for which there is often no past experience, making it necessary to extrapolate using Bayesian statistical models. Experts disagree on the accuracy and reliability of these extrapolations, and some experts question the credibility they lend to risk assessments.²⁰ The National Academies of Science recognized the difficulty in quantifying the probability of possible attack scenarios at nuclear weapon and nuclear material storage facilities and advised against relying on PRA to improve security at U.S. National Nuclear Security Administration sites.²¹

Identifying and Estimating Correlations

In developing a list of possible failure scenarios or components that might fail, it is essential that each scenario or component is truly independent. With nuclear weapons, as with any complex system, it is difficult to identify, estimate, and incorporate correlations into risk assessments, especially if the correlations are subtle or if they may only be apparent as a result of a severe external insult to the system.²² If events are independent, the probability of them occurring together amounts to the product of the marginal probabilities of each, but if they are dependent, simply multiplying their respective probabilities together

19. Stubbs, “Interplay between Civilian and Military Nuclear Risk Assessment,” 101.

20. Ibid., 100.

21. National Research Council, *Understanding and Managing Risk in Security Systems for the DOE Nuclear Weapons Complex* (Washington, DC: National Academies Press, 2011).

22. Stubbs, “Interplay between Civilian and Military Nuclear Risk Assessment,” 98–99.

may underestimate the risk and undermine the risk assessment.²³ Similarly, unplanned or unforeseen interactions between redundant safety components applied to ensure reliability may initiate a common-mode error, causing all the components to fail.²⁴

The Subjective Nature of Risk Assessments

Risk assessments are inherently subjective because they require individuals to classify a scenario as risky and then fold assumptions about the consequences into a model. “Red-teaming,” or engaging a team of experts to challenge assumptions, is a helpful antidote but not a panacea.

Risk assessments are also often conducted by parochial actors who have a vested interest in demonstrating that the system they manage has low risk.²⁵ In the nuclear weapons realm, this is a particularly potent question given that the national laboratories, the Department of Energy (DOE), and the Department of Defense (DOD)—the organizations that built, maintain, and deploy U.S. nuclear weapons—assess the safety and security of the U.S. nuclear weapons stockpile annually.

The Human Factor

The challenge of incorporating the varied and sometimes unpredictable role of humans in nuclear risk assessments deserves more attention. As Scott Sagan writes, “Why have imperfect humans, working in imperfect organizations and operating imperfect machines, been so successful?”²⁶ It is tempting to equate the so-called human factor with human error, but in reality, the human factor is much more complicated. It encompasses human error, performance, and judgment, which can impact nuclear weapon system safety and security positively or negatively. Subjectivity, as noted above, is one manifestation of the human factor and is present in nuclear weapon design, maintenance, deployment, and risk assessment.

Human judgment adds a fascinating layer. Scrutiny of past close calls has focused largely on human error and technical failures and less on the judgment of individuals who, in all cases of near nuclear use so far, have resisted launching nuclear weapons, sometimes against protocol.²⁷ For instance, in the dozens of examples in the literature of false warnings—caused by faulty computer chips, training tapes mistaken for actual events, and failures in communication—caution and critical thinking led to what was later determined to be the “appropriate” outcome.

23. Elisabeth Paté-Cornell, “On ‘Black Swans’ and ‘Perfect Storms’: Risk Analysis and Management When Statistics Are Not Enough,” *Risk Analysis* 32 (2012): 1825, 2014, doi: 10.1111/j.1539-6924.2011.01787.x.

24. Scott Sagan, “The Problem of Redundancy Problem: Why More Nuclear Security Forces May Produce Less Nuclear Security,” *Risk Analysis* 24 (2004): 937, doi: 10.1111/j.0272-4332.2004.00495.x.

25. Bier, “Challenges to the Acceptance of Probabilistic Risk Analysis,” 705.

26. Sagan, *Limits of Safety*, 4.

27. Lewis et al., *Too Close for Comfort*, 2.

The human factor touches many different fields of study, including organizational behavior, ergonomics, and behavioral psychology. These are areas of extensive scholarship, and this section will merely attempt to highlight relevant concepts for nuclear weapon accidents and nuclear risk assessments.

HUMAN ERROR

Human error is “an identifiable human action that in retrospect is seen as being the cause of an unwanted outcome.”²⁸ The concept seems straightforward, but there is some debate about what should be considered human error. Frederick Hansen argues that the inclusion of “slips, lapses, violations, and blunders” when referring to human error overstates the concept, though broadening the term highlights the true dynamics of human involvement in accidents.²⁹

Other scholars rightly include these types of actions in the definition of human error. Slips are errors of execution on routine tasks that have been practiced many times and can include omitting a step on a checklist—known as an “error of omission”—or a clumsy action that disrupts the procedure—an “error of commission.” Errors of omission are generally easier to catalog because they are based on steps of a well-defined operating procedure. Conversely, errors of commission are more difficult to model in a risk assessment because of the enormous variety of actions a person could take.³⁰

A higher-level type of error is a mistake. These can be “rule-based mistakes,” where an operator misapplies a correctly chosen course of action (a rule) to solve a problem or follows a rule or procedure that is wrong for the circumstances. Alternatively, an operator may make a “knowledge-based mistake” when solving a novel problem for which there is no prepackaged procedure. This requires quick, independent thinking on the spot and is highly error prone.³¹

Violations and errors are the two types of human acts that cause failure. Errors are unintentional, whereas violations are usually deliberate. Violations are “deviations from safe operating procedures, recommended practices, rules or standards,” and although they are generally intentional, the bad consequences that stem from them are not.³² The most relevant type of violation for nuclear weapons management is a “necessary” or “situational violation,” where an operator may feel the need to commit a violation in order to complete the mission. For example, there are numerous examples of launch officers violating protocol in response to a warning of a nuclear first strike because they deem the warning to be false.

28. Erik Hollnagel, “Human Reliability Assessment in Context,” *Nuclear Engineering and Technology* 37 (2005): 159, <http://www.kns.org/jknsfile/v37/JK0370159.pdf>.

29. Frederick D. Hansen, “Human Error: A Concept Analysis,” *Journal of Air Transportation* 11 (2006): 75.

30. Bier, “Challenges to the Acceptance of Probabilistic Risk Analysis,” 706.

31. Reason and Maddox, “Chapter 14: Human Error.”

32. Ibid.

These human-driven failures can be either “active” or “latent.” Active failures are the result of errors or violations and have immediate consequences, whereas latent failures are usually introduced when a weapon or component is designed or when a procedure is developed and may not become apparent until much later.

A 2007 incident in which U.S. Air Force personnel mistakenly loaded and flew six nuclear-armed cruise missiles across the country serves as a potent example of human error in the management of nuclear weapons. Crews at the point of origin in Minot, North Dakota, and the destination at Barksdale Air Force base in Louisiana broke protocol throughout the operation and left the weapons on a runway overnight—unguarded and unaccounted for—for 36 hours. What might have happened had the B-52 crashed or caught on fire? The airmen would not have known to invoke the emergency procedures required when transporting nuclear weapons—posing a potentially serious threat to those along the flight path.³³

PERFORMANCE SHAPING FACTORS

Engineers incorporating human error into PRA have tended to use simple probability trees and basic assumptions about human error probabilities,³⁴ but there is a general consensus among those who study risk and human factors that assessments would be more meaningful if they accounted for organizational, environmental, and cultural performance shaping factors.³⁵

Organizational Factors

Scott Sagan has done extensive work on the role of system or organizational factors in nuclear weapon accidents. In *The Limits of Safety*, Sagan applies two organizational theories to nuclear weapons management, using close calls from history to evaluate which theory is most relevant. He finds that the more pessimistic “normal accidents theory” fits most closely with U.S. nuclear weapon policies. According to the theory, accidents are inevitable if organizations managing hazardous technology have system components that can fail simultaneously and in unexpected ways (“high interactive complexity”) and when these failures can escalate out of control rapidly (“tight coupling”).³⁶ This is especially true when human operators must follow procedures in a strict sequence and on a short timescale, as with nuclear weapons. Essentially, Sagan argues that the U.S. systems we have built in the name of nuclear deterrence are laden with potential latent failures.³⁷

33. Scott D. Sagan, “On the Brink,” review of *Command and Control: Nuclear Weapons, the Damascus Accident, and the Illusion of Safety* by Eric Schlosser, *American Scholar* (autumn 2013), <http://theamericanscholar.org/on-the-brink/#.U9bGJkDDaSo>.

34. Bier, “Challenges to the Acceptance of Probabilistic Risk Analysis,” 707.

35. See Reason and Maddox, “Chapter 14: Human Error”; Hollnagel, “Human Reliability Assessment in Context”; and Bier, “Challenges to the Acceptance of Probabilistic Risk Analysis,” 707.

36. Sagan, *Limits of Safety*, 44.

37. *Ibid.*, 276.

Sagan also highlights how organizational culture might enable failures. Members of the U.S. military—and nuclear launch officers in particular—experience extreme socialization, strict discipline, and isolation from broader society. This suggests that individuals within the nuclear command and control structure are part of a “total institution,” where the overall mission conflicts with more self-serving organizational interests, such as self-preservation. This coexistence can “encourage excessive loyalty and secrecy, disdain for outside expertise, and in some cases even cover-ups of safety problems, in order to protect the reputation of the institution.”³⁸

How personnel are managed is also relevant to nuclear risk reduction. Whether workers are disgruntled, whether they feel there is a clearly defined path for career advancement, and whether lower-level operators feel frustrated by their lack of influence over policy are all organizational factors that may contribute to nuclear safety and security, as illustrated by recent scandals within the U.S. ICBM force.³⁹

Environmental and Cultural Factors

Factors affecting the operator’s local environment can also contribute to errors and violations. Examples of these factors include fatigue due to long shifts, stress, pressure to perform perfectly, adverse physical environmental conditions (e.g., hot and confined spaces), inadequacy of training, and availability of procedures or plans.

National culture may also impact performance in a crisis. For example, the Japanese cultural tendency to make decisions collectively may have been a barrier to timely action to mitigate the Fukushima nuclear disaster.⁴⁰ Although this example is on the civil nuclear side, its relevance and application to nuclear command and control is obvious.

ASSESSING THE HUMAN FACTOR IN RISK MODELS

The human factor is thought to have contributed to 70 to 90 percent of past accidents in other complex, high-risk systems (nuclear power and civil aviation, for example).⁴¹ As Erik Hollnagel writes, “Since no system has ever built itself, since very few systems operate themselves, and since furthermore no systems maintain themselves, the search for a human in the path of events leading to a failure is bound to succeed.”⁴²

Anticipating how a human might commit an unsafe act is less straightforward. Human reliability assessment (HRA) is used to estimate the occurrence of human errors, and the earliest and most widely implemented HRA methods were modeled on PRA in order to easily incorporate the results into PRA fault trees. These early methods used estimated

38. Ibid., 252–254.

39. Robert Burns, “Nuclear Weapons Investigation,” *Associated Press*, <http://www.ap.org/index/ap-in-the-news/us-nuclear-weapons>.

40. Richard Harris, “What Went Wrong in Fukushima: The Human Factor,” *National Public Radio*, July 5, 2011, <http://www.npr.org/2011/07/05/137611026/what-went-wrong-in-fukushima-the-human-factor>.

41. Hollnagel, “Human Reliability Assessment in Context,” 160.

42. Ibid.

probabilities of whether an operator will succeed or fail at a certain task and assumed that human failure can be decomposed like a system or component.⁴³

The first-generation HRA method of predicting human error probabilities (still used in the global civilian nuclear enterprise) has been replaced in newer second-generation models of HRA in favor of examining variability in human performance as a more useful measure of the human contribution. These second-generation methods also recognize that context may be an error-forcing condition and thus account for performance shaping factors.⁴⁴

Illustrating a first-generation HRA approach, Niles T. Welch walks through the tasks required by a navy operator for a particular procedure. In referring to the first step, he writes, “If the power button is pushed when connections are not completely seated, the operator may be injured and/or the equipment damaged. However, since the operator is well trained, the likelihood of an error at this step is highly remote (human error probability = 1×10^{-6}).”⁴⁵

Welch does not provide any supporting evidence as to why that specific human error probability is assigned to that task or any other task within the procedure, raising questions about the reliability of the overall analysis.

Second-generation models are still being developed, and many have yet to be empirically validated, but the recognition they give to the variability of human performance and the role of context are promising.⁴⁶

Assessing the Risk of a Catastrophic Nuclear Weapon Incident in the United States

The United States employs a variety of risk assessment techniques to evaluate the risk of a catastrophic nuclear weapon incident and the range of potential safety and security failures that could lead to such an event. The full spectrum of methods and assumptions employed to evaluate risks is not available to the public, but this analysis attempts to describe U.S. practices broadly. Without complete information, it is impossible to make a judgment about the adequacy of U.S. risk assessment efforts, but questions are raised for further investigation.

43. Ibid.

44. Julie Bell and Justin Holroyd, *Review of human reliability assessment methods*, prepared by Health and Safety Laboratory for the Health and Safety Executive, RR679 (Derbyshire, UK: Crown, 2009), 8, <http://www.hse.gov.uk/research/rrpdf/rr679.pdf>.

45. Niles T. Welch, “Human Error Risk Assessment,” *Professional Safety* 43 (1998): 19.

46. Bell and Holroyd, *Review of human reliability assessment methods*, 8.

MEETING QUANTITATIVE STANDARDS

Every year, the United States assesses the safety, security, and reliability of its nuclear weapons arsenal. Through modeling, component testing, surveillance, and risk assessment, members of the U.S. nuclear weapons establishment certify that the weapons in the arsenal meet a set of safety criteria throughout the range of environments to which a nuclear weapon might be exposed. The secretaries of energy and defense communicate that judgment in a letter to the president.⁴⁷

Regarding the potential for accidents, the U.S. nuclear weapons establishment assesses the stockpile's safety against the 1968 "Walske Criteria," which states that the probability of a premature nuclear warhead detonation (due to component malfunctions and without any input signals) should not exceed 1 in 10^9 per warhead lifetime for "normal environments" and 1 in 10^6 when exposed to an "abnormal environment" or accident.⁴⁸ The Walske probabilities do not account for the likelihood of an accident—an airplane fire, for example—but for the probability of getting nuclear yield assuming the accident or malfunction has already happened.⁴⁹

An STS document for each weapon type considers the range of possible physical environments to which a nuclear weapon may be exposed throughout its lifecycle—from stockpiling to deployment—and categorizes these environments as "normal" (expected) or "abnormal" (unexpected or likely to cause the weapon to lose full operational capability). According to the 2014 DOD *Nuclear Weapon System Safety Program Manual*, "Credible combinations of abnormal environments pose an additional risk to nuclear weapon systems and may not have been tested extensively for their combined effects."⁵⁰

STS documents focus only on physical environments (fire, explosion, vibration, and temperature) and not necessarily on the human factors that could contribute to those environments or to the management of the weapon from stockpiling to deployment.⁵¹ Human error probabilities during manufacture, assembly, testing, monitoring, quality control, and surveillance by the labs are folded into the quantitative nuclear weapon risk assessments that certify that the U.S. nuclear weapons arsenal meets the Walske Criteria,⁵² but the integration of human error probabilities may not be completed for deployment scenarios.

This annual assessment process focuses on the warhead itself and involves testing safety features and components within the warhead meant to safeguard against an

47. For a thorough description of the annual assessment process, see Gene Aloise, *Nuclear Weapons: Annual Assessment of the Safety, Performance, and Reliability of the Nation's Stockpile*, GAO-07-243R+ (Washington, DC: U.S. Government Accountability Office, 2007).

48. U.S. Department of Defense, *Nuclear Weapon System Safety Program Manual*, 3150.02 (Washington, DC: Department of Defense, 2014) 15.

49. Jason Weaver, e-mail message to author, July 10, 2014.

50. U.S. Department of Defense, *Nuclear Weapon System Safety Program Manual*, 39.

51. John Harvey, telephone interview by Elise Rowan, June 12, 2014.

52. Jason Weaver, e-mail message to author, July 10, 2014, and Hendrickson and Durham, interview by Elise Rowan.

accidental or unauthorized detonation. If the surety of these individual components is confirmed, the cumulative probability of their success meets the quantitative safety requirements. This determination is reached using PRA and, increasingly, a technique called Quantification of Margins of Uncertainty (QMU). Today, QMU quantifies confidence that a nuclear weapon will operate as intended; this approach is evolving to assess safety as well.⁵³

Outside experts and advisory groups, such as the JASONs and the Defense Science Board, review surety assessments, and their feedback is sometimes incorporated to strengthen safety over specific portions of the STS.⁵⁴ External oversight—from production to deployment—is a crucial tool for accountability and for ensuring the surety of the stockpile.

MEETING QUALITATIVE STANDARDS

The Departments of Defense and Energy, including the national laboratories, also adhere to qualitative safety and security standards to prevent accidental or unauthorized launch. These standards call for “positive measures” to protect against catastrophic nuclear weapon incidents.⁵⁵ Positive measures include a design feature, procedure, or device (described above and evaluated using PRA and QMU) to protect against human and system failure. They are applied in a layered approach to reduce the likelihood that an accident could happen due to failure of a single component.⁵⁶ Taken together, these measures provide “defense-in-depth” and have been informed by decades of lessons learned through the management of nuclear weapons. Though they are not the focus of this chapter, it is essential to note that these technologies, policies, and procedures are the U.S. nuclear enterprise’s response to risk of an accidental detonation and unauthorized, accidental, or miscalculated launch.⁵⁷

The annual *Nuclear Weapons Surety Report* details any safety, security, and use control incidents over the past year—including applicable human performance components—and provides information about efforts to improve nuclear surety, such as force-on-force exercises to strengthen nuclear security.

Other assessments used to measure the risk of an accidental detonation or an unauthorized or accidental launch are called Unauthorized Launch Analyses (ULAs) and Inadvertent Launch Analyses (ILAs). Unlike the annual assessment undertaken by the nuclear weapons enterprise, these methods consider the warhead and the warhead’s delivery vehicle as well as command and control and support elements. According to DOD, they can be qualitative

53. National Research Council, *Evaluation of Quantification of Margins and Uncertainties Methodology for Assessing and Certifying the Reliability of the Nuclear Stockpile* (Washington, DC: National Academies Press, 2008), http://www.nap.edu/download.php?record_id=12531#.

54. John Harvey, e-mail message to author, July 18, 2014.

55. Kidder, “Report to Congress,” D-2.

56. Ibid.

57. For a discussion of specific nuclear weapon safety devices and measures, see Jason Weaver, “One in a Million, Given the Accident: Assuring Nuclear Weapon Safety,” *Nuclear Scholars Initiative: A Collection of Papers from the 2014 Nuclear Scholars Initiative* (Washington, DC: CSIS, 2014).

or quantitative and are used to “analyze technical malfunctions, natural events, human errors, and malicious acts that could result in the inadvertent or unauthorized use of a nuclear weapon.”⁵⁸ A ULA is meant to shed light on elements of a nuclear weapon system’s design that could be vulnerable to malfeasance. It considers the range of human actions that could circumvent nuclear weapon safety measures. An ILA looks at what could go wrong with the weapon system to lead to an accidental launch. Human error, component failure, and combinations of the two are evaluated using fault trees and PRA. These techniques are used when there is enough weapon system design data and are updated periodically when the weapon system undergoes changes or when DOD or DOE requests an updated assessment.⁵⁹

DOD recognizes the role of the human factor “in the degradation of nuclear weapon surety standards through noncompliance with established safety policy or guidance” and states that the Nuclear Weapon System Surety Group, an interagency body with jurisdiction over nuclear weapon surety in the United States, will consider the results of quantitative and qualitative ULAs and ILAs.⁶⁰ Yet there is no publicly available description for how these results are used and against what standards.

Conclusion

The United States may be the most advanced state with respect to nuclear surety, given its seven decades of experience with nuclear weapons, extensive test record, and expansive nuclear enterprise. Other countries’ safety systems, in particular—and the methods used to assess their vulnerabilities—may not be as rigorous and may pose significant risks. Yet, U.S. safety and security systems are fallible, making the risk of a catastrophic incident with nuclear weapons credible, however unlikely such an incident may be. The intrinsic shortcomings of risk assessments, coupled with the complexity of nuclear weapon systems, may mean that we are underestimating the risk and overestimating the system’s surety.

The management and deployment of nuclear weapons is inherently risky, and the role of humans may not be adequately factored into risk assessments. To address this, the United States—and all countries with nuclear weapons—should focus efforts to better understand human factors with respect to nuclear weapons and work to vet and integrate second-generation HRA methods into risk assessments. Incorporating the true nature of human performance, including the impact of performance shaping factors, will improve understanding of nuclear safety and security. The U.S. Air Force’s recent troubles present an opportunity for the nuclear enterprise to shift focus toward human and organizational factors.

Additionally, more information should be available to the public about how nuclear weapon risks are assessed and how the United States determines what level of risk is

58. U.S. Department of Defense, *Nuclear Weapon System Safety Program Manual*, 39.

59. *Ibid.*, 40–41.

60. *Ibid.*, 39.

acceptable. Specific information that could jeopardize nuclear weapon safety and command and control should remain secret, but some insight into the process of assessing risk and assurances that risks are being mitigated effectively would boost public confidence. A modified, unclassified version of one of the existing annual reports, or a new report altogether that provides a comprehensive overview of the risks and how they are assessed and addressed, could be a valuable tool for public oversight. The consequences of an incident with nuclear weapons would be horrific, making this a matter of extreme relevance to publics around the world.

Improving Nuclear Life Extension Program Management: A B61-12 Case Study

Lauren Rutledge¹

Life extension programs (LEPs) are the cornerstones of maintaining the nuclear deterrent. Given the technical complexity involved, LEPs require high-precision planning and coordination of resources, schedules, requirements, and logistics between the National Nuclear Security Administration (NNSA) and the Department of Defense (DOD). This analysis seeks to use the B61-12 LEP as a case study to illustrate how DOD and NNSA functionally work together on an LEP in the status quo, identify any incongruities or obstacles in the process, and recommend policy and process solutions to facilitate a more integrated, system-oriented, and efficient LEP management and implementation process in the future. This analysis focuses on the areas of organizational structure and management, acquisition processes, and cost/scheduling processes.

Introduction

The DOD and the NNSA are two very different organizations. These differences are apparent in their organizational cultures, philosophies, policies, regulations, funding sources, acquisition processes, and other areas. Despite these differences, they come together to execute one unified mission to produce, secure, and manage the nation's nuclear stockpile. This joint mission arose from the creation of the Atomic Energy Commission under the Atomic Energy Act of 1946, which mandated a single civilian control organization, independent from military control in order to maintain checks and balances that would be

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responsible for the development and production of nuclear weapons.² However, in today's fiscally constrained environment, with greater scrutiny on the nuclear mission and the increasing age of the stockpile and supporting infrastructure, these two separate and distinct nuclear establishments must collaborate more seamlessly than ever to maintain a safe, secure, and effective nuclear deterrent. This represents a unique challenge for the two organizations, especially for the execution of LEPs.

LEPs are the cornerstones of nuclear deterrent maintenance. LEPs repair and replace components of nuclear weapons to ensure that they can meet military requirements safely and reliably for an additional 20 to 30 years.³ Given the technical complexity involved, LEPs require high-precision planning and coordination of resources, schedules, requirements, and logistics from both agencies even in the most stable of environments. In the current environment of budget uncertainty, geopolitical instability, and constant threats to national security, an integrated program management process is more vital than ever. While seamless integration between the DOD and NNSA life cycle sustainment processes is ideal, it is not always reality. This is not surprising considering that the processes were designed independently by two autonomous organizations with different missions. Currently, the two processes are made to work together by sheer determination and effort. The result, while still mostly effective, leaves room for improvements in programmatic efficiency.

The future of the nuclear stockpile is the 3+2 Strategy,⁴ which will require a higher level of coordination and collaboration between DOD and NNSA than ever before. Given the near-term necessity for increased collaboration between the two agencies, it would be beneficial to analyze their LEP management and implementation processes as a whole system rather than two independent processes. Evaluating the processes holistically creates potential for improved integration and efficiency. This analysis seeks to use the B61-12 LEP as a frame of reference and case study to illustrate how DOD and NNSA functionally work together on an LEP in the status quo, identify any incongruities or obstacles in the process, and recommend policy and process solutions to facilitate a more integrated, system-oriented, and efficient LEP management and implementation process in the future.

Methodology

The analysis for this paper used several sources to evaluate both the DOD and NNSA LEP management processes. Primary public domain sources, such as DOD and NNSA policy documents and regulatory memorandums, were analyzed to determine how the processes

2. Alice Buck, *The Atomic Energy Commission* (U.S. Department of Energy, Office of Management, July 1983), <http://energy.gov/sites/prod/files/AEC%20History.pdf>.

3. "Life Extension Programs," Nuclear National Security Administration, <http://nnsa.energy.gov/ourmission/managingthestockpile/lifeextensionprograms>.

4. The 3+2 strategy will combine existing weapons systems and reduce the stockpile to three interoperable ballistic missile warheads deployed on both the SLBM and ICBM legs and two air-delivered warheads or bombs; National Nuclear Security Administration, *Fiscal Year 2015 Stockpile Stewardship and Management Plan* (Washington, DC: U.S. Department of Energy, April 2014).

are mapped out on paper. The author interviewed program leadership, key personnel, and stakeholders currently working on the B61-12 LEP effort in both NNSA and the Air Force in order to determine how program management translates from policy to practice in the areas of organizational structure and management, acquisition processes, and cost/scheduling processes. Through analysis of the above sources, potential policy and process mitigations are suggested to facilitate optimal integration between the Air Force and NNSA management and implementation approaches.

B61-12 LEP Background

The B61 nuclear gravity bomb is currently the oldest weapon in the U.S. nuclear stockpile. Designed by Los Alamos National Laboratories (LANL) and Sandia National Laboratories (SNL), it first entered the stockpile in the late 1960s.⁵ There have been 15 total variations (i.e., “mods”) in the B61 family, but 9 have been retired or canceled.⁶ The 5 remaining mods were built from 1979 to 1998.⁷ The B61-12 LEP will combine 4 of the remaining mods (the -3, -4, -7, and -10) into one weapon (based primarily on the mod 4 nonstrategic design) that will meet both strategic and tactical requirements. It will also enable the retirement of the earlier mods as well as the B83-1 bomb, further reducing the size of the nuclear stockpile while maintaining a safe, secure, and effective deterrent.

In designing the B61-12, NNSA and DOD determined the need for a weapon that would meet both U.S. and NATO requirements, resulting in a new desired Military Characteristic (MC) of a lower yield with higher accuracy. Previous versions of the B61 have been gravity bombs (i.e., free fall with no guidance package).⁸ In order to meet these new MC requirements, the B61-12 will include a tail-kit assembly (TKA) that includes guidance and steering mechanisms that the air force is responsible for procuring. While the air force is procuring the TKA, NNSA will simultaneously be performing the LEP on the bomb itself. The estimated first production unit (FPU) date of the B61-12 is 2020, and it is currently in Phase 6.3 of the NNSA Phase 6.X process (Development Engineering), which is roughly the equivalent of Engineering and Manufacturing Development in the DOD process.⁹

The B61-12 was chosen as the test case to illustrate the program management and integration of DOD and NNSA because the two activities (the TKA and the bomb LEP) require parallel and simultaneous levels of development and completion. If certain aspects of either program are delayed or finish too early (e.g., testing interface requirements, production hardware, etc.), it can result in millions of dollars of waste to maintain that capability and infrastructure until the component is complete.

5. Hans M. Kristensen and Robert S. Norris, “The B61 Family of Nuclear Bombs,” *Bulletin of the Atomic Scientists*, April 22, 2014, <http://bos.sagepub.com/content/early/2014/04/16/0096340214531546.full.pdf+html>.

6. Ibid.

7. Ibid.

8. Hans M. Kristensen, “General Confirms Enhanced Targeting Capabilities of B61-12 Nuclear Bomb,” *Federation of American Scientists Security Blog*, January 23, 2014, <http://fas.org/blogs/security/2014/01/b61capability/>.

9. National Nuclear Security Administration, FY15 Stockpile Stewardship.

Additionally, the B61-12 is the most technically complex weapon in the stockpile; NNSA estimates that it is approximately three times as complex as the W76-1.¹⁰ If solutions can be found for the most complicated integration process, it is likely that they would also be applicable to less complex weapons systems in the future. Lastly, the B61-12 is the first weapons system that will progress through the entire Phase 6.X process (excluding alts). While some might argue that the W76-1 could be a complete case study, it has a much smaller scope than the B61-12 and went through only approximately 90 percent of the Phase 6.X process.¹¹ Given these facts, the B61-12 LEP is slated to be the only complete case study to date.¹² Procedures for Joint DOD-DOE Nuclear Weapons Life-Cycle Activities are laid out in Department of Defense Instruction (DODI) 5033.55, which identifies the relevant players within DOD and NNSA and delegates responsibility to a number of groups and subgroups.

Management Structure

POLICY

There are 13 distinct groups and subgroups involved in the B61-12 LEP management structure, which illustrates the complexity involved in coordinating an LEP (see Figure 1).

The primary governing decisional body in joint DOD-DOE life cycle activities is the Nuclear Weapons Council (NWC), chaired by the undersecretary of defense for acquisition, technology, and logistics, or USD(AT&L) in short.¹³ The NWC is responsible for providing high-level oversight and decisional guidance for the B61-12 LEP and advising the secretaries of defense and energy as well as the president. Directly under the NWC is the Nuclear Weapons Council Standing and Safety Committee (NWCSSC), cochaired by the assistant to the secretary of defense for nuclear and chemical and biological defense programs and the NNSA deputy administrator for defense programs. The NWCSSC handles day-to-day decisional matters affecting the stockpile that do not require the level of oversight of the NWC.¹⁴ The B61-12 Executive Steering Group, which includes representatives from NNSA, the air force, the Office of the Secretary of Defense, and the military delivery platforms, provides senior direction to the Executive Program Officers Group.

The NNSA management effort is led by the Office of Defense Programs (NA-10) through the Office of Major Modernization Programs (NA-19). The B61-12 LEP NNSA federal program manager (FPM), who reports to NA-19, is responsible for overall management of the B61-12 LEP and integrating the program across NNSA's design and production sites. The scope of the NNSA effort includes a combination redesign, reuse, and remanufacture of B61 nuclear and nonnuclear components to extend service life and maximize safety, security, and

10. Roger Kropf, e-mail message to Lauren Rutledge, July 15, 2014.

11. Robert McKay (director, Office of Air Delivered System Acquisitions, NA-19, National Nuclear Security Administration), telephone interview by Lauren Rutledge, July 16, 2014.

12. John Evans (NA-19 staff), interview by Lauren Rutledge, April 3, 2014.

13. Department of Defense, DODI 5030.55 (Washington, DC: January 25, 2001).

14. Ibid.

Figure 1. B61-12 Program Management Structure



Source: Air Force Global Strike Command, *B61-12 Program Management Structure* (Barksdale AFB, LA: 2012).

reliability without enhancing capability.¹⁵ The NNSA FPM and the Federal Program Office are responsible for managing and controlling program scope, cost, and schedule; integrating site schedules and deliverables; and integrating campaign and capital program requirements for the B61-12 LEP. The FPM is the federal interface to the B61 LEP Project Officers Group (POG), ensuring that DOD expectations and requirements are negotiated consistently with Phase 6.X requirements.¹⁶ The air force effort is coordinated by the secretary of the air force for acquisition and the program executive officer for strategic systems (PEO/SS). The PEO/SS is responsible for working with the TKA System Program Office (SPO) to ensure that the TKA can meet nuclear certification requirements, which is a new challenge for that office.

Most of the day-to-day work takes place at the lower level in the Executive Program Officers Group. The national labs are responsible for designing and coordinating the life extension components of the weapon while the air force B61 TKA SPO is responsible for developing the tail-kit portion. Since the end goal of the LEP is to merge the B61 bomb with the air force TKA, it is essential that the NNSA, the air force, the national labs, and Boeing coordinate in lockstep throughout the entire acquisition process from design to fielding.

15. Robert McKay, e-mail message to Lauren Rutledge, July 18, 2014.

16. Ibid.

The B61 POG, headed by the lead project officer (LPO), is responsible for making sure that NNSA and air force are coordinating and staying in constant communication regarding appropriate capabilities and requirements.

PRACTICE

While the management structure appears to be logically designed, there are several ways in which it functions differently than intended. For example, the NWC is meant to be the top level governing body of the LEP process, which implies that it has the ability to make and enforce major decisions. However, in reality the NWC can only advise the secretaries of energy and defense, who in turn advise the president. The NWC can make recommendations, but the decision to endorse them or not is ultimately up to the secretaries of energy and defense. However, if the NWC makes a recommendation and there is disagreement between the two agencies, there is no decision authority below the president to break the stalemate. Forcing every top-level disagreement up to the presidential level can make program management difficult and slows the process significantly.¹⁷ While there have not yet been any major disagreements requiring presidential intervention, adding a decisional level underneath the president could prevent any future conflicts or program obstacles.

Another management structure challenge lies in the role of the LPO. The LPO is supposed to manage the project day to day, coordinate with the NNSA project manager and the air force project manager, and make sure that the project stays on time and on track. The LPO role is most similar to that of a DOD joint program executive officer (PEO) that has to coordinate the interests, cultures, and budgets of all the services simultaneously,¹⁸ with one major and vital difference. The PEO controls program funding, which means his or her decisions can be enforced with the power of monetary incentives or consequences. Conversely, the LPO does not directly control any program funding. For the B61-12 program, the U.S. Air Force (USAF) PEO for strategic systems has allocated funding to the LPO for program integration; however, by statute the funds are the responsibility of the TKA senior program manager (SPM). To efficiently manage the funds, the LPO and SPM chair a budget control board. The LPO has no control of NNSA funding of the bomb assembly, for which the NNSA federal program manager is responsible.

Similar to the NWC authority versus enforcement conundrum mentioned above, the LPO has a significant amount of authority on paper but little enforcement ability in reality.¹⁹ This is not to say that either agency deliberately fails to cooperate with the directives of the LPO, but management by cooperation and influence are not the same as having authority over program funds. However, simply giving the LPO control over the funding may not provide a solution. NNSA bears most of the financial and technical integration risk in the LEP, with a budget of approximately \$8 billion compared to the air force's \$2 billion.

17. Dr. Billy Mullins (associate assistant chief of staff, Strategic Deterrence and Nuclear Integration, U.S. Air Force), interview by Lauren Rutledge, May 2, 2014.

18. Roger Kropf (B61-12 lead project officer, U.S. Air Force), interview by Lauren Rutledge, May 7, 2014.

19. Ibid.

When considering how to mitigate this issue, this disproportionate risk has to be considered.²⁰

POTENTIAL MITIGATIONS: MANAGEMENT STRUCTURE

1. Designate a decisional tie-breaking authority above the NWC but below the presidential level that does not represent either agency directly. This could be a single person, a task force or small agency, or a simple addition of cabinet-level members to the existing decisional panel of the secretaries of energy and defense.
2. Elevate and consolidate program management and execution funding to the control of the LPO. If the LPO had his or her own ability to distribute funds, it would enable the necessary capability gaps to be filled more quickly. Additionally, in the event of agency disagreement or shortfall, the ability to provide a monetary incentive or disincentive to both sides would streamline the process and save time. This would require NNSA funds to be managed by DOD.
3. Rebalance the funding and technical integration risk by having NNSA take over the mission of the TKA via SNL. NNSA or the air force could provide SNL with Work for Others funding, enabling them to contract with Boeing and manage the TKA integration which would reduce the technical integration risk and correct for the imbalanced funding risk that currently exists. This would also reduce the technical integration risk and have all design work managed through one acquisition process.

Acquisition Processes

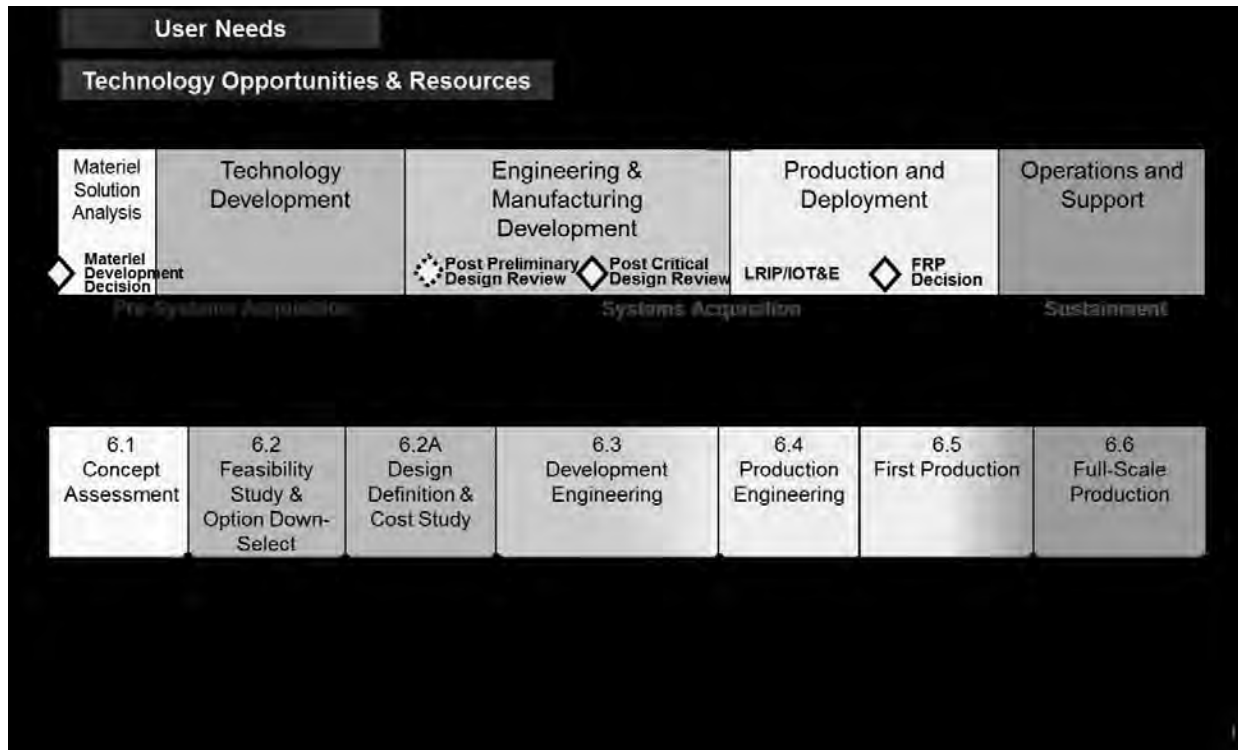
POLICY

The LEP begins for both DOD and NNSA with their acquisition processes. DOD uses the same acquisition process department-wide, known as the 5000 process (DODI 5000.02). On the air force side, the TKA follows the 5000 process. On the NNSA side, the bomb LEP uses the Phase 6.X process, which is roughly equivalent to the 5000 process. However, there are points of questionable congruity. Ideally, both processes should move forward at roughly the same speed so that the appropriate decisional authority can review at the appropriate decision gates and render guidance quickly; the NWC is the decisional authority for Phases 6.2, 6.3, and 6.6, as well as budget certification, while USD(AT&L) is the decisional authority for Milestones A, B, and C. Additionally, both processes should be roughly the same level of effort and have similar resources and methods. Lastly, both processes should incorporate best practices of systems engineering and industry and be regularly reviewed and updated. See Figure 2 for an illustration of the how the two processes relate.

To design and execute the TKA and bomb LEP, both NNSA and DOD make substantial use of government contractors. The air force's prime contractor for the TKA design is Boeing, while NNSA is using SNL to design and qualify the bomb components. The USAF has contracted with SNL to support the system integration of the B61 bomb and TKA into a

20. Robert McKay, e-mail message to Lauren Rutledge, July 18, 2014.

Figure 2. DOD 5000 vs. NNSA 6.X Joint Nuclear Acquisition Processes



Source: This figure is a rough generalization and does not reflect precise alignment of each milestone/decisional gate; U.S. Air Force, *DOD 5000 vs. DOD 5030 (6.X)* (Washington, DC: May 8, 2014).

single qualified weapon system. The TKA and the bomb must join and interface perfectly in order to maintain the B61-12's capabilities. In order to achieve this, Boeing and SNL must work very closely together. The results of their coordination meetings end up in the *Integrated Requirements Document*, which details down to a very practical level exactly which components will need to connect and communicate, and how.²¹

The first step is to determine the technical requirements. Teams from Boeing and SNL collaborate on this process to determine technical requirements for the two systems to interface. The high-level requirements process occurs in Phase 6.2, with the bomb cost analysis taking place in Phase 6.2/2A. The TKA cost analysis is developed, resulting in the Service Cost Position submitted at the TKA Milestone B and approved by USD(AT&L) as the TKA funding baseline. Ideally, both agencies should have validated and repeatable cost estimation processes to give an accurate idea of what funding resources will be needed and to ensure that resources arrive in a timely manner on both ends. During Phase 6.3, with air force and NNSA oversight, teams from Boeing and SNL collaborate on refining technical requirements for the two systems to interface. The results are documented in the *Bomb-to-Tail Interface Control Document*, which details down to a very practical

21. Roger Kropf, interview by Lauren Rutledge, May 7, 2014.

(systems-specification) level exactly what components will need to connect and communicate, and how.²²

PRACTICE

In practice, the acquisition processes do not always move together in step, especially in the case of the B61-12. On one hand, the air force has been making tail kits for decades and has developed mature infrastructure and expertise in the area.²³ The major differences between the B61-12 TKA and a conventional TKA are that the B61-12 needs to function in nuclear environments, meet very high reliability requirements out of the box, and meet stringent nuclear certification requirements. Because of the maturity of conventional TKA technology, addressing these differences requires some engineering development, but not nearly at the level of the bomb LEP. On the other hand, the B61-12 nuclear bomb is the most technically complex weapon in the stockpile, in addition to the oldest, so it requires a much longer and more complicated systems engineering and qualification effort than other weapons. This combination means that over the years, substantial capability, infrastructure, and knowledge have somewhat eroded.

This difference in development capability means that the TKA and the bomb LEP began at different points in the acquisition process. The USD(AT&L) approved the TKA to skip Milestone A entirely and move directly to Milestone B due to the already mature TKA capability of the air force.²⁴ The TKA was approved for Milestone B on November 12, 2012, while the bomb LEP was approved for Phase 6.3 on February 27, 2012,²⁵ a disparity of almost 10 months.

Additionally, the contracting processes used by DOD and NNSA are very different. To select the contractor to handle the TKA, the air force followed typical federal contracting procedures and put out a request for proposal, took bids, reviewed them, and then made the selection based on a clear, standardized set of criteria. Ultimately, Boeing was selected to provide contracting support to the TKA, and their relationship with the air force is one of a traditional client-prime relationship; that is, the air force gives directives to Boeing, and Boeing implements them.

The NNSA contracting process is much different. Because of the sensitive and complex safety designs and special nuclear materials, it is not feasible for NNSA to maintain a large competitive industry base. There is also no formal bidding process in place internally among the labs. The SNL and LANL were selected to design and conduct the B61 bomb LEP without a competitive process. Additionally, the national labs are integrated into the NNSA program offices, which is unlike the client-prime relationship exercised by the air force

22. Ibid.

23. Dr. Billy Mullins, interview by Lauren Rutledge, May 2, 2014.

24. USD(AT&L), *B61 Mod 12 Life Extension Program Tailkit Assembly Milestone B Acquisition Decision Memorandum* (Washington, DC: Department of Defense, November 19, 2012).

25. Nuclear Weapons Council, *B61 Life Extension Program (LEP) Phase 6.3 Authorization* (Washington, DC: February 27, 2012).

and Boeing. The relationship between the NNSA Federal Program Office and the site Managing and Operating (M&O) contractors allows for more flexibility and program responsiveness, while the Boeing–air force client-prime structure provides less flexibility but improved cost control and cost management.²⁶

For example, the NNSA B61-12 FPO has only 18 full-time employees (FTEs), while the combined Air Force Nuclear Weapons Center and Life Cycle Management Center have 80 FTEs. However, as noted earlier, the air force is managing a smaller program (\$2 billion) in an area they have not produced in before, whereas the NNSA Nuclear Security Complex has a much larger program (\$8 billion).²⁷ Having a larger staff manage a smaller program can occasionally lead to challenges in managing the interfaces and differing expectations between the two offices.²⁸ In addition, managing an M&O contract is different than managing a more traditional fixed-fee or cost-plus contract, such as the air force has with Boeing. M&O contracts require four possible tiers of pricing based on whether the awardee is a laboratory or nonlaboratory that includes complex classification factors and considerations. In addition, the management has special considerations that can create challenges.²⁹ Both the NNSA and air force contracting methods have advantages and drawbacks, but the problem in the case of the B61-12 is that these two different methods can create occasional difficulty in coordination between SNL and Boeing due to the mismatch of management styles.³⁰

POTENTIAL MITIGATIONS: ACQUISITION PROCESSES

1. Explore integrating the prime contractor into the DOD program offices to facilitate better coordination and more flexibility while retaining structure and efficiency.
2. Explore redesigning a more integrated joint nuclear acquisition process that combines the 5000 and the Phase 6.X processes into one nuclear process that accounts for the realities of dual-agency management and system engineering while retaining the benefits of both original processes.
3. Explore creating more competition for contracts within the national labs to facilitate more innovation and efficiency while retaining the program office integration and flexibility (e.g., having multiple labs or multiple teams at a lab develop two or more designs for the weapons in Phase 6.2/6.2A, or instituting a more performance-based system for the M&O structure tied to LEPs).

26. Robert McKay, e-mail message to Lauren Rutledge, July 18, 2014.

27. Ibid.

28. Ibid.

29. Department of Energy, *Acquisition Guide Subpart 970.01*, July 22, 2009, <http://energy.gov/sites/prod/files/maprod/documents/DEAR970.pdf>.

30. Roger Kropf, interview by Lauren Rutledge, May 7, 2014.

Cost/Schedule

POLICY

The air force TKA and NNSA bomb LEP are funded through separate and independent processes. The TKA is appropriated through the House and Senate Defense Appropriations Subcommittees, while the bomb LEP is appropriated through the House and Senate Energy and Water Development Appropriations Subcommittees. In theory, both programs should receive sufficient funding to continue their operations without interruption at the appropriate times. In addition to being assigned to different congressional budget authorities, the air force and NNSA operate on different budget validation cycles.

Scheduling is another area where coordination is critical. The B61-12 schedule is known as JIMS (Joint Integrated Management Schedule). It combines the NNSA schedule with the air force schedule and allows for risk evaluation, contingency planning, and monthly updates. Both agencies develop their timelines separately and then try to integrate them. The cost estimation process is also vital to the success of the B61-12 LEP and is one of the most widely publicized challenges. Underestimating the cost can result in program stoppages and schedule compromise, while overestimating can result in pushback from Congress. Similar to the scheduling process, both agencies have their own cost estimation processes.

PRACTICE

Over the last four years, it has been rare for either program to receive anywhere close to their budget requests, let alone on time. However, progress has been made on this issue, and B61-12 LEP received the full amount of the president's request in FY14 and in the congressional marks for FY15, which suggests a hopeful turn for funding continuity and lower program risk in the future. However, should congressional budget tensions resurface in the future, this challenge could arise again for future LEPs.

Government-wide budget instability also affects the B61-12's ability to stay on cost and on schedule. The inability to agree on a budget for the past few fiscal years resulted in several scheduling obstacles and cost increases. For example, the FY14 continuing resolution (CR) held NNSA B61-12 funding at \$369 million instead of the requested \$537 million.³¹ While the funding cut did not cause any actual schedule slippage in this case, it created a substantial contingency loss that greatly increased program risk.³² Cost also increased as a result of the CR funding freeze. At one point, the SNL team was unable to continue product development because they were forced to spend the little money they received to keep their team together to maintain the development capability.³³ The air force was able to continue

31. B61-12 NNSA Program Office, interview by Lauren Rutledge, June 2, 2014.

32. Robert McKay, e-mail message to Lauren Rutledge, July 18, 2014.

33. Roger Kropf, interview by Lauren Rutledge, May 7, 2014.

working only because they were forward funded.³⁴ Without this advantage, the air force may have experienced cost increases as well.

As a result of the combination of budget instability and sequestration, the B61-12 FPU date was pushed from FY19 to FY20 in the NNSA B61-12 *Selected Acquisition Report*. This relative lack of scheduling slippage can be partially attributed to the fact that the B61-12 has a management reserve fund. However, it is the first LEP to have one, and it is not common practice across NNSA's weapons systems.³⁵ This historic lack of flexibility and contingency in program funding and budget instability is one of the larger challenges facing the future LEPs and needs to be addressed in the future.

The difference in the scheduling process also illustrates an unanticipated challenge in the LEP process. Both the NNSA integrated master schedule (NIMS) and the Boeing IMS feed a joint IMS (JIMS) used for the overall joint program management, keeping all agencies of the program synchronized. The NIMS for the B61-12 LEP is over 100,000 lines long.³⁶ The Boeing portion of the JIMS is closer to 10,000 lines.³⁷ This is primarily due to the complexity of the nuclear bomb assembly in relation to the TKA. However, the software tools chosen by each agency to manage their schedules were also different. NNSA initially developed their NIMS without the use of a work breakdown structure and chose to use a software tool that did not have the robustness necessary to handle a schedule of that complexity. However, they have since transitioned to more robust scheduling management,³⁸ eliminating many of the software compatibility problems faced prior to the switch. While the problem has been rectified, transitioning a schedule of that size to a new software platform set the scheduling process back six months to a year.³⁹

The difference in NNSA and DOD cost estimation processes is a complication discussed frequently in the nuclear policy community and has created several obstacles in the B61-12 LEP process. In the past, NNSA did not have a methodical, accurate process to perform cost estimation, which resulted in several controversial cost miscalculations. The primary contributor to the cost discrepancies was a lack of oversight of the national labs' cost estimations and inconsistency among the labs' accounting processes.⁴⁰ However, NNSA is taking substantial steps to rectify this issue. The B61-12 in particular has faced cost criticism. This primarily resulted because the LEP budget was required prior to Phase 6.2, precluding time for a full budget validation and resulting in a coarse projection (roughly equivalent to a DOD pre-Milestone A estimate).⁴¹ However, when the actual cost analysis was done after the budget was submitted, it became apparent that the real cost was almost twice the initial rough estimate. This simple cost estimation schedule mismatch created disproportionate confusion and political pushback from Congress.

34. Robert McKay, e-mail message to Lauren Rutledge, July 18, 2014.

35. Alan Felser (director, Stockpile Service, NNSA), interview by Lauren Rutledge, April 3, 2014.

36. Roger Kropf, interview by Lauren Rutledge, May 7, 2014.

37. Ibid.

38. Eric Single (chief, Global Strike Division, SAF/AQPN), interview by Lauren Rutledge, May 8, 2014.

39. Ibid.

40. B61-12 NNSA Program Office, interview by Lauren Rutledge, June 2, 2014.

41. Roger Kropf, interview by Lauren Rutledge, May 7, 2014.

Despite past missteps, NNSA has recently made vast improvements in their cost estimation capability and has dedicated significant effort to increasing its transparency and fidelity. For example, the B61-12 LEP has utilized General Accounting Office best practices in developing the cost estimate for the program, and the B61-12 LEP is the first NNSA LEP effort to make use of earned value management.⁴² The effort of implementing earned value management required implementing significant changes at two NNSA sites; increasing the level of detail for planning work at all sites; and establishing site control accounts, resource loaded schedules, and performance management baselines.⁴³ While the B61-12 has taken these measures, it is important to see that they spread throughout other LEPs in the future as well.

POTENTIAL MITIGATIONS: COST/SCHEDULE

1. Consolidate budget and funding: appropriating the LEP under the authority of two different congressional committees creates incongruences with political priorities, funding cycles, and budget validation timelines. Consolidating the budget under the House and Senate Defense Appropriations Committees would help alleviate some of the funding struggles and timing issues LEPs have experienced in the past.
2. Stabilize funding: while there is no practical solution to preventing congressional budget stalemate and sequestration-like actions, these types of budget uncertainties could be mitigated by allowing all LEP programs (not just the B61-12) to carry contingency funding over from year to year, or by requiring a management reserve for each LEP to provide for these types of funding setbacks and ensure that work continues on time and on schedule.
3. Coordinate cost and scheduling: the relative independence of the NNSA and DOD cost and scheduling development processes creates some difficulty with tool compatibility, timing, and general coordination. Designating a task force to look at both agencies' processes and create a more integrated process would drastically improve the ease of coordination between the agencies and develop a level of standardization and transparency.

Conclusion

The B61-12 LEP program is an excellent case study to illustrate the complexities involved in managing a dual-agency large-scale life extension program. After reviewing the primary policy and governance documents and discussing the functional implementation of policy within the B61-12 LEP with major stakeholders, it is clear that there are several areas that could be addressed with policy or process changes to streamline, accelerate, and generally improve the LEP management process. Most obstacles facing the LEP process seem to stem from a lack of standardization or integration. Addressing issues that fall under this

42. Ibid.

43. Ibid.

category could provide immediate gains to both NNSA and DOD. The next step in this analysis would be to benchmark the DOD and NNSA joint process against the best practices of comparable industry or other government programs. LEPs will be a necessary and vital part of the national security effort until such a time as nuclear weapons are no longer needed. Continuously improving the LEP management process will ensure that the United States can maintain a safe, secure, and effective nuclear deterrent well into the future.

Living on the Hedge: A Nuclear Arsenal for an Insecure Japan

Travis Stalcup¹

Analysts and scholars have sought to understand whether or not Japan will ever overcome its nuclear allergy and pursue an arsenal of its own. This research asks not whether but how a nuclear Japan would structure and deploy its arsenal and what challenges it would face in doing so. While China's ascendancy has contributed to the changes in Japan's defense policy, the recent reforms sought by Prime Minister Shinzo Abe have been a goal for many Japanese politicians for decades. Stronger, more flexible Japan Self-Defense Forces would add balance to the alliance while serving as an insurance policy against a future perceived erosion of U.S. commitment. A weakening of the alliance rather than China's military modernization would catalyze a Japanese nuclear program, but the pursuit would be difficult technically and politically. Challenges include perfecting a delivery platform and the war-head design and overcoming U.S. opposition. Even if Japan were to overcome these barriers, the path to credibility would be difficult. Given the country's lack of strategic depth, its population density, and the missions nuclear weapons would be intended to execute, Japanese military planners may find that their retaliatory threats lack sufficient credibility to deter aggression.

Introduction

Japanese prime minister Shinzo Abe's careful but determined drive to reorder Japan's national security policy has renewed interest in his country's stance on nuclear weapons. The issue is not a new one, and it is only one facet of a much broader long-standing national security debate. Since the 1952 Mutual Security Assistance Pact, there has existed a segment of Japan's political class that is suspicious of the United States and advocates a more robust if not more independent defense policy. Nobusuke Kishi, Abe's grandfather, advocated for a revision of Japan's pacifist constitution during his tenure as prime minister in

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the 1950s and 1960s. Over time, the debate about nuclear weapons, once isolated to right-wing Japanese politics, has moved into the mainstream. Moderate figures such as retired ground self-defense force general Toshiyuki Shikata and former defense minister Satoshi Morimoto have argued for a thorough debate of Japan's nuclear policy even while maintaining the centrality of the U.S.-Japan alliance.²

In previous periods of strategic vulnerability—for example, following China's nuclear test in 1964 and North Korea's in 2006—Japan's leaders have reconsidered their dependence on the United States. Official studies by the Japanese government in both 1968 and 1995 surreptitiously examined the costs and benefits of nuclear arms and ultimately decided to maintain a foreign policy wholly reliant on U.S. security guarantees.³ For those who see in Chinese growth and military modernization—as well as U.S. political and budgetary gridlock—a need to venture alone, nuclear weapons are the ultimate expression of a state's autonomy. For others, these changes in the East Asian security environment require greater cooperation with U.S. allies, not less. Decades of policy and polling show that most Japanese, while wary of China, see their nation's alliance with the United States as essential to their security.

Although the threat from China is potent, the erosion of U.S. credibility would be the factor most likely to catalyze a shift in Japanese defense policy. Knowing this, U.S. policymakers worry that Japan's perception of U.S. commitments is diminishing.⁴ As lawmakers and scholars debate the health of the transpacific alliance, it is prudent to ask not only under what conditions Tokyo might choose nuclear weapons but what those weapons would look like and what missions they would serve. Answering these questions is the subject of this research, which proceeds in three parts. First, it examines the East Asian security environment from the perspective of Japan. The incremental manner in which Abe has pursued his defense reforms acknowledges that public and political opinion on the threats Japan faces is mixed. Second, this chapter examines what an early Japanese arsenal might look like and where it is likely to progress. Although Japan has emulated the United States in many of the recent changes to its defense establishment, it is unlikely to pursue nuclear deterrence in the same way Washington did during the Cold War or has since. Third, it explores Japan's postnuclear security environment, including challenges to the credibility of its arsenal as well as its arsenal's effect on the U.S.-Japan alliance.

2. Yuki Tatsumi, "Maintaining Japan's Non-Nuclear Identity," in *Security Assurances and Nuclear Nonproliferation*, ed. Jeffrey Knopf (Stanford, CA: Stanford University Press, 2012), 151–152.

3. The 1995 study concluded that even in the event that both the U.S.-Japan alliance and nonproliferation regime disintegrate, "nuclearization would nevertheless not be in Japan's national interest." See Llewelyn Hughes, "Why Japan Will Not Go Nuclear (Yet)," *International Security* 31, no. 4 (2007): 67–96.

4. According to U.S. Pacific Command's admiral Samuel Locklear, Pacific allies question U.S. "staying power." *U.S. Pacific Command and U.S. Forces Korea*, 113th Cong. (response by Adm. Samuel Locklear, USPACOM commander, Washington, DC, 2013), <http://www.pacom.mil/commander/statements-testimony/20140325-hearing-of-the-senate-armed-services-committee.shtml>.

Not Truth, Perception

Thanks to its economic largesse, China has sought to expand its military capabilities across every domain—land, air, sea, space, cyberspace, and nuclear. Specifically, Chinese armed forces hope to master “internal control, area denial around its periphery, and limited regional force projection.”⁵ Taking advantage of a relatively peaceful though tense regional environment, Chinese leaders have continued to invest in its military, enabling it to “fight and win short-duration, high-intensity regional military conflict[s].”⁶ According to a 2013 report by the Japanese Ministry of Defense, increased defense spending by China has focused on “its nuclear and missile force as well as its Navy and Air Force, and strengthening its capability for extended-range power projection.”⁷ These new missions, supported by a growth in military capabilities, are what frighten China’s neighbors and “may spark a new regional security dilemma.”⁸ Moreover, Japan fears “the eventual emergence of a regional environment within which China can ‘effectively [impose] its will within the region . . . at seemingly low thresholds.’”⁹

These new capabilities and China’s increasingly assertive territorial claims give credibility to speculation that Beijing is attempting to decouple the United States from its Asian alliances.¹⁰ Fear of such decoupling has driven Japan to improve its own conventional capabilities and make them more robust and flexible, at the urging of political factions long hopeful of a normalized military posture. Since taking office for the second time in 2012, Prime Minister Abe, who has long advocated for expanding Japan’s military capabilities, has built on recent momentum to push Japan “away from its postwar pacifism.”¹¹ In addition to “increased defense spending, [Japan] passed a strengthened state secrets act at the United States’ behest, and deployed JSDF [Japan Self-Defense Forces] ships to patrol near the disputed Senkakus.”¹² Abe, bolstered by a recent cabinet report, has also sought a reinter-

5. M. Taylor Fravel, “China’s Search for Military Power,” *Washington Quarterly* 31, no. 3 (2008): 129.

6. Office of the Secretary of Defense, *Annual Report to Congress: Military and Security Developments Involving the People’s Republic of China 2013* (Washington, DC: Department of Defense, 2013), i.

7. Ministry of Defense of Japan, *Defense of Japan 2013* (white paper, Ministry of Defense of Japan, 2013), 32, http://www.mod.go.jp/e/publ/w_paper/pdf/2013/11_Part1_Chapter1_Sec3.pdf, 32.

8. Fravel, “China’s Search for Military Power,” 128.

9. James Schoff, “Implications of Extended Deterrence for the 2009–2010 Nuclear Posture Review” (PowerPoint, CSIS, Washington, DC, June 3, 2009), as quoted in Clark A. Murdock and Jessica M. Yeats, *Exploring the Nuclear Posture Implications of Extended Deterrence and Assurance: Workshop Proceedings and Key Takeaways* (Washington, DC: CSIS, November 2009), 47.

10. Tetsuo Kotani, *The Senkaku Islands and the U.S.-Japan Alliance: Future Implications for the Asia-Pacific* (Kotani Futuregram 13-002, Project 2049 Institute, September 19, 2013), http://project2049.net/documents/senkaku_kotani.pdf; For more on Chinese efforts to decouple the alliance, see Narushige Michishita, “Changing Military Strategies and the Future of the U.S. Marine Presence in Asia,” in *Challenges for the U.S.-Japan Alliance and U.S. Military Bases in Okinawa* (Naha City, Japan: Okinawa Prefecture Government, 2013), 62–63; and Mark A. Stokes, “The Second Artillery Force and the Future of Long-Range Precision Strike,” in *Strategic Asia 2012-13: China’s Military Challenge*, ed. Ashley J. Tellis and Travis Tanner (Washington, DC: National Bureau of Asian Research, 2012), 128.

11. Martin Fackler, “Japan Ends Decades-Long Ban on Export of Weapons,” *New York Times*, April 1, 2014, <http://www.nytimes.com/2014/04/02/world/asia/japan-ends-half-century-ban-on-weapons-exports.html>.

12. Matt Ford, “Will Japan Abandon Pacifism?,” *Atlantic*, January 23, 2014, <http://www.theatlantic.com/international/archive/2014/01/will-japan-abandon-pacifism/283298/>. For an overview of Japan’s military reforms, see Ministry of Defense of Japan, *National Defense Program Guidelines for FY2014 and Beyond* (December 17, 2013), http://www.mod.go.jp/j/approach/agenda/guideline/2014/pdf/20131217_e2.pdf, and the Office of

pretation of the Japanese constitution that would allow Japan to engage in collective defense—combat to support an ally under attack.¹³ Japan’s renunciation of “war as a sovereign right of the nation” dates back to 1946, when U.S. occupiers drafted the nation’s constitution, and Abe’s desire to amend rather than merely reinterpret it is well known.¹⁴ Were an amendment to pass, it would herald a sea change in East Asian security relations. In the meantime, Japan’s growing capabilities and the legal revisions to use them are intended to steer the country away from complete dependence on the United States and transform it into a “full-fledged defense partner” capable of executing a variety of missions and participating in regional conflicts alongside its allies and partners in the region.¹⁵

Chinese military modernization is not in itself troubling. What concerns Japanese planners most is that these investments are taking place with very little transparency and during a period of nationalist fervor. Speaking in 2005, then foreign minister Taro Aso framed the Chinese threat as “a country with a population of 1 billion that possessed atomic bombs, and which increased its military budget by double digit amounts for seventeen years in a row with a considerable lack of transparency.”¹⁶ Five years later in 2010, Prime Minister Yukio Hatoyama warned that with regard to its military buildup, “the transparency is not necessarily sufficient.” Japan’s most recent *National Security Strategy* references China’s insufficient transparency as “an issue of concern” requiring “careful attention” and stresses that the threat to Japan is becoming “ever more severe . . . complex and grave.”¹⁷ The Ministry of Defense’s 2013 *Defense of Japan* white paper articulates Tokyo’s complaint:

China has not disclosed specific information on possession of weapons, procurement goals and past procurements, organization and locations of major units, records of main military operations and exercises, and a detailed breakdown of the national defense budget. Moreover, China does not clarify a specific future vision of its military modernization and the transparency of its decision making process in military and security affairs is not sufficient either.¹⁸

A March 2014 editorial in *Asahi Shimbun* asked, “What is the aim of China’s continuous and massive expansion of armaments?”¹⁹ Without a clear understanding of what China

the Prime Minister of Japan, *National Security Strategy* (December 17, 2013), http://www.kantei.go.jp/foreign/96_abe/documents/2013/_icsFiles/afiedfile/2013/12/17/NSS.pdf.

13. Justin McCurry, “Shinzo Abe reveals plans to lift Japan’s ban on fighting in conflicts overseas,” *Guardian*, May 15, 2014, <http://www.theguardian.com/world/2014/may/15/shinzo-abe-plan-lift-japan-ban-fighting-conflicts-overseas>. See also Ayako Mie, “Officials push to scrap limits on SDF missions,” *Japan Times*, June 3, 2014, <http://www.japantimes.co.jp/news/2014/06/03/national/politics-diplomacy/officials-push-scrap-limits-sdf-missions/#.U5sDzvldV8E>.

14. *Constitution of Japan*, Chapter 1, Article 9, http://japan.kantei.go.jp/constitution_and_government_of_japan/constitution_e.html.

15. Fackler, “Japan Ends Decades-Long Ban.”

16. Akio Takahara, “A Japanese Perspective on China’s Rise and the East Asian Order,” in *China’s Ascent: Power Security and the Future of International Politics*, ed. Robert S. Ross and Zhu Feng (Ithaca, NY: Cornell University Press), 28.

17. Office of the Prime Minister, *National Security Strategy*, 12–13 and 3.

18. Ministry of Defense, *Defense of Japan 2013*, 32.

19. “China should stop its dangerous military expansion,” *Asahi Shimbun*, March 6, 2014, <http://ajw.asahi.com/article/views/editorial/AJ201403060028>.

intends to do with its improved military, the Japanese are left to wonder and speculate. According to the Pew Research Center, positive Japanese attitudes toward China have steadily declined since 2002, which is attributable in part to “a surge in popular nationalism that seems to have grown out beyond the [Chinese Communist] party’s control.”²⁰ In that year, 55 percent of the public held a favorable view of China. Just over a decade later, that measure dropped to 7 percent, the lowest of all countries polled in the Asia-Pacific. When asked what country Japanese consider their greatest threat, 68 percent of respondents indicated China.²¹

Average Japanese citizens and political leaders recognize that China’s economic largess will afford it “the ability to wield physical veto power according to its own preferences,”²² but they are also wary of the reliability of their U.S. ally. Another poll, one by *Nikkei Shimbun*, Japan’s leading economic newspaper, indicated that 84 percent of respondents were either “slightly” or “very” anxious about the state of the U.S.-Japan alliance.²³ Following the crisis in Ukraine, which saw Russian troops seizing Crimea and its subsequent annexation, Japanese security officials began seeking additional assurances from Washington. One Japanese analyst quoted in the *New York Times* asked, “Between the Pentagon budget cuts, and the need to put more forces in Europe, can the United States still offer a credible deterrence?”²⁴ A former advisor to Prime Minister Abe, Kunihiro Miyake, remarked, “If Japan is attacked, and the Americans decline to respond, then it is time for the Americans to pull out.”²⁵ The dispute over the Senkaku Islands is central to Japanese security, and it is one issue U.S. policymakers would like to avoid.²⁶ During a joint press conference with Abe in April 2014, President Obama stated that the Senkakus indeed fell under Article 5, but “There’s no ‘red line’ that’s been drawn [with regard to military action.]”²⁷ The United States preserved its freedom of action, but Prime Minister Abe was disappointed, remarking, “On such a day as this, Obama didn’t need to make statements that sounded like he was tiptoeing around China.”²⁸

Although the Japanese are clearly concerned about their country’s future relations with China and the United States, that anxiety has not resulted in a national consensus for a

20. Takahara, “A Japanese Perspective,” 219.

21. “Global Opposition to U.S. Surveillance and Drones, but Limited Harm to America’s Image: Many in Asia Worry about Conflict with China” (Pew Research Center, June 14, 2014), <http://www.pewglobal.org/2014/07/14/global-opposition-to-u-s-surveillance-and-drones-but-limited-harm-to-americas-image/>.

22. *Japan’s Security Strategy toward China* (Tokyo, Japan: Tokyo Foundation, 2011), 13, http://www.tokyoofoundation.org/en/additional_info/security_strategy_toward_china.pdf.

23. Sheila A. Smith, “An East China Sea Update,” *Asia Unbound Blog*, Council on Foreign Relations, February 4, 2014, http://blogs.cfr.org/asia/2014/02/04/an-east-china-sea-update/?utm_content=bufferd82e8&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer.

24. Helene Cooper and Martin Fackler, “U.S. Response to Crimea Worries Japan’s Leaders,” *New York Times*, April 5, 2014, <http://www.nytimes.com/2014/04/06/world/asia/us-response-to-crimea-worries-japanese-leaders.html?partner=rss&emc=rss&r=2>.

25. *Ibid.*

26. Mizuho Aoki, “Obama Assures Abe over Senkakus,” *Japan Times*, April 24, 2014, <http://www.japantimes.co.jp/news/2014/04/24/national/obama-tells-abe-security-treaty-covers-senkakus/#.U3YWuvldV8E>.

27. “Japan in Depth: Japan-U.S. pact to enter new stage,” *Yomiuri Shimbun*, July 2, 2014, <http://the-japan-news.com/news/article/0001396334>.

28. *Ibid.*

more energetic national security policy. The public views Prime Minister Abe's recent defense reforms with a great deal of skepticism. Over half of respondents in a recent poll supported the new interpretation, but 76 percent said the public debate on the matter had been insufficient. Opposition has materialized across a variety of strata, including the rank and file of coalition partner, the New Komeito Party, and prefectural and local governments, which "could haunt [ruling coalition] candidates in local elections."²⁹ In acknowledgement of this opposition, the New Komeito Party worked to temper Liberal Democratic Party (LDP) plans to amend Japan's pacific constitution, successfully incorporating conditions for the use of force as a "brake on the SDF."³⁰ The caution with which Abe and the LDP have pursued national security reforms and the opposition they have encountered in the process demonstrate that a decision as monumental as nuclear weapons acquisition would require considerably more public debate. While discussing nuclear weapons has become socially acceptable, making the decision to embark on a nuclear program would require far more than a "severe" security environment; relations with the United States and China would have to rupture significantly. At that point, it might be possible for right-wing groups, long hesitant about the alliance with the United States, to press for an independent defense policy with greater success. In such circumstances, a Japanese nuclear deterrent would become more plausible; however, what would remain of the U.S.-Japan alliance would be shattered by such a decision.

Arming Japan

Given the gravity of a nuclear program, Japan will hedge for a period of time while it weighs various options. Toshi Yoshihara and James R. Holmes argue that during this period, Japan will build up "the planning and strategy-making processes, expertise, infrastructure, and materiel" necessary to reduce its breakout time.³¹ Although it is clear that a nuclear arsenal would not currently serve Japanese national interests, circumstances may change, and therefore it is useful to think about what such a capability would look like.

Tokyo would hope that its nuclear arsenal would induce Chinese caution and immunize Japan against Chinese coercion.³² The backbone of its strategy would be the threat of limited nuclear retaliation against a handful of Chinese targets such as Shanghai, which lies only about 1,900 kilometers from the southern coast of the Japanese Home Islands, the prosperous city of Guangzhou, only about 3,200 kilometers away, and military installations along the East China Sea. As a relatively small and densely populated nation, Japan would disproportionately suffer during a nuclear exchange, and thus it has an incentive to "re-

29. Eric Johnston, "Prefectural and local authorities warn government over Constitution," *Japan Times*, July 1, 2014, <http://www.japantimes.co.jp/news/2014/07/01/national/local-authorities-warn-government-over-constitution/>.

30. Ayako Mie, "Japan on verge of legalizing war as Komeito bends," *Japan Times*, June 30, 2014, <http://www.japantimes.co.jp/news/2014/06/30/national/politics-diplomacy/japan-on-verge-of-legalizing-war-as-komeito-bends/#.U77CmfdVAA>.

31. Toshi Yoshihara and James R. Holmes, "Thinking about the Unthinkable," *Naval War College Review* 62, no. 3 (2009): 64.

32. Waltz, "The Spread of Nuclear Weapons."

nounce the war-fighting utility of nuclear weapons.”³³ Moreover, a small nuclear arsenal would fit within Japan’s traditional defensive orientation and impart deterrent value while demonstrating restraint.³⁴ With a smaller footprint, such an arsenal would be easier to conceal, harder to destroy, and would enjoy “operational simplicity.”³⁵

To execute a deterrence mission, Japan could develop a modestly sized nuclear arsenal based first on mobile ballistic missiles and later on sea-launched cruise missiles. Though not a perfect analog, Japan’s robust space program could serve as a model for a future intermediate-range ballistic missile project. Ballistic missiles are unparalleled in their precision and speed, and, armed with penetration aids, they are also difficult to defeat. The Japanese Epsilon rocket, the successor to the recently retired M-5, is a solid-fuel, three-stage rocket capable of carrying a 1,200-kilogram payload into space.³⁶ In 2003, an M-5 rocket carried the 513-kilogram Hayabusa miniland, which successfully landed on an asteroid, retrieved samples, and returned to earth in 2010.³⁷ Journalist Chester Dawson quoted sources in 2011 who claimed that the Hayabusa used “the same type of atmospheric re-entry technology needed to guide ballistic missiles.”³⁸ Even if this is technically correct, Japanese engineers would need to master inertial guidance to ensure that warheads arrived on target. Additionally, this type of rocket has been improved over time “to enhance its capabilities, rather than its reliability,” which brings its direct utility into question.³⁹ Intermediate-range ballistic missiles loaded onto mobile transporter erector launchers would be relatively survivable, but given Japan’s limited railway system and geography they would remain vulnerable to attack by China’s own ballistic missiles.

33. A report by the UK government estimated that “some 30 to 120 atomic bombs accurately delivered by the USSR might cause the collapse of the United Kingdom without invasion, whereas several hundred bombs might be required by the United States or the United Kingdom to bring about the collapse of the USSR.” John Baylis, *Ambiguity and Deterrence: British Nuclear Strategy, 1945-1964* (Oxford, UK: Clarendon Press, 1995), 51. Quoting Indian defense minister George Fernandes, S. Paul Kapur writes that “Given the size disparity between the two countries, . . . a nuclear confrontation would be extremely costly to India, but it would probably mortally damage Pakistan.” Kapur, “India and Pakistan’s Unstable Peace: Why Nuclear South Asia Is Not Like Cold War Europe,” *International Security* 30, no. 2 (2005): 147. Also see Yoshihara and Holmes, “Thinking about the Unthinkable,” 69.

34. Yoshihara and Holmes quote Prime Minister Yasuhiro Nakasone: “I believe it is constitutional for Japan to possess small-size nuclear weapons as long as we use them only for the purposes of defending our country.” See Yoshihara and Holmes, “Thinking about the Unthinkable,” 69. In 2002, as Deputy Chief Cabinet Secretary Shinzo Abe made public statements that echoed this legal reasoning. See Katsuhisa Furukawa, “Nuclear Option, Arms Control, and Extended Deterrence: In Search of a New Framework for Japan’s Nuclear Policy,” in *Japan’s Nuclear Option: Security, Politics, and Policy in the 21st Century*, ed. Jeffrey W. Thompson and Benjamin Self (Washington, DC: Henry L. Stimson Center, 2003), 105.

35. Jordan Seng, “Less is More: Command and Control Advantages of Minor Nuclear States,” *Security Studies* 6, no. 4 (1997): 63.

36. “Space Transportation Systems: Epsilon Launch Vehicle,” *Japan Aerospace Exploration Agency*, <http://global.jaxa.jp/projects/rockets/epsilon/>.

37. “Satellites and Spacecraft: Asteroid Explorer Hayabusa (MUSES-C),” *Japan Aerospace Exploration Agency*, http://global.jaxa.jp/projects/sat/muses_c/.

38. Chester Dawson, “In Japan, Provocative Case for Staying Nuclear,” *Wall Street Journal*, October 28, 2011, A-14.

39. Jeffrey W. Thompson and Benjamin L. Self, “Nuclear Energy, Space Launch Vehicles, and Advanced Technology: Japan’s Prospects for Nuclear Breakout,” in *Japan’s Nuclear Option: Security, Politics, and Policy in the 21st Century*, ed. Jeffrey W. Thompson and Benjamin Self (Washington, DC: Henry L. Stimson Center, 2003), 175.

For this reason, Japan would also pursue a submarine-launched cruise missile capability. Cruise missiles are difficult to detect and destroy because of their low-altitude and circuitous flight paths. The highly accurate guidance systems on cruise missiles—such as terrain contour matching, radar scene matching, and satellite navigation—while not beyond the capability of Japanese scientists and engineers, would present challenges. Yoshiro and Holmes suggest that political sensitivities would preclude Japan from acquiring U.S. Tomahawk cruise missiles, and that consequently Japan would procure off-the-shelf systems in the open market or develop its own.⁴⁰ Deploying these missiles in the torpedo tubes of Japan's diesel-electric submarines would enhance survivability, especially with the expanded submerged endurance of the new Soryu-class.⁴¹ Even with the additional subs required for a continuous at-sea deterrent,⁴² such a concept of operations would be significantly less expensive than developing a strategic ballistic missile submarine fleet, which one analyst estimates would cost as much as \$100 billion.⁴³

The findings of Prime Minister Sato's 1969 study concluded that Japan would acquire nuclear material as a by-product of its civilian energy program.⁴⁴ Already endowed with a vast stockpile of fissile material, it is assumed by many that Japan could build a nuclear weapon in a period of "six months." Even after committing to divest itself of nearly 550 kilograms of plutonium and highly enriched uranium in 2014, Japan will have more than enough fissile material for a nuclear program.⁴⁵ However, actually fielding a nuclear arsenal would require Japanese engineers to overcome a number of technical challenges; contrary to conventional thinking, the process would span years, not months, and it would cost billions of dollars.⁴⁶ In addition to developing sophisticated guidance for delivery platforms, Japanese scientists would need to design a warhead without the benefit of explosive testing and military planners, and civilian political leaders would need to develop the intricate command and control systems required to ensure that the deterrent is secure as well as useable in a crisis.

40. Yoshihara and Holmes, "Thinking about the Unthinkable," 68.

41. According to Kockums, which manufactures the Soryu's Stirling air-independent propulsion (AIP) system, its AIP system "outperform[s] any other conventional submarine with regard to that key capability—submerged endurance," while it is "practically vibration-free" with a "very low" infrared signature. However, diesel electric is not as quiet as nuclear propulsion, a technology in which Japan has no experience or expertise. See "Stirling AIP System," *Kockums*, <http://kockums.se/en/products-services/submarines/stirling-aip-system/>; and Thompson and Self, "Nuclear Energy," 174.

42. The Japan Maritime SDF (MSDF) would need at least 12 submarines to maintain a continuous at-sea deterrent. See Yoshihara and Holmes, "Thinking about the Unthinkable," 71.

43. Yoshihara and Holmes cite analysis by Tetsuo Sawada of the Tokyo Institute of Technology. See Yoshihara and Holmes, "Thinking about the Unthinkable," 73–74.

44. Furukawa, "Nuclear Option," 104.

45. In addition to 640 kilograms of unreported plutonium in MOX form, Japan possesses 44 tons of plutonium at domestic and European reprocessing facilities. The Rokkasho reprocessing facility, which is currently under construction, could "provide Japan with a steady and undetectable supply of plutonium, enough for 10 bombs per year," despite international safeguards. See Hui Zhang, "China worries about Japanese plutonium stocks," *Bulletin of Atomic Scientists*, June 17, 2014, <http://thebulletin.org/china-worries-about-japanese-plutonium-stocks7248>.

46. The former foreign minister summed up Nakasone's policy: "Nakasone was of the opinion that having the ability to possess such weapons if the need arose would become a form of nuclear deterrent." See Takuya Suzuki, "Nuclear Leverage: Long an advocate of nuclear energy, Nakasone now says Japan should go solar," *Asahi Shimbun*, July 21, 2011, http://ajw.asahi.com/article/0311disaster/analysis_opinion/AJ201107214814.

Credibility is Hard

In addition to the technical challenges of developing a nuclear arsenal, the Japanese government would face intense opposition from the United States. “Sustained American pressure, combined with reassurances,” prevented Taiwan and South Korea from further pursuing their nuclear aims.⁴⁷ Israeli success stemmed from its ability to conceal its true intentions and play allies and adversaries off one another. The United Kingdom leveraged the expertise and resources it gained from its cooperation on the U.S. Manhattan Project during the 1940s. France, recalling the disaster of 1940, pursued its deterrent through force of will and by withdrawing from the NATO alliance altogether.⁴⁸

If Japan were to successfully overcome U.S. pressure and the technical obstacles inherent in a nuclear project, it would still face three barriers to achieving the credibility of its nuclear deterrent. First, with 126 million people inhabiting 372,000 square kilometers, Japan is significantly more densely populated than China and lacks strategic depth.⁴⁹ Like other nuclear powers lacking strategic depth, Japan would suffer a great deal more during a nuclear exchange than China. Second, nuclear detonations on China’s coast are likely to blow fallout across the East China Sea and onto Japanese territory. Third, it is unclear how much escalation Tokyo is willing to countenance in defense of its far-flung, uninhabited island territories. The ability of nuclear threats to deter amphibious invasions of the Senkakus and other minor Japanese islands is questionable. Attacking ships at sea or land forces during an amphibious assault is difficult, and attacking targets on the Chinese mainland risks retaliatory strikes against the Japanese Home Islands. Of all forms of aggression China might display, action against disputed islands is more likely than direct attacks on Honshu. Nuclear weapons are better suited to deter the latter contingency rather than the former. To deter military aggression along Japan’s periphery, a robust conventional force is likely to have better success. However, the loss of the Senkakus would increase pressure on Tokyo to protect the remaining islands under Japanese administration, such as Okinawa, and it would also provide an incentive for a nuclear project.

These three complicating factors bring into question the credibility of a Japanese nuclear arsenal in safeguarding Japan’s interests. Were Japan to pursue a nuclear arsenal, it would likely do so on a small scale, opting for intermediate-range ballistic missiles and sea-launched cruise missiles and threatening limited nuclear retaliation. However, the risk of disproportionate suffering and nuclear weapons’ lack of utility in deterring amphibious

47. Yoshihara and Holmes, “Thinking about the Unthinkable,” 66.

48. For more information on past U.S. efforts to prevent its allies from pursuing nuclear weapons, see, for Taiwan and the Republic of Korea, Rebecca K. C. Hersman and Robert Peters, “Nuclear U-Turns,” *Nonproliferation Review* 13, no. 3 (2006): 539–553; for the United Kingdom, see John Simpson, *The Independent Nuclear State: The United States, Great Britain and the Military Atom* (New York: St. Martin’s Press, 1983); for France, see Wilfrid Kohl, *French Nuclear Diplomacy* (Princeton, NJ: Princeton University Press, 1971); and for Israel, see Avner Cohen, *Israel and the Bomb* (New York: Columbia University Press, 1999).

49. China has 145 inhabitants per square kilometer, while Japan has 350. See World Bank, *World Development Indicators*, 2014, <http://data.worldbank.org/indicator/EN.POP.DNST>. For arguments about Japan’s lack of strategic depth, see T. V. Paul, *Power versus Prudence: Why Nations Forgo Nuclear Weapons* (Montreal: McGill-Queen’s University Press, 2000), 55.

assaults on distant islands would hollow out Japan's nuclear threats. Lacking a way to make its threats credible, Japan's efforts would undermine its strategic objectives—namely, preventing China from pressing its territorial claims by force. Acquiring a nuclear weapon would certainly prove difficult for scientists and engineers, but military planners and political leaders responsible for determining a nuclear force's structure and posture would find the road to credibility uphill, winding, and fraught with danger.

Wanted: A Reliable Ally

Although Japan would face “normative, material, geographic, institutional, and strategic” challenges to fielding a credible nuclear deterrent, “the logic of national security—of threat and response—is not so readily dismissed.” Circumstances—an even greater threat from China and the near collapse of the U.S. security guarantee—may conspire to make nuclear weapons more palatable to the broader Japanese public. Chinese aggression that results in a loss of Japanese-administrated territory, such as the Senkakus, would bolster the position of nuclear advocates seeking to deter further aggression against more integral island possessions such as Okinawa. Speaking in 2013, Defense Minister Itsunori Onodera articulated the government's prevailing view: “Over the last few years, the Japanese people's feelings about the national security environment, and also about the Ministry of Defense and the Self-Defense Forces, have changed.” He continued, “Japan has 6,800 islands. . . . Any country should be able to defend itself.”⁵⁰ Indigenous nuclear weapons represent the quintessential and unequivocal hedge against the ambivalence of security patrons. At the same time, statements like those by former Japanese ambassador Hisahiko Okazaki show that Japan has no intention of pursuing an independent security policy.⁵¹ Even while many Japanese political leaders worry over American commitment and are increasingly willing to debate the issue of nuclear weapons, most ordinary citizens continue to be wary of recent defense reforms and any path that might jeopardize the alliance with the United States.

Although the prospect of a Japanese bomb is unlikely, it is still important to understand what one may look like. Given the country's unique vulnerability with regard to geographic size and population density, Japan would deter by threatening only limited nuclear retaliation. Its modest arsenal of lower-yield nuclear weapons would be deliverable at first by ballistic missile, leveraging the country's existing rocket and space infrastructure, and then by cruise missile deployed aboard Japanese attack submarines. While it has sufficient nuclear material for a nuclear weapon, operationalizing a credible deterrent would take years and require the investment of billions of dollars in areas integral to nuclear research, such as labs and manufacturing plants. In addition, Japan would need secondary

50. Defense Minister Itsunori Onodera in July 2013. See Martin Fackler, “Japanese Minister Proposes More Active Military Presence in Region,” *New York Times*, July 26, 2013, <http://www.nytimes.com/2013/07/27/world/asia/japanese-minister-proposes-more-active-military-presence-in-region.html?pagewanted=all>.

51. In an op-ed from 2010, Okazaki wrote that “Japan-U.S. alliance is too valuable an asset to lose.” Okazaki, “Stronger alliance is on the way,” *Japan Times*, January 31, 2010, <http://www.japantimes.co.jp/opinion/2010/01/31/commentary/stronger-alliance-is-on-the-way/#.U0boMW3Ap5o>.

but essential capabilities, such as launch platforms, command and control systems, and improved intelligence, surveillance, and reconnaissance. Furthermore, threats to retaliate may lack credibility given the disproportionate damage Japan would suffer during a nuclear exchange; its proximity to its targets and thus its susceptibility to fallout; and the difficulty of using nuclear weapons to defend remote islands.

The greatest cost, however, would be the loss of whatever remained of the U.S.-Japanese alliance, which would shatter under the strain of Tokyo's nuclear effort. Although there will remain a sector of Japan's political class pressing for greater independence from the United States, most Japanese continue to believe their future security is tied to a robust partnership with their U.S. allies. However, the United States cannot assume Japanese trust of U.S. intentions is unconditional. As Japanese perception of the threat from China intensifies, the United States should tread carefully; Tokyo is watching.

Bi-/Multilateral Authentication Technology Development Framework for Future Treaty Verification Regimes

Scott Stewart¹

There has been a renewed emphasis on treaty verification with the entry into force of the New Strategic Arms Reduction Treaty (New START) in 2011. New work in the field has focused on the next steps in arms control, especially the next steps in limiting the number of deployed strategic and nonstrategic nuclear weapons. Any future arms control treaties focused on these objectives will face far more complicated verification challenges than past treaties due to the variety of nonstrategic weapons, as well as the potential difficulty of defining and differentiating these weapons. As verification technology becomes more complex to meet these challenges, there needs to be a renewed focus on ensuring that the information coming from verification instruments is reliable. This chapter proposes a framework that would allow for a common language centering around authentication, or the verification of data integrity and authenticity, based on vulnerability assessment (VA) techniques used for nuclear facility security. The adoption of this framework would create an accepted norm for authentication discussions during future treaty negotiations and would allow decisionmakers to quantify the confidence they can have in a verification technology's authentication system.

Introduction

In President Barack Obama's 2009 Prague speech, he outlined his vision for the future of nuclear weapons in the twenty-first century.² As part of his speech, the president commit-

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2. "Remarks of President Barak Obama," *Arms Control Association*, April 5, 2009, <https://www.armscontrol.org/node/3626>.

ted the United States to reducing the number of its nuclear weapons through bilateral negotiations with the Russian Federation. Due in part to this commitment, as well as the Russian desire to have an upper limit on the number of U.S. strategic nuclear warheads, New START was signed on April 8, 2010, and entered into force through the exchange of instruments of ratification between the United States and Russia on February 5, 2011. The new treaty limits the number of deployed strategic nuclear warheads to 1,550, deployed and non-deployed strategic launchers and heavy bombers to 800, and deployed strategic launchers and heavy bombers to 700.

Obama later outlined his desire to “engage Russia to seek further reductions in our nuclear arsenals” during his February 12, 2013, State of the Union address.³ During his June 19, 2013, address at the Brandenburg Gate in Berlin, Obama more specifically stated that he would like to limit U.S. strategic warheads to 1,000, or to reduce them by one-third of their New START values.⁴ These further reductions would continue to fulfill the spirit of Article VI of the Non-Proliferation Treaty, which calls for nuclear weapons states to initiate negotiations to eliminate their nuclear arsenals,⁵ as well as improve global security by reducing the number of attractive nuclear targets for potential weapons-seeking terrorists. As both the United States and Russia continue to reduce the number of strategic nuclear weapons, there will come a time when further reductions will require each party to examine previously unexamined parts of the other’s nuclear weapons arsenal. Steven Pifer, in his January 2013 memorandum to the president on nuclear arms control, presents one potential strategy for addressing these other forms of nuclear weapons.⁶ In his article, Pifer suggests that the United States exchange reductions in its numerically superior strategic nuclear weapons reserve for Russian reductions in their comparably larger tactical nuclear weapons arsenal.

Pifer’s proposal is a sound negotiating tactic, as it offers reductions in an area of U.S. superiority in exchange for reductions in an area of Russian superiority, but it may complicate the role of treaty verification in the bilateral arms control regime.

Role of Verification

Treaty verification processes are intended to provide confidence to signatories of a treaty that all other parties are meeting the obligations outlined within the treaty. Verification is of particular importance in bilateral treaty arrangements between the United States and Russia regarding nuclear weapons and has enhanced the strategic stability created

3. Tom Z. Collina, “Obama Calls for Deeper Nuclear Cuts,” *Arms Control Association*, March 2013, https://www.armscontrol.org/act/2013_03/Obama-Calls-for-Deeper-Nuclear-Cuts.

4. Jefferson Morley and Daryl G. Kimball, “Obama Calls for Deeper Nuclear Cuts,” *Arms Control Association*, July/August 2013, https://www.armscontrol.org/act/2013_0708/Obama-Calls-for-Deeper-Nuclear-Cuts.

5. Leonard Weiss, “Nuclear-Weapon States and the Grand Bargain,” *Arms Control Association*, December 2003, https://www.armscontrol.org/act/2003_12/Weiss.

6. Steven Pifer, “Nuclear Arms Control: Another New START,” *Brookings Institute*, January 17, 2013, <http://www.brookings.edu/research/papers/2013/01/nuclear-arms-control-another-new-start>.

through arms control between the two weapon states over the past four decades of cooperation.

Verification in New START is a fairly well understood process because much of it is based upon elements of the 1991 START Treaty. Previous experience from START allowed for a reduction in relative complexity of the verification regime while still providing the same level of confidence.⁷ The negotiated verification toolset for New START includes on-site inspections and exhibitions, a detailed database on the types and locations of treaty-limited strategic nuclear weapons, notifications of various activities involving treaty-limited items, and restrictions that enable each country to use its national technical means (which primarily consists of satellite imaging) to more easily verify treaty-related activity in each country.⁸

Each party is allowed to perform 18 on-site inspections in the other country each year. These inspections are broken into two types, conveniently named “Type One” and “Type Two.” Type One inspections are geared toward verifying the presence on-site of a declared number of deployed and non-deployed strategic nuclear weapons, while Type Two inspections are only intended to take place on sites with non-deployed strategic nuclear weapons systems.⁹

All of these inspections are based on confirming the absence of a nuclear device on a strategic weapon of a particular type by measuring the system with a neutron detector to test for absence of radioactive material. The technology and systems used to perform this assessment rely on fairly well understood and simple nuclear measurements technology, as they are simply verifying that neutron counts are below a certain level. On-site inspection toolkits also include measuring tapes, compasses, uniquely identified tamper-indicating tape seals, and cameras to aid in the ability to verify compliance with the treaty during inspection visits.¹⁰

This verification process becomes much more complicated when nonstrategic nuclear weapons are added to the mix, as they likely will be in the future. One major advantage of monitoring strategic weapons is that the delivery vehicles are well defined, large, and limited in variety, whereas nonstrategic nuclear weapons are more of a catchall category that contains a wide variety of systems with a multitude of potential delivery vehicles. Functionally, this means that incorporating treaty language that allows for effective verification of the limitation of deployed nonstrategic nuclear weapons based on the type of delivery system is not feasible. Alternative verification methods may be required, such as performing warhead confirmation using methods like the zero-knowledge protocol for nuclear warhead verification proposed by Glaser, Barak, and Goldston.¹¹ Additionally,

7. Tom Collina, “New START at a Glance,” *Arms Control Association*, August 2012, <https://www.armscontrol.org/factsheets/NewSTART>.

8. “New START Treaty,” *U.S. Department of State*, <http://www.state.gov/t/avc/newstart/index.htm>.

9. “New START Treaty,” *U.S. Department of State*, <http://www.state.gov/t/avc/newstart/c52405.htm>.

10. *Ibid.*, <http://www.state.gov/documents/organization/141293.pdf>.

11. Alexander Glaser, Boaz Barak, and Robert Goldston, “A zero-knowledge protocol for nuclear warhead verification,” *Nature* 510 (2014): 502.

future verification regimes may need to confirm the dismantlement of a weapon (i.e., the separation of the special nuclear material from the high explosive) for each system to build confidence in the reduction of treaty-accountable items.

The introduction of a warhead as the treaty-accountable item in an arms control treaty introduces complications regarding how to verify disarmament with a high degree of confidence while minimizing the intrusiveness of the regime and protecting classified information. In addition, warhead confirmation requires a more complicated measurement than just a basic neutron count. The additional burden of protecting sensitive information increases the difficulty involved in ensuring that the detector is performing as designed and not suffering from electronic errors, that the equipment has not been intentionally configured to provide false readings, or that the detector has not been tampered with between inspection visits.

Complications of More Intrusive Verification

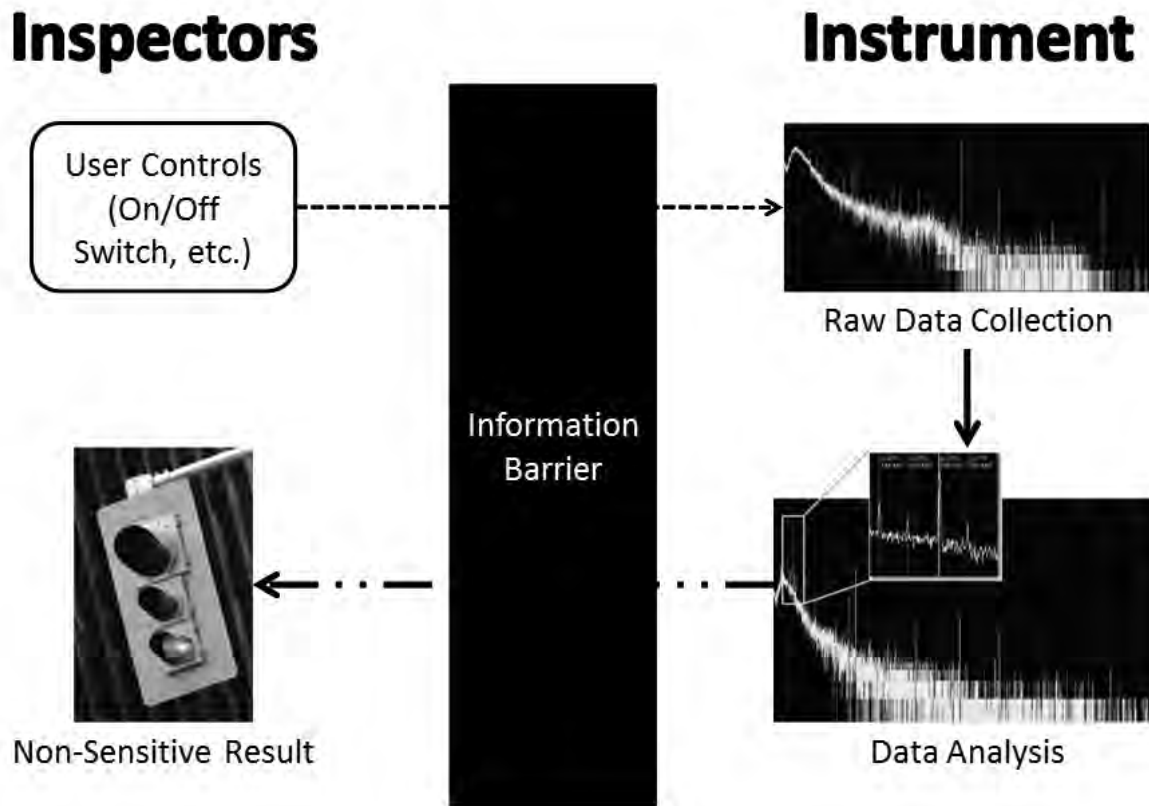
One of the main ways to protect classified information in an arms control regime is to use information barriers, which protect the sensitive information while allowing for inspectors to glean enough information to give them confidence in the veracity of the host country's compliance with the treaty. One good example of a radiation detection instrument with an information barrier built in is the Nuclear Arms Verification Instrument (NAVI). Figure 1 demonstrates the flow of information through a system with an information barrier, like the NAVI.¹² The NAVI uses basic neutron measurements and low-resolution gamma counting to verify the dismantlement of inspection objects. In NAVI, gamma measurements are of particular concern due to their potential to disseminate sensitive information to inspectors. NAVI prevents the transmission of this information by collecting and analyzing information internally behind an information barrier. Once the electronics analyze the data, the information is communicated to the inspection team through the use of a green or a red light. Other than the two-light output system, NAVI users are able to access basic measurement control functions in the system using a simplified user interface.¹³

The green/red light system, as demonstrated in the flow diagram in Figure 1, is a very effective information barrier. That, coupled with strict control over the instrument's data storage system, results in a high level of protection for the sensitive information that is collected, due to the complete divorce of the inspector from any level of visibility into the raw data itself. The problem with this bifurcation is that it significantly reduces the inspector's ability to identify problems with the measurement due to tampering, operator error, or instrument error. Another concern for inspectors is that a NAVI-like instrument, which more than likely would be jointly designed by both countries in a treaty regime, would

12. "The SHIELD Project at Texas A&M," *Texas A&M University*, <http://shield.tamu.edu/>.

13. M. W. Johnson, J. E. Doyle, and C. L. Murphy, "Recovering START Institutional Knowledge," *Proceedings of the 52nd Annual Meeting for the Institute of Nuclear Materials Management*, Palm Desert, CA, July 17–21, 2011.

Figure 1. An Example of Information Barrier Design for a Radiation-Based Treaty Verification System



need to be built within the host country, so ensuring it is built according to the specifications provides an additional challenge. The requirement to build the instrument in the host country stems from safety and security concerns that arise from introducing a foreign-made detection system into a sensitive facility.

There are three hedges against these issues: functional testing of the system, instituting standard procedures for the use of the system during a verification regime, and putting in place authentication processes to protect the integrity of the data. Functional testing consists of a rigorous series of tests in which inspectors use the system to inspect known radiation standards in order to confirm that the instruments are performing as expected. Ideally, the team would use multiple radiation standards to test the system. Some of these standards would be similar to the expected inspection objects, and some could potentially test outlier cases to help test the performance of the equipment against what was seen during the development of the system.

A rigorous set of procedures for the use of the verification system helps ensure that measurements on verification objects are performed in a consistent and replicable manner. Given the need for information barriers, strict procedures help protect against irregularities in the data created through variances in how the measurement is set up. Procedures

also make functional testing more reliable because they significantly limit the number of measurement cases that an inspector would generally expect to see for a certain system to a more manageable subset of instances.

Authentication in this context refers to tools that help assure an inspector of the integrity of the data coming from the treaty verification system. This can include things such as an authenticated handshake between different pieces of electronics within the verification system to make man-in-the-middle attacks more difficult,¹⁴ or a tamper-indicating enclosure to indicate if any unauthorized access to the verification system occurred between inspection visits. A viable set of authentication tools significantly increases the confidence an inspection team can have in the data coming from the detector and reduces the amount of testing that needs to occur with standards during each inspection visit in order to verify that the equipment is working as intended.

The problem with each of these hedges is that their use in any arms control regime will have to be negotiated quite carefully, which becomes very difficult when there are not standardized or widely accepted international practices governing how each of these three confidence-building measures should be deployed in a sensitive environment. The next section addresses this issue for one of the hedges by proposing a framework to discuss authentication approaches in a treaty verification context.

Framework for Authentication in Treaty Verification

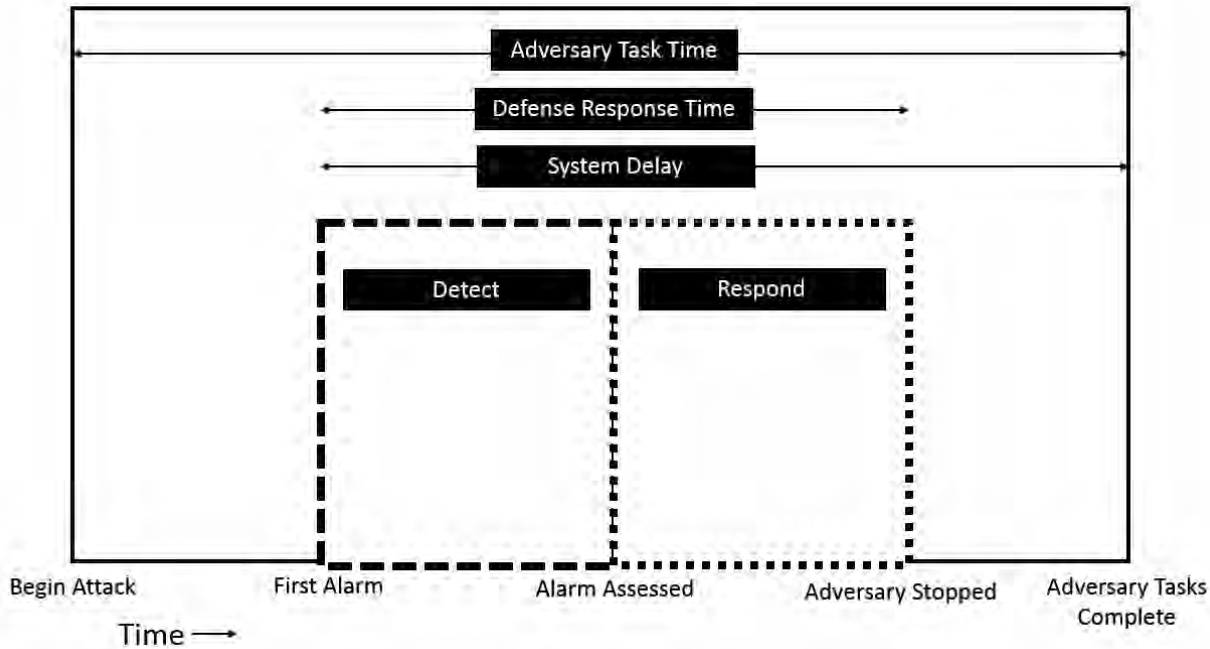
A common vernacular and accepted practices for how to talk about and use a given technology would increase the likelihood that arms control negotiations incorporating that technology will be successful. It is rather difficult to come to a consensus about a complicated technology for a treaty unless there is some preexisting common ground, such as a perceived need for the equipment and a common understanding of how to use the technology.

In the area of authentication tools, it is possible to adapt a standard mathematical model from nuclear security research to give the international community a common framework with which to discuss authentication. In order to understand how to adapt this methodology to authentication toolsets, it is important to first have a base level of knowledge about the original model. VAs are currently used in nuclear security research to study the protection of a specific nuclear site and to ensure that resources are deployed in the most effective way possible to meet the broad spectrum of potential adversaries who could attack that site.

The framework of the VA assumes that whenever there is an attack on a nuclear facility, the attacker has a list of actions to carry out, each of which takes a certain amount of time

14. Note that a handshake in this case refers to an automated process of negotiation between two electronic devices that sets the parameters for their communication, while a man-in-the-middle attack is a form of eavesdropping in which the attacker intercepts all communications between two targets and manipulates their communication with each other.

Figure 2. The Relationships between Different Task Times during an Attack on a Nuclear Facility



to complete. This can be seen as the adversary task time in Figure 2.¹⁵ Once the attacker has completed all the tasks on his list, he achieves his objective or wins the scenario. For the defender to win, they have to first detect that they are under attack, which means that an alarm must sound and then that alarm must be successfully identified as an attack. This is shown as the “detect” box in Figure 2. The defender then needs the time to mobilize response forces and neutralize the adversary. The defender attempts to rig the game, so to speak, by stacking detection in the outer layers of the facility and adding delay as the adversary gets further inside the facility. This effectively pushes the first alarm as close to the start of the adversary task time as possible, while increasing the amount of system delay after first detection to give the defense force ample time to respond.

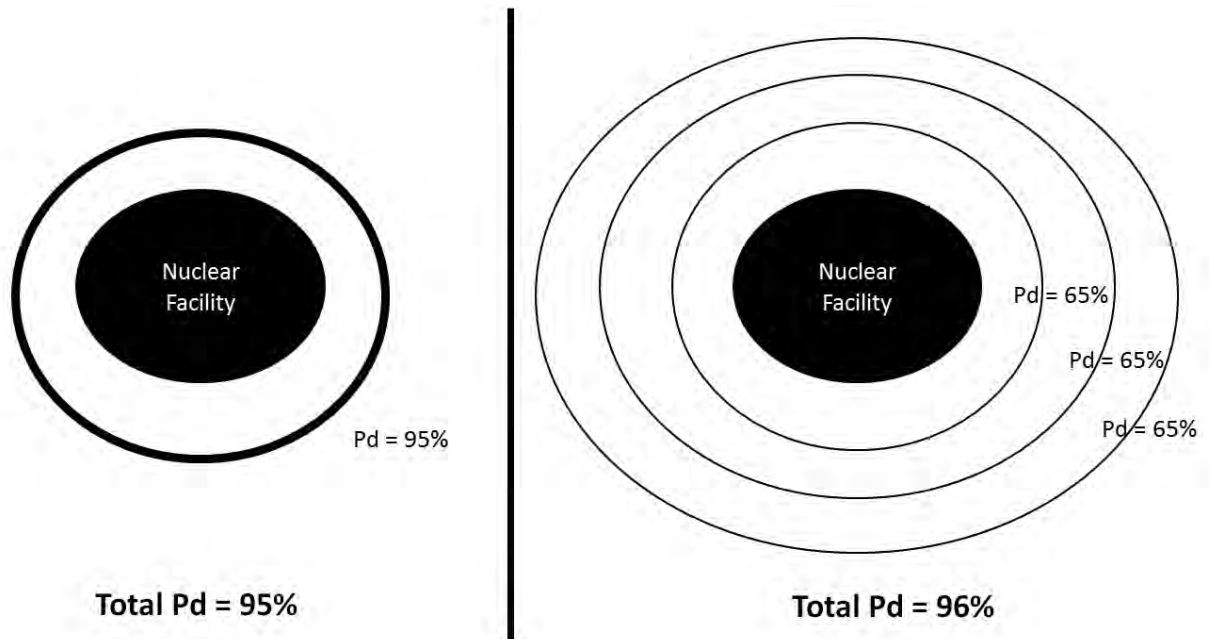
A mathematical model using basic probability is used to gain greater insight into the type of adversary attack presented generally in Figure 2. The conditional risk formula for this mathematical model is

$$Risk = (1 - P_d P_n) * C$$

where P_d is the probability of detection by the security system, P_n is the probability of neutralization by the response force, and C is the consequence associated with a successful attack. $P_d P_n$ in this equation essentially represents the effectiveness of a security system. P_d

15. Betty E. Biringer, Rudolph V. Matalucci, and Sharon L. O'Connor, *Security Risk Assessment and Management: A Professional Practice Guide for Protecting Buildings and Infrastructures* (Hoboken, NJ: John Wiley & Sons, 2007).

Figure 3. Comparison between Single Detection Point and Defense-in-Depth Detectors



is evaluated using the probabilities of detection for each discrete detection element in the system before the final point at which an adversary can be detected and potentially neutralized by the guard force. Each discrete potential detection event is treated as an independent event. P_n is calculated using force-on-force exercises and attack simulation programs to generate a realistic measure of the guard force's ability to neutralize an adversary. By using this equation as well as detailed information on a site's security system, a VA model is able to demonstrate how effectively a site could defend against various threats across the threat spectrum.

Another fundamental principle of nuclear security incorporated into VA modeling is defense-in-depth. Essentially, defense-in-depth at a nuclear facility is geared toward creating redundancy in the security system in order to increase effectiveness and prevent single-point failure. So, for instance, instead of placing one set of intrusion sensors looking for the same type of signature along a high-security fence line, proper defense-in-depth practice would call for a second set of intrusion sensors focusing on a different signature covering the same area as the first intrusion sensors. The difference in the probability of detection for three less effective detectors working in tandem compared to one highly effective detector guarding an area is compared in Figure 3. The values for the system of detectors are calculated as follows:

$$P_{system} = 1 - \{(1 - .65) * (1 - .65) * (1 - .65)\}$$

This equation and figure show how a series of three independent detectors can be more effective at detecting an adversary than one detector.

This concept can also be applied to treaty verification. When a complex detection system needs to be left within a foreign nuclear facility between inspection visits, this tests an inspector's ability to maintain confidence in the verification system. In this scenario, the adversary has a virtually infinite amount of time to penetrate the verification system and make modifications to its electronics to impact measurements. The only way to mitigate the risks is to ensure that the authentication tools within the verification system are designed in such a way that they are not susceptible to single-point failures, and that they instead take full advantage of layered complimentary defenses in order to increase the chance that any tampering will be detected.

It is difficult to imagine any scenario where a sophisticated detection system used to verify warheads would ever leave the nuclear facility in which verification activities are taking place. Consequently, reworking VA mathematics for authentication means focusing on the portion of the model with the probabilities of detection, since no friendly guard force will be available in a foreign nuclear facility. This modification impacts the portion of the equation that determines system effectiveness and results in a partial equation for the confidence level in the treaty verification regime, which is referred to as the authentication component of confidence in this equation. The equation is as follows:

$$Confidence_{auth} = (1 - P_d) * C$$

where P_d is the authentication system's probability of detecting any tampering with the data integrity of the system, and C is the consequence of a failing to recognize tampering. In this modified equation, P_d is now equivalent to the system effectiveness.

This mathematical model has the potential to allow negotiators on both sides of an arms control treaty to have a common way of discussing the effectiveness of authentication tools as part of a verification regime. This equation will also be able to quantify the confidence each party can have in the final set of authentication tools deployed as part of a verification regime.

Bi-/Multilateral Work on the Authentication Framework

If an adaptation of the VA model used in nuclear security is chosen to help frame conversations about authentication, then there is one major area that will require bilateral or multilateral work in order to give weight to this model for arms control treaty negotiations: the compilation of the probabilities of detection for various authentication technologies. In traditional nuclear security, there are multiple groups that test various security systems to determine their probability of detecting an intruder, and they also test other equipment to determine the amount of delay it provides against intruders. Some of these centers tabulate these results and put them together in one large security compendium for use throughout the security community.

A similar approach could be taken with defining the probabilities of detection with authentication technologies. International teams of scientists and engineers could meet as part of a commission to define broad categories of authentication technology, and then they could create common scenarios per category that would be used to test the effectiveness of those systems against a wide range of attack vectors. Each scenario could then be assigned to either a multinational group of scientists to perform testing or to multiple laboratories within different countries. Countries may be concerned with the sensitivity of information revealed through this process, but it may be possible to have conversations about technology in terms of open source, known vulnerabilities that do not reveal country-specific capabilities, or it may be possible to filter the probabilities of detection through the International Atomic Energy Agency (IAEA) and then discuss them in an international forum where the probabilities are not connected to a specific laboratory or country. The commission would then use the results from all the scenarios as a basis to define the probability of detection for a certain technology, compile all such probabilities for the subset of authentication technologies chosen for the process, and then publish these probabilities in a large appendix that could be used for further authentication discussions. Given the present tension between the United States and Russia over Ukraine, as well as the general Russian reluctance to work on any arms control issues in the present environment, it is highly unlikely that this sort of effort could be completed anytime soon in the bilateral context. Instead, it would be advisable to give the IAEA the lead role in this effort.

The authentication framework proposed in this chapter could just as easily serve as a model to study the effectiveness of the IAEA's authentication systems used to protect the confidentiality and integrity of information in a variety of safeguards systems, be they individual detectors, containment/surveillance equipment, or remote monitoring deployments. This means that the IAEA Department of Safeguards could be responsible for forming a commission focused on this effort, and they could in turn request assistance from member states for performance testing of the equipment and for the development of the technology categories, scenarios, and equipment lists. As this effort would ostensibly be focused on safeguards applications rather than treaty verification, it may even be possible to draw in Russian involvement.

The advantage of including the IAEA in this effort to develop an authentication framework is that the resulting appendix of probabilities of detection, as well as authentication practices, could become international norms created by a large, multinational team of scientists. This would lend strength to any U.S. attempt to use this framework, as well as to the appendix itself, as a basis for authentication conversations in any future nuclear arms control negotiations with the Russians or others.

Conclusion

While the realities of the current relationship between the United States and the Russian Federation make any near-term bilateral nuclear arms control treaties highly unlikely, there is a clear impetus on the part of the administration to focus on nuclear arms

reductions. This has led to a resurgence of research and development activities across the United States focused on how to support future arms control work. One case to consider for arms control is how to verify the compliance with any treaty that incorporates nonstrategic nuclear weapons. Due to the diversity amongst nonstrategic delivery systems, a future arms control treaty may need to move away from the strategic weapon model of identifying nuclear arms based on their delivery vehicles and instead consider new verification technologies, such as the zero-knowledge protocol or verification through warheads.

In either case, the verification of a nonstrategic nuclear weapons arms control regime will require more sophisticated treaty verification systems. Some might incorporate information barriers as well as multiple forms of radiation measurements to verify information about a nuclear weapon while protecting sensitive weapons information, while others might employ sophisticated schemata to provide confidence while avoiding the capture of classified information. To ensure that the verification systems are performing as expected and have not been tampered with to give faulty information, the systems will need to undergo rigorous functional testing once they are completed, will need procedures governing their use, and will need to be protected with authentication tools to guard the integrity of the data within the system.

Both the verification system itself as well as all of the methods to build confidence in that system will have to be negotiated bilaterally as part of any arms control regime. This tends to introduce complications whenever one of the parties to the negotiations has not been involved in the development of the system, or if there are no broadly accepted international standards that are used to discuss the deployment of the system. This chapter proposes a framework to use when discussing authentication tools based on a mathematical model used in VA research for ensuring the security of nuclear sites, from hospitals to nuclear plants to research facilities.

This framework advocates using a defense-in-depth approach to authentication for deployed verification systems and assumes that the goal of any such system would be to alert inspectors if a system has been tampered with. This framework also has applications in the international safeguards realm, as it could easily be modified to give the IAEA a metric to gauge the effectiveness of the authentication tools protecting their deployed safeguards equipment.

This framework could potentially be utilized as a way to engage the international community through the IAEA in developing broadly accepted metrics that could be used to discuss both how to deploy authentication tools within a system and to measure the performance of the individual tools. This could, in turn, help with any future arms control treaty negotiations by giving both parties a common, broadly accepted lexicon to discuss the application of authentication tools within verification systems.

Al Qaeda's Nuclear Ambitions

Ariane Tabatabai¹

After the September 11, 2001, attacks, the U.S. government and its allies acted to stem the threat of nuclear terrorism. First, they implemented counterterrorism measures, including drone strikes and targeted killings of key al Qaeda leaders, resulting in a change in the terrorist network's structure and focus. Second, the United States cooperated with other states to strengthen nuclear security to diminish terrorist access to fissile materials. This chapter assesses whether al Qaeda continues to remain a viable nuclear terrorism threat in the face of these developments by analyzing its willingness and ability to develop and use nuclear capability.

Introduction

U.S. president Barack Obama's 2009 Prague speech and his administration's Nuclear Posture Review identified nuclear terrorism as one of the greatest threats to security and gave rise to the Nuclear Security Summit (NSS) process.² The Prague speech noted that nuclear weapons proliferation, nuclear security, and nuclear terrorism, are inherently linked:

We must ensure that terrorists never acquire a nuclear weapon. This is the most immediate and extreme threat to global security. One terrorist with one nuclear weapon could unleash massive destruction. Al Qaeda has said it seeks a bomb and that it would have no problem with using it. And we know that there is unsecured nuclear material across the globe. To protect our people, we must act with a sense of purpose without delay.³

Nuclear terrorism is increasingly viewed as a real threat to international peace and security. However, the progress made on nuclear security, combined with the effective counterterrorism measures undertaken by the United States and other countries, seems to have reduced the threat of nuclear terrorism. Al Qaeda, widely viewed as the most likely

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2. *Nuclear Posture Review Report* (Washington, DC: U.S. Department of Defense, April 2010), iii.

3. Barack Obama, "Remarks by President Barack Obama" (speech, Prague, Czech Republic, April 5, 2009).

terrorist entity to acquire nuclear weapons and launch a nuclear attack, has lost some of its key leaders, including Osama bin Laden. Yet, while considerable progress has been made on nuclear security, many challenges remain.⁴ For instance, al Qaeda has proven to be flexible and able to adjust to leadership changes and counterterrorism measures. The terrorist network has taken several steps to adjust to the new environment in which it operates. This chapter discusses internal changes to al Qaeda's network, developments in nuclear security, and their combined impact on the network's nuclear ambitions and ability to use nuclear weapons. The analysis identifies the motivations behind al Qaeda's nuclear ambitions and how these driving forces could be affected in light of recent internal developments within the network and broader international security considerations.

Background

Our ability to predict trends in terrorism and to stop terrorist attacks is imperfect. Until the September 11 (9/11) attacks, the possibility of a terrorist attack of that scale was dismissed by most observers. Prominent terrorism experts, including Brian Jenkins, argued that the aim of terrorists was to have many people watching, not many people dead: "Acts aimed at causing thousands or tens of thousands of casualties," Jenkins argued, "may be the least likely."⁵ This is while, according to Rolf Mowatt-Larssen, 9/11 could have been prevented had the fatwas issued by the network been taken seriously.⁶ Similarly, a mostly declassified 1986 National Intelligence Estimate (NIE) on nuclear terrorism reveals that the intelligence community did not believe terrorists would be willing to perpetrate acts of nuclear terrorism.⁷ The argument advanced by the NIE is based on the absence of terrorists' political will to undertake such an attack. It argued that if a sophisticated terrorist group gained access to a nuclear weapon or sufficient fissile material, it would have the ability to detonate a nuclear device; however, known groups would refrain from doing so, as such an attack could interfere with their political objectives.⁸ The 9/11 attacks changed that conventional wisdom, showing that while this was true of certain terrorist groups, it did not accurately describe the intent and tactics of all terrorists. Scholars began to revisit al Qaeda's history, strategy, goals, motivations, and narrative. Policymakers began to seek solutions to the shift in threat, from the known (i.e., interstate conflict) to the unknown (i.e., mass-casualty terrorism). U.S. efforts included counterterrorism measures and steps to strengthen nuclear security.

As a result, several controversial and robust counterterrorism measures have been adopted. It appears that, despite the controversy, these measures have been increasingly effective in preventing al Qaeda from perpetrating mass-casualty attacks. Yet they have

4. William H. Tobey, "We Are Failing at Nuclear Security," *Nuclear Security Matters Blog*, March 1, 2014, <http://nuclearsecuritymatters.belfercenter.org/blog/we-are-failing-at-nuclear-security>.

5. Brian M. Jenkins, "Will Terrorists Go Nuclear?" (testimony, Committee on Energy and Diminishing Materials of the California State Assembly, November 19, 1975), 2.

6. Author interview with Rolf Mowatt-Larssen.

7. Director of Central Intelligence, *The Likelihood of Nuclear Acts by Terrorist Groups*, NIE 6-86 (Washington, DC: April 1986), 3.

8. Ibid.

also failed to prevent several deadly attacks in the years following 9/11, including in Madrid (March 11, 2004), London (July 7, 2005), and Bali (October 1, 2005). Likewise, the extent to which these measures can be viewed as effective in preventing future mass-casualty attacks by the network and its affiliates is debatable. Indeed, the network has shown considerable flexibility and adaptability, making it more resistant to counterterrorism measures. Like mass-casualty attacks, nuclear terrorism, once viewed with skepticism, is now considered as a possible low-probability, high-consequence threat, and steps have been taken to address this threat. These steps include the elimination of highly enriched uranium (HEU) from thirteen countries between 2009 and 2014; strengthening of rules and procedures for securing nuclear weapons, materials, and facilities; and the NSS process, organized on a presidential and ministerial level.⁹

CHANGES IN THE LANDSCAPE

Al Qaeda defies the logic that had previously driven other terrorist groups, such as the Irish Republican Army (IRA), the Basque separatist group, Euzkadi Ta Askatasuna, Harakat al-Muqawamah al-Islamiyyah, and Hezbollah. Terrorism experts and scholars have identified several ways in which al Qaeda is different from these groups. First, scholars refer to al Qaeda as the first “postmodern” terrorist network, thus differentiating it from the aforementioned groups, which they qualify as “modern” terrorists. Indeed, while modern terrorist groups are often attached to a territory and claim to represent a population, al Qaeda transcends geopolitical borders. Hence, the lack of concentration in a given territory makes al Qaeda less vulnerable to reprisals. Second, while modern terrorist groups often attempt to become part of the political discourse, al Qaeda completely rejects the status quo and does not seek to be involved in what it sees as a corrupt and un-Islamic order.¹⁰ Therefore, while modern groups attempt to appeal to a given constituency, al Qaeda does not. Al Qaeda’s constituency is the entire Sunni world, especially Arab Sunni populations. Third, while many modern terrorist groups are reluctant to kill great numbers of people,¹¹ al Qaeda has been willing to inflict mass casualties.¹² During the 1980s and 1990s, over a quarter of casualties resulting from terrorism were victims of Shiite terrorist groups, yet these groups did not perpetrate attacks using chemical, biological, radiological, and nuclear (CBRN) weapons. These groups generally did not show an interest or declare the intent to acquire and use such weapons. As discussed by Benjamin Cole, this shows that the correlation between “the general trend of the increasing lethality of contemporary terrorism” and the use of weapons of mass destruction is “equivocal at best.”¹³ This highlights another difference between global terrorist networks, such as al Qaeda, and modern

9. Matthew Bunn, Martin B. Malin, Nickolas Roth, and William H. Tobey, *Advancing Nuclear Security: Evaluating Progress and Setting New Goals* (Cambridge, MA: Belfer Center for Science and International Affairs, March 2014), ii.

10. “The Al Qaeda Manual,” *Air University*, http://www.au.af.mil/au/awc/awcgate/terrorism/alqaida_manual/manualpart1_1.pdf.

11. Stephen Maurer, ed., *WMD Terrorism: Science and Policy Choices* (Cambridge, MA: MIT Press, 2009), 4.

12. Brian Michael Jenkins, *Countering al-Qaeda: An Appreciation of the Situation and Suggestions for Strategy* (Arlington, VA: RAND Corporation, 2002): 6.

13. Benjamin Cole, *The Changing Face of Terrorism: How Real Is the Threat from Biological, Chemical and Nuclear Weapons?* (London: I. B. Tauris, 2011), 11.

terrorist groups. Indeed, whereas modern terrorist groups, such as the IRA, were sometimes reluctant to even launch deadly attacks with minimal casualties, and would in some cases issue apologetic statements after perpetrating attacks, al Qaeda has not hesitated to inflict mass casualties and proudly defended its actions. As discussed below, al Qaeda is not alone in possessing nuclear terrorism ambitions. Other groups, including Chechens and Aum-Shinrikyo, have also shown a willingness to inflict mass casualties and have sought nuclear weapons or material. However, al Qaeda has gone even a step farther by trying to justify the necessity and legitimacy of mass killings in both practical and Islamic terms from ethical, legal, and strategic angles. Hence, the group's nuclear ambitions are considered as a serious threat by observers.¹⁴

AL QAEDA'S NUCLEAR AMBITIONS

These differences explain why al Qaeda is seen as a greater potential nuclear threat than the aforementioned groups. While the modern groups could be easily targeted, the states and territories they are associated with destroyed, and their constituencies retaliated against, al Qaeda is not constrained by such concerns. Likewise, while modern terrorists often have to reevaluate their tactics due to the pressure they feel from the factions they try to galvanize, al Qaeda does not have a single, unified audience. An indiscriminate attack, inflicting unnecessary suffering on hundreds of thousands of noncombatants, could completely delegitimize and consequently put an end to a modern terrorist group. However, in the case of al Qaeda, this would not necessarily be the case.

Obtaining a nuclear weapon for deterrence purposes could be helpful to modern terrorist groups; it would serve the same purpose as for a state actor. It could, however, also complicate matters for the group domestically. For a network that is as spread out geographically as al Qaeda, deterrence would be more complicated.

For all these reasons, al Qaeda's core remains one of three non-state actors that have sought to use nuclear weapons. The other two exceptions are the Japanese group Aum Shinrikyo, responsible for the 1995 sarin attack in the Tokyo subway, and possibly some groups based in the North Caucasus.¹⁵ Most recently, a former al Qaeda affiliate, the Islamic State of Iraq and the Levant (ISIL),¹⁶ which has announced the return of the Islamic Caliphate, took over a chemical weapons facility in Iraq¹⁷ and acquired 40 kilograms of uranium compounds.¹⁸ Zawahiri has disavowed ISIL, calling for its leader, Abu Bakr al-Baghdadi, to leave Syria.¹⁹ The group has global ambitions and has proven its willingness and ability to

14. Maurer, *WMD Terrorism*, 4.

15. Author interview with Rolf Mowatt-Larssen; Bunn et al., *Advancing Nuclear Security*, i.

16. Also known as the Islamic State (IS) or Islamic State of Iraq and Syria (ISIS).

17. Awad Mustafa, "Experts Assessing ISIL's Seizure of Iraqi Weapons Facility," *DefenseNews*, July 2, 2014, <http://www.defensenews.com/article/20140702/DEFREG04/307020015/Experts-Assessing-ISIL-s-Seizure-Iraqi-Weapons-Facility?odyssey=nav|head>.

18. Matthew Bunn, "ISIS Seizes Nuclear Material—but That's Not the Reason to Worry," *National Interest*, July 11, 2014, <http://nationalinterest.org/feature/isis-seizes-nuclear-material%E2%80%94but-That%E2%80%99s-not-the-reason-worry-10849>.

19. Mark Tran, "Who are Isis? A terror group too extreme even for al-Qaida," *Guardian*, June 11, 2014, <http://www.theguardian.com/world/2014/jun/11/isis-too-extreme-al-qaida-terror-jihadi>.

inflict mass casualties. However, al Qaeda's ambitions have surpassed those of other groups, combining concrete efforts to develop a nuclear capability with justifications for its potential acquisition and use in practical and Islamic terms. Indeed, while al Qaeda's nuclear capabilities remain unknown, the network has carried out "crude but sensible conventional explosive tests for the nuclear program in the desert of Afghanistan."²⁰ The network also took steps to procure nuclear weapons and materials in the 1990s under bin Laden's leadership.

Between 1999 and 2001, al Qaeda led basic chemical, biological, and radiological training courses in its training camps.²¹ While training its recruits to use CBRN weapons and making efforts to acquire a nuclear capability, al Qaeda's core leadership also issued a number of statements, including fatwas, supporting the acquisition and use of such weapons. In his interview with *Time* magazine on November 24, 1998, Osama bin Laden stated that "acquiring WMD [weapons of mass destruction] for the defense of Muslims is a religious duty."²²

AL QAEDA TODAY

Today, al Qaeda "can be divided into four tiers: central al Qaeda, affiliated groups, allied groups, and inspired networks."²³ First, central al Qaeda or al Qaeda core, based in Pakistan, is currently led by bin Laden's successor, Ayman al-Zawahiri. The core serves as a hub for technical support.²⁴ In 2008, Zawahiri updated a fatwa issued in 2003 by Nasser bin Hamid al-Fahd, deeming the use of nuclear weapons against the United States "obligatory."²⁵ However, "There is no standardized definition of al Qaeda's 'core.'"²⁶ Second, the affiliates are the formal branches of the network, whose leaders pledge *'bayat* (loyalty) to the core leadership. The affiliates were established in the early 1990s,²⁷ while bin Laden was in Sudan and attempting to procure HEU. These groups include al Qaeda in the Arabian Peninsula (AQAP), Somalia's Al-Shabāb, and Jabhat al-Nusrah. Third, the allied groups are those that have a direct relationship with al Qaeda but have not become formal members, thus preserving their independence yet working with al Qaeda on specific operations. Lastly, the inspired networks are those without a direct contact to the core but that are inspired by the network's cause and share its "hatred of the West and its allied regimes in the Middle East." The Boston Marathon bombers could fall under this category.²⁸

20. Bunn et al., *Advancing Nuclear Security*, 6.

21. Rolf Mowatt-Larssen, *Al Qaeda Weapons of Mass Destruction Threat: Hype or Reality?* (Cambridge, MA: Belfer Center for Science and International Affairs, January 2010), 13.

22. Ibid.

23. Seth G. Jones, "Re-Examining the Al Qaeda Threat to the United States" (testimony, Committee on Foreign Affairs Subcommittee on Terrorism, Nonproliferation and Trade, "Global Al-Qaeda: Affiliates, Objectives, and Future Challenges," July 18, 2013), 5.

24. Eric Denécé, *Al-Qaeda: Les nouveaux réseaux de la terreur* (Paris: Ellipses, 2004), 48 (translated by the author).

25. Nasser Bin Hamid al-Fahd, *A Treatise on the Legal Status of Using WMD against Infidels*, 2003.

26. Thomas Joscelyn, "Testimony of Thomas Joscelyn" (testimony, Committee on Foreign Affairs Subcommittee on Terrorism, Nonproliferation and Trade, "Global Al-Qaeda: Affiliates, Objectives, and Future Challenges," July 18, 2013), 38.

27. Joscelyn, "Testimony of Thomas Joscelyn," 40.

28. Jones, "Re-Examining the Al Qaeda Threat," 6.

Despite the robust counterterrorism measures currently in place, the majority of al Qaeda's nuclear players remain alive.²⁹ What is more, Zawahiri remains interested in a nuclear option. If able to develop a nuclear capability, al Qaeda, in particular al Qaeda core, would be more willing to use these weapons strategically and to inflict mass casualties. Smaller affiliated groups, however, would be more reluctant to inflict mass casualties and more likely to use these weapons tactically, mainly to impact a given society psychologically and economically.³⁰

Changes in al Qaeda and the Security Environment

Several developments have led counterterrorism experts and policymakers to believe that al Qaeda has been effectively dismantled to a large degree. Experts argue that “the architects of 9/11 have been captured or killed. Al Qaeda’s founder and titular leader is dead. Its remaining leadership has been decimated. The group’s wanton slaughter of Muslims has alienated much of its potential constituency.”³¹ What is more, the group has been unable to “carry out a significant terrorist operation in the West since 2005, although it is still capable of mounting plausible, worrisome threats.”³² This is due to several factors, including the Arab Spring,³³ the “fluidity among the jihadist groups,” and its periphery’s strength, “though its center has been hollowed.”³⁴ In recent years, al Qaeda’s operations have been chiefly tactical ones, carried out by al Qaeda affiliates.

Nevertheless, as suggested previously, al Qaeda core’s weakening has led to an increasing level of activity by the network’s affiliates. Other groups have also become more active or more capable of inflicting casualties, particularly several Pakistani groups. These include the anti-Shiite group, Lashkar-e Jhangvi, which “has driven much of this violence in Pakistan.”³⁵ What is more, “where once Islamist militant organizations embraced al Qaeda core’s global ideology, . . . the targeting of internationally focused militants by the United States and its partners . . . appears to have fomented a return to more locally focused (and inherently less conspicuous) ideologies.”³⁶ Hence, the threat in the region seems to have become more focused around “domestic enemies, be they local governments, ethnic populations, or religious groups.”³⁷ This in turn could mean that nuclear terrorism is becoming

29. Bunn et al., *Advancing Nuclear Security*, 6.

30. Gary Ackerman and Jeremy Tamsett, *Jihadists and Weapons of Mass Destruction* (Boca Raton, FL: CRC Press, 2009), xv.

31. Brian Michael Jenkins, *Al Qaeda in Its Third Decade: Irreversible Decline or Imminent Victory?* (Arlington, VA: RAND Corporation, 2012): 2.

32. Ibid.

33. Jenkins suggests that “al Qaeda has scrambled to correctly interpret fast-moving events, adjusting its messaging to address the new circumstances. It has firmly aligned itself with the uprisings while interpreting events in the context of its own struggle”; Ibid., 6.

34. Ibid., 1–2.

35. Thomas Sanderson et al., *Trends in Militancy across South Asia: A Region on the Brink* (Washington, DC: CSIS, April 2013), 11.

36. Ibid., 12–13.

37. Ibid., 13.

less of a threat in the region, as terrorism in South Asia reshifts from postmodern to modern terrorism. Nevertheless, the access of these groups to nuclear materials could still represent a threat of radiological terrorism and a risk that one of these groups, some of which continue to maintain ties to a weakened al Qaeda core, will procure nuclear weapons and provide them to the organization, which could look for a “spectacular come back.” This represents a great challenge, given the Pakistani state’s fragility and the concerns over the security of its nuclear arsenal and facilities.

The counterterrorism operations led by the United States and other Western powers may have proved effective. This includes the controversial drone program, which has been questioned as unethical and illegal.³⁸ These operations also encompass the assassination of core al Qaeda leadership, including bin Laden.³⁹ Indeed, while some expected al Qaeda to respond to the assassination by carrying out other attacks against the West and the United States in particular, such operations have not materialized. Bin Laden’s death has had two major implications: a psychological blow to the organization and a rationale for some of his followers and supporters to distance themselves from the group. “In a culture where fealty remains personal, those who swore loyalty to Osama bin Laden may consider themselves less bound to his successor.”⁴⁰

Covert operations and drone strikes have led to the deaths of key al Qaeda core leaders. Two theories regarding the direction of the network can be put forward. First, al Qaeda has a history of becoming quiet for long periods before striking dramatically. The network could be in one such quiet phase, outsourcing its activities to the affiliates, while awaiting the opportune moment to strike back. A second and alternative theory could be a longer-term approach: al Qaeda seems to be evolving from a postmodern transnational terrorist organization to a loose network of modern terrorist groups. Indeed, while the group was previously composed of a core leadership and affiliates, its affiliates were not as active. In an attempt to adjust to the counterterrorism measures implemented in South Asia and the Middle East since 9/11, the network seems to have empowered affiliates. Hence, its efforts seem to have become more localized. The organization seems to be focusing on more tactical operations rather than strategic ones, such as those it pursued in the years following 9/11.

In recent years, especially since bin Laden’s death, the conventional wisdom has been that the network “is on its last legs” and that the “remnants of al-Qaeda that remain are too weak for us to be concerned about.”⁴¹ The al Qaeda core (in Pakistan) has suffered the most in recent years, with four out of five of its top leaders having been killed.⁴² “As a result, its

38. Ed Pilkington and Ryan Devereau, “US Defends Drone Strikes as ‘Necessary and Just’ in Face of UN Criticism,” *Guardian*, October 25, 2013, <http://www.theguardian.com/world/2013/oct/25/un-drones-us-policy-debate>.

39. “Bin Laden’s Death: How the Story Unfolded,” *CNN*, May 1, 2013, <http://www.cnn.com/2013/05/01/world/bin-laden-recap/>.

40. Jenkins, *Al Qaeda in its Third Decade*, 4.

41. “Global Al-Qaeda: Affiliates, Objectives, and Future Challenges,” (hearing transcript, Committee on Foreign Affairs Subcommittee on Terrorism, Nonproliferation, and Trade, July, 18, 2013), 1.

42. *Ibid.*, 2.

regional affiliates in Iraq, North Africa, and especially Yemen, the base of [AQAP], currently pose the greatest threat.”⁴³ The 2014 *Worldwide Threat Assessment of the US Intelligence Community* identified AQAP as posing “a significant threat” to the United States and remaining “intent on targeting the United States and US interests overseas.”⁴⁴

Yet al Qaeda’s threat remains significant, though its source has changed. Indeed, the network has become more decentralized, and “its chief terrorist activity is now being conducted by its local and regional affiliates.”⁴⁵ In fact, Seth Jones argues that “there has been a net expansion in the number and the geographic scope of al-Qaeda affiliates and allies over the past decade.”⁴⁶ This, Jones argues, is due to two factors. First, the Arab Spring, in particular the events in Egypt, have played a crucial role in weakening various regimes across the Middle East and North Africa region, allowing al Qaeda affiliates to establish themselves throughout the region. As Islamist regimes have replaced secular autocracies, the path has been increasingly paved for al Qaeda to set foot in the region. This is tied to the growing sectarianism in the region, with the Sunni side being funded by state and non-state actors alike, providing more resources to al Qaeda and its affiliates. Second, as noted previously, the network has become increasingly decentralized, with various affiliates running their operations autonomously while still communicating with the core. Hence, according to Jones, even if Zawahiri were successfully removed, he could be replaced by at least four individuals, thus ensuring the movement’s continuity.⁴⁷

These developments do not signify that al Qaeda core is becoming insignificant but rather the opposite. In fact, as noted by Mowatt-Larssen, al Qaeda core is resurging. This is despite two key developments since 9/11. First, the aforementioned counterterrorism measures led by the United States have not been as effective as commonly portrayed in dismantling the network’s leadership. Second, prior to the Arab Spring, al Qaeda represented an alternative ideology to mainstream Arab politics. The Arab Spring seemed to provide a more compelling alternative ideology, thereby effectively rendering al Qaeda redundant. However, due to the disillusionment stemming from the failure of the Arab Spring to deliver its promise of change, al Qaeda’s ideology seems to once again become the alternative avenue. This is further reinforced by the events in Iraq, Syria, and Afghanistan. By obtaining a nuclear capability, al Qaeda could establish itself even further as an alternative political entity in the Muslim world, developing a capability that the Muslim world, with the exception of Pakistan, has thus far failed to obtain. This would provide evidence of the network’s superiority to traditional Arab governments, which its leadership has often depicted as corrupt and incompetent. This corruption and incompetence, al Qaeda core leadership argues, explains why the West has been able to effectively attack and occupy Muslim territories.

43. Jenkins, *Al Qaeda in its Third Decade*, 3.

44. James R. Clapper, *Worldwide Threat Assessment of the US Intelligence Community* (Washington, DC: Senate Select Committee on Intelligence, January 29, 2014), 4.

45. “Global Al-Qaeda,” 1.

46. Jones, “Re-Examining the Al Qaeda Threat,” 1.

47. Ibid.

The Benefits of Nuclearization

Two contradictory theories have been developed by scholars to explain the potential impact of a nuclear-armed jihadi network. On one hand, some argue that given the indiscriminate and disproportionate nature of a nuclear attack, the procurement and use of nuclear weapons would only delegitimize the group among Muslims. Hence, some experts believe that al Qaeda supporters would distance themselves from the group if it nuclearized.⁴⁸ On the other hand, some argue that given al Qaeda's current status as more of a nuisance than a serious threat and its waning influence, the network could choose to go down the nuclear path to assert itself as still relevant. By doing so, it would show that it remains a "predominant international threat" and that it is on par with nation-states and should receive equal respect.⁴⁹ What is more, a nuclear attack would result in a determined response from the international community. Al Qaeda could seek such a response to provoke a state of conflict in order to promote its agenda. It is also important to note that the network continues to inflict as much damage as possible to its foes.

It is argued that the prestige model, developed in the context of the nuclearization of state actors, would also be applicable to non-state actors and a nuclear al Qaeda would garner support. Thus, the acquisition of nuclear weapons could lead to al Qaeda's rebirth. Indeed, some argue that, as the group's legitimacy and influence declines, the prestige factor becomes more prominent. Therefore, the organization's ability to procure and successfully detonate a nuclear weapon could generate support and facilitate fundraising and recruitment.⁵⁰

Even without going as far as using nuclear weapons, al Qaeda could have a number of reasons why it would seek to possess such weapons in the current political environment. Some of these reasons are those traditionally applied to state actors in the study of proliferation drivers.⁵¹ First, the prestige factor could appeal to the network's leadership. Indeed, having access to the world's most powerful weapon, one which only nine countries have obtained, could help revitalize al Qaeda. This is especially the case as coalition forces leave Afghanistan this year. Several benefits would likely stem from the network's revitalized attractiveness, including possibilities of securing more funding, enhancing the morale of network's members and affiliates, and recruiting more volunteers.

Second, deterrence and the idea of nuclear weapons as the guarantor of security could hold true for non-state actors. However, while a nuclear weapons capability might once have increased the security of al Qaeda core when the group was more concentrated, this no longer seems to be the case. The network is too widely dispersed to be able to effectively deter the United States and other potential threats. What is more, conclusive evidence of the network's possession of nuclear weapons would likely result in a firm response from

48. Jessica Stern, *The Ultimate Terrorists* (Cambridge, MA: Harvard University Press, 1999), 83.

49. Todd Masse, *Nuclear Jihad: A Clear and Present Danger?* (Washington, DC: Potomac Books, 2011), 115.

50. Ackerman and Tamsett, *Jihadists and Weapons of Mass Destruction*, 194–195.

51. Scott Sagan, "Why do States Build Nuclear Weapons?," *International Security* 21, no. 3 (winter 1996/97).

the international community. Thus, al Qaeda's affiliates would not benefit from nuclear deterrence. It is, however, important to note that, while al Qaeda could also seek nuclear weapons to deter the West and other foes and to increase its prestige, it is unlikely to refrain from using such weapons if it does obtain them; the stockpiling of these weapons without using them would be dangerous for the network, as it does not have the facilities to safely and securely store them.⁵²

Many terrorism experts argue that the use of nuclear weapons to inflict mass casualties would not help al Qaeda but further isolate and weaken it. This is supported by the idea that most Muslims condemn violence, especially against innocent noncombatants. For example, Browne suggests that it would not be in al Qaeda's interest to conduct a WMD attack, as the "current domestic and international political situation is more favorable now than could be expected after a WMD attack."⁵³ But such an attack would be counterproductive for two additional reasons. First, it would provide the United States with "an even greater freedom of action than that granted after the September 11 attacks." Second, "jihadi and fundamentalist groups would either turn further away or be crushed by the international response."⁵⁴

However, al Qaeda core's statements and fatwas testify that the network does not share these views. While many in the West consider the use of nuclear weapons by al Qaeda or any other terrorist group as counterproductive and, therefore, unlikely, "we can be confident that Zawahiri does not think this way." As discussed previously, the fact that he updated Nasser al-Fahd's fatwa describing the use of nuclear weapons as obligatory for Muslims provides evidence that he considers these weapons to be a viable tactic. The response to al Qaeda's justification of mass-casualty terrorist attacks has been somewhat effective. Many Muslims and Islamic institutions denounced the 9/11 attacks; yet many others applauded al Qaeda's tactics and approved of its aspirations.⁵⁵ This was particularly the case in Saudi Arabia, where the events were met with praise and admiration. In fact, Abdel Bari Atwan, recounting his encounter with "a close relative of the late King Fahd of Saudi Arabia," noted that "she confided to [him] that she greatly admired bin Laden and the recent al Qaeda assault on the US," an enthusiasm "shared by the general public of the kingdom."⁵⁶ He further notes that "after 11 September a Saudi intelligence survey found that 95 per cent of a sample of educated Saudis aged twenty-five to forty-one supported bin Laden's cause." What is more, "in December 2004, CNN reported that a poll in the kingdom had found bin Laden's popularity exceeded that of King Fahd."⁵⁷ In Saudi Arabia, therefore—a U.S. ally having greatly benefited economically and militarily from relations with Washington—an overwhelming majority of the population expressed admiration for bin Laden and endorsed the 9/11 attacks and the killing of thousands of U.S. citizens (and many

52. Mowatt-Larssen, *Al Qaeda Weapons of Mass Destruction*.

53. James Russel and James Wirtz, eds., *Globalization and WMD Proliferation: Terrorism, Transnational Networks, and International Security* (London: Routledge, 2008), 96.

54. Ibid.

55. Jenkins, *Countering Al Qaeda*, 7.

56. Abdel Bari Atwan, *The Secret History of al Qaeda* (Berkeley, CA: University of California, 2008), 150.

57. Ibid., 150–151.

Muslims or noncitizens) in an indiscriminate attack against a nonmilitary target. This demonstrates that al Qaeda's core leadership has been successful in justifying its deeds.

As some scholars have noted, the assassination of al Qaeda's key leaders might inspire its new leadership to launch a "spectacular" attack, not only to demonstrate that the group is still in business and still must be taken seriously but also to "maintain the integrity of the group or to meet their own psychological needs."⁵⁸ This is especially the case, as "terrorists might resort to more lethal tactics to avenge the deaths of members of their group or to retaliate against perceived slights."⁵⁹

As discussed previously, the nature of terrorism has changed drastically since the end of the Cold War. One of the factors contributing to this change lies in the fact that modern terrorist groups were "comparatively well-defined, contained, and stable." Postmodern terrorist organizations, by contrast, are "broadly spread out" and "amorphous," and "while held together by a common ideology, [they] may lack any strong or direct linkage among members."⁶⁰ What is more, the organization is the first and only current "non-governmental terrorist organisation."⁶¹ This has created a challenge for counterterrorism experts in defining al Qaeda. This provides evidence for "the need for a clear and systematic way of articulating the important differences between [the] different labels" used to describe the network.⁶² Al Qaeda is further a "global organization," with "significant heterogeneity." There is "no consistency in what analysts are referring to when the term Al Qaeda is used."⁶³ It is "in reality a conglomerate of a number of terror groups and their cells, of varying autonomy but who share a common ideology and who cooperate with each other."⁶⁴

In his testimony before the U.S. House of Representatives, Thomas Hegghammer shaped his conclusions around three main axes. Most importantly, he noted that the primary threat that al Qaeda poses to the United States is "ad-hoc attacks by unaffiliated agents, which are harder to prevent, but less lethal on average."⁶⁵ Deterrence seems to be working to some extent, and these groups seem to be pursuing local agendas. As such, the possibility of the use of CBRN weapons is less likely. Indeed, the use of such weapons against the United States, the European Union, and their allies would be met with potentially massive retaliation by the West. Additionally, the use of WMDs for tactical purposes and local operations not only seems impractical but also counterproductive, as it would antagonize local populations. Another argument lies in the affiliates' ability to acquire nuclear weapons. Al Qaeda's core, which had more resources during the 1990s, failed to acquire or

58. Stern, *The Ultimate Terrorists*, 83.

59. Ibid.

60. Brian Jackson, "Groups, Networks, or Movements: A Command-and-control-Driven Approach to Classifying Terrorist Organizations and Its Application to Al Qaeda," *Studies in Conflict & Terrorism* 29 (2006): 242.

61. Denécé, *Al-Qaeda*, 47.

62. Jackson, "Groups, Networks, or Movements," 242.

63. Ibid., 250.

64. Ibid., 251.

65. Thomas Hegghammer, "The Future of Anti-Western Jihadism" (testimony, House Foreign Affairs Committee Subcommittee on Terrorism, Nonproliferation, and Trade, "Global Al-Qaeda: Affiliates, Objectives, and Future Challenges." July 18, 2013), 2.

procure nuclear weapons and materials. Smaller, less resourceful affiliates are less likely to be able to succeed where the core failed. In fact, these groups “are not operationally capable of circumventing the many countermeasures and detection systems that Western governments have put in place since 9/11.”⁶⁶

Conclusion

In recent years, a number of steps have been taken by the international community to reduce the threat of nuclear terrorism. However, much remains to be done. Additionally, counterterrorism measures have been put in place to weaken al Qaeda, dismantle its core, eliminate its leaders, and render the network unable to perpetrate mass-casualty attacks similar to 9/11. Yet, al Qaeda has changed since it perpetrated the 9/11 attacks and has adapted to U.S.-led counterterrorism measures. What is more, as noted previously, the network’s nuclear “team” remains largely in place. This demonstrates the group’s flexible and dynamic nature, which has not only been forced to change by the U.S.- and EU-led counterterrorism but also due to the network’s own “efforts to change and adapt.”⁶⁷ In fact, al Qaeda “has become more an idea or a concept than an organization; an amorphous movement tenuously held together by a loosely networked transnational constituency.”⁶⁸ There is no evidence that al Qaeda’s willingness and ability to obtain and use nuclear weapons have diminished. Indeed, even semisuccessful operations are a major political achievement if there is comprehensive media coverage of the event.⁶⁹ Hence, if the network successfully acquires CBRN weapons but fails to achieve the impact it desires, it would still be successful if it received coveted media attention.

Much of the information on al Qaeda’s nuclear ambitions and capabilities remains classified in the United States. In other parts of the world, the threat is simply not taken as seriously. In Europe, for instance, many experts consider the threat of nuclear terrorism to be real, yet “blown out of proportion” by U.S. experts. In much of the Middle East, potential, abstract threats such as nuclear terrorism are overshadowed by concrete, immediate ones, which in some countries kill dozens of people on a daily basis. Thus, nuclear terrorism is viewed with skepticism as yet another far-fetched WMD threat exaggerated by Washington to advance its own agenda. Releasing the classified intelligence on al Qaeda’s concrete efforts to obtain a nuclear capability could convince the skeptics both within and beyond the borders of the United States. It could further galvanize support for additional steps in nuclear security.

66. Ibid., 5.

67. Jackson, “Groups, Networks, or Movements,” 243.

68. Ibid., 251.

69. Denécé, *Al-Qaeda*, 52.

Strategic Stability and Tactical Nuclear Weapons in South Asia

*Julia Thompson*¹

Developments since the reciprocal Indian and Pakistani nuclear tests in 1998, in particular India's Cold Start limited war doctrine and Pakistan's development of tactical nuclear weapons (TNWs), pose particular challenges to strategic stability in South Asia. This chapter seeks to explore the drivers behind Indian development of the Cold Start doctrine and how Cold Start, paired with conventional force asymmetries, has prompted Pakistani development of TNWs. It also highlights the challenges that TNWs pose, including those relating to command, control, and communications (C³), security, and escalation control. Because India and Pakistan remain in a competitive strategic environment, strategic instability in South Asia could deteriorate should these developments continue apace in both the conventional and nuclear realms.

Introduction

Since India and Pakistan became declared nuclear weapon states in 1998, escalatory developments have come to pose particular challenges to strategic stability in South Asia. These include India's limited conventional war plans, termed a "proactive strategy,"² or Cold Start, and Pakistan's development of TNWs. This chapter seeks to explore why TNWs emerged in South Asia and the challenges they pose to the regional strategic environment. The chapter offers a brief history of South Asia's nuclearization, followed by assessments of India's Cold Start doctrine and the introduction of TNWs, or short-range, low-yield nuclear delivery systems. After reviewing India and Pakistan's nuclear decisionmaking processes and doctrines, the chapter then provides an assessment of the unique challenges TNWs introduce into the South Asian strategic environment in the areas of security, C³, and escalation control.

1. Julia Thompson is a research associate for the South Asia program at the Stimson Center. The author wishes to thank George Perkovich for his comments on her draft paper.

2. Ajai Shukla, "Army able to launch faster response against Pakistan," *Business Standard*, January 13, 2012, http://www.business-standard.com/article/economy-policy/-army-able-to-launch-faster-response-against-pakistan-112011300097_1.html.

Bridging the gap between conventional military actions and strategic nuclear use, TNWs send a powerful message of deterrence, with serious associated challenges and risks. Should developments continue apace in both the conventional and nuclear realms, strategic instability in South Asia could deteriorate.

Nuclear South Asia

On May 18, 1974, 10 years after the Chinese nuclear tests, India conducted what it termed a “peaceful nuclear explosion.” “Smiling Buddha” had a claimed yield of 12 kilotons (kt), although U.S. intelligence estimates put the yield at 4-6 kt. India would refrain from testing again for nearly 24 years. Starting in 1995, however, momentum toward another test began to build in India.³ The 1998 election manifesto of the Bharatiya Janata Party (BJP) “reject[ed] the notion of nuclear apartheid” and committed to “re-evaluate the country’s nuclear policy and exercise the option to induct nuclear weapons.”⁴ In 1998, when BJP candidate Atal Bihari Vajpayee again became prime minister after his brief stint in 1996, the government immediately set to making India a nuclear weapon power.⁵ The testing of three nuclear devices at Pokhran on May 11, 1998, named Operation Shakti, shocked international observers. India announced the successful tests of a “fission device with a yield of about 12 kilotons, a thermonuclear device with a yield of about 43 kilotons, and a sub-kiloton device,” although outside analysts subsequently disputed whether the one device was thermonuclear.⁶ Two additional subkiloton devices were detonated on May 13.

The Indian nuclear tests posed a dilemma for the country’s nascent nuclear neighbor: a test would place Pakistan in the proverbial doghouse alongside India, but refraining from testing risked undermining the credibility of the Pakistani nuclear deterrent.⁷ George Perkovich summarizes the view of Indian officials: “If Pakistan truly had nuclear weapon capabilities, they would conduct tests. This would ameliorate India’s international isolation. If Pakistan actually could not produce and detonate nuclear weapons, their weakness would be exposed.”⁸ On May 13, Prime Minister Nawaz Sharif convened a meeting of the Defence Committee of the Cabinet to deliberate Pakistan’s response to the Pokhran II tests.⁹ On May 28, 1998, Pakistan tested its nuclear devices. The Pakistan Atomic Energy Commission reported that five tests generated total yield of 40 kt;¹⁰ external observers and analysts question the claimed total yields and even the number of devices tested.¹¹ Two

3. George Perkovich, *India’s Nuclear Bomb: The Impact on Global Proliferation* (Berkeley, CA: University of California Press, 2001), 353–403.

4. BJP, “BJP Manifesto 1998,” 30, 31, <http://bjpelectionmanifesto.com/pdf/manifesto1998.pdf>.

5. L. K. Advani, *My Country My Life* (New Delhi: Rupa & Co., 2008), 541.

6. Perkovich, *India’s Nuclear Bomb*, 416.

7. Feroz Khan, *Eating Grass: The Making of the Pakistani Bomb* (Stanford, CA: Stanford University Press, 2012), 271.

8. Perkovich, *India’s Nuclear Bomb*, 419.

9. Khan, *Eating Grass*, 270.

10. Federation of American Scientists, “Pakistan Nuclear Weapons,” December 11, 2002, <http://fas.org/nuke/guide/pakistan/nuke/index.html>.

11. Michael Krepon, “Looking Back: The 1998 Indian and Pakistani Nuclear Tests,” *Arms Control Today*, May 2008, http://www.armscontrol.org/act/2008_05/lookingback.

days later, Pakistan also tested a “miniaturized device”; Feroz Khan suggests this miniaturized design was intended for Pakistan’s ballistic missiles and aircraft.¹²

International concern and condemnation of the tests were swift. United Nations Security Council Resolution 1172 passed in June. It condemned the Indian and Pakistani tests, terming them “a serious threat to global efforts towards nuclear non-proliferation and disarmament” and demanded that both countries refrain from further testing.¹³ The United States also imposed economic sanctions on both countries.

Conventional Imbalance and Cold Start

The February 21, 1999, Lahore Declaration recognized that “the nuclear dimension of the security environment of the two countries add[ed] to their responsibility for avoidance of conflict.”¹⁴ Signed in the wake of Indian prime minister Vajpayee’s symbolic ride to Lahore, the declaration seemed to signal a new era in India-Pakistan relations less than a year after their mutual nuclear tests. By May 1999, however, the two countries were engaged in a conventional war on the Kargil Heights—the first conflict in South Asia under the visible shadow of nuclear weapons. Pakistani militants and regular forces crossed the Line of Control (LoC) to occupy Indian Army defensive positions in the Kargil-Dras sectors in Kashmir.¹⁵ International opinion overwhelmingly condemned Pakistani actions. As the tide of conflict turned and began to favor the Indians, Pakistani prime minister Nawaz Sharif sought the assistance of the United States.¹⁶ President Clinton and Prime Minister Sharif issued a joint statement on July 4 agreeing “that the current fighting in the Kargil region of Kashmir is dangerous and contains the seeds of a wider conflict. . . . It was agreed between the president and the prime minister that concrete steps will be taken for the restoration of the Line of Control in accordance with the Simla agreement.”¹⁷ The Kargil War was taken to affirm India’s significant conventional military advantage.

Crisis under the nuclear shadow erupted again only two years later. On December 13, 2001, five gunmen killed 7 and injured 18 at the Parliament House in New Delhi.¹⁸ The next day, Indian officials publicly linked Pakistan-based terrorist groups Lashkar-e-Taiba and Jaish-e-Mohammad (JeM) to the attack.¹⁹ Occurring only two months after the October 1 JeM attack on the Jammu and Kashmir legislative assembly that killed 38, and in the face of

12. Khan, *Eating Grass*, 282.

13. United Nations Security Council, “Press Release SC/6528: Security Council Condemns Nuclear Tests by India and Pakistan,” June 6, 1998, <http://www.un.org/News/Press/docs/1998/sc6528.doc.htm>.

14. “Lahore Declaration,” February 21, 1999, <http://cns.miis.edu/inventory/pdfs/aptlahore.pdf>.

15. P. R. Chari, “Nuclear Crisis, Escalation Control, and Deterrence in South Asia,” *Stimson Center Working Paper*, August 2003, 18, http://www.stimson.org/images/uploads/research-pdfs/escalation_chari_1.pdf.

16. C. Christine Fair, *Fighting to the End: The Pakistan Army’s Way of War* (Oxford, UK: Oxford University Press, 2014), 153.

17. “Full text of US-Pakistan statement,” *BBC News*, July 5, 1999, <http://news.bbc.co.uk/2/hi/world/monitoring/386171.stm>.

18. Celia W. Dugger, “Suicide Raid in New Delhi; Attackers Among 12 Dead,” *New York Times*, December 14, 2001, <http://www.nytimes.com/2001/12/14/world/suicide-raid-in-new-delhi-attackers-among-12-dead.html>.

19. Atul Aneja, “Lashkar responsible for attack, says Jaswant,” *Hindu*, December 15, 2001, <http://www.hindu.com/thehindu/2001/12/15/stories/2001121500310100.htm>.

continuing skirmishes along the LoC, the Parliament House attack prompted an Indian military mobilization called Operation Parakram. According to Walter Ladwig, the operation was intended to signal India's resolve to end Pakistani support for militants in Kashmir; however, "the decisiveness of its message was undercut by the inability of the Indian Army to present a timely threat to Pakistan."²⁰ In the following weeks, Pakistani troops countermobilized, and on January 12, 2002, President Musharraf gave a speech condemning "terrorism in all its forms and manifestation[s]" as well as the October 1 and December 13 attacks; he also asserted that the Pakistani government was "taking steps . . . for speedy trial of cases relating to terrorism and extremism."²¹ The crisis continued for 10 months and saw nearly a million Indian and Pakistani troops massed along the international border and LoC, along with widespread international fears of a potential nuclear confrontation.

At the time of the 2001–2002 mobilization, India employed a primarily defensive military posture, known as the Sundarji Doctrine. It called for seven Indian Army corps to be deployed near the Pakistani border, whose primary task would be to stop an advance into Indian territory. Three offensive corps based in central India would counterattack once the defense corps had halted an attack.²² The 2001–2002 crisis, however, revealed the doctrine's limitations. In the time it took for Indian troops to mass along the border, the situation changed so much that an Indian military response was no longer politically feasible.

The Indian Army therefore moved to create a new offensive doctrine that would enable quick and decisive military action below the nuclear threshold before outside factors or players could intervene. The Indian chief of army staff revealed the existence of this Cold Start doctrine in a closed-door seminar at the military academy at Shimla in April 2004. Walter Ladwig describes the goal of Cold Start as being "to establish the capacity to launch a retaliatory conventional strike against Pakistan that would inflict significant harm on the Pakistan Army before the international community could intercede, and at the same time, pursue narrow enough aims to deny Islamabad a justification to escalate the clash to the nuclear level."²³ The limited war doctrine calls for the reorganization of India's three offensive corps into eight "integrated battle groups" (IBGs) to be stationed near the international border.²⁴ These IBGs would have the ability to mobilize more quickly in a crisis than the three offensive corps under the Sundarji Doctrine. Publicly available sections of the 2004 Indian Army Doctrine, while not mentioning Cold Start specifically, do

20. Walter C. Ladwig III, "An Overview and Assessment of the Indian Army's Cold Start Strategy" (paper presented at "Cold Start: India's New Strategic Doctrine and its Implications," Naval Postgraduate School, Monterey, CA, May 29–30, 2008), 3, <http://users.ox.ac.uk/~mert1769/Ladwig,%20Cold%20Start%20NPS%20Paper.pdf>.

21. "In Musharraf's Words: 'A Day of Reckoning,'" *New York Times*, January 12, 2002, 6, <http://www.nytimes.com/2002/01/12/international/12WIRE-TEXT.html?src=pm&pagewanted=6>.

22. Walter C. Ladwig III, "A Cold Start for Hot Wars? The Indian Army's New Limited War Doctrine," *International Security* 32, no. 3 (winter 2007/08): 159–160.

23. *Ibid.*, 164.

24. *Ibid.*

emphasize maneuverability, joint operations, and greater integration as being “essential for success.”²⁵

There remain questions as to whether or to what extent Cold Start has been or could be operationalized, or whether India continues to place any stock in the value of a large-scale, conventional incursion into Pakistani territory.²⁶ Indian officials, retired and serving, have repeatedly asserted no Cold Start doctrine exists.²⁷ Nevertheless, Christopher Clary asserts that while current force balances allow Pakistan at least to deny India a conventional “victory on the cheap, . . . there is no doubt that Pakistan will be unable to maintain even a patina of conventional parity over time.”²⁸ This growing imbalance, paired with the perception that Cold Start creates space for limited war below the nuclear threshold, has prompted Pakistani technological developments in the form of TNWs to counter these asymmetries. In 2008, Ladwig described the doctrine as potentially escalatory due to its risk of inciting Pakistani counterdevelopments, including lowering of nuclear red lines, moving nuclear weapons to a higher state of readiness, developing TNWs, or undertaking “some equally destabilizing course of action.”²⁹

Tactical Nuclear Weapons in South Asia

Since 1998, India and Pakistan have introduced 14 new nuclear-capable missiles.³⁰ Of these missiles, eight have a range of less than 1,000 km. Pakistani missiles include the Babur CM (700 km), the Ra’ad CM (350 km), the Abdali (180 km), the Shaheen (700 km), the Ghaznavi (290 km), and the Nasr (60 km). Indian systems include the Agni 1 (700 km) and the K-15 (700 km). Not included in this number are the Prahaar (140 km), the Nirbhay (700 km), and the BrahMos (290 km); it remains unclear whether these systems will be nuclear capable without a miniaturized warhead.³¹ Of these systems, the Nasr is of particular note as its range is significantly lower than the other short-range systems in South Asia, and the Pakistani Strategic Plans Division (SPD) has explicitly conveyed its deterrence value against conventional threats.

On April 10, 2011, Pakistan completed the first successful flight test of the Nasr missile, a short-range surface-to-surface multitube ballistic missile. An Inter-Services Public Relations (ISPR) press release said that the system “carries nuclear warheads of appropriate

25. Headquarters Army Training Command, “Indian Army Doctrine,” October 2004, ii, http://www.nti.org/media/pdfs/8_11.pdf?_=1317928499.

26. See Shashank Joshi, “India’s Military Instrument: A Doctrine Stillborn,” *Journal of Strategic Studies* 36, no. 4 (2013): 512–540, <http://shashankjoshi.files.wordpress.com/2013/07/coldstartjss2013.pdf>.

27. Manu Pubby, “No ‘Cold Start’ doctrine, India tells US,” *Indian Express*, September 9, 2010, <http://archive.indianexpress.com/news/no—cold-start—doctrine-india-tells-us/679273/0>.

28. Christopher Clary, “Deterrence Stability and the Conventional Balance of Forces in South Asia,” in *Deterrence Stability and Escalation Control in South Asia*, ed. Michael Krepon and Julia Thompson (Washington, DC: Stimson Center, 2013), 136.

29. Ladwig, “A Cold Start for Hot Wars?,” 169.

30. Michael Krepon and Julia Thompson, “Introduction,” in *Deterrence Stability and Escalation Control in South Asia*, ed. Michael Krepon and Julia Thompson (Washington DC: Stimson Center, 2013), 14.

31. Dinshaw Mistry, “Missile Proliferation and Deterrence Stability in South Asia,” in Krepon and Thompson, *Deterrence Stability and Escalation Control*, 124–126.

yield with high accuracy, [and has] shoot and scoot attributes.”³² SPD director general Lt. Gen. (ret.) Khalid Ahmed Kidwai described this initial test as “a very important milestone in consolidating Pakistan’s strategic deterrence capability at all levels of the threat spectrum.”³³ It is difficult for outside observers to judge whether Pakistan has warheads capable of being mounted on Nasr; still, Pakistan may have an interest in creating the perception that this capability exists.

Current estimates put Pakistan’s nuclear weapons arsenal at roughly 100 to 120 weapons,³⁴ and with the capability to add 10 to 15 warheads per year the country has been described as having the fastest growing arsenal in the world.³⁵ Pakistan has also been testing delivery systems at a regular pace. Of note, since the April 2011 test, Pakistan has tested the Nasr three more times: in May 2012, February 2013, and November 2013. ISPR press releases have consistently described the system as consolidating Pakistan’s deterrent across a spectrum of threats. The release after the most recent test referred to “full spectrum deterrence” for the first time.³⁶

Short-range, low-yield systems, or TNWs, are intended to “fill the hole” in Pakistan’s deterrent against a conventionally advantaged India. SPD leaders describe Nasr as a “weapon of peace”³⁷ able to “pour cold water on Cold Start.”³⁸ Lowering the threshold for nuclear use, TNWs send a profound deterrent message.

Pakistani and Indian Nuclear Weapon Programs and Doctrine

NUCLEAR DECISIONMAKING

Nuclear decisionmaking is characterized by a small cohort of decisionmakers in both India and Pakistan. In India, this group consists of a small circle of senior political leaders, although the nuclear scientific enclave also influences nuclear policy and planning. In Pakistan, the role of scientists was diminished greatly with the formation of the SPD in 2000. While the prime minister is at the apex, the military now has the prime management role in Pakistan’s nuclear planning and decisionmaking structure.

32. Inter-Services Public Relations, *Press Release No. PR94/2011-ISPR*, April 19, 2011, http://www.ispr.gov.pk/front/t-press_release.asp?id=1721&print=1.

33. Ibid.

34. Phillip Schell and Hans M. Kristensen, “World Nuclear Forces,” *SIPRI 2013 Yearbook*, July 2013, <http://www.sipri.org/yearbook/2013/06>.

35. Nuclear Threat Initiative, “Country Profile: Pakistan,” last modified July 2013, <http://www.nti.org/country-profiles/pakistan/nuclear/>.

36. Inter-Services Public Relations, *Press Release No. PR179/2013-ISPR*, November 5, 2013, https://www.ispr.gov.pk/front/main.asp?o=t-press_release&date=2013/11/5.

37. Inter-Services Public Relations, *Press Release No. PR130/2012-ISPR*, May 29, 2012, https://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=2075.

38. David O. Smith, “The US Experience with Tactical Nuclear Weapons: Lessons for South Asia,” in Krepon and Thompson, *Deterrence Stability and Escalation Control*, 80.

Indian nuclear decisionmaking rests firmly under civilian control; a reflection of the primacy India has placed on ensuring strong civilian control of the military since independence. George Perkovich notes that “the founders of independent India, influenced by the British legacy, decided from the beginning to separate the military from national security decision making.”³⁹ The Nuclear Command Authority (NCA), announced in January 2004, is responsible for India’s nuclear weapons. The Indian NCA is composed of a Political Council and an Executive Council. The Political Council, chaired by the prime minister, is the only body able to authorize nuclear weapons’ use. The Executive Council, chaired by the national security advisor, provides inputs for decisionmaking and executes directives of the Political Council.⁴⁰ The Indian nuclear scientific enclave also plays a role in the country’s nuclear development, planning, and infrastructure. Indian nuclear decisionmaking is thereby marked by strong civilian control, arguably to the exclusion of military planners, but with the scientific enclave having more influence than is the case in Pakistan.

The SPD forms the secretariat of Pakistan’s NCA. It was established in 2000 and was headed by Lt. Gen. Kidwai from its inception until his December 2013 retirement. Feroz Khan describes the SPD’s influence:

Within a year of its formation, the SPD had evolved into a true nuclear enclave; currently, with a decade of experience, it is the key to Pakistan’s nuclear management. The growth of SPD led to systematic control over strategic organizations and provided direction for the nuclear program. In the past, Pakistan lacked oversight over its covert nuclear program, leading to the AQ Khan network and other mishaps. But today SPD has a firm hold of Pakistan’s nuclear organization and policy.⁴¹

While the prime minister sits at the apex of the Pakistani NCA, where the final decision on nuclear use would be made, the SPD plays a crucial role in the formation and implementation of Pakistan’s nuclear weapons program and doctrine. The SPD determines which, when, and how systems are developed, tested, and fielded and is also responsible for systems’ safety and security.

DOCTRINE

India

India released a draft nuclear doctrine in August 1999 that stated the country would pursue a doctrine of “credible minimum nuclear deterrence,” in a policy of “retaliation only.”⁴² In January 2003, the Cabinet Committee on Security released a statement committing to a “credible minimum deterrent,” a posture of no-first-use, and “massive”

39. Perkovich, *India’s Nuclear Bomb*, 10.

40. Prime Minister’s Office, “Cabinet Committee on Security Reviews Progress of Operationalizing India’s Nuclear Doctrine,” January 4, 2003, <http://pib.nic.in/archieve/lreleng/lyr2003/rjan2003/04012003/r040120033.html>.

41. Khan, *Eating Grass*, 331.

42. “India’s Draft Nuclear Doctrine,” *Arms Control Today*, August 17, 1999, <https://www.armscontrol.org/print/514>.

retaliation to a first strike that would be “designed to inflict unacceptable damage.”⁴³ India’s current nuclear doctrine may thus be summarized as one of no-first-use and massive relation.

In April 2013, Shyam Saran, a former foreign minister and chairman of India’s National Security Advisory Board, clarified the Indian stance in a speech at the India Habitat Centre in New Delhi. He dismissed limited nuclear war as a “contradiction in terms,” saying that “the label on a nuclear weapon used for attacking India, strategic or tactical, is irrelevant from the Indian perspective. . . . Any nuclear exchange, once initiated, would swiftly and inexorably escalate to the strategic level.”⁴⁴

Nonetheless, questions arise as to the credibility of massive retaliation in the face of TNWs. For example, what would be the response to TNW use against Indian conventional forces on Pakistani territory? Would it rise to the level of a strategic, counter-city strike? Such a disproportionate response could lead a crisis sparked by another Mumbai-type attack to escalate to a nuclear exchange that risks the lives of millions. Such a connection strains credibility.

The March 2014 publication of the BJP election manifesto raised debate in India over a potential revision of India’s nuclear doctrine. The manifesto pledged that, in pursuit of an “Independent Strategic Nuclear Programme,” the government would “study in detail India’s nuclear doctrine, and revise and update it, to make it relevant to challenges of current times.”⁴⁵ It remains to be seen whether or when the government of Narendra Modi might implement a review of Indian nuclear doctrine.

Pakistan

Pakistan’s nuclear doctrine remains deliberately opaque, but it has often been described as “minimum credible deterrence.”⁴⁶ Vipin Narang, however, describes Pakistan’s nuclear posture—the operational, rather than declaratory nuclear doctrine of a country⁴⁷—as an “asymmetric escalation strategy,” where “in actuality Pakistan envisions the early use of nuclear weapons in a conventional conflict as a deterrent to its outbreak.”⁴⁸

Pakistan’s nuclear posture may also be gleaned from SPD officials’ public statements. In 2002, Lt. Gen. (ret.) Kidwai delineated Pakistan’s red lines for nuclear use as the following:

43. Prime Minister’s Office, “Cabinet Committee on Security.”

44. Shyam Saran, “Is India’s Nuclear Deterrent Credible?” (remarks at India Habitat Centre, New Delhi, April 24, 2013), 16, <http://krepon.armscontrolwonk.com/files/2013/05/Final-Is-Indias-Nuclear-Deterrent-Credible-rev1-2-1-3.pdf>.

45. BJP, “Election Manifesto 2014,” March 26, 2014, 39, http://www.bjp.org/images/pdf_2014/full_manifesto_english_07.04.2014.pdf.

46. Mark Fitzpatrick, *Overcoming Pakistan’s Nuclear Dangers*, 28.

47. Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict* (Princeton, NJ: Princeton University Press, 2014), 4.

48. *Ibid.*, 57.

Nuclear weapons are aimed solely at India. In case that deterrence fails, they will be used if

- a. India attacks Pakistan and conquers a large part of its territory (space threshold)
- b. India destroys a large part either of its land or air forces (military threshold)
- c. India proceeds to the economic strangling of Pakistan (economic strangling)
- d. India pushes Pakistan into political destabilization or creates a large scale internal subversion in Pakistan (domestic destabilization)⁴⁹

Pakistan's expanding nuclear arsenal, increasing number and variety of systems, and nuclear posture call into question any "minimal" approach to deterrence. Pakistan is pursuing nuclear deterrence not just at the strategic level but also at lower levels via short-range systems for what it has termed "full spectrum deterrence"⁵⁰ in order to deny India the space for limited conventional conflict.

Challenges of Tactical Nuclear Weapons

Questions arise as to the credibility of nuclear deterrence in South Asia at both the strategic and tactical levels. Although there are notable differences, comparisons of the current situation in South Asia to the Cold War rivalry between the United States and the Soviet Union are inevitable. For example, like Pakistan, the United States employed TNWs to balance against conventional asymmetry. Like U.S. TNWs, Pakistani TNWs have caused concern in light of their doctrinal, security, command and control, and escalation control implications.

COMMAND, CONTROL, AND COMMUNICATIONS

While Pakistan insists that C³ for TNWs remains centralized with the NCA, the challenges of maintaining centralized C³ during a crisis are notable. Feroz Khan and Ryan French term centralized command and control (C²) "conceptually and logistically difficult." They note that the time needed to obtain launch authorization complicates field commanders' ability to capitalize on "fleeting, high value targets. . . . For this reason, it is possible that the Pakistanis may quickly abandon centralized C² early in a crisis and grant pre-delegated launch authority to forward-deployed field commanders."⁵¹ Predelegation would increase the operational responsiveness and usefulness of TNWs, but C³ challenges could increase the risk of inadvertent or unauthorized use.

49. Paolo Cotta-Ramusino and Maurizio Martellini, "Nuclear safety, nuclear stability and nuclear strategy in Pakistan," *Landau Network*, January 2002, <http://www.centrovolta.it/landau/content/binary/pakistan%20Januray%202002.pdf>.

50. Inter-Services Public Relations, *Press Release No. PR179/2013-ISPR*, November 5, 2013.

51. Feroz Hassan Khan and Ryan W. French, "U.S.-Pakistani Nuclear Relations: A Strategic Survey," U.S. Naval Postgraduate School, April 2014, 28–29.

David Smith argues that nuclear C³ networks should be “reliable, redundant, and separate” from conventional tactical networks. He suggests that unless they are used in preemption, TNW use “will almost certainly occur in the midst of a tactical crisis. Thus, the need for nuclear C³ will come at precisely the time the communications system is most severely taxed and vulnerable to enemy disruption.”⁵² TNWs face inherent and unavoidable tension between the need for operational readiness and flexibility and the requirement of reliable, effective C³ to prevent unauthorized or unintentional use.

SECURITY

President Obama terms nuclear terrorism “the single most important national security threat that we face.” Pakistan has often been cited as a potential source of the dreaded “loose nuke,”⁵³ and Pakistani officials have taken pains to stress the country’s nuclear security measures. Since the revelation of A. Q. Khan’s proliferation network in particular, Pakistan has made notable improvements in its nuclear security infrastructure. The U.S. National Nuclear Security Administration continues to collaborate on nuclear security with Pakistan. The 2014 Nuclear Threat Initiative Nuclear Materials Security Index—while still ranking Pakistan 22nd overall—acknowledges Pakistan as the “most improved” nuclear-armed state, in part due to to “an increased score for on-site physical protection resulting from new laws and regulations requiring licensees to provide physical protection to nuclear sites and on-site reviews of security.”⁵⁴

Mark Fitzpatrick asserts that “the threat [of nuclear terrorism] is typically hyped and the efforts that Pakistan has taken to reduce the risks too often overlooked.”⁵⁵ He describes the SPD’s “four-tiered” approach to nuclear security, encompassing physical protection (the Security Division has a force of 20,000), personnel reliability programs, an emergency management system, and comprehensive training.⁵⁶

As discussed earlier, however, the challenges facing TNWs become more complicated when deployed—as they could be during a crisis—and these complications extend to security. Pakistani warheads, fissile cores, and delivery systems, like Indian ones, are kept “de-mated.” This security measure limits the possibility that unauthorized actors could acquire a complete weapon. However, deployment of TNWs would require the “mating” of warheads with delivery systems and the removal of nuclear weapons from their secure locations. Doing so would strain security measures. Deployed TNWs demand additional manpower to provide adequate security when they are removed from their secure storage facilities. David Smith notes that, in the U.S. experience, as the number of personnel required to guard TNWs increased, the number available for conventional military needs

52. Smith, “US Experience with Tactical Nuclear Weapons,” 77.

53. See, for example, Seymour M. Hersh, “Defending the Arsenal: In an unstable Pakistan, can nuclear warheads be kept safe?,” *New Yorker*, November 16, 2009, http://www.newyorker.com/reporting/2009/11/16/091116fa_fact_hersh?currentPage=all; Jeffrey Goldberg and Marc Ambinder, “The Ally from Hell,” *Atlantic*, October 28, 2011, <http://www.theatlantic.com/magazine/archive/2011/12/the-ally-from-hell/308730/>.

54. “Pakistan,” *NTI Nuclear Materials Security Index*, <http://ntiindex.org/countries/pakistan/>.

55. Fitzpatrick, *Overcoming Pakistan’s Nuclear Dangers*, 105.

56. *Ibid.*, 118–120.

decreased. TNWs place additional demands on already scarce manpower.⁵⁷ Even assuming perfect implementation of Pakistan's security measures—which is a challenge for any nuclear weapon state, and cannot be independently verified—TNW deployment would degrade even “foolproof” measures.

ESCALATION CONTROL

TNWs lower the threshold of nuclear use, using the fear of escalation to large-scale nuclear use to prevent conventional attacks; in essence, TNWs seek to serve as a credible bridge connecting conventional actions to nuclear use. This deliberate disturbance of stability challenges escalation control. The use of a TNW would imply a willingness to escalate beyond tactical use to strategic and would very likely prompt a nuclear conflict spiral. In the case of South Asia, while India maintains a pledge of no-first-use, its doctrine states that nuclear weapons may “be used in retaliation against a nuclear attack on Indian territory or on Indian forces anywhere.”⁵⁸

Evan Braden Montgomery and Eric S. Edelman's description of a competition for “escalation dominance” in South Asia is apt. They contend that Pakistani pursuit of TNWs, paired with Indian defense modernization and doctrinal changes, could increase the risk of a regional nuclear conflict: “India, for example, might conclude that it can invade Pakistan without inciting nuclear retaliation, while Pakistan might believe that it can use nuclear weapons without triggering a nuclear exchange.”⁵⁹

The C³ and security challenges associated with the introduction of TNWs also feed into the risk of crisis escalation. Failure of C³ or security can lead to accidental or unauthorized use, and weaknesses in either risk missing signals during a crisis. Additionally, the relatively short range and distinctive signature of the Nasr when deployed would increase the risk of preemption. Rodney Jones notes that “the Nasr system will also have a distinct signature (even if camouflaged), with each launcher truck accompanied by a radar/C³ and a trans-loader vehicle, and would be a high priority for detection and preemptive conventional air attack.”⁶⁰ Fear of preemption, regardless of an adversary's actual capability to do so, could induce pressure to “use or lose” TNWs in a crisis. Should maintaining reliable nuclear C³ become difficult in a crisis or should security measures fail, accidental or unauthorized use could initiate a nuclear conflict spiral.

Conclusions

Escalatory developments have continued since India and Pakistan both tested nuclear weapons in 1998. Cold Start and Pakistan's development of TNWs pose particular

57. Smith, “The US Experience with Tactical Nuclear Weapons,” 78.

58. Prime Minister's Office, “Cabinet Committee on Security.”

59. Evan Braden Montgomery and Eric S. Edelman, “Rethinking Stability in South Asia: India, Pakistan, and the Competition for Escalation Dominance,” *Journal of Strategic Studies* (April 2014): 2.

60. Rodney W. Jones, “Pakistan's answer to Cold Start?,” *Friday Times*, May 13, 2011, <http://www.thefridaytimes.com/13052011/page7.shtml>.

challenges to strategic stability in South Asia. Cold Start, be it myth or reality, has been used to justify Pakistani development of TNWs. Bridging the gap between conventional military actions and strategic nuclear use, TNWs send a powerful message of deterrence, with complex associated risks. These risks, especially in the areas of security, C³, and escalation control, are profound and have drawn international attention and concern. It is worth investigating how Indian leaders would respond to the deployment of TNWs.

India and Pakistan remain in a competitive environment where each seeks to gain an advantage and to avoid being deterred through the pursuit of additional capabilities and strategies. While from each country's perspective this pursuit may be logical, the net result is greater instability. Confidence-building measures and arms control initiatives are a means of mitigating these risks, but they can only come about through mutual and concerted efforts. Should developments continue apace in both the conventional and nuclear realms, strategic stability will deteriorate in South Asia.

One in a Million, Given the Accident: Assuring Nuclear Weapons Safety

Jason Weaver¹

Since the introduction of nuclear weapons, there has never been an instance of accidental or unauthorized nuclear detonation, but there have been numerous accidents and “close calls.” The need for a robust nuclear weapons safety philosophy has grown with increasing understanding of the risks associated with these weapons. This chapter describes some of the methods used by the U.S. nuclear weapons complex today to ensure nuclear weapons safety, including testing, modeling, analysis, and design features. It also reviews the continued role of safety in the future and examines how nuclear safety’s present maturity can play a role in strengthening security and other areas, as well as how increased coordination can improve safety and reduce long-term cost.

Introduction

Designing a “safe” nuclear weapon may seem to be an oxymoron. Yet one of the most important factors in maintaining an effective deterrent is assuring that weapons will operate when needed but never when unintended. This must be true for the normal life of a nuclear weapon, from assembly to retirement. But it must also hold across such varied scenarios as aircraft accidents, natural disasters, and human error during production or maintenance. Over such a wide and unpredictable range of possible abnormal environments, it would be impossible to plan for and design against every scenario, yet nuclear weapons must remain safe across these scenarios nonetheless. The U.S. nuclear weapons complex follows a robust philosophy of nuclear weapons safety to assure that the likelihood of an inadvertent nuclear detonation is “vanishingly small.”²

1. Jason Weaver is a senior systems engineer at Sandia National Laboratories. The views expressed in this paper are those of the author and do not necessarily reflect the views of Sandia National Laboratories.

2. Morgan Sparks to Major General Joseph K. Bratton, June 1, 1977, quoted in Stanley D. Spray, *Nuclear Weapon Safety from Production to Retirement* (Albuquerque: Sandia National Laboratories, 2001), SAND2001-0600, 27.

This chapter examines the role nuclear weapons safety plays in the design, refurbishment, and deployment of the U.S. nuclear arsenal. A brief overview is presented of the evolution of the nuclear weapons safety philosophy, including nuclear weapon accidents, the “Walske criteria” requirements on assured safety, and the advent of Enhanced Nuclear Detonation Safety (ENDS) architecture. The chapter then describes the current “principles-based” approach to assuring nuclear weapons safety, showing how including passive safety features allows safety to be claimed at “one in a million” and “one in a billion” confidence with no underground weapon testing and only limited nonnuclear testing.³

Also considered is the question of what role nuclear weapons safety should play in the larger scope of maintaining a nuclear deterrent. Recommendations are provided on how increased coordination between nuclear safety and other related areas (command and control, use control, etc.) can lead to a safer nuclear arsenal even within the current political environment. The possible benefits and risks of sharing technology and information about nuclear weapons safety with other nuclear weapon states are also examined.

A Brief History of Nuclear Weapon Accidents

Five years after the atomic bomb entered the stockpile, the United States experienced its first recorded nuclear weapon accident.⁴ On February 13, 1950, a B-36 carrying a nuclear weapon on a mission from Alaska to Texas developed mechanical problems over British Columbia. The crew flew over the Pacific Ocean, jettisoned the weapon, and bailed out as the airplane crashed. This accident was followed by four other similar cases the same year: three airplane crashes and one emergency bomb release over water.⁵ From 1951 to 1960, over 30 additional accidents and incidents occurred.⁶ These early accidents, though frequent, did not pose a risk of nuclear detonation; the weapons involved were designed with “removable cores,” where the nuclear material was kept separate from the weapon until shortly before intended use.

In the late 1950s, however, weapon design moved to a “sealed pit” architecture, where warheads are manufactured and stored with the nuclear material already in place.⁷ This new design has many benefits, including improved personnel safety and increased readi-

3. For related commentary on the role of human factors in nuclear weapons safety, see, in this volume, Elise Rowan, “A Perfect Record: Assessing Risk and the Human Factor in Avoiding Nuclear Catastrophe,” *Nuclear Scholars Initiative: A Collection of Papers from the 2014 Nuclear Scholars Initiative* (Washington, DC: CSIS, 2014).

4. William L. Stevens, *Report D: A Summary of Accidents and Significant Incidents Involving U.S. Nuclear Weapons and Nuclear Weapon Systems* (Albuquerque: Sandia National Laboratories, 1986), J-3. The report quotes the DOD definition of an “accident involving nuclear weapons” as an unexpected event involving a nuclear weapon or nuclear weapon components that results in accidental or unauthorized use of a nuclear-capable weapon system, nuclear detonation, nonnuclear detonation or burning of the weapon or components, radioactive contamination, loss of the weapon or components, or other public hazard.

5. Shaun Gregory, *The Hidden Cost of Deterrence: Nuclear Weapon Accidents* (Washington, DC: Brassey’s, 1990), 147–148.

6. *Ibid.*, 148–156.

7. David W. Plummer and William H. Greenwood, “The History of Nuclear Weapon Safety Devices,” *American Institute of Aeronautics and Astronautics* (July 1998): 1, doi: 10.2514/6.1998-3464.

ness, but it made the existing safety protocol of removing the nuclear material infeasible. Instead, switches and other components were used to isolate the nuclear material from the energy needed to cause detonation.

Accidents in this new era became more worrisome. Safety devices such as ready/safe switches and environmental sensing devices (ESDs) were supposed to assure that firing signals were kept away from detonation-critical components, but accidents and testing showed new ways to bypass or spoof these systems.⁸ Many ready/safe switches were operated via small motors powered by a 28-volt signal from the airplane. In theory, the bomb could be detonated only if the crew flipped the switch to arm the bomb. Instead, in an accident, loose wires or shorts in the airplane or weapon could connect, apply a voltage to enable the switch, and then energize the firing circuit. The switch could also be enabled inadvertently by a crewmember bumping the control or playing with it when bored. ESDs, typically forms of accelerometers or barometers, were supposed to enable only when they sensed the proper environment (acceleration or altitude). But if a bomb were accidentally dropped out of an airplane, how would the ESDs distinguish between an accidental drop and deliberate use?

A prime example of this occurred on January 24, 1961, when a B-52 carrying two nuclear weapons broke apart over Goldsboro, North Carolina. The two bombs separated from the aircraft. One of the bombs fell free and broke apart upon impact. No explosion occurred. The other bomb's parachute deployed and the weapon received little impact damage.⁹ As Sandia National Laboratories engineer Parker Jones later noted in a memo, the bomb had four safety mechanisms, but three were damaged or activated by the aircraft breakup and fall. The weapon failed to detonate only because a single ready/safe switch was set to "safe," preventing the firing signal from reaching the explosives. "One simple, dynamo-technology, low voltage switch stood between the United States and a major catastrophe!"¹⁰ Jones further pointed out that this switch was hardly foolproof—several instances were discovered where weapons were flown with the switch enabled as a result of shorted wires or human error. When newly appointed Secretary of Defense Robert McNamara learned of the accident, "the story scared the hell out of him."¹¹

As airborne global alert programs kept B-52s in the air around the clock in the 1960s, accidents continued with increasing frequency. The role of nuclear weapons safety finally gained widespread public attention after accidents in Palomares, Spain, and Thule, Greenland. In January 1966, a B-52 collided with its refueling tanker and both aircraft crashed near Palomares, Spain. The B-52 carried four nuclear weapons. One was recovered on the

8. Ibid., 2–3.

9. Plummer and Greenwood, "History of Nuclear Weapon Safety Devices," 1.

10. Parker F. Jones, *Goldsboro Revisited, or How I Learned to Mistrust the H-Bomb, or to Set the Record Straight* (Albuquerque: Sandia Laboratories, October 22, 1969), 1–2. This document was originally classified Secret/Formerly Restricted Data; a redacted, unclassified version was released to Eric Schlosser via a Freedom of Information request and published online by the *Guardian* at <http://www.theguardian.com/world/interactive/2013/sep/20/goldsboro-revisited-declassified-document>.

11. Eric Schlosser, *Command and Control: Nuclear Weapons, the Damascus Accident, and the Illusion of Safety* (New York: Penguin Press, 2013), 247.

ground and one was recovered from the sea on April 7 after extensive search and recovery efforts. Two of the weapons' high-explosive materials exploded on impact with the ground, releasing some radioactive materials. Approximately 1,400 tons of slightly contaminated soil and vegetation were removed to the United States for storage at an approved site. The Pentagon put the bomb recovered from the ocean on display for reporters, hopeful that actually seeing the recovered weapon would quell the bad press and reassure the public.¹²

Two years later, a B-52 crashed and burned some seven miles southwest of the runway at Thule Air Force Base, Greenland, while approaching the base to land. The bomber carried four nuclear weapons, all of which were destroyed by fire. Some 237,000 cubic feet of contaminated ice, snow and water, with crash debris, were removed to an approved storage site in the United States. The day after the Thule accident, the airborne alert program was canceled, permanently.¹³

The most recent nuclear weapon accident occurred on September 19, 1980, in Damascus, Arkansas. In a Titan II silo, an air force repairman dropped a heavy wrench socket, which rolled off a work platform and fell toward the bottom of the silo. After dropping 70 feet, the socket bounced and struck the missile, causing a leak from a pressurized fuel tank. Eight and a half hours later, fuel vapors within the silo ignited and exploded. The nuclear warhead was recovered intact. There was no radioactive contamination. Nevertheless, the accident resulted in serious injuries and one death.¹⁴

Even today, nuclear weapons continue to be susceptible to these types of scenarios. Numerous "incidents," where fires, crashes, or other abnormal situations occurred but did not damage or affect the nuclear weapon itself (and thus be classified as an "accident"), have continued to be reported in the years since 1980.¹⁵ In 2008, for example, a maintenance crew entered a Minuteman III silo at F. E. Warren Air Force Base to investigate a faulty sensor reading. They found the wires to the sensor had been shorted out in a fire five days earlier—a fire that, until then, nobody had known about. A power interruption, a battery charger leaking hydrogen gas, a lack of circulating fresh air, a nearby flammable shotgun case (filled with ammunition), and an abundant use of duct tape on the missile's umbilical cables had combined to result in a brief but serious fire. The heat had destroyed the umbilical cables and the pressure monitor cable leading to the missile. Fortunately, the majority of the missile and the warhead itself were undamaged.¹⁶

12. Ibid., 314–319.

13. Ibid., 320–325.

14. Ibid., 6–7.

15. Gregory, *The Hidden Cost of Deterrence*, 177–183.

16. "United States Air Force Missile Accident Investigation Board Report," Minuteman III Launch Facility A06, 319th Missile Squadron, 90th Operations Group, 90th Missile Wing, F. E. Warren AFB, Wyoming, May 23, 2008, Robert M. Walker, president, Accident Investigation Board, September 18, 2008, 1:1–18.

Enhanced Nuclear Detonation Safety

At the beginning of the nuclear era, the Atomic Energy Commission (AEC) was responsible for safety during the production, transportation, and storage of nuclear material. This nuclear material remained separate from the weapon until shortly before use; thus, the possibility of accidental nuclear yield during peacetime was very low.¹⁷ However, competing demands for reliability and readiness during the Cold War led to the development of the sealed-pit design. With the ingredients for nuclear yield now permanently assembled within the warhead, a more disciplined approach was needed to assure these weapons remained as safe as possible.

In the 1950s, the Department of Defense (DOD) and the AEC began instituting standards for nuclear weapons safety. Policy maintained that nuclear weapons “require special consideration because of their political and military importance, their destructive power, and the potential consequences of an accident. . . . The search for increased weapon system safety shall be a continuous process beginning as early as possible in development, and continuing throughout the life cycle of a nuclear weapon system.”¹⁸ The use of “positive measures,” or features included in the design specifically to prevent arming or firing a weapon, was strongly encouraged.

However, two issues stunted the progress of nuclear weapons safety. The first was an overconfidence in the effectiveness of existing designs and practices. It was assumed that highly complex, dangerous systems like nuclear weapons could be safely governed merely through careful design and strict adherence to procedures in the field.¹⁹ Despite the many nuclear weapon accidents, no weapon had ever gone off unintentionally, so it could be argued that the status quo was working just fine. Post-accident statements by the military, such as “the possibility of an accidental nuclear explosion taking place is essentially impossible” or “[the chances are] so remote that they can be ruled out completely” perpetuated the public belief that these weapons were safer than they actually were.²⁰

The second obstacle to improving nuclear safety was the perceived trade-off between safety and reliability. This is the “Always/Never” problem—assuring that a nuclear weapon will always work when you want it to but never go off otherwise.²¹ Any additional feature added to the system to prevent accidental or unauthorized use would also be a potential point of failure that could dud the weapon during authorized use. When engineers at Sandia National Laboratories started pushing for ESDs on ballistic missile warheads in the late 1950s, the army pushed back, claiming that adding an additional switch would hurt

17. Stanley D. Spray, *History of U. S. Nuclear Weapon Safety Assessment: The Early Years* (Albuquerque: Sandia National Laboratories, 5 May 1996), SAND96-1099C, 2–3.

18. Spray, *History of U. S. Nuclear Weapon Safety Assessment*, 4.

19. For an analysis of this perspective, see Scott D. Sagan, *The Limits of Safety: Organizations, Accidents, and Nuclear Weapons* (Princeton, NJ: Princeton University Press, 1993), 14–52.

20. Hanson W. Baldwin, “Chances of Nuclear Mishap Viewed as Infinitesimal,” *New York Times*, March 27, 1966.

21. Peter Douglas Feaver, *Guarding the Guardians: Civilian Control of Nuclear Weapons in the United States* (Ithaca: Cornell University Press, 1992), 12–20.

reliability.²² Even up through the 1970s and 1980s, it would routinely take years, even decades, to get approval from the military and funding from Congress to implement what was seen by design engineers to be rather urgent safety improvements.²³

Slowly, safety became a more visible priority. In 1957, Sandia conducted the first comprehensive look at all nuclear weapon accidents up to that point. It was clear that nuclear weapons were not safe and really never could be made completely safe. Instead, any state with a nuclear arsenal was fundamentally “playing percentages.”²⁴ The military attempted to determine what those odds would be and what would be acceptable to the American people. An initial DOD study assumed the public would accept accidents with a frequency similar to major natural disasters such as earthquakes. It gave a recommended maximum probability of an accidental nuclear explosion at one in 100,000 per year for hydrogen bombs and one in 125 per year for atomic bombs. A second study gave a probability of one in 10 million for any given weapon over its lifetime, if kept in storage. However, if the weapons were loaded onto planes, the study’s probabilities for a weapon going off every decade were one in five for a hydrogen bomb and 100 percent for an atomic bomb.²⁵

By the late 1960s, there were many different methods being used to determine the safety of nuclear weapons probabilistically. Some agencies took a conservative approach, determining the probability of producing nuclear yield with the assumption that an accident had occurred. Others held the view that the probability of the accident itself could be rolled into the calculations. It was unclear whether a stated probability was for a single weapon or for all weapons, for each year or for a weapon’s lifetime. This led to confusion as to whether individual weapon designs were in fact meeting the required probabilities. In 1968, the assistant to the secretary of defense for atomic energy, Dr. Carl Walske, codified the safety standard for nuclear weapons:

The probability of a premature nuclear detonation of a bomb [or warhead] due to bomb [or warhead] component malfunctions, in the absence of any input except for specified signals (e.g. monitoring and control) shall not exceed:

(1) Prior to receipt of the pre-arm signal, for normal storage and operational environments described in the STS (Stockpile-to-Target Sequence), 1 in 10^9 (one in one billion) per bomb [or warhead] lifetime.

(2) Prior to receipt of the pre-arm signal, for the abnormal environments described in the STS, 1 in 10^6 (one in one million) per bomb [or warhead] exposure or accident.²⁶

Walske also stipulated that all nuclear weapons in the stockpile must be “one-point safe”; that is, the weapon must have a probability of less than one in a million of producing a nuclear detonation if a detonation of the high explosives originates from a single point (as

22. Schlosser, *Command and Control*, 196–197.

23. *Ibid.*, 453–454.

24. *Ibid.*, 171.

25. *Ibid.*, 172.

26. Joint Nuclear Weapons Publication System, “Glossary of Nuclear Weapons Materiel and Related Terms,” Technical Publication 4-1, May 31, 2005.

would likely happen in a crash or fire). These “Walske Criteria” are essentially the same standards that are followed today by the nuclear weapons complex and the DOD for all nuclear weapons.

About the same time, Sandia National Laboratories formed a safety department to examine whether current design practices were sufficient for nuclear safety. The group determined that even with the more precise wording of the Walske Criteria, it was still virtually impossible to accurately gauge probabilities using existing methods. The number of nuclear weapons exposed to accidents was simply too low to generate any statistically significant conclusions. The fact that weapons had survived several fires, crashes, and other incidents was not sufficient to make a meaningful calculation of how likely they were to survive all future incidents. The space of possible accident scenarios and abnormal environments was too vast, and the behavior of current safety components across all environments was essentially unknowable. As Richard Feynman would later say about the Challenger shuttle explosion, “the fact that this danger did not lead to a catastrophe before is no guarantee that it will not the next time, unless it is completely understood. When playing Russian roulette, the fact that the first shot got off safely is little comfort for the next.”²⁷

Instead of relying only on probabilistic analysis, the safety engineers proposed developing a more thorough understanding of component behavior in abnormal environments. As they began to experiment, the results were shocking, even to the safety engineers. Fundamental assumptions about how materials and components would behave in certain environments were proven false. To demonstrate the flaws in current hardware, the department assembled a “burned board room” that they could show to Sandia management and visiting DOD officials. Circuit boards, wires, and switches that were supposed to keep electrical energy away from critical areas of the weapon were shown to behave unpredictably in fires and other abnormal environments: wires on opposite sides of the warhead could come into contact; circuit boards could melt and short to other locations; switches could be forced closed through mechanical impact or stray electrical signals. The evidence was indisputable, and within two years a new plan for assuring nuclear safety was formulated. This new philosophy was termed Enhanced Nuclear Detonation Safety, or ENDS. ENDS depends on three fundamental nuclear safety principles: isolation, incompatibility, and inoperability.

In ENDS, to ensure that a nuclear weapon remains safe, critical components such as high explosives, detonators, and firing sets must be kept isolated from any energy that could set off the detonation sequence. The primary focus is electrical energy, but it could also include any other types of compatible energy, such as heat or mechanical impact. These detonation-critical components are enclosed by robust barriers that form complete Faraday cages, preventing electromagnetic energy from reaching the interior “exclusion regions.”

27. Richard Feynman, “Personal Observations on the Reliability of the Shuttle,” *Report of the Presidential Commission on the Space Shuttle Challenger Accident*, 1986, Appendix F.

In order for the weapon to function, however, there must be some way for the proper arming signals to be delivered to the detonation-critical components. Thus, the design must assure that signals that can activate the weapon for intended use are incompatible with signals resulting from other sources in normal or abnormal environments. For example, the ready/safe switches previously described could easily be enabled by accidental application of DC power from the aircraft. ESDs are more appropriate for driving incompatibility, as they can be enabled only by specific environments, such as a predetermined barometric pressure or acceleration. Yet even these devices are not very robust in accidents—many common accident environments can replicate the enabling environments. ENDS recommends using devices called “strong links” to regulate what signals are passed through the barriers to the detonation-critical components. A strong link is a mechanical switch designed to always be fail-safe—it remains in a safe state when exposed to an insult that damages it to failure. The only way to enable a strong link and allow arming signals through is to send it a specific complex pattern called a “unique signal.” This unique signal is engineered to be extremely unlikely to be found anywhere in normal or abnormal environments. The signal is not stored anywhere in the weapon until the weapon is deliberately armed by the aircraft or missile crew. If an incorrect unique signal or a similar but different signal from the environment is received by the strong link, the device immediately and permanently locks up in the safe state.

Combining isolation and incompatibility allows the weapon to passively control what signals and energy types are allowed to reach the detonation-critical components. Yet there is still a major concern: no barrier or strong link can be designed sufficiently robust to survive every possible accident scenario. Of particular concern are thermal environments. Accidents involving fires from jet fuel or rocket propellant are among the most common accidents encountered. Even the most exotic alloys may weaken or melt in such a scenario, creating breaches in the isolation barriers and strong links. The solution to this limitation is the principle of inoperability. In an accident, at some point before isolation may be lost, one or more of the detonation-critical components must be rendered inoperable. This is often done by including in the component a key material known to melt at a specific temperature well below the failure temperature of the barriers and strong links. A detonation-critical component that is assured to become permanently inoperable in certain environments is called a “weak link.” A weapon system using ENDS typically includes at least a thermal weak link, and other types of weak links (such as ones that become inoperable in certain mechanical impact or crush environments) are also encouraged.

In addition to isolation, incompatibility, and inoperability, there is also a fourth “i” used in ENDS: the principle of independence. It is extremely difficult, often impossible, to design, build, and test devices that can be shown to be reliable to levels of one in a million or billion. Instead, an ENDS safety architecture will include multiple sets of strong links, weak links, and barriers nested within one another, with each safety subsystem largely independent of the others. If the different subsystems are sufficiently independent, the respective assurance levels for each subsystem can be multiplied together to get an overall system assurance level. Two one in 1,000 safety subsystems can be combined to yield a

system assurance of one in a million; three can be combined to provide one in a billion. This method of multiplying probabilities is only possible if the failure modes for each safety subsystem are truly independent from each other, which becomes more and more difficult as more complexity is added.

Because the positive measures used in ENDS are passive and designed to be fail-safe, the designers more fully understand how the weapon will behave in an accident, even though some specifics about the environment are unknown. Thus, a properly implemented ENDS safety architecture can assure that the weapon meets the one in a million and one in a billion levels mandated by the Walske Criteria, regardless of the accident type encountered.

Assuring Nuclear Weapons Safety Today

Implementing ENDS into the nuclear stockpile was a slow and painful process. Almost every weapon in the 1970s stockpile needed some sort of alteration to fully meet ENDS, but both the DOD and the weapons labs were reluctant to take the drastic and expensive measures needed for such a retrofit. Thus, the primary means for implementing ENDS was one weapon system at a time, as new ones were designed and existing ones were retired or modernized. As late as 1990, over two decades after ENDS was first recommended, only half of the weapons in the stockpile were equipped with ENDS.²⁸ As the Cold War ended in the late 1980s and early 1990s, focus finally shifted from meeting the Soviet threat to cost cutting, modernization, and responsibly shrinking the stockpile. With aging weapons and new constraints on budget and testing, there was a major push to determine how to better ensure that the stockpile as a whole remained safe, secure, and reliable.

Today, several life extension programs and alterations are in various stages of development: the W76-1 and B61-12 life extension programs, the W88 Alteration 370, and the W87 fuze program. Several more are being planned, detailed in the “3+2” long-term schedule proposed by the Nuclear Weapons Council.²⁹ For every one of these programs, the major intent is to replace limited-life components, increase safety and reliability by upgrading components and safety architectures, and decrease lifetime costs by making them easier to manufacture and inspect.

This new generation of weapons, beginning with the W76-1 currently in full production, will include strong links and weak links much more sophisticated and foolproof than the first generation of ENDS weapons. Future weapons may include features that support safety even more strongly, such as more sophisticated strong links and weak links,

28. *The Report of the Nuclear Weapons Safety Panel before the House of Representatives Committee on Armed Services* (“The Drell Report”), 101st Cong. 10 (1990), statement of Sidney D. Drell, chairman, Nuclear Weapons Safety Panel.

29. *Fiscal Year 2015 Stockpile Stewardship and Management Plan* (Washington, DC: U.S. Department of Energy, April 2014), 1-2-1-4.

insensitive high explosives, fire-resistant pits, and improved fabrication and inspection techniques.

There are limitations to what can be done for safety, however. The nuclear weapons complex no longer has a blank check for weapon development. Even though the enterprise makes up only a small portion of the defense budget, every line item is inspected and negotiated. The possibility of bureaucratic wastefulness, both within the nuclear weapons complex and within the military and government in general, increases the overall reluctance to spend billions of dollars to upgrade weapons that appear to already meet their requirements satisfactorily. The moratorium on underground testing and the restriction that refurbished weapons often must reuse nuclear material and various other components also limit what improvements are possible.

In light of these restrictions, how do engineers at Sandia, Los Alamos, and Lawrence Livermore National Laboratories demonstrate safety today? The weapons labs approach this analysis from several angles. First, extensive computer modeling is done at system, subsystem, and component levels. These models are far more sophisticated than anything available when previous generations of weapons were being designed. Mechanical, thermal, and electrical models can simulate the behavior of the weapon systems in a wide variety of accident scenarios. These simulations are reinforced by physical testing, also performed at system, subsystem, and component levels. These tests are used to calibrate and confirm the simulations, and they give insight into complex abnormal environments that cannot be accurately modeled. Both physical testing and computer modeling begin early in the design process and continue long after production ends, taking into account continued aging and any information discovered through stockpile surveillance. And, of course, the passive, fail-safe features found in ENDS architectures provide confidence that the weapons remain safe even in those accidents that defy our expectations.

The American Association for the Advancement of Science and the Union of Concerned Scientists recently published a summary of opinions expressed at their 2012 workshop on nuclear weapons safety and security.³⁰ The consensus appeared to be that nuclear weapons safety in the U.S. stockpile is reasonably mature: “In general, participants were not greatly concerned about the safety of existing warheads. A few participants noted that improved safety was beneficial. . . . But overall, as one participant noted, safety ‘is not something I lose sleep over.’” The participants in the workshop in general felt that cost, command and control, and evolving threats to security (particularly cybersecurity and use control) were areas of far greater concern.

The Continuing Role of Nuclear Weapons Safety

The safety of the U.S. nuclear arsenal has improved greatly in the last half century, and it now seems fairly robust. What, then, is the role of nuclear weapons safety assurance going

30. *Summary Report: Workshop on U.S. Nuclear Weapons Safety and Security, December 12, 2012*, American Association for the Advancement of Science and the Union of Concerned Scientists, September 2013, 1–2, 13–20.

forward? Is safety being neglected due to budget constraints, or are currently planned spending levels for nuclear safety sufficient or even excessive to maintain a safe stockpile? If all the current weapon systems meet the Walske Criteria and have ENDS architectures, what is there left to do?

The question of how much to spend refurbishing U.S. nuclear weapons is, of course, complicated. The multibillion dollar B61-12 program has drawn attention to the question of what level of spending can be justified for these life extension programs.³¹ The B61-12 will feature new strong links and weak links, as well as other incremental safety improvements. However, other more substantial safety proposals for the weapon were tabled due to projected cost and required development time. This trend will likely continue in future life extension programs—minor improvements will be implemented as the opportunity arises, but major design changes that would dramatically improve safety margin will have difficulty finding support. Often, such changes fall outside the limited scope of individual programs or require lead time and research investment far beyond what any one program is willing to support. Sandia National Laboratories attempts to address the second problem by devoting part of its funding to long-term research, separate from the individual weapon programs, thereby providing a means to develop concepts to sufficient maturity so they can be implemented down the road.

It is vital that nuclear weapons safety remain tightly integrated into both the design of new weapons and the surveillance of the existing stockpile. There are two main points to consider. The first is that continued vigilance is necessary to prevent unsafe designs or practices from creeping in. As experienced designers, manufacturers, testers, and handlers are gradually replaced by new personnel, the lessons from the past are likely to be forgotten unless carefully passed down to the next generation. The weapons labs have been forced to deal with this issue already. From the time that new weapon design stopped in the early 1990s until work started on the W76-1 in the early 2000s, much experience was lost as the workforce contracted and shifted to other priorities. As a result, new engineers tasked with designing the W76-1 had a substantial learning curve as they tracked down the rationale for previous design choices and formulated their own safety architectures. A detailed record of past programs and a competent workforce must be maintained at each of the weapons labs to avoid repeating mistakes of the past or accidentally overlooking a potential safety concern.

The second reason nuclear safety must remain a core focus of research is that our understanding continually grows as new knowledge comes to light. It is important to remember that most of the engineers in the 1950s and 1960s believed that their designs were safe, too. It was not until accidents revealed possible flaws and key tests were performed that a paradigm shift occurred and changes were made. Although the nuclear weapons complex maintains that the current stockpile is safe, future accidents or studies may reveal gaps in our understanding—accidents previously deemed infeasible, manufacturing flaws discovered in the field, unanticipated byproducts of design choices, or

31. *Ibid.*, 9–10.

behavior by those handling the weapons that is not consistent with what is established in documented processes. Some of these may merely show the wisdom of future upgrades in the next round of life extension programs; others may possibly necessitate immediate removal of some weapons from the stockpile for repair or retirement.

Beyond the core responsibility of designing and maintaining safe weapons, the nuclear weapons safety community can contribute to the nuclear community in other ways. As seen previously, command and control has often been mentioned as an area of concern. Though the situation is much better coordinated than it has been in the past, it remains an area where substantial safeguarding and improvement is possible. The lessons learned in developing assured nuclear weapons safety may in many cases be carried over into this field. In particular, aspects of the command and control structure could be redesigned, incorporating more design features that are fail-safe (minimizing false positives) without hampering the ability to transmit and verify legitimate messages. Better communication and coordination between those designing safety into the weapons themselves and those managing safety, security, and control administratively can help assure that instead of hardware and behavior possibly neutralizing each other's effectiveness and introducing holes to the system, they can work together to keep the arsenal predictably safe and secure.

The nuclear weapons safety community can fulfill an important function in public outreach as well. As is apparent by the interplay between the military and the public during past nuclear weapon accidents, there is a long history of mutual distrust, with the military often understating the severity of accidents. Some level of security is of course necessary to preserve classified information; however, representatives from the weapons laboratories (particularly the accident response teams) could be seen by the public as a more safety-oriented voice clarifying the background of any future accident and explaining the steps taken to ensure the public's safety.

Finally, an interesting opportunity may exist to share some level of nuclear weapons safety design with other nuclear-armed states. Studies by Sandia National Laboratories³² and a NATO research workshop³³ in the mid-1990s examined the merits and risks of opening a dialog among the five recognized nuclear weapon states discussing best practices in nuclear surety. They concluded that such an exchange would be beneficial. Possible risks or hindrances could include adversaries using the exchange as a platform for other issues, giving an adversary increased readiness or reliability as a result of enabling safer designs, or unwittingly revealing non-surety-related information. It was agreed that a formal, summit-type meeting would be counterproductive, but that informal exchanges should be actively pursued and documented. This has been pursued to some extent under mutual

32. Steve Parker and Jessica Glicken, *A Vital Issues Report: The Merits of Conducting an International Exchange on Nuclear Surety Topics among the Five Acknowledged Nuclear Weapon States* (Washington, DC: Sandia National Laboratories, 24 July 1995), 1N.2958, 5–20.

33. Scott D. Sagan and Benjamin A. Valentino, *Nuclear Weapons Safety after the Cold War: Technical and Organizational Opportunities for Improvement*, report of a NATO Advanced Research Workshop (Stanford, CA: Stanford University, 1994), 4–7.

defense agreements³⁴ and papers presented in public forums,³⁵ but more can likely be done, particularly with newer nuclear-armed states such as India and Pakistan (while carefully considering the risks above). An accidental nuclear weapon detonation would affect everybody. Improving the assured safety of all nuclear weapons, even those of our adversaries, is a noble goal that would make the world just a little bit safer.

34. For example, “Agreement between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of the United States of America for Co-operation on the Uses of Atomic Energy for Mutual Defence Purposes, U.S.-U.K.,” August 4, 1958, TIAS 4078.

35. For example, G. K. Hansen, S. Lydersen, and H. Sandtorv, eds., *Safety and Reliability: Proceedings of the ESREL '98 Conference, Trondheim, Norway* (Rotterdam: Balkema, 1998).

Evaluating U.S. Policy Options: Up the Savannah River without a Paddle?

Nic Wondra¹

The 2000 Plutonium Management and Disposition Agreement (PMDA) between the United States and the Russian Federation is at risk of failure due to cost overruns. The capital investment needed to dispose of the bulk of U.S. plutonium through the construction of a Mixed Oxide (MOX) Fuel Fabrication Facility at the Savannah River Site is immense, which has led to ballooning costs. This chapter assesses the nonproliferation benefits of the program followed by its economic viability. While the nonproliferation benefits are found to be limited in the context of all other nonproliferation programs, the economic benefits are quickly becoming apparent. Not only is the other viable plutonium disposition facility, the Waste Isolation Pilot Plant (WIPP), out of full-scale service, but its costs are similarly rising. Completing and operating the Savannah River MOX Fuel Fabrication Facility (MFFF) carries the fewest risks of knock-on effects at other facilities and ensures that the United States can recoup some economic value from its plutonium stocks. The economic benefit of enhanced energy security provided is addressed; the Savannah River facility would provide an alternative fuel supply in the case of uranium market shocks and geopolitical crises, greatly increasing its utility and market value in an energy supply emergency. The debate about whether to complete the facility should begin to be seen as part of a larger debate about whether to change the policy on spent fuel reprocessing in the United States.

1. This chapter represents only the private views of the author and should never be considered an official statement of any department, agency, or organization. Nic Wondra is a nonproliferation graduate fellow working in the Office of International Operations of the National Nuclear Security Administration. Mr. Wondra holds an MA in international economics and international relations from the Johns Hopkins School of Advanced International Studies, where he focused on Russian area studies and nuclear nonproliferation issues. He also holds a BA from Cornell College in Russian and international relations.

Introduction

In 2000, the United States and the Russian Federation signed the PMDA, obligating both countries to convert separated plutonium into less sensitive materials. Both countries later opted to produce plutonium-uranium MOX fuel for this purpose, and each committed to destroying 34 metric tons of plutonium² through fission. This required significant capital investment in both countries; an MFFF was built in each country, with similar specifications.

The Russian facility is complete, operational, and produced its first fuel in the spring of 2014. The U.S. facility located at Savannah River, South Carolina, based on the successful AREVA facility in France,³ is languishing, several billion dollars over budget, and still not completed. The project is now at risk of being cut by Congress because of the cost and schedule overruns.⁴ The political future of the program's main proponent, Congressman Clyburn of the Georgia Congressional delegation, is also uncertain.⁵

The questionable future of MOX fuel in the United States is a problem because it carries serious implications for U.S. nonproliferation interests, the civil nuclear fuel market, nuclear technology, industrial capacity, and the U.S.-Russian bilateral relationship. The argument that follows stems from two main questions, both of which remain divisive. The first is whether reducing plutonium stocks permanently through fission in nuclear fuel does indeed have a positive effect on nonproliferation. The second question is what economic effects the decision to complete the U.S. facility is likely to have. At \$3.9 billion,⁶ and expected to cost \$2.9 billion more,⁷ the decision is no small one.

While answers to both questions carry uncertainties, the argument in this chapter is that the United States should fully fund the MOX fabrication facility, complete it, and carry out its obligations under the 2000 disposition agreement, as amended. Doing so, ironically, involves the least total cost for the United States. If the United States is indeed committed to fulfilling its obligations, it can demonstrate this through completing the facility while also building some redundancy and flexibility into its nuclear fuel market. To fail to complete the facility would require the construction of new capabilities or the drastic overhaul of

2. While "fifty tons" is the target in the agreement's body, the agreement obligates the Russian Federation and the United States to dispose/isolate no less than 34 metric tons of plutonium. This is called for in Article II, "Agreement between the Government of the United States of America and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes and Related Cooperation," U.S. Department of State, <http://www.state.gov/documents/organization/18557.pdf>.

3. MOX Fuel Fabrication Facility, <http://www.moxproject.com/about/>.

4. Meg Mirshak, "MOX facility at Savannah River Site placed on standby while alternatives assessed," *Augusta Chronicle*, March 4, 2014, <http://chronicle.augusta.com/news/metro/2014-03-04/mox-facility-savannah-river-site-placed-standby-while-alternatives-assessed>.

5. Dave Boyer, "Rep. Clyburn: White House could do more to help for midterm elections," *Washington Times*, March 31, 2014, <http://www.washingtontimes.com/news/2014/mar/31/rep-clyburn-white-house-could-do-more-help-midterm/>.

6. *Audit Report: Cost and Schedule of the Mixed Oxide Fuel Fabrication Facility at the Savannah River Site*, May 2014, U.S., <http://energy.gov/sites/prod/files/2014/05/f16/DOE-IG-0911.pdf>.

7. *Ibid.*

existing ones. Completing the facility and producing MOX fuel actually makes the most economic sense, compared with other options for plutonium disposition.

History

The main reason the United States entered the 2000 PMDA is because separated plutonium can be used in a weapon, and reducing the amount of the material lowers the risk of that material being employed in a device. After the collapse of the Soviet Union in 1991, it was apparent that U.S. interests were served by promoting security at former Soviet nuclear sites and storage facilities. A range of programs sponsored by Senators Sam Nunn and Richard Lugar created the Megatons to Megawatts program, which facilitated the purchase of Soviet-origin uranium for use in U.S. civil reactors. Plutonium is trickier: while it can fission in power reactors, its properties do not readily lend it to power reactor use.

The Russian Federation's scientists insisted on the value of plutonium as a potential fuel⁸ in not-yet-built, liquid sodium-cooled fast neutron reactors.⁹ According to two of those scientists,¹⁰ the United States succumbed to Russian pressure and agreed to the PMDA, despite the fact that their U.S. counterparts disagreed on the feasibility of plutonium as a potential fuel. Because it is not economical to guard plutonium indefinitely, the logic was to permanently reduce plutonium stocks in both countries, thereby furthering nonproliferation interests.¹¹ The diplomatic achievement was persuading Russian counterparts to undertake the plutonium reductions in parallel. The problem is that the Russian Federation's pursuit of fast reactors means that no amelioration of plutonium will ensue—in fact, more plutonium is likely to be created as Russia transitions to a fast reactor plutonium fuel cycle.¹²

Nonproliferation Ramifications

Originally conceived of as a nonproliferation program, the policy decision on whether to continue to support MOX in the United States brings two questions into play. First, how much plutonium needs to be destroyed to ameliorate risk? The amount of plutonium in question is only 34 metric tons in each country, compared to the 159 metric tons held in Japanese spent fuel and reprocessing facilities.¹³ The United States and Russia have much more plutonium in total, so this is a comparatively small amount of material. Second, does this program contribute to nonproliferation goals? Since the argument is that U.S. policy is

8. MOX Fuel Fabrication Facility, "Reducing a Clear and Present Danger," <http://www.moxproject.com/files/factsheets/ReducingaClearandPresentDanger.pdf>.

9. Tom Clements, Edwin Lyman, and Frank von Hippel, "The Future of Plutonium Disposition," *Arms Control Today*, July/August 2013, https://www.armscontrol.org/act/2013_0708/The-Future-of-Plutonium-Disposition.

10. Dr. Bruce MacDonald and Dr. Robert Alvarez, "Issues in Nuclear Nonproliferation," course at Johns Hopkins-SAIS, 2013.

11. MOX FFF, "Reducing a Clear and Present Danger."

12. Clements, "The Future of Plutonium Disposition."

13. Fredrik Dahl, "U.S. defends Japan against China's plutonium criticism," Reuters, March 5, 2014, <http://www.reuters.com/article/2014/03/05/us-japan-plutonium-usa-idU.S.BREA2421A20140305>.

advanced with this agreement, because MOX fuel is a way to completely get rid of plutonium, what would the effects be if the United States backs out of the agreement? Seeing as the amount of material is small, stopping the program is likely to have a proportionately small impact on nonproliferation policy writ large. The effects on the U.S.-Russia relationship will likely be damaging but short lived; and the Russian Federation will continue to fabricate plutonium fuel regardless of the U.S. policy.

HOW MUCH PLUTONIUM MUST BE DESTROYED TO AMELIORATE RISK?

Fissioning plutonium and decreasing overall stocks is an admirable attempt to decrease risks posed by this material, but concluding that this will have far-reaching nonproliferation effects is putting the cart before the horse. There are three problems: the overall separated plutonium stocks, not just in Russia and the United States, are so large compared to the volumes in this disposition agreement that fulfilling obligations under this agreement alone will not make a significant nonproliferation impact. The second problem is one of fundamental attribution error: analyses tend to attribute to stocks of plutonium the risk of non-state actors stealing the material to make a nuclear explosive device. Several have suggested that this is not the risk the United States should be concerned about; instead, the United States should be concerned about profligate states. The third problem is the corollary to the second: if non-state actors are the main threat, and their capabilities are such that they cannot make a nuclear explosive device, most agree that the main risk is posed by radiological dispersal devices (RDDs). If that is the case, then separated plutonium is less of a risk to public safety in such a device than recently irradiated material and other fissile materials.

Therefore, it is no longer clear in this post-Soviet period whether separated plutonium stocks pose an inherent threat to U.S. national security. If they did, or do, the primary window of opportunity for such material falling into non-state actors' hands was during the mid-1990s. Ameliorating plutonium stocks today cannot mitigate the risks posed by material that may already be lost.

Special Nuclear Material and "Significant" Quantities

The PMDA requires the United States and Russia to destroy only 34 metric tons of plutonium. The United States is estimated to have approximately 99.5 tons of separated plutonium for defense purposes, and the Russian Federation is estimated to have 145 tons.¹⁴ Overall, there is estimated to be 1,830 tons in existence in the world, held across 35 countries.¹⁵ The central problem with the logic behind the PMDA as a nonproliferation agreement is that the proportion of plutonium to be destroyed relative to the total amount held is quite small. The average nuclear weapon is assumed to need 4 kg of plutonium.¹⁶ Consider-

14. "Plutonium Disposition," The Stimson Center, last modified May 30, 2007, <http://www.stimson.org/plutonium-disposition/>.

15. David Albright and Kimberly Kramer, *Plutonium Watch: Tracking Plutonium Inventories*, July 2005, revised August 2005, http://www.isis-online.org/uploads/isis-reports/documents/plutonium_watch2005.pdf.

16. David Albright, Frans Berkhout and William Walker, *Plutonium and Highly Enriched Uranium 1996: World Inventories, Capabilities and Policies* (New York: Oxford University Press, 1997), 8.

ing the International Atomic Energy Agency's (IAEA's) figure of 8 kg of plutonium constituting a "significant quantity," even if this disposition agreement was carried out in full, this would still leave tens of thousands of warheads' equivalent worth of plutonium in both states' stocks.

A secondary problem is that there is a great deal of attention paid to plutonium, rather than to both plutonium and uranium, the latter of which the United States considers to be "special nuclear material" and suitable for use in a nuclear explosive device. The United States has historically been very open about its plutonium stocks and the scientific uncertainties involved in U.S. plutonium production, though it has been far less transparent in its weapons-grade uranium holdings. The Russian Federation, by comparison, is the opposite and is comparatively transparent about its uranium holdings but has not made plutonium figures public. Treating plutonium differently than uranium makes sense from a programmatic perspective but not from a nonproliferation perspective.

Are Nonexplosive Weapons the Real (Nuclear) Threat?

Definitions of terrorism differ. A lowest-common-denominator definition would be the use of violence to disrupt, discourage, and frighten an established authority and its public. While contemporary thoughts about terrorists' technological capabilities are not absolute, most conclude that such bombs and other devices would be quite rudimentary. The most likely use of nuclear material in a terror attack would be the use of an RDD or a radiological exposure device (RED).

Assuming that a terrorist organization does not have the technical capability to produce a nuclear explosive device, this leaves RDD and RED as the most likely methods to be employed. According to a paper from the National Defense University's Center for the Study of Weapons of Mass Destruction, a "nonexplosive, aerosolized dissemination of respirable radioactive particles is the type of RDD likely to produce the most casualties,"¹⁷ and this is therefore the type likely to be favored for an attack. The same paper also notes that technological advancement will make devices and substances harder to attribute and harder to detect and defend against.

The only real public example of an attack with such devices is a 1995 event in which Chechen rebels contacted a Russian television station and declared that they had buried a container of radioactive material in Moscow's Ismailovsky Park, which was discovered to contain 10–50 millicuries of cesium-137.¹⁸ While this particular act did not use any special material, either type of device would achieve terrorism's political aims. RDDs and REDs also pose significant public health risks through radiation exposure and, more importantly, through radiological and chemical contamination.

17. John P. Caves Jr. and W. Seth Carus, *The Future of Weapons of Mass Destruction: Their Nature and Role in 2030*, Center for the Study of Weapons of Mass Destruction Occasional Paper No. 10 (Washington, DC: NDU Press, 2014): 21.

18. *CNS Global Incidents and Trafficking Database, 2013 Annual Report*, March 2014, http://www.nti.org/media/pdfs/global_trafficking_report.pdf?_id=1395275964.

One reason that RDDs and REDs pose a serious problem is that not only do such devices require very little nuclear material, there is a range of material besides plutonium that could be used, meaning a program focused narrowly on plutonium at great expense may not be a wise use of scarce nonproliferation resources. Potential sources of nuclear material that could be used in such a device include industrial and medical sources that can be as large as thousands of curies. A recent incident in Mexico where a source of cobalt-60 was stolen in transit (but luckily recovered) illustrates the ubiquity and vulnerability of this material in civilian use.¹⁹ Of all radioisotopes in the world, the IAEA estimates that 15 percent are not under safeguards and are not in the direct custody of states.²⁰ This represents a number of sources that would be comparatively easy to procure and use in a device. Reducing plutonium stocks, therefore, has at best a negligible impact on improving public safety today, since U.S. and Russian plutonium stocks are already under high security.

Attribution Error: Does the Material in Question Pose Inherent Risks?

Many experts, including scholars such as Graham Allison and authorities within the U.S. government, have assessed the risk posed by a terrorist attack involving a nuclear detonation to be quite high. They have done so because the consequences of such an attack would be catastrophic, even though the probability is actually quite low. Other security experts have persuasively argued that the risk of nuclear use by states is much higher than we have assumed. Many incidents that have been made public from the Cold War illustrate how misidentification, miscommunication, and miscalculation led to nuclear near use. The most notable examples include the Cuban Missile Crisis, the NATO Able Archer exercise in 1983, and the Norwegian sounding rocket episode in 1995. In all of these instances, authorities received mixed signals that could have led to an actual nuclear use. These are only the episodes that have been made public, but it is not unreasonable to conclude that there may be other instances of nuclear near use that remain undisclosed.

As the bipolar strategic balance between the United States and the Soviet Union fades into the past, security scholars are beginning to recognize that the most likely pathways for nuclear use involve regional conflicts with or between secondary nuclear powers. The most notable example of such a pathway is the ongoing India-Pakistan conflict. Both countries possess nuclear arsenals in excess of 100 weapons and a suite of missile delivery systems. India is slowly developing a nuclear triad capability, though it has seen recent naval accidents set back its sea-based deterrent aspirations.²¹ Poor nuclear security and the nature of political leadership in both countries exacerbate the risks of nuclear use. In Pakistan, a centralized military authority is subject to internal power struggles and state fragmentation. In India, staunch civilian political control over the weapons and a lack of

19. Gabriela Martinez and Joshua Partlow, "Stolen cobalt-60 found in Mexico; thieves may be doomed," *Washington Post*, December 5, 2013, http://www.washingtonpost.com/world/stolen-cobalt-60-found-in-mexico-curious-thieves-likely-doomed/2013/12/05/262ef990-5d66-11e3-8d24-31c016b976b2_story.html.

20. Gaukhar Mukhatzhanova, verbal remarks in "Nuclear Weapons Policy and Arms Control," course at James Martin Center for Nonproliferation, Washington, DC, July 2014.

21. "Nuclear security: India worse than Pakistan!," *Rediff News*, January 9, 2014, <http://www.rediff.com/news/slide-show/slide-show-1-defence-news-nuclear-security-india-worse-than-pakistan/20140109.htm>.

military coordination exacerbate poor strategic decisionmaking. India's political history has left it with a civilian government relatively free from military interference, but this also means that India lacks a general staff to coordinate action or restrain overreaction. If the Cold War-era superpowers were capable of accidents and miscalculation, other states are, too.

In the post-Cold War era, Western theorists have relegated nuclear weapons to a deterrent-only role because of their immense destructive power and the unpalatable damage to civilian populations. Ward Wilson correctly argues that this is based on the myth that the U.S. atomic bombing of Japan achieved ultimate victory.²² In reality, the victory was won using many military methods, while the atomic bombings provided political cover to the Japanese leadership to surrender. This is important because it demonstrates that even in the context of utter devastation—and a full nuclear exchange—there may yet be the will to fight. If, in reality, a nuclear weapon cannot end a war, then nuclear weapons may have to be assessed on the basis of their battlefield utility. The use-them-or-lose-them dilemma that led the United States to discontinue basing its tactical nuclear weapons in many places is not universally shared. Military leaderships of countries that perceive themselves to be at a disadvantage in a total war using only conventional weapons may find the utility and usability of nuclear weapons to be quite different.

A second pathway to nuclear use is the risk of naval nuclear use. In Soviet doctrine, nuclear use at sea was debated and considered possible because it virtually assured that there would be no civilian casualties. Very high speed torpedoes and missiles were developed, both with nuclear weapons delivery in mind, to counter U.S. naval supremacy. Analysis of Russia's 2010 defense doctrine concludes that a nuclear option will be considered in some circumstances—namely, if the survival of the state is at risk.²³ But could threatening a state's vital interests strike too close to home while not threatening the state per se? An asymmetric naval battle virtually ensures that the weaker power will be compelled to use nuclear weapons at sea in order to compensate for conventional inferiority. The U.S. Air-Sea Battle doctrine²⁴ could be so effective as to provoke such use as a defensive measure against overwhelming conventional naval force. Particularly in the conflict over the disputed Japanese Senkaku Islands, nuclear use is not impossible. But in the event of a Japan-China confrontation that involved the United States, the path of escalation is not as clear.

The lesson is that, contrary to popular belief, the fact that the world has avoided a nuclear conflict so far does not validate deterrence as a robust concept. Nuclear use by states is far more likely than nuclear use by terrorists, and “nuclear weapons are likely to play a more significant role in the [emerging] international security environment”²⁵ as the United States' preponderance of power wanes in the global political system and nuclear

22. Ward Wilson, *Five Myths of Nuclear Weapons* (New York: Houghton Mifflin Harcourt, 2012).

23. “Russia Nuclear Capabilities Overview,” *Nuclear Threat Initiative*, last modified June 2014, <http://www.nti.org/country-profiles/russia/nuclear/>.

24. “Air-Sea Battle: Service Collaboration to Address Anti-Access & Area Denial Challenges,” Air-Sea Battle Office, May 2013, <http://www.defense.gov/pubs/ASB-ConceptImplementation-Summary-May-2013.pdf>.

25. Caves, “The Future of Weapons of Mass Destruction,” 41.

weapons become more central to many states' national security policies. This means that reducing plutonium stocks has nothing to do with lowering the risks of a nuclear attack.

Are the Inherent Risks Associated with Material Stocks Uniform between Countries?

Recent security breaches at U.S. nuclear sites, most famously the breach by three activists including an 82-year-old Roman Catholic nun at the Y-12 site at Oak Ridge National Laboratory,²⁶ cannot be superimposed on the Russian Federation. Attempts at quantifying the risk associated with the level of security at nuclear sites, such as the Nuclear Threat Initiative's 2014 *Nuclear Materials Security Index*, rate Russian security at nuclear sites to be low because of certain social and political factors associated with Russia's comparatively authoritarian political system.²⁷ This is despite the U.S. breach in which three people reached a building housing 400 tons of highly enriched uranium.²⁸

Such quantitative analysis of qualitative factors is dubious and misleading because it attempts to quantify subjective criteria that do not have underlying quantitative values. Studies like this are also biased toward the authors' own forms of government. It is also worth noting, as an aside, that such a breach of a nuclear site in the Russian Federation by religious protestors is inconceivable because the Russian Orthodox Church officially supports nuclear weapons possession²⁹ and, under some circumstances, nuclear use.³⁰ This example is not meant to be conclusive but illustrates the extent to which access at facilities might be pursued by a public advocating against nuclear weapons. It is highly unlikely, at a Russian nuclear facility, that any group of clergy could gain access to the extent of the U.S. breach at Oak Ridge without being shot at on sight. While the United States lauds itself on transparency, its tangible security record is questionable.

26. Dan Zak, "The Prophets of Oak Ridge," *Washington Post*, April 30, 2013, <http://www.washingtonpost.com/sf/wp-style/2013/09/13/the-prophets-of-oak-ridge/>.

27. An excerpt from the Nuclear Threat Initiative (NTI) reads as follows:

Russia's score remains unchanged compared to 2012 and it is in the bottom third of the NTI Index. Although Russia's scores are high for most indicators, including those in the important Security and Control Measures category, in the future, its nuclear materials security conditions could be further improved by strengthening its laws and regulations for physical security of material during transport to reflect the latest IAEA nuclear security guidelines. Russia's nuclear materials security conditions also remain adversely affected due to its high quantities of weapons-usable nuclear materials, the large number of sites at which those materials are located, and very high levels of corruption among public officials.

Nuclear Materials Security Index, Nuclear Threat Initiative, 2014, <http://ntiindex.org/countries/russia/>.

28. Dan Zak, "Nun, 83, and two other activists guilty of intrusion at nuclear complex," *Washington Post*, May 8, 2013, http://www.washingtonpost.com/lifestyle/style/nun-83-and-two-other-activists-guilty-of-intrusion-at-nuclear-complex/2013/05/08/9ae9d57a-b82f-11e2-92f3-f291801936b8_story.html.

29. Adrian Blomfield, "Orthodox Church unholy alliance with Putin," February 23, 2008, <http://www.telegraph.co.uk/news/worldnews/1579638/Orthodox-Church-unholy-alliance-with-Putin.html>.

30. Kyle Keeton, "Russia: Church and Nuclear Weapons?," *Windows to Russia Blog*, September 5, 2007, http://windowstorussia.com/russia-church-and-nuclear-weapons_05.html.

CONCLUSION ON NONPROLIFERATION RAMIFICATIONS

The nonproliferation benefits of the U.S. MOX program are therefore spurious at best; pursuing such a program in the context of the Soviet collapse, the risk of institutional failure, and the existence of loose fissile material made sense, but in 2014 it does not. The risks posed by fissile material are not limited to plutonium and the “significant quantities” that much of policy is based around are largely arbitrary. The risks posed by RDD and RED are very real and, as elucidated in the section where risk is wrongly attributed to total material stocks, comprise a more difficult security question than can be addressed by reducing stocks of plutonium. Lastly, destroying the material departs from the faulty assumption that Russian plutonium stocks are insecure. Such a conclusion today is couched too firmly in Russia’s past (1990s) history.

How much plutonium needs to be destroyed to ameliorate risk? It turns out that this question is too simplistic. Plutonium is only a risk if used in a weapon against a state, and whether that occurs is entirely about the political and technological context of that conflict. It is quite possible that destroying all of the plutonium in the world will do nothing to advance U.S. nonproliferation goals, writ large. And, then again, all of the world’s plutonium would have to be destroyed to assure universal nonproliferation. More importantly, does this program contribute to U.S. nonproliferation goals? The answer is a profound “yes,” if the logic is accepted that destroying plutonium is tantamount to nonproliferation, but this is an expensive tenet to accept, as is detailed below.

Is It Economically Feasible to Stop the Construction of the Facility?

Completing the U.S. MOX fabrication facility has already cost a great deal, and it will require more funding to complete, so in the event that the facility’s construction is canceled, what are the alternative means to destroy this plutonium fuel and fulfill U.S. commitments? The U.S. Government Accountability Office has published a report harshly criticizing the National Nuclear Security Administration’s (NNSA) oversight of the project and calling the agency’s original figures “minimally credible.”³¹ While the savings are a tantalizing target for congress, how economical is it to actually cancel?

There are three factors that determine the economic viability of the Savannah River MOX facility. First, the price of an alternative method of disposing of the plutonium in question is also high, and it is not a method that is comparable in its nonproliferation benefits. Even if the facility were available, it is not currently operational. Another factor is the unpredictability of the global nuclear fuel market. MOX could yet be competitive, and this one facility stands to have a large impact on the nuclear fuel market. Lastly, the

31. “Nuclear Nonproliferation: DOE [Department of Energy] Needs to Address Uncertainties with and Strengthen Independent Safety Oversight of Its Plutonium Disposition Program,” Government Accountability Office (GAO) report GAO-10-378, *Government Accountability Office*, March 26, 2010, <http://www.gao.gov/htext/d10378.html>.

fulfillment of U.S. commitments in good faith shows Russia and the world that the United States upholds nonproliferation as a policy priority.

THE ALTERNATIVE TO MOX IS NOT A PERMANENT REDUCTION METHOD—AND IT’S NOT FULLY OPERATIONAL

The first argument against completing the Savannah River MOX facility is the expense. The plant is only 60 percent completed and has already cost \$3.9 billion,³² and it is expected to cost \$2.9 billion more.³³ This is an embarrassing increase from the 2007 baseline figure of \$4.8 billion and represents a schedule slipping back by three years, meaning the plant would only begin to produce fuel in November 2019.³⁴ It is now expected to cost \$30 billion over its entire life cycle.³⁵ Some have claimed that initial Department of Energy figures did not represent an effective estimate and that they were created with a poor understanding of the engineering required.

If the MOX facility is cut, the U.S. would still be obligated to destroying a concomitant mass from its plutonium stocks. This would require a capability that is currently in legal limbo: the WIPP in Carlsbad, New Mexico, which would “down-blend plutonium” and lock it into a substance that could then be buried in a geological repository. This does not meet the initial requirements under the agreement, which requires the permanent destruction of plutonium. Even after fixing the plutonium in ceramic or silica “pucks,” the plutonium could still be removed, in theory, using chemical processes. This is not as robust a nonproliferation standard as fissioning the plutonium in fuel.

The Waste Isolation Pilot Plant, however, was shut down in February 2014 after contamination was detected outside the facility and 13 workers were medically treated.³⁶ After backing the project as a boon to regional employment and economic development, New Mexico’s congressional delegation is now fighting for more funding to restart work at the facility.³⁷ The only facility that could potentially be used to carry out U.S. obligations is therefore the incomplete Savannah River facility. A recent bill in the U.S. Senate Energy and Water Development Subcommittee that would authorize \$323 million for WIPP in FY2015 is under consideration in the Senate.³⁸ Unless the United States wants to pay for another WIPP, funding and completing the MOX facility ironically remains the cheapest

32. *Audit Report*, 2.

33. *Ibid.*

34. *Ibid.*, 2–3.

35. Meg Mirshak, “MOX facility at Savannah River Site placed on standby while alternatives assessed,” *Augusta Chronicle*, March 4, 2014, <http://chronicle.augusta.com/news/metro/2014-03-04/mox-facility-savannah-river-site-placed-standby-while-alternatives>.

36. John R. Emshwiller, “Managers Blamed in Nuclear Leak: Energy Department Report on Feb. 14 Accident at New Mexico Waste Site Blames Management,” *Wall Street Journal*, April 25, 2014, <http://online.wsj.com/news/articles/SB20001424052702304788404579521881640155124>.

37. Associated Press, “NM Senators urge Obama for more federal funding for WIPP,” *KOB-TV*, June 5, 2014, <http://www.kob.com/article/stories/s3463897.shtml>.

38. Zach Ponce, “Sen. Udall meets with DOE, WIPP officials,” July 3, 2014, http://www.currentargus.com/carlsbad-news/ci_26087816/sen-udall-meets-doe-wipp-officials.

alternative because it is mainly a fixed cost that will produce a product that can recover value from U.S plutonium stocks.

Though numbers are constantly being revised in the constantly changing political climate, numbers from 2002 illustrate the discrepancy between the capital costs: the MOX fuel fabrication method was expected to cost \$3.3 to 5.4 billion, while immobilization at WIPP could cost in the \$2.0 to 3.2 billion range.³⁹ Since the immobilization figures have continued to climb, and completing MFFF now is expected to cost an additional \$2.9 billion, MOX is now the economical choice.

Could MOX Be a Competitive Fuel?

In theory, MOX could be a competitive fuel if the facility is completed. One argument against completing the facility is that power companies would not purchase MOX fuel; some have said that evidence of this is that no companies have committed to do so.⁴⁰ This is a straw man, however; because power companies contract for fuel anywhere from two to seven years before it enters a reactor and the fuel is likely to be in a reactor core for up to three years, the immediate effects of MOX fuel coming onto the civil energy market will be limited. MOX fuel was developed in the 1960s to “recycle” the fissionable material from spent nuclear fuel.⁴¹ Today, many reactors in Europe and Japan are licensed to use MOX fuel as up to one-third of their nuclear fuel.⁴² A few reactors are equipped to handle even more MOX assemblies.⁴³ Despite these advances in reactor and fuel technology, MOX makes up only 2 percent of the global nuclear fuel market;⁴⁴ this is because a steady supply of fuel has not been continuously available and few new reactors have been authorized. To hedge against the risk of fuel market disruption, new reactors are being built with the flexibility to use MOX and conventional uranium fuels.

Over the long term, MOX fuel could be quite competitive and even recoup economic value from the very plutonium that the United States once argued held negative economic value. The projected volume that the Savannah River MOX plant would have is not negligible. It is expected to convert 3.5 tons of plutonium metal into MOX fuel annually.⁴⁵ This is large enough to have unforeseen effects on nuclear fuel prices in a currently oligopolistic market. The *Bulletin of Atomic Scientists* illustrates the elasticity of demand for nuclear fuels: “In 1997, the market price for a kilogram of low-enriched uranium for use in research reactors was about \$5,400. By 2005, that price had risen to about \$8,800—an

39. Christine Kucia, “Russia Agrees to Use MOX Facility Design,” January/February 2003, https://www.armscontrol.org/act/2003_01-02/mox_janfeb03.

40. Taxpayers for Common Sense, “Joint Letter to the President—Mixed Oxide Fuel,” February 5, 2013, <http://www.taxpayer.net/library/article/step-outside-the-mox>.

41. “Mixed Oxide (MOX) Fuel,” *World Nuclear Association*, last modified December 2014, <http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Fuel-Recycling/Mixed-Oxide-Fuel-MOX/>.

42. Ibid.

43. Ibid.

44. Ibid.

45. *MOX Fuel Fabrication Facility* homepage, <http://www.moxproject.com/>.

increase of over 60 percent in eight years.”⁴⁶ While the specifications of manufactured fuel and its quality will determine its marketability, it is safe to say that power companies do not yet have a MOX product that they can evaluate for use in civil reactors. Ensuring that high-quality fuel is produced from the facility will require public investment beyond the plant’s completion, but it is also the best way to guarantee revenues.

Follow-through Shows That the U.S. Upholds Nonproliferation as a Foreign Policy Goal

Having the U.S. MOX facility operational would not only greatly change the domestic nuclear fuel market, it would also carry positive diplomatic benefits. The 2000 plutonium disposition agreement was a compromise struck largely in part because Russian counterparts insisted on the feasibility of plutonium fuel. Over 20 years and more than \$10 billion later, such fuel fabrication may become a reality. In this era when the U.S.-Russia relationship has been damaged by old-fashioned realpolitik, follow-through on this agreement will demonstrate that the U.S. is a committed partner in nonproliferation efforts.

CONCLUSIONS ON THE ECONOMIC VIABILITY OF THE U.S. MOX FACILITY

It may be more economical in the long term to complete and operate the U.S. Savannah River MOX facility, and it has the added benefit of fulfilling U.S. obligations and bolstering U.S. prestige as an honest partner. These positive diplomatic ramifications are needed,⁴⁷ especially in the recent context of the poor bilateral relationship with Russia. The United States has an interest in actually recouping its costs associated with plutonium fuel fabrication, and this cannot be done unless the facility is completed. Plutonium stocks actually hold negative economic value—that is, they must constantly be guarded and secured; changing this into positive economic value is the task at hand. Completion of the Savannah River facility gives this reality the best opportunity.

Conclusions and Recommendations

This chapter does not suggest that risks posed by plutonium stocks are being assessed in a vacuum. Other pieces in this volume detail how many U.S. nonproliferation programs are working in concert to reduce risks associated with nonproliferation, including highly enriched uranium reactor conversion programs,⁴⁸ verification technologies, and monitoring and detection capabilities. As far as programs go, however, this is among the biggest and

46. Ta Minh Tuan, “Calculating the value of an international fuel bank,” August 28, 2012, <http://thebulletin.org/nuclear-fuel-bank-good-investment/calculating-value-international-fuel-bank>.

47. Chad Mills, “Rep. Wilson: MOX termination would hurt U.S.-Russia relations,” *WRDW-TV*, March 3, 2014, <http://www.wrdw.com/home/headlines/Rep-Wilson-MOX-termination-would-hurt-U.S.-Russia-relations-248278891.html>.

48. Anatoli S. Diakov, “Russian Non-Proliferation Efforts” (remarks to the Non-Proliferation course at the NATO School, Oberammergau, Germany, March 19, 2010), <http://www.armscontrol.ru/pubs/en/russian-non-proliferation-efforts.pdf>.

most expensive for NNSA. The Russian Federation facility is expected to cost \$2.4 billion, and a \$400 million contribution to the Russian program from the United States is expected after FY2018, when the disposition was due to begin.⁴⁹ The United States has already spent \$3.9 billion, with more funding needed. The cost overruns are challenging political wills and endangering the U.S. MOX project's chances of contributing to a safer world—and a lucrative nuclear fuel market. By completing the Savannah River MFFF and recouping value from U.S. plutonium stocks, the United States can show that it is serious about nonproliferation while avoiding the headaches and expense of finding an alternative disposition method.

The nonproliferation benefits of the U.S. MOX program are questionable because the risks posed by fissile material are not limited to plutonium alone, but incremental benefits can be argued. The quantities of plutonium encapsulated by the agreement are largely arbitrary, and to muddy the waters even more, no verification mechanism is yet agreed between the Russian Federation, the United States, and the IAEA, which is charged with verifying this bilateral agreement.

The risks posed by terrorists' devices are a more difficult security question than can be addressed by reducing stocks of plutonium, and insisting on destroying the material hastily assumes that Russian plutonium stocks are unsecured. While the United States could cut the program on the grounds that its contribution to nonproliferation is marginal, this does not account for strategic surprises, state collapse, and the future need of such an industrial capacity to diversify the nuclear fuel market. What if a new stock of plutonium needs to be recovered and destroyed from a collapsed state? On top of the present-day economic argument of building the facility and fulfilling the plutonium disposition agreement, maintaining U.S. fuel cycle capabilities brings benefits that may not be predictable today.

The economic argument detailed here is based largely on three factors that determine the viability of the Savannah River MFFF. First, the price of disposing of the plutonium at WIPP is also high and is not comparable in its nonproliferation benefits. Second, the WIPP facility is in legal and environmental limbo, unlike MFFF. Third, the United States must also be known as a country that carries out its contractual obligations. Today, as Ukraine's security and political fate are open questions, the U.S.-Russian partnership remains important to solve global and regional nonproliferation challenges.

A problem not addressed in this chapter is the limited space for U.S.-origin spent nuclear fuel in site storage ponds. The issue is strongly related to fuel cycle services generally and the current U.S. policy of not reprocessing nuclear fuel. So long as the United States refrains from reprocessing spent fuel, several pressures will necessitate that the U.S. expand a range of capital capacities to deal with the challenges posed by the finite space for spent fuel. Redeveloping its fuel cycle capacities and revisiting its policy of no reprocessing is beginning to make economic sense for the United States as a whole, and the MOX project is a piece of this renewed debate. AREVA said as much to its U.S. counterparts early in the

49. Mark Holt and Mary Beth D. Nikitin, "Mixed-Oxide Fuel Fabrication Plant and Plutonium Disposition: Management and Policy Issues," *Congressional Research Service*, March 28, 2014, fas.org/sgp/crs/nuke/R43125.pdf.

planning staged, arguing that the MFFF should be seen as one piece of a larger nuclear fuel reprocessing complex.⁵⁰ The proliferation-resistant qualities of spent fuel will have to be weighed against the negative economies of scale that U.S.-origin spent nuclear fuel poses and the economic opportunities of providing complete fuel-cycle services.

The unpredictability of the global nuclear fuel market is a consideration that needs far more attention from economists. The United States no longer reprocesses fuel, it has only two commercial enrichment facilities operating, and it has only one uranium mill operating. In the event of a major market disruption to the global uranium supply, the United States would be better off if it had a domestic MOX facility. The economic and strategic surprise associated with such fuel markets is immense, and the risks to U.S. nuclear fuel supplies can be hedged in this way. As discussed, MOX could be competitive, and the Savannah River facility stands to have a large impact on the domestic nuclear fuel market. In a world dominated by state-run nuclear companies, the debate about primacy in the nuclear sector and public investment needs renewal.

Because Russia has completed its construction of the BN-800 fast neutron reactor in Beloyarsk, Sverdlovsk, planned operations from 2014 are expected to reduce Russian Plutonium stocks through MOX fuel incorporation.⁵¹ This program is likely to continue whatever course the United States pursues based on the energy and security benefits from Russia's side of the program. As cost overruns in both Russia and the United States reach surprising figures,⁵² the 2000 Plutonium Disposition Agreement should remain a priority over competing but less resource intensive nonproliferation programs. If MOX programs are cut due to budget constraints, the second-best alternative to maintain the requirements of the agreement is using the WIPP facility, but this is an expensive and very political prospect. An often-overlooked component of the plutonium disposition agreement is parity and parallelism in reductions,⁵³ and failing to fulfill obligations could lead to new diplomatic tensions in addition to programmatic failure. Lastly, if the expensive project should be weighed against competing budgetary and security priorities, MFFF is no white elephant by comparison: a single F-35C is looking like it will cost \$337 million, not including research and design costs.⁵⁴ Is alleviating the potential risk posed by civil power reactor uranium fuel market shocks worth eight of these awful airplanes?⁵⁵ While expensive, completing the U.S. MOX facility can have positive effects on nonproliferation, energy security, the perception of U.S. nonproliferation policy, and the United States' bilateral relationship with Russia.

50. Paul Murray, "Backend of the Fuel Cycle," December 2012, <http://www.energy.sc.gov/files/gnac/12012AREVA.pdf>.

51. "Beloyarsk NPP," OKBM, <http://www.okbm.nnov.ru/english/beloyarsk-npp>.

52. Matthew I. Wald, "U.S. Moves to Abandon Costly Reactor Fuel Plant," *New York Times*, June 25, 2013, http://www.nytimes.com/2013/06/26/us/us-moves-to-abandon-costly-reactor-fuel-plant.html?_r=0.

53. Anatoli Diakov, "Disposition of Excess Russian Weapons Fissile Material," undated, presentation for United Nations Institute for Disarmament Research, slide 12 of 19, <http://www.unidir.ch/files/conferences/pdfs/disposition-of-excess-russian-weapon-heu-and-plutonium-en-1-640.pdf>.

54. Winslow Wheeler, "How Much Does an F-35 Actually Cost?," *War is Boring*, July 27, 2014, <https://medium.com/war-is-boring/how-much-does-an-f-35-actually-cost-21f95d239398>.

55. David Axe, "F'd: How the U.S. and Its Allies Got Stuck with the World's Worst New Warplane," *War is Boring*, August 16, 2013, <https://medium.com/war-is-boring/fd-how-the-u-s-and-its-allies-got-stuck-with-the-worlds-worst-new-warplane-5c95d45f86a5>.

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