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Framing the Next Nuclear Posture Review:

A State-Centric, Strategic Approach

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EXECUTIVE SUMMARY

The Nuclear Posture Review (NPR), released by the Department of Defense (DoD) in 2010, announced an unprecedented shift in the U.S. nuclear policy away from state-based threats to nuclear proliferation and nuclear terrorism concerns. While these issues remain important, the evolving global strategic environment dictates that the next NPR return to a state-centric, strategic focus emphasizing four states: Russia, China, North Korea, and Iran. The only strategic peer to the United States, Russia, is actively modernizing all aspects of its nuclear arsenal and has placed non-strategic nuclear weapons (NSNWs) at the center of its national security.[1] China has overhauled the structure of its nuclear weapons program and nuclear and missile developments in North Korea are ongoing. Not long ago Iran reached the cusp of nuclear capability before the implementation of the Joint Comprehensive Plan of Action (JCPOA). The United States must now ensure that this agreement is implemented effectively. All of these developments make it impossible to ignore the importance of nuclear weapons in the U.S. global strategic posture today.

With changing capabilities and postures in each of these four states, extended deterrence challenges will feature prominently in the next NPR. In Europe, reductions in U.S. manpower and the minimization of NSNWs in NATO's war-fighting strategy have called into question the U.S. ability to defend the Baltic States from potential Russian aggression in the region. In Asia-Pacific, Japan and South Korea are concerned whether current U.S. capabilities will adequately deter China and North Korea, especially given the ongoing developments in Chinese and North Korean str arsenals. In the Middle East, Gulf allies remain concerned about the threat of a future nuclear Iran. In light of the resurgence of these state threats to U.S. allies, the next NPR must consider a range of options to address the growing challenges to extended deterrence and assurance across Europe, Asia-Pacific, and the Middle East.

Beyond extended deterrence, the next NPR must address three other key issues. First, the U.S. must consider the balance between extended nuclear deterrence and conventional deterrence, especially when considering states with limited nuclear arsenals such as North Korea. Second, the U.S. must consider its global strategic messaging and assess its impact upon central and extended deterrence. Third, as parts of the U.S. strategic triad have already exceeded their intended service lives, the U.S. must assess the modernization priorities for the nuclear triad and infrastructure.

Nuclear security will also continue to be a significant concern for upcoming administrations. Although progress has been made since 2010, new challenges have emerged that increasingly threaten the security of nuclear materials, infrastructure, and command and control systems. First, the U.S. must consider the growing cyber threats to its nuclear infrastructure posed by state and non-state actors. Second, the U.S. must consider ways to continue the international momentum towards locking down global stockpiles of nuclear weapons and materials. This is a dominant concern for continuing progress in nuclear security. Although a recent series of nuclear security summits championed by the current presidential administration made significant international strides, Russia's withdrawal from various cooperation regimes, including the Cooperative Threat Reduction Program (CTR), could have serious implications for the security of nuclear materials, weapons, and technology.

There is one further topic worth consideration in the next NPR that was entirely absent in the 2010 report. This is nuclear crisis management of a conflict to which the U.S. is a third party. Nuclear crisis management is of grave importance for the U.S. because any violation of the non-

[1] Woolf, Amy F. *Non-Strategic Nuclear Weapons*: Congressional Research Service, February 23, 2015, p. 23

use norm could facilitate further escalation and continued use of nuclear weapons—especially NSNW—in the global system. With the development of new nuclear capabilities and doctrines by many nuclear states, the U.S. must consider whether its current crisis management strategies and frameworks are prepared to handle the range of nuclear crises that could emerge in the future.

The global nuclear environment has shifted significantly since 2010. These changes mean that the next NPR must return to a state-centric, strategic focus in order to adequately face emerging challenges to the global security environment.

INTRODUCTION

The 2010 Nuclear Posture Review (NPR) announced a shift in U.S. nuclear policy away from state-based threats to the threats relating to nuclear proliferation and nuclear terrorism.[2] The NPR announced that it was time to "put an end to Cold War thinking" and "better align our nuclear policies and posture to our most urgent priorities—preventing nuclear terrorism and nuclear proliferation."[3] While the NPR did highlight the ambiguity of the Chinese and Russian nuclear weapons programs, it largely limited the prescription for addressing these concerns to high-level, bilateral dialogues with both countries to produce more stable, strategic relationships.[4] Significant shifts in U.S. relations with both of these states make it increasingly difficult to pursue these options.

While nuclear terrorism and nuclear proliferation remain important concerns, global events since the 2010 NPR require a return to a state-centric strategic focus. Four state actors are of particular concern for the United States: Russia, China, North Korea, and Iran. The recent nuclear developments within these states matter—all of them have threatened U.S. allies and have resorted to (or sought) nuclear weapons to strengthen their ability to challenge the United States or its interests.

Since the 2010 NPR, Russia has grown increasingly aggressive towards the U.S. and its allies. Russia labeled the North Atlantic Treaty Organization (NATO) as a threat to its national security in a recent update to its national security strategy.[5] In addition, Russia has opposed many of the security interests of the U.S. and its allies since the last NPR, most notably with its annexation of Crimea and its support for Bashar-al Assad's regime in Syria. In the nuclear arena, Russia has grown more dependent upon non-strategic nuclear weapons (NSNWs) as a means of bridging the conventional weapons capability gap with the U.S. Most threatening is its "escalate to de-escalate" doctrine, which calls for the use of Russian NSNW to coerce its adversaries to back down in a conflict.[6] If clearly employed defensively, such a doctrine might not be a critical confrontation for the United States. For example, the American New Look doctrine in the 1950s similarly relied upon NSNWs as a means of countering perceived Soviet conventional superiority in Europe. However, what is different about the Russian "escalate to de-escalate" doctrine is that Russian policymakers have threatened to use NSNWs to support its invasions of sovereign states, such as Ukraine.[7] This doctrine has grim implications for U.S. extended deterrence in Europe, especially with the U.S. obligation to come to the defense of NATO allies, such as the Baltic States along Russia's Western border.

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[2] *The Nuclear Posture Review*. Washington, D.C.: U.S. Department of Defense, 2010, p. 5.
[3] Ibid, p. 6.
[4] Ibid, p. 28.
[5] Farchy, Jack. "Putin Names NATO among Threats in New Russian Security Strategy." The Financial Times. http://www.ft.com/intl/cms/s/0/6e8e787e-b15f-11e5-b147-e5e5bba42e51.html#axzz45UrSJyac (accessed March 4, 2016).
[6] Woolf, Amy F. *Non-Strategic Nuclear Weapons*: Congressional Research Service, February 23, 2015, p. 23.
[7] Paul Sonne, "As Tensions With West Rise, Russia Increasingly Rattles Nuclear Saber," The Wall Street Journal. http://www.wsj.com/articles/as-tensions-with-west-rise-russia-increasingly-rattles-nuclear-saber-1428249620 (accessed April 22, 2016).

Similarly, China has infringed on the security of U.S. allies in the Asia-Pacific with its militarization of the South China Sea and its continuing escalation of the conflict over the Diaoyu / Senkaku Islands. At the same time, China has undertaken significant nuclear modernization programs since the 2010 NPR. In conjunction with a quantitative increase in its nuclear arsenal, China has also begun actively upgrading nuclear warheads and delivery systems, such as the conversion of its single warhead missiles into multiple independently targetable reentry vehicles (MIRV) to improve survivability.[8] The U.S. should consider whether such capabilities simply enhance strategic stability or whether these improvements undermine the ability of the U.S. to intervene against China's increasingly assertive military actions in the Asia-Pacific. Unsurprisingly, Chinese nuclear modernization, in conjunction with its increasing aggression in the region, has generated concern among U.S. allies about the strength of American extended deterrence in the region as escalatory risks continue to increase.

North Korea, an international pariah, has also made improvements in its nuclear weapons program since the 2010 NPR. U.S. Commander of the United States Northern Command (NORTHCOM) Admiral William Gortney and General Curtis Scaparotti of U.S. Forces Korea both assert that North Korea can now miniaturize nuclear devices.[9] This, coupled with ongoing satellite launches which likely serve as de facto tests for long-range ballistic missiles, are important steps toward developing a nuclear capability that could reach the mainland United States.[10] Although it is unlikely North Korea has detonated its first hydrogen bomb as it claimed in January of 2016, the improvements to its nuclear weapons technology does indicate that North Korea has evolved in a more threatening direction since the 2010 NPR. These developments have enormous significance for U.S. extended deterrence and assurance in the Asia-Pacific.

Finally, since the 2010 NPR, Iran has expanded its regional influence in the Middle East to new heights with its active involvement in Iraq, Syria, and Yemen in conflict with the interests of Saudi Arabia and the Gulf States. Iran coupled this expansionist role with the pursuit of a nuclear weapons program. Before the implementation of the Joint Comprehensive Plan of Action (JCPOA), Iran's nuclear weapons program had progressed to the point at which it could have constructed a device within two to three months.[11] Although the JCPOA has reduced the immediacy of the Iran nuclear threat, it is unclear if the U.S. and the international community will be able to prevent Iran from acquiring nuclear weapons in the long-term. The U.S. must ensure the effective implementation of the JCPOA, but also begin to hedge for a possibility of a nuclear Iran and how it could affect U.S. extended deterrence and assurance in the Middle East.

In conjunction with a reorientation toward state-based threats, the next NPR must address several key areas strongly related to extended deterrence and the assurance of allies. First, with Russia and other states increasing the role of their non-strategic nuclear weapons, the United States must consider what role U.S. non-strategic and conventional weapons should have in its own

[8] *Annual Report to Congress*: Military and Security Developments Involving the People's Republic of China 2015: U.S. Department of Defense, 2015.

[9] Snyder, Scott A. "U.S. Assessments of North Korean Missile Capabilities since 2011." Council on Foreign Relations. http://blogs.cfr.org/asia/2016/02/07/u-s-assessments-of-north-korean-missile-capabilities-since-2011 (accessed February 9, 2016).

[10] "Kim Jong Un's War Games: North Korea Tests another Missile." The Economist. http://www.economist.com/blogs/graphicdetail/2016/02/daily-chart-6. (accessed February 9, 2016).

[11] Nephew, Richard. "Based on Breakout Timelines, the World is Better Off with the Iran Nuclear Deal than without it." The Brookings Institution. http://www.brookings.edu/blogs/markaz/posts/2015/07/17-iran-breakout-nephew (accessed February 26, 2016).

posture. Second, the United States must also consider whether current capabilities provide adequate reassurance to allies in Europe, Asia, and the Middle East.

Nuclear Security and Modernization

The next NPR must address three important issues that were neglected or underserved by the previous NPR. First, the United States must address the modernization of its aging strategic nuclear arsenal and nuclear infrastructure. This comprises a variety of issues including the enduring necessity of all legs of the U.S. nuclear triad (bombers, intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs)). If security and extended deterrence concerns justify the retention of the triad, then it is important to prioritize future nuclear modernization objectives. Furthermore, it is important to address the financial cost of the modernization effort, especially in relation to conventional modernization priorities.

Second, cyber vulnerabilities must be included in any discussion of U.S. nuclear infrastructure improvements. A cyber threat could emerge from either a state adversary (e.g. Russia) or a non-state organization, like al-Qaeda or the so-called Islamic State (ISIL), which are continuing to improve their capabilities in this arena. Vulnerabilities within the U.S. nuclear infrastructure created by years of neglect further accentuate these dangers. Numerous officials—such as General C. Robert Kehler, commander of U.S. Strategic Command (USSTRATCOM)—have expressed concern about what an advanced cyber-attack on the U.S. nuclear architecture could achieve.[12] While the idea of an offensive cyber-attack being used to launch a U.S. nuclear warhead is not realistic, it is known that cyber-attacks can do real physical damage to nuclear facilities and related infrastructure.

Third, the next NPR should examine the current and future state of global nuclear security as an essential component of preventing nuclear terrorism and nuclear proliferation. Important areas to further examine include the security of nuclear stockpiles globally—with special attention to former Soviet states—and encouraging other states to reduce the production of highly enriched uranium, a primary source for a nuclear explosive. Unfortunately, Russia's refusal to extend the Cooperative Threat Reduction (CTR) agreement with the U.S. will make these goals more difficult. In addition, the United States must reinforce the security of nuclear sites at home and among allies abroad; for example, the Belgian police discovered that the same terror cell responsible for the 2015 Paris attacks used a video camera to monitor a high-ranking Belgian official with access to nuclear and radiological material in Belgian nuclear facilities.[13] Although the Obama administration's Nuclear Security Summits are a step in the right direction, the next NPR should consider the need for a broader improvement of the security of nuclear sites and securing nuclear weapons materials abroad.

There is one further topic worth consideration in the next NPR that was entirely absent in the 2010 report: nuclear crisis management of a conflict to which the U.S. is a third party. Nuclear crisis management is of grave importance for the United States because any violation of the non-use norm could facilitate further escalation and continued use of nuclear weapons—especially NSNW—in the global system. With the development of new nuclear capabilities and doctrines by many nuclear states, the United States must consider whether its current crisis management

[12] Farnsworth, Timothy. "Study Sees Cyber Risk for U.S. Arsenal." Arms Control Association. https://www.armscontrol.org/act/2013_04/Study-Sees-Cyber-Risk-for-US-Arsenal (accessed March 1, 2016).
[13] Schreuer, Milan and Rubin, Alissa J. "Video found in Belgium of Nuclear Official may Point to Bigger Plot." The New York Times. http://www.nytimes.com/2016/02/19/world/europe/belgium-nuclear-official-video-paris-attacks.html (accessed February 25, 2016).

strategies and frameworks are prepared to handle the range of nuclear crises that could emerge in the future. Although there has been significant analysis of Cold War era crises involving the U.S. and Soviet Union, as well as discussion of potential crises that could arise involving an ally under the U.S. nuclear umbrella, this third form of crisis in which the U.S. might not have any direct alliance commitments has been notably absent in policy making.

STRATEGIC CONCERNS

Four states currently dominate the security environment of the U.S. and allied partners worldwide: Russia, China, North Korea, and Iran. The first three have already acquired nuclear capabilities and all have significantly updated their nuclear programs. Although Iran has temporarily halted its nuclear weapons program as a result of the Joint Comprehensive Plan of Action (JCPOA), the agreement does not provide a long-term guarantee that Iran will not pursue a nuclear weapons program in the future.

In accordance with these growing state threats, the key focus of this report is centered on strategic level concerns. To help unfold the unique dynamics presented by each of these challenges, this report addresses the "theories of victory" for Russia, China, North Korea, and Iran. This report draws upon the work of former Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy, Brad Roberts who defines a theory of victory as "a set of concepts for how to force termination of a war in a manner favorable to one's objectives and to achieve an acceptable post-war balance of power."[14] For all four states, the theory of victory does not involve the outright defeat of the U.S. in a conflict; instead, they focus on raising the costs of U.S. interference in a conflict to unacceptably high levels. Understanding this concept for each state is essential for structuring the U.S. extended deterrence and assurance postures in Europe, the Asia-Pacific, and the Middle East. This section will cover the theories of victories for each of these countries in further detail.

RUSSIA

When considering the state-level focus of the upcoming NPR, Russia must remain central. Russia is the only nuclear peer competitor of the United States, and it has pursued a nuclear modernization program since the previous NPR. Furthermore, Russia's aggression against Georgia and Ukraine has alarmed Eastern European NATO members, especially the Baltic States. With Russia's continued nuclear modernization and aggressive policies, it is essential that the U.S. deter Russia from threatening NATO states and assures allies that the U.S. is committed to the defense of NATO and the preservation of regional stability. In order to address this growing concern, it is important to understand Russia's nuclear security posture and the current U.S. extended deterrence posture in Europe.

National Strategy

The 2014 Military Doctrine of the Russian Federation provides insights regarding the purpose of Russia's nuclear arsenal and the growing concern it presents for the U.S. and NATO. In this document, Russia emphasized the danger it faces from NATO, including enhanced U.S. conventional capabilities and the continued presence of NATO on its borders. Alexander Grushko, Russia's permanent representative to NATO, identified NATO's current posture as a "determination to contain Russia."[15] This sense of vulnerability is also influenced by Russian domestic politics and a fear of U.S. interference through the promotion of so-called color (pro-

[14] Roberts, Brad. *The Case for U.S. Nuclear Weapons in the 21St Century*. Stanford: Stanford University Press, 2016, p. 13.

[15] "NATO's Determination to Contain Russia Dangerous," PravdaReport, http://www.pravdareport.com/news/world/15-02-2016/133334-nato_rusia-0 (accessed April 22, 2016).

democracy) revolutions among its neighbors.[16] In response to this perceived threat, Russia has reemphasized the role of NSNWs as a means of countering NATO's superior conventional capabilities within its security strategies.

Russia enhanced the role of NSNWs in its national strategy through its doctrine of "escalate to deescalate."[17] This doctrine calls for the Russian use of NSNWs early in a conflict in order to make the cost of continuing the conflict for its adversary too high to pursue.[18] A specific scenario in which Russia has threatened to employ this doctrine is in response to an attempt by Ukraine and/or the West to retake Crimea from Russian forces. Regarding the annexation of Crimea, Russian President Vladimir Putin stated, "We were ready to do this [put nuclear forces on alert]…and that is why I think no one was in the mood to start a world war."[19] This policy generates troubling implications for the U.S. and NATO. Although Russia has not initiated a conflict against a state to which the U.S. has a security obligation, the recent Russian invasions of Georgia and Ukraine indicate that the U.S. and NATO ought to plan for a Russian invasion of the Baltic States and other Eastern European allies. In the event of a Russian conflict with the Baltic States, NATO would have to be prepared to respond to the use of NSNWs from Russia. NATO forces could very well be faced with the choice of either risking nuclear escalation or suing for peace on terms favorable to Russia. The latter option could undermine the credibility of both NATO and U.S. extended deterrence in Europe or perhaps even globally. This understanding of Russian doctrine illustrates why the U.S. must ensure that deterrence does not fail in Eastern Europe.

Developments and Capabilities

Like those of the U.S., Russia's strategic nuclear forces consist of a triad—land-based intercontinental ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs), and nuclear-capable heavy bombers. It is estimated that Russia currently possesses roughly 1,650 active strategic warheads.[20] Pursuant to the 2010 New START treaty, Russia is committed to reducing its active stockpile to 1,550 deployed strategic warheads by February 2018.[21] However, this does not prevent Russia from the active modernization of its current nuclear arsenal.

Russia does not disclose its numbers of non-strategic weapons, however it is estimated that Russia deploys approximately 2,000 active NSNWs.[22] Although the secrecy of Russia's NSNW program makes it difficult to pinpoint the deployment of Russia's NSNWs, an estimate from Hans Kristensen of the Arms Control Association estimates that Russia has 170 warheads for Army missiles, 430 warheads for missile-and air defense forces, 730 warheads for the air force, and 700

[16] Roberts, Brad. *The Case for U.S. Nuclear Weapons in the 21St Century*. Stanford: Stanford University Press, 2016, p. 129.
[17] Пыж, В. В. Геополитическая обусловленность военной политики России. Можайск, РФ: Можайск-Терра, 2003, с. 166.
[18] Colby, Elbridge. Nuclear Weapons in the Third Offset Strategy: Avoiding a Nuclear Blind Spot in the Pentagon's New Initiative: Center for a New American Security, February 2015, p. 7.
[19] *Russia's Nuclear Posture*: National Institute for Public Policy, March, 2015.
[20] "Russia," Nuclear Threat Initiative, March 2016, accessed April 22, 2016, http://www.nti.org/learn/countries/russia/.
[21] Ibid.
[22] Lewis, Jeffrey. "Russian Tactical Nuclear Weapons." Arms Control Wonk. http://www.armscontrolwonk.com/archive/203309/russian-tactical-nuclear-weapons/ (accessed February 17, 2016).

naval nonstrategic nuclear warheads.[23] These figures indicate that Russia relies upon a variety of delivery vehicles for its NSNWs, unlike the United States, which solely relies upon its bombers.

Nuclear Modernization

Russia started to modernize all three legs of its triad in 2011 and announced a total allocation of $70 billion for the replacement and introduction of new nuclear capabilities.[24] Since 2011, Russia has made some progress. First, Russia is more than halfway finished with the replacement of its Soviet-era ICBMs. The Soviet ICBMs are being replaced with the SS-27 Mod 1 and the SS-27 Mod 2. The SS-27 Mod 1 is a single-warhead missile with either mobile or silo-based capabilities, and the SS-27 Mod 2 is similar to the SS-27 Mod 1 except that it functions as a multiple independently targetable reentry vehicle (MIRV) carrying multiple warheads on each missile.[25] In addition, Russia has announced plans for road-mobile delivery systems and rail-mobile ICBMs.[26]

Second, Russia has announced the construction of eight Borei-class submarines that will gradually replace older Soviet vessels. Currently, the Russians have completed three of these new submarines with the rest of the vessels not scheduled for completion until the early to mid-2020s.[27] These new submarines will increase the capabilities of the Russian SLBM fleet through the introduction of the SS-N-32 Bulava SLBMs, which each carry six warheads, compared to three to four carried by current models.[28] Finally, the Russians have focused on modernizations of the current Tu-160 Blackjack and Tu-95MS strategic bombers. It is estimated that Russia has completed the modernization of only seven strategic bombers out of an estimated total of sixty.[29]

Russia has also started modernizing its NSNWs. Although only limited information on the modernization of NSNWs is currently available, it is known that Russia has planned the modernization of a variety of NSNWs including the construction of new nuclear attack missile submarines, aircraft, and short-range ballistic missiles.[30] Unfortunately, the progress and cost estimates for these new capabilities are unknown.

Low global oil prices and international sanctions have placed economic limitations on Russia's nuclear modernization program. With roughly half of its government revenue stemming from the oil and gas sector, the Russian government has had substantial financial shortfalls with oil prices dropping as low as $34 per barrel in January 2016.[31] Russian Finance Minister Anton

[23] Kristensen, Hans M. *Non-Strategic Nuclear Weapons*: Federation of American Scientists, May 2012.
[24] Kristensen, Hans M. "Nuclear Weapons Modernization: A Threat to the NPT?" Arms Control Association. https://www.armscontrol.org/act/2014_05/Nuclear-Weapons-Modernization-A-Threat-to-the-NPT (accessed February 22, 2016).
[25] Kristensen, Hans M. and Robert S. Norris. "Russian Nuclear Forces, 2015." The Bulletin of the Atomic Scientists 71, no. 3 (November 27, 2015), http://thebulletin.org/2015/may/russian-nuclear-forces-20158299 (accessed February 27, 2016).
[26] "Sarmat." Missile Threat: A Project of the George C. Marshall and Claremont Institutes. http://missilethreat.com/missile-class/sarmat/ (accessed February 19, 2016).
[27] Kristensen, Hans M. "Russian Nuclear Forces, 2016." FAS - Federation of American Scientists. http://fas.org/blogs/security/2016/04/russian-nuclear-forces-2016/ (accessed April 20, 2016).
[28] Ibid.
[29] Ibid.
[30] Ibid.
[31] Pifer, Steven. "Pay Attention, America: Russia is Upgrading its Military." The Brookings Institution. http://www.brookings.edu/research/opinions/2016/02/05-russian-military-modernization-us-response-pifer (accessed February 17, 2016).

Siluanov reflected on the severity of these shortfalls when he admitted that Russia's modernization plan is "unaffordable." These budget limitations are forcing tradeoffs between nuclear and conventional capabilities. Regarding the nuclear program, budget cuts have delayed plans to build a rail-based ICBM system, delayed the development of the new PAK-DA bomber until the early 2020s (at the earliest), and have disrupted the construction of warships and submarines. Generally, these budget concerns indicate that Russia could struggle to achieve the full extent of its nuclear and even conventional modernizations in the immediate future.

Russia's Theory of Victory

Russia's theory of victory is focused on local and regional conflicts. It aims to solidify its sphere of influence, undermine NATO, and discredit U.S. commitments to Europe.[32] An example of a scenario in which Russia might enact its theory of victory is the potential suppression a color revolution within a bordering country.[33] It could use a combination of Special Forces, disinformation, and propaganda to repress a popular uprising and secure control of the country before NATO forces could react.[34] NSNWs would play a large role in such a scenario, and Russia would likely be prepared to employ these weapons preemptively against incoming NATO forces to de-escalate any conflict.[35] Such a decision would signal Russian resolve and alert U.S. and NATO decision-makers to the asymmetry of the stakes at play in the conflict. This calculus carries the assumption that the U.S. and NATO would not be willing to escalate the conflict over a territory in which it has much less interest than Russia. This could result in negotiations that favor Russian interests and discredit NATO. According to former DASD Brad Roberts, such a theory of victory is "instantiated in [Russian] doctrine and capabilities."[36]

EXTENDED DETERRENCE IN EUROPE

Allies and Partners

A major component of the U.S. extended deterrence (and assurance) posture in Europe is its leadership within the NATO alliance. Although originally founded to protect Western Europe from Soviet aggression during the Cold War, NATO expanded into Eastern Europe in the 1990s and 2000s with the addition of Poland, Romania, and the Baltic States, among others. The most powerful assurance of the U.S. commitment to the defense of its NATO allies is Article V of the 1949 North Atlantic Treaty, which states that an attack on one NATO state is an attack against all NATO states.[37]

Current Extended Deterrence Posture and Challenges

[32] Roberts, Brad. *The Case for U.S. Nuclear Weapons in the 21St Century*. Stanford: Stanford University Press, 2016, p. 131.
[33] Ibid, p. 133.
[34] Ibid, p. 133.
[35] Ibid, p. 134.
[36] Ibid, p. 136.
[37] "The North Atlantic Treaty," North Atlantic Treaty Organization, March 21, 2016, accessed April 24, 2016, http://www.nato.int/cps/en/natolive/official_texts_17120.htm.

Recent Russian aggression in Eastern Europe, especially the annexation of Crimea, have brought into question the credibility of the U.S. extended deterrence posture, especially with Russia's emphasis on NSNWs. To meet this growing Russian challenge, the U.S. has 160-200 NSNWs and 62,000 conventional forces in Europe, levels far below those at the end of the Cold War.[38] [39] Significantly, the U.S. and NATO have actually minimized the role of non-strategic nuclear weapons within their national security strategies. Instead, the U.S. posture has emphasized conventional capabilities to reinforce deterrence against Russian forces, especially considering U.S. conventional superiority in technology, firepower, and accuracy.

However, reductions in U.S. manpower have become an increasing concern for both U.S. and NATO military leaders. For example, NATO Supreme Allied Commander Philip Breedlove urged Congress in February 2016 to consider reversing manpower cuts in the European theater specifically because of the "substantial increase in our deterrence and reassurance operations in response to Russian occupation of Crimea and its aggression in eastern Ukraine."[40] The vast majority of the 62,000 U.S. troops are stationed in Western Europe only a fraction of U.S. forces and equipment are stationed in Eastern European states[41]. This posture emerges from the Founding Act on Mutual Relations, Cooperation and Security of 1997 between NATO and the Russian Federation in which both Russia and NATO agreed to avoid stationing large numbers of troops along borders shared by Russia and members of NATO.[42] In the current European security environment, this presents a risk. Without Eastern stationed forces, Russia could move in Eastern Europe swiftly, and make significant geographical and political changes that the West would be forced to accept. Although it is far from certain that the Russians would attempt such an invasion of any NATO members, especially with its struggling economy, U.S. and allied NATO forces are extremely vulnerable at current levels of deployment, according to U.S. Army Chief of Staff General Mark Milley.[43]

To both bolster its deterrence posture and reassure allies in the region, the U.S. has taken several measures. First, it has bolstered its conventional presence in Eastern Europe, reversing reductions in U.S. tanks and aircraft in Germany and redeploying them on a rotational basis in Central and Eastern Europe.[44] To further assure allies, the U.S. has increased the budget for military spending in Europe from $789 million to $3.4 billion in 2017 for a one-year period.[45]

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[38] Gen. Breedlove, Phillip C. *U.S. European Command Posture Statement 2016*: EUCOM - United States European Command, February 25, 2016.
[39] Woolf, Amy F. *Nonstrategic Nuclear Weapons*: Congressional Research Service, February 23, 2015, p. 17.
[40] Gen. Breedlove, Phillip C. *U.S. European Command Posture Statement 2016*: EUCOM - United States European Command, February 25, 2016.
[41] *Total Military Personnel and Dependent End Strength by Service, Regional Area, and Country*: U.S. Department of Defense, Defense Manpower Data Center, 2014.
[42] "Founding Act on Mutual Relations, Cooperation, and Security between NATO and the Russian Federation." North Atlantic Treaty Organization. http://www.nato.int/cps/en/natohq/official_texts_25468.htm (accessed February 25, 2016).
[43] Shlapak, David A. and Johnson, Michael W. "Outnumbered, Outranged, and Outgunned: How Russia Defeats NATO." War on the Rocks. http://warontherocks.com/2016/04/outnumbered-outranged-and-outgunned-how-russia-defeats-nato/ (accessed April 22, 2016).
[44] Coffey, Luke and Daniel Kochey. "The Baltic States: The United States must be Prepared to Fulfill its NATO Treaty Obligations." The Heritage Foundation. http://www.heritage.org/research/reports/2015/09/the-baltic-states-the-united-states-must-be-prepared-to-fulfill-its-nato-treaty-obligations (accessed February 22, 2016).
[45] Landler, Mark and Cooper, Helene. "U.S. Fortifying Europe's East to Deter Putin." The New York Times. http://www.nytimes.com/2016/02/02/world/europe/us-fortifying-europes-east-to-deter-putin.html (accessed March 2, 2016).

Although these moves have received support from European allies, concerns remain about whether rotational deployments, rather than permanent commitments, do enough to reinforce deterrence. For example, Supreme Allied Commander Phillip Breedlove noted in his Congressional testimony in 2016 that "[a] temporary surge in rotational presence, for example, will not have lasting effect unless it is followed by the development and fielding of credible and persistent deterrent capabilities."[46]

Second, the United States has strengthened its missile defense posture in Europe. Deployments of missile defense technology include the stationing of the PATRIOT surface-to-air guided air and missile defense system in Germany, Greece, the Netherlands, and Spain.[47] As of 2015, the United States has deployed four ballistic missile defense-capable Aegis ships to Spain, which ostensibly adds another layer of missile defense in Europe.[48] Furthermore, the U.S. has strengthened its missile defense capabilities in Eastern Europe through the construction of an Aegis ballistic missile defense site in Romania and is currently working on the construction of a sister base in Poland.[49] To be clear, modern missile defense capabilities are designed to intercept only the limited number of missiles launched by states with limited nuclear arsenals, such as a duture Iran and North Korea; in fact, Russia would be able to overwhelm current missile defense capabilities. However, missile defense commitments, coupled with manpower reinforcements, have reinforced that the United States remains committed to the defense of its NATO allies in Eastern Europe. These commitments are critical considering recent estimates from the RAND Corporation that claim it would only take thirty-six to sixty hours for a Russian offensive to overwhelm the current defenses of the Baltic States.[50]

OPTIONS

Even though these conventional improvements are a step in the right direction, more could be done to strengthen the U.S. deterrence posture against Russia and further bolster the assurance of NATO allies. Furthermore, the U.S. could consider options to salvage areas of nuclear cooperation in the hopes of stabilizing relations in the long term. This report outlines three options:

- Strengthen the U.S. Conventional Posture in Eastern Europe: Bolster U.S. conventional manpower and capabilities in Eastern Europe.
- Overhaul U.S. NSNW Posture in Europe: Reemphasize NSNWs in U.S. and NATO security strategy and continue modernization programs
- Confidence Building: Although the U.S. and Russia have many areas of substantive political disagreement, both could emphasize areas of mutual interest and build upon successful negotiations

[46] Gen. Breedlove, Phillip C. *U.S. European Command Posture Statement 2016*: EUCOM - United States European Command, February 25, 2016.
[47] *PATRIOT Deployment. Fact Sheet*: NATO - North Atlantic Treaty Organization, May 2015, http://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2015_05/20150508_1505-Factsheet-PATRIOT_en.pdf.
[48] Rourke, Ronald O. *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*: Congressional Research Service, December 11, 2015, p. 5.
[49] Larter, David. "U.S. Missile Defense Site in Romania Starts Up, Angering Russia." Navy Times. http://www.navytimes.com/story/military/2015/12/17/romania-missile-shield-capable-putin-russia-navy/77478556/.
[50] Shlapak, David A. and Michael W. Johnson. *Reinforcing Deterrence on NATO's Eastern Flank*: RAND Corporation, 2016, p. 12.

Option #1: Focus on Conventional Improvements

This option calls for the U.S. extended deterrence posture to focus squarely on improvements to conventional capabilities. This option explicitly rejects increasing the number of NSNWs in Europe or the prioritization of NSNWs in U.S. strategy. During the Cold War, the United States relied upon NSNWs as a response option to bridge the gap between conventional and strategic nuclear weapons. Today, however, conventional weapons have bridged the accuracy and firepower gaps that NSNWs were designed to address.[51] Furthermore, increasing the number of deployed NSNWs provides little value-added as a deterrent because current U.S. nuclear doctrine strongly suggests that the United States would not use nuclear weapons in any situation less than an existential threat to the homeland or its allies.[52] Instead, the United States ought to rely upon a variety of conventional improvements to improve its deterrence posture in Europe. These improvements significantly contribute to the U.S.' ability to signal its commitment to NATO allies in Eastern Europe.

First, the United States could bolster its advanced conventional capabilities that could serve as a counter to NSNWs. Already, advanced information technology and highly accurate sensors allow conventional cruise missiles to achieve powerful impact results with a high degree of accuracy.[53] The United States could also continue to develop additional advanced conventional technologies that could serve as a deterrent to Russian NSNWs. These include Conventional Prompt Global Strike (CPGS) capabilities that would enable the United States to hit high-value targets anywhere in the globe in under an hour.[54] Another example is the development of specifically conventional variants of air-launched cruise missiles (ALCMs) that have the particular benefit of evading missile defenses to strike targets with great precision.[55] The development of such technologies would send a message to the Russians that the United States would not require NSNWs to respond to a Russian provocation with precise, devastating force and raise the costs for Russia of initiating provocations.

Second, under this option the U.S. would reverse its cuts in manpower in order to bolster its capabilities in Eastern Europe. The U.S. has already begun to take steps in this direction. The United States has recently implemented a one-year commitment to increase military spending in Europe from $789 million to $3.4 billion.[56] However, under this option these changes would shift from rotational deployments to permanent commitments to NATO allies bordering Russia. Furthermore, the United States would preposition heavy equipment and supplies in Eastern European states. These adjustments would add further credibility to the quality of American extended assurance to NATO allies and demonstrate resolve to the Russians.

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[51] Blechman, Barry and Russell Rumbaugh, "Bombs Away: The Case for Phasing Out U.S. Tactical Nukes in Europe," Foreign Affairs, (July/August 2014), p. 165.
[52] Kristensen, Hans M. *Non-Strategic Nuclear Weapons*: Federation of American Scientists, May 2012, p. 30.
[53] Blechman, Barry and Russell Rumbaugh, "Bombs Away: The Case for Phasing Out U.S. Tactical Nukes in Europe," Foreign Affairs, (July/August 2014), p. 166.
[54] Woolf, Amy F. *Conventional Prompt Global Strike and Long-Range Ballistic Missiles: Background and Issues*: Congressional Research Service, February 24, 2016, p. 1-2.
[55] Broad, William J. and Sanger, David E. "As U.S. Modernizes Nuclear Weapons, 'Smaller' Leaves some Uneasy." The New York Times. http://www.nytimes.com/2016/01/12/science/as-us-modernizes-nuclear-weapons-smaller-leaves-some-uneasy.html (accessed April 20, 2016).
[56] Landler, Mark and Cooper, Helene. "U.S. Fortifying Europe's East to Deter Putin." The New York Times. http://www.nytimes.com/2016/02/02/world/europe/us-fortifying-europes-east-to-deter-putin.html (accessed March 2, 2016).

Third, the U.S. would consider the expansion of missile defense capabilities in Eastern Europe to provide further reassurance to allies. Current deployments of missile defense technology include the posting of the PATRIOT surface-to-air guided air and missile defense system in Germany, Greece, the Netherlands, and Spain and four ballistic missile defense-capable Aegis ships to Spain. In conjunction, the United States has expanded Aegis missile defense sites to Romania and Poland. The U.S. could also foster bilateral agreements to sell the Patriot air and missile defense to Eastern European allies outside of NATO agreements to bolster national defense in Eastern Europe.[57] Furthermore, even for countries without American missile defense commitments, such as the Baltic States, the presence of missile defense in nearby states reinforces the strength of U.S. assurance in the region.

A key strength of this option is that it provides an explicit assurance of U.S. commitment to Eastern Europe. For example, forward deployment of capabilities and forces in Eastern Europe sends a demonstrable signal that an attack on the Baltics will directly involve the U.S. In a sense it creates a tripwire in the Easternmost NATO states, as a major ground assault will have to target U.S. positions. This trip-wiring in addition to the development of advanced conventional capabilities could convince the Russians that the costs of initiating a conflict would be too high.

However, an important concern with this option is that the mobilization of U.S. conventional capability in Eastern Europe might further deepen Russia's fears of NATO presence and further increase Russian dependence on NSNWs. Although Russia has emphasized NSNWs in its security doctrine, in practice, it has relied upon covert and conventional methods in its intervention in Georgia and Ukraine. The ramping up of U.S. conventional capability in Eastern Europe could convince Russia that it has to further expand and modernize its NSNW program in order to compensate for its growing conventional inferiority. Considering Russia's economic struggles, the acceleration of a U.S. conventional presence in Eastern Europe could provoke an aggressive Russian response and serve as a catalyst for conflict.

Option #2: Improve flexible response options, demonstrate nuclear risks

This option rejects the assertion that the United States can deter the use of NSNW in Europe by Russia through conventional means in Europe. Russia has increased reliance on NSNW as a reaction to its conventional inferiority—not unlike U.S. strategic posture during the Cold War. Therefore it is logical to contend that Russia views its NSNW as beyond the threshold of conventional deterrence. In the event of a Russian NSNW strike, it might also prove useful to give U.S. policymakers a wider range of options, rather than responding with only conventional capabilities or escalating to strategic nuclear strikes.

With this in mind, the U.S. could consider a reemphasis of NSNWs in Europe in order to provide a clear deterrent to Russian NSNW capabilities. Broadly, this option calls for NATO's security strategies to reverse discussions about minimizing the role of NSNWs in Europe and re-center NATO's deterrence posture on its NSNWs. Concerning capabilities, this option calls for the continuation of modernization programs for the U.S. NSNW arsenal in Europe. Of specific interest is the continuation of dial-a-yield weapons, or variable yield weapons, which provide a range of options that can be tailored to specific Russian provocations. This explicitly rejects calls from influential nuclear thinkers, such as former assistant secretary of defense Andrew C. Weber, that

[57] Wlodarczak-Semczuk, Anna. "Poland Hopes to Buy U.S. Patriot Missiles." Reuters. http://www.reuters.com/article/us-poland-defence-raytheon-idUSKCN0UU0YR (accessed March 5, 2016).

this modernization is "unaffordable and unneeded" and ought to be reconsidered.[58] Furthermore, the U.S. might consider the expansion of delivery vehicles for its NSNWs. Nuclear expert Matthew Kroenig argues that using bombers as the sole delivery vehicle for NSNWs creates risks to survivability in a conflict because of Russia's air defenses.[59] Thus, the U.S. could consider further improvements to the survivability of dual-capable aircraft while considering other launch options, such as sea-launched cruise missiles.[60]

Most importantly, this option calls for the addition of nuclear scenarios into NATO military exercises. Russia has already done this, with one scenario playing out a nuclear attack on Poland. This would signal to Russia that nuclear weapons are still on the table, and if Russia crosses that threshold escalation is likely, generating greater risk for all involved. The U.S. does not need to believe a nuclear war is 'winnable'; rather it should play on the fear of what a limited nuclear war would look like, and how it would end.

The overall goals of this option are twofold—to deter the Russian threat in kind and to demonstrate to Russia that the costs of escalating to NSNW are exceedingly high. Whether conventional or NSNW, the United States would have a specific range of options to meet the Russian threat at every level of escalation. However the primary benefit of this option is that it would signal to the Russians that the U.S. is prepared to engage if the nuclear threshold is crossed, exponentially increasing the cost of attempting a limited nuclear attack. Additionally this option would assure European allies that the U.S. would not back down in the event of a conflict with Russia.

A major concern of this option is the idea that creating lower yield weapons increases the usability of these weapons in the midst of a crisis. This inherently creates escalatory risks. Second, it is unclear whether expanding the NSNW supply would provide any additional value for U.S. deterrence. The U.S. already has 160-200 NSNWs distributed throughout Europe, and it seems unlikely that Russia could credibly undermine the ability of the U.S. to use its NSNWs in a potential conflict.

Option #3: Confidence Building

Since the early 1990s, the U.S. and Russia improved the security of Russian military and civilian facilities and repatriated Russian origin Highly Enriched Uranium (HEU) reactors from Central and Eastern Europe.[61] Recently, however, U.S. and Russian policymakers have reduced nuclear cooperation programs because of broad political and security disagreements, especially the Russian annexation of Crimea. For example, the U.S. Congress prohibited the use of U.S. funds in Russia, which has precluded numerous areas of nuclear cooperation; likewise, Russia has informed the U.S. that it would reduce its participation in a joint campaign to secure nuclear material on Russian territory. Linking political and security disagreements to nuclear cooperation

[58] Broad, William J. and Sanger, David E. "As U.S. Modernizes Nuclear Weapons, 'Smaller' Leaves some Uneasy." The New York Times. http://www.nytimes.com/2016/01/12/science/as-us-modernizes-nuclear-weapons-smaller-leaves-some-uneasy.html (accessed April 20, 2016).
[59] Kroenig, Matthew. "Facing Reality: Getting NATO Ready for a New Cold War." Survival: Global Politics and Strategy 57, no. 1 (30 January, 2015), https://www.iiss.org/en/publications/survival/sections/2015-1e95/survival--global-politics-and-strategy-february-march-2015-4c22/57-1-04-kroenig-3009 (accessed April 5, 2016), p. 57.
[60] Ibid.
[61] Hecker, Siegfried S. and Davis, Peter E. "Why the U.S. should Keep Cooperating with Russia on Nuclear Security." Carnegie Perspectives on Peace and Security. http://perspectives.carnegie.org/us-russia/u-s-keep-cooperating-russia-nuclear-security (accessed April 21, 2016).

is problematic because it eliminates areas of potential agreement between the U.S. and Russia that might exist otherwise. However there is room for cooperation through international institutions like the International Atomic Energy Agency (IAEA). The U.S. could use opportunities within international frameworks to enhance mutual trust that will be vital to securing cooperation for an additional mutual reduction treaty after the expiration of New START in 2021.

The first step towards fostering a better relationship would be to address areas of mutual concern. While nuclear materials cooperation between the U.S. and Russia are all but shut down, both sides have common goals in this area, such as the repatriation of HEU fuels from Poland and Kazakhstan to Russia.[62] Likewise, the U.S. and Russia could work to expand effort within the Global Initiative to Combat Nuclear Terrorism, an organization in which both the U.S. and Russia are founders and co-chairs. Building from small successes, the U.S. and Russia could outline concerns regarding each other's security postures in Europe. For example, the U.S. could outline its concern regarding the obscurity of Russia's NSNW arsenal, while Russia could express its concern regarding the expansion of NATO missile defense systems in Europe. Negotiations could then begin with a dialogue in which each side explains its concerns to the other. After these discussions, each side could offer gestures of good faith for the continuation of the negotiations. For example, the U.S. could publicly pledge to curb the expansion of missile defense in Europe. Likewise, Russia could offer limited information about its non-strategic weapons arsenal or issue public statements deemphasizing their role in Russian strategy. Although potential negotiations would take a great deal of time, U.S. and Russian negotiations have resulted in mutually beneficial outcomes even at times of great mistrust, as shown by U.S. and Soviet cooperation during the Cold War.

One particular concern about a cooperation option is the message that it might send to allies in the region. For example, if the U.S. were willing to reduce its expansion of missile defense in Europe, it could generate questions about U.S. security commitment to allies. Furthermore, there are legitimate concerns from both the U.S. and Russia about whether it can negotiate with the other state in good faith. For example, the U.S. withdrew from the Anti-Ballistic Missile Treaty while the Russians have not fully honored their commitment within the Presidential Threat Initiative to reduce the number of NSNWs within their arsenal.

[62] Einhorn Robert, "Prospects for U.S.-Russian Nonproliferation Cooperation," The Brookings Institution, http://www.brookings.edu/research/papers/2016/02/26-us-russian-nonproliferation-cooperation-einhorn (accessed April 20, 2016).

ASIA-PACIFIC

China and North Korea feature prominently in U.S. regional concerns for the Asia-Pacific. Since the previous NPR, China has made substantive progress in its nuclear modernization and has implemented important shifts in its nuclear doctrine; North Korea has also made several improvements to its nuclear weapon's arsenal and is continuing to develop its offensive and long-range ballistic capabilities. It is important for the U.S. to determine the best way to deter both states from engaging in aggressive regional practices that infringe on the interests of the U.S. and its allies and partners. In the case of potential military escalation, particularly on the part of North Korea, it is vital that the U.S. consider the best options for extending deterrence and assuring its allies of U.S. commitment and resolve to defend their sovereignty.

CHINA

Although China has been a nuclear weapons state for decades, its historically stable nuclear arsenal and nuclear posture are changing. China is developing and modernizing its nuclear weapons, taking an increasingly assertive military posture in the Asia-Pacific, and even changing its nuclear policies. These developments are important, as they could significantly impact the interests of the U.S. and its allies and partners in the Asia-Pacific.

National Strategy

From its inception, China's nuclear weapons program has remained minimal. Chairman Mao and other founding Communist elites felt that simply having nuclear weapons was sufficient to deter other nuclear powers from attempting to coerce China. Therefore, China did not need to possess a huge arsenal like the U.S. or the Soviet Union. To this day, China still prioritizes the survivability of its arsenal over the number of weapons it has; however, recent changes in the nuclear command and control system and shifts in military rhetoric could indicate an important shift in this minimal deterrent posture.

Developments and Capabilities

China had approximately 260 nuclear weapons in 2015, according to the Stockholm International Peace Research Institute.[63] The quantity of its nuclear arsenal has remained relatively constant over the years, but it is slowly growing. In addition, China is actively upgrading nuclear warheads and delivery systems. It is estimated to have 160 land-based strategic ballistic missiles used as delivery vehicles, along with aircraft and a ballistic submarine fleet; it is also estimated that 45-60 of China's inter-continental ballistic missiles (ICBMs) can hit the United States.[64]

[63] "Nuclear Forces: China." SIPRI - Stockholm International Peace Research Institute. http://www.sipri.org/research/armaments/nuclear-forces/china (accessed February 20, 2016).
[64] Kristensen, Hans M. and Robert S. Norris. "Chinese Nuclear Forces, 2015." *The Bulletin of the Atomic Scientists* 71, no. 4 (July 1, 2015): 77, http://thebulletin.org/2015/july/chinese-nuclear-forces-20158459 (accessed February 25, 2016).

Analysts report China has approximately 150 non-strategic nuclear warheads on short-range ballistic missiles (SRBMs); however, most of these are deployed near Taiwan.[65]

Nuclear Modernization

The Chinese military has been working on substantial modernizations of its nuclear triad. First, China is upgrading its ICBMs. One key upgrade is the conversion of its single warhead missiles into multiple independently targetable reentry vehicles (MIRVs), allowing them to carry multiple warheads on one missile.[66] According to a 2015 Department of Defense report, a "new generation of mobile missiles, with warheads consisting of MIRVs and penetration aids, are intended to ensure the viability of China's strategic deterrent in the face of continued advances in U.S. and, to a lesser extent, Russian strategic Intelligence Surveillance Reconnaissance (ISR), precision strike, and missile defense capabilities."[67] This has serious national security implications for the U.S. because this means that more Chinese nuclear warheads could hit the American homeland.[68] China, like Russia, is also working to improve the survivability of its ICBMs by making them mobile.[69] This is intended to ensure that an adversary would be unable to guarantee that a preemptive strike could eliminate all of China's nuclear weapons, strengthening China's ability to retaliate.

Second, China is continuing to work on making its submarine fleet capable of carrying nuclear warheads.[70] Like mobile missiles, nuclear armed submarines also improve the survivability of China's nuclear weapons and further secure its second strike capability.

Third, China is modernizing its bombers. Although China has reduced the total number of its bombers, it is steadily replacing older models with newer versions.[71] Some of these newer versions are strategic bombers used for long-range and standoff attacks that carry land attack cruise missiles (LACMs), which could potentially carry a nuclear warhead.[72]

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[65] "China: Nuclear." NTI - Nuclear Threat Initiative. http://www.nti.org/country-profiles/china/nuclear (accessed February 18, 2016).
[66] Gady, Franz-Stefan. "China Tests New Missile Capable of Hitting Entire United States." The Diplomat. http://thediplomat.com/2015/08/china-tests-new-missile-capable-of-hitting-entire-united-states/ (accessed February 20, 2016).
[67] *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2015*: U.S. Department of Defense, 2015, pg. 31.
[68] Gertz, Bill. "China Adds Warheads to Older DF-5s." Washington Times. http://m.washingtontimes.com/news/2016/feb/10/inside-the-ring-china-adds-warhead-to-older-df-5s/?page=all (accessed February 18, 2016).
[69] *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2015*: U.S. Department of Defense, 2015, pg. 31.
[70] Ibid.
[71] Cordesman, Anthony and Steven Colley. "Chinese Strategy and Military Modernization in 2015: A Comparative Analysis." CSIS - Center for Strategic and International Studies, http://csis.org/files/publication/150901_Chinese_Mil_Bal.pdf (accessed March 12, 2016).
[72] Gertz, Bill. "China Deploys New Bomber with Long-Range Land Attack Missile." The Washington Free Beacon, http://freebeacon.com/national-security/china-deploys-new-bomber-with-long-range-land-attack-missile (accessed April 2, 2016).

The New Rocket Force

China recently restructured its military. Since 1966, the Second Artillery Force (SAF), a sub-branch under the People's Liberation Army (PLA), was in charge of China's land-based nuclear and conventional weapons. However, on December 31, 2015, President Xi Jinping announced that the new Rocket Force was to replace the previous SAF.[73] Unlike the SAF, the Rocket Force is not a sub-branch under the PLA; it is its own branch in China's military, like the Army, Navy, and Air Force.[74] The Rocket Force will now control all nuclear and conventional ballistic and cruise missiles, not just land-based missiles. It is tasked with enhancing nuclear deterrence and counter-strike abilities, and ensuring they are credible and reliable.[75]

This change appears to be a way to streamline command and give control directly to Xi under his role as Chairman of the Central Military Commission (CMC).[76] Despite reassurances from Chinese officials, this change from the SAF to the Rocket Force should be carefully monitored. By taking out the middleman, namely the PLA, the nuclear arsenal comes under the direct control of the CMC, with a civilian political leader at its head. This falls in line with recent developments that indicate President Xi is rapidly moving to consolidate power within the PLA and the Chinese Communist Party (CCP). Although it is unclear what the implications are of a civilian political leader consolidating control over China's nuclear weapons, it is a historic shift from China's previous policy and requires further study by U.S. security strategists.

Changing the No First Use Policy

China's No First Use (NFU) policy has been a "cornerstone of its nuclear policy" since it first developed its nuclear weapons program in the 1950s.[77] However, in the last few years, China's commitment to this policy has come into question, especially after it was not explicitly stated in the 2013 Defense White Paper.[78] The 2015 Defense White Paper did reaffirm China's NFU policy and stated that the sole purpose of nuclear weapons was for "strategic deterrence and nuclear counterattack", but the paper also said that China was interested in improving its "strategic early warning" system. This could be the first step towards moving towards a high alert posture, as putting weapons on high alert requires early warning of incoming attacks.[79] Chinese nuclear weapons on high alert would be a significant shift in the strategic posture of the region as a whole, and could signal further destabilizing developments.

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[73] "China Establishes Rocket Force and Strategic Support Force." Ministry of National Defense of the People's Republic of China. http://eng.mod.gov.cn/ArmedForces/second.htm (accessed February 18, 2016).
[74] Cheng, Dean. "Look Out, America: China's New Military Forces are Awakening." The National Interest. http://nationalinterest.org/blog/the-buzz/look-out-america-chinas-new-military-forces-are-awakening-14872 (accessed February 12, 2016).
[75] "China Inaugurates PLA Rocket Force as Military Reform deepens." Xinhua. http://news. xinhuanet.com/ english/2016-01/01/c_134970564.htm (accessed February 12, 2016).
[76] Tiezzi, Shannon. "The New Military Force in Charge of China's Nuclear Weapons." The Diplomat. http:// thediplomat.com/2016/01/the-new-military-force-in-charge-of-chinas-nuclear-weapons (accessed February 18, 2016).
[77] Yao, Yunzhu. "China Will Not Change its Nuclear Policy." China-US Focus. http:// www.chinausfocus.com/ peace-security/china-will-not-change-its-no-first-use-policy (accessed February 18, 2016).
[78] Acton, James. "Is China Changing its Position on Nuclear Weapons?" The New York Times. http://www.nytimes. com/2013/04/19/opinion/is-china-changing-its-position-on-nuclear-weapons.html (accessed February 12, 2016).
[79] "China's Military Strategy, 2015." Ministry of National Defense. http://eng.mod.gov.cn/Database/WhitePapers/index.htm (accessed February 18, 2016).

Weapons on High Alert

China has historically kept its nuclear weapons off of high alert, unlike the U.S. and the Soviet Union during the Cold War and today.[80] This means Chinese warheads are currently kept separate from the delivery vehicles. This ensures that a nuclear launch would take time to prepare, signaling that China does not intend to launch a first strike. However, Gregory Kulacki, the China Project Manager at the Union of Concerned Scientists, claims internal military dialogue, including speeches from officers and military texts, shows discussion of China moving its nuclear weapons to an alert posture.

According to Kulacki's documents, this change is happening because of concerns over the continued technological advancement and accuracy of U.S. nuclear weapons, high-precision conventional weapons, and missile defenses which lessen China's credible second-strike capability. Further, America's unwillingness to acknowledge mutual vulnerability with China leads China to believe the U.S. is seeking both nuclear superiority and to make itself invulnerable to a potential retaliatory strike from China.[81] These documents show that the Chinese military believes putting its nuclear weapons on high alert would help to establish assured retaliation vis-á-vis the U.S. and would make its nuclear deterrence posture more credible.

China moving its nuclear weapons to high alert would be concerning to the U.S. because of the dangers of the early phase of this change. In the early deployment and operation phase of early warning systems, mistakes are especially likely to occur as the hardware is not yet reliable and procedures have not been perfected. A crisis situation would further increase these risks.[82]

China's Theory of Victory

China's theory of victory is centered on winning a future war without fighting a single battle, harkening back to Sun Tzu's teachings in *The Art of War*. To do this, China uses its hard and soft power, such as economic and informational tools, to position itself in the region in a way that deters other states from acting against its interests.[83] China's greatest victory would be deterring the U.S. from intervening in a Chinese conflict in the Asia-Pacific. To do this, China has worked to attain credible strike capabilities for attacking an adversary at sea, put U.S. allies at risk, and made detailed plans about how to get the international community on its side during a conflict over sovereignty. If the U.S. were not successfully deterred, China would aim for a quick and decisive win in a short, limited war before the U.S. could engage. Overall, China's theory of victory is successfully deterring other states' from acting in a way that harms its own interests.

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[80] Panda, Ankit. "Is China Considering a High-Risk Change to its Nuclear Deterrence Posture?" The Diplomat. http://thediplomat.com/2016/02/is-china-considering-a-high-risk-change-to-its-nuclear-deterrence-posture (accessed February 18, 2016).

[81] Kulacki, Gregory. "China's Military Calls for Putting its Nuclear Forces on Alert. " Union of Concerned Scientists. http://www.ucsusa.org/nuclear-weapons/us-china-relations/china-hair-trigger#.VsZ91xgS2J_ (accessed February 18, 2016).

[82] Negin, Elliot. "China May Put its Nuclear Weapons on High Alert, and it's a Dangerous Idea." Huffington Post. http://www.huffingtonpost.com/elliott-negin/china-may-put-its-nuclear_b_9213552.html (accessed February 18, 2016).

[83] Roberts, Brad. *The Case for U.S. Nuclear Weapons in the 21St Century*. Stanford: Stanford University Press, 2016, p. 169.

NORTH KOREA

North Korea is the most volatile nuclear weapons state in the world today, and it is continuing to develop its nuclear arsenal and long-range ballistic missile capabilities. North Korea's improving technology and continued hostility to the U.S. and its allies in the Asia-Pacific make it imperative that the U.S. finds a way to credibly deter both conventional and nuclear attacks from North Korea. This section will examine North Korea's nuclear strategy, developing capabilities, and theory of victory.

National Strategy

North Korea's national strategy is difficult to assess, particularly given uncertainties about the growth of North Korea's nuclear and missile forces; however, its strategy is known to reflect five core principles: 1) the maintenance of the Kim family leadership; 2) elimination of all internal threats to the leadership; 3) deterrence of the United States and South Korea; 4) economic development of the nation; and 5) reunification of the Korean peninsula. The regime has moved forward with it weapons development despite continued isolation from the international community and crippling sanctions for developing its nuclear program because its nuclear capabilities and other weapons of mass destruction (WMD) are considered to be necessary tools to protect these interests. While North Korea's nuclear doctrine is not as formalized or developed as other nuclear powers, at a minimum it is thought to be a strategy of deterrence. Much like the nuclear strategy of NATO against the Soviet Union, North Korea seeks to create an increasingly credible second-strike capability to deter aggression at the conventional and nuclear levels from superior opponents.[84] However, given North Korea's record of threatening statements directed at the U.S. and its allies, any significant improvements in North Korea's offensive capabilities must be carefully examined.

Developments and Capabilities

Due to its deliberate opaqueness, accurately assessing the capabilities of North Korea's nuclear arsenal is an inexact science. It is thought that North Korea currently possesses less than ten nuclear warheads, but the amount of fissile material it currently has or could produce is estimated to be enough to fuel 20-100 additional warheads by 2020.[85] To date, North Korea has conducted four nuclear tests that have all been simple fission devices with relatively low yields.[86] On January 6, 2016, however, North Korea conducted its fourth nuclear test and unlike the previous three, Pyongyang announced that it had successfully detonated its first hydrogen bomb. That claim has been met with international skepticism, as seismic evidence seems to indicate that

[84] Wit, Joel S. and Sun Young Ahn, "North Korea's Nuclear Futures: Technology and Strategy," U.S.-Korea Institute at SAIS, http://38north.org/wp-content/uploads/2015/09/NKNF_NK-Nuclear-Futures.pdf (accessed April 5, 2016), pg. 9.
[85] Kristensen, Hans M. and Norris, Robert S. "Status of World Nuclear Forces." FAS - Federation of American Scientists. http://fas.org/issues/nuclear-weapons/status-world-nuclear-forces (accessed February 2, 2016).
[86] Chanlett-Avery, Emma, Ian E. Rinehart, and Mary Beth D. Nikitin. *North Korea: U.S. Relations, Nuclear Diplomacy, and Internal Situation.* Washington, DC: Congressional Research Service, 2013, pg. 12

the yield of the detonated bomb was too small to have been a thermonuclear device.[87] While it was unlikely a hydrogen bomb, it is worth noting that the yield of North Korea's tests rose incrementally in the first three tests and the fourth produced roughly the same yield as the third test at an estimated 7-9 kilotons.[88] Even though North Korea does not yet possess some of the capabilities it claims to have, it is clear its capabilities are growing. Indeed, developing its nuclear arsenal continues to be one of the main focuses for the regime today.

North Korea also continues to make strides in expanding its missile program. Currently, North Korea is thought to possess an estimated 700-800 Soviet-designed ballistic missiles that are mostly short-range. A 2013 U.S. government report estimated that North Korea has also deployed small numbers of medium and intermediate-range ballistic missiles (about 100 and fewer than 30, respectively) that could reach Japan, but the intermediate-range missiles have never been flight-tested.[89] While these missiles are capable of doing catastrophic damage within the region, most concerning for the U.S. is North Korea's efforts to develop a reliable long-range ballistic missile capability.[90] A key milestone would be for North Korea to develop a nuclear warhead that is "miniaturized" or able to mount on long-range ballistic missiles.[91] In fact, a number of high-ranking U.S. officials have claimed that North Korea has already achieved this feat. This includes USNORTHCOM commander Admiral William Gortney who stated that, "…we assess that…they have the weapons, and they have the ability to miniaturize those weapons, and they have the ability to put them on a rocket that can range the homelands."[92] Additionally, General Curtis Scaparrotti of U.S. Force Korea made a similar assessment stating that North Korea has, "…the capability to have miniaturized a device at this point, and they have the technology to potentially actually deliver what they say they have."[93] In support of this developing capability, North Korea launched its second satellite into space on February 7, 2016, in the wake of its January nuclear test. While Pyongyang claims these types of launches are a part of its right to have a peaceful space program, it was widely thought to be a thinly veiled excuse to conduct a long-range missile test. The rocket in question was an Unha-3, which is believed to be capable of reaching Alaska and perhaps Hawaii if modified to carry a warhead.[94]

Also noteworthy are North Korea's claims that it had successfully conducted its first two SLBM tests in May and December of 2015. International analysts, however, heavily disputed the

[87] Greenemeier, Larry, "Nuclear Confusion: The Data Suggest North Korea's "H–Bomb" Isn't," Scientific American, http://www.scientificamerican.com/article/nuclear-confusion-the-data-suggest-north-korea-s-h-bomb-isn-t (accessed January 26, 2016).
[88] Ibid.
[89] Chanlett-Avery, Emma, Ian E. Rinehart, and Mary Beth D. Nikitin. *North Korea: U.S. Relations, Nuclear Diplomacy, and Internal Situation.* Washington, DC: Congressional Research Service, 2013, p. 17.
[90] Ibid.
[91] Almasy, Steve, "North Korea claims to have nuclear warheads that can fit on missiles," CNN, http://www.cnn.com/2016/03/08/asia/north-korea-nuclear-warheads (accessed March 9, 2016).
[92] Snyder, Scott A. "U.S. Assessments of North Korean Missile Capabilities since 2011." Council on Foreign Relations. http://blogs.cfr.org/asia/2016/02/07/u-s-assessments-of-north-korean-missile-capabilities-since-2011 (accessed February 9, 2016).
[93] "Department of Defense Press Briefing by General Scaparrotti in the Pentagon Briefing Room." U.S. Department of Defense. http://www.defense.gov/News/News-Transcripts/Transcript-View/Article/606951 (accessed March 6, 2016).
[94] "Kim Jong Un's War Games: North Korea Tests another Missile." The Economist. http://www.economist.com/blogs/graphicdetail/2016/02/daily-chart-6. (accessed February 9, 2016).

success of the claims and stated that any evidence of success was probably doctored.[95] It is generally reported that the tests were not only unsuccessful but that it is evident that North Korea is far from possessing such a capability. While this means that a North Korean SLBM capability is not of immediate concern, the U.S. must remain wary that North Korea is actively pursuing these capabilities.[96] North Korea appears to be determined to develop a more robust and survivable nuclear arsenal and has so far has been willing to bear whatever costs necessary to develop its nuclear program. So while a North Korean operational SLBM may not be feasible in the immediate future, its ability to develop such a capability in the long-term should not be underestimated.

North Korea's Theory of Victory

Like Russia and China, North Korea is concerned with how to safeguard its national interests in the event of a potential nuclear confrontation with the United States. North Korea seems to seek an end to the U.S.'s aggressive regional policies (seen as hostile policies against the regime) by using its nuclear arsenal to threaten and provoke the U.S. This is part of a larger strategy of nuclear brinksmanship, in which North Korea must demonstrate that its nuclear threats are credible, while refraining from crossing a threshold at which the U.S. would feel compelled to retaliate with a nuclear strike.[97]

The regime's ultimate theory of victory is centered on quickly achieving decisive military goals (usually against South Korea) using conventional forces within a time-span that does not allow the U.S. to significantly intervene. The U.S. then is expected to accept the changed political situation in North Korea's favor because a reversal of the fait accompli would carry unacceptably high costs to the U.S.[98]

In the event of a direct military confrontation with the U.S., North Korea hopes that its nuclear capabilities will allow the conflict to quickly reach an unacceptable level of costs to the U.S. This could involve either the use or threatened use of nuclear weapons to attack U.S. military bases or allies in the Asia-Pacific or even credibly threaten to strike the U.S. homeland in the future. This would then force the U.S. to capitulate to the North Korean regime.[99] To this end, North Korea relies heavily on nuclear blackmail and brinksmanship. Ultimately, a North Korean theory of victory involves the use of nuclear weapons to persuade Washington that any decision to intervene in North Korean military action, or to otherwise politically interfere with the North Korean regime, would result in unacceptably high costs and casualties to the U.S. and its allies.[100]

EXTENDED DETERRENCE IN THE ASIA-PACIFIC
Allies and Partners

[95] Chanlett-Avery, Emma, Ian E. Rinehart, and Mary Beth D. Nikitin. *North Korea: U.S. Relations, Nuclear Diplomacy, and Internal Situation.* Washington, DC: Congressional Research Service, 2013, p. 15.
[96] Ibid.
[97] Roberts, Brad, "On the Strategic Value of Ballistic Missile Defense," IFRI: Proliferation Papers 50, http://www.ifri.org/sites/default/files/atoms/files/pp50roberts.pdf (accessed April 1, 2016).
[98] Roberts, Brad, 2015, "Nuclear Deterrence in the 21st Century," Universite Paris I Pantheon Sorbonne, http://chairestrategique.univ-paris1.fr/fileadmin/chairestrategiesorbonne/conferences_2015/07-2015/01_Brad_Roberts_-_Nuclear_Deterrence_in_the_21st_Century.pdf (accessed April 1, 2016).
[99] Ibid.
[100] Ibid.

Because regional security in the Asia-Pacific is maintained by bilateral alliances, rather than institutional collective defense mechanisms like NATO, it is worth examining the concerns facing key U.S. allies in the region. Each ally presents its own unique concerns that must be considered by the U.S. in order to achieve extended deterrence objectives in the region and prevent nuclear proliferation.

South Korea

The Korean Peninsula is one of the most hotly charged regions in Asia, and South Korea keenly feels its own vulnerability to a North Korean nuclear or conventional attack. But the North-South tensions in the Korean Peninsula are not the only volatile factors in the region: Chinese interests in maintaining a buffer state between itself and a pro-U.S. ally, as well as Japan's historical interest and misgivings about Korean reunification, both play a significant role in rising tensions in the region. [101] U.S.-South Korean bilateral relations since the end of the Cold War have become increasingly stable, with the establishment of formal processes for consultation and increased cooperation. However, they have also been accompanied by an increasingly unstable and volatile nuclear regime in North Korea. Uncertainty regarding U.S. commitment to extended deterrence to South Korea remains one of the main potential elements for nuclear escalation on the Korean Peninsula.[102]

Japan

Underlying tensions in Sino-Japanese relations, as well as China superseding Japan as the region's dominant economic powerhouse, have increasingly deteriorated Japan's security environment.[103] Japan maintains a policy of nuclear hedging: pursuing continued protection under the U.S. nuclear umbrella, while hedging against future uncertainties through the development of ballistic missile defenses and civilian nuclear power industry, while preserving the proliferation status quo.[104] In addition, North Korea's nuclear development has made Japan vulnerable to both conventional and nuclear first-strike attacks from Pyongyang. Long-term historical animosities between the two countries further amplify Japan as a potential first-strike target in addition to South Korea.[105] Japan remains sensitive to any possibility of a weakening U.S. role in Asia and extended deterrence remains at the forefront of bilateral relations. Regionally, Japan plays an important role in maintaining perceptions of stability; it is generally considered to be a strong anchor, tying the U.S. to the region and balancing increasing Chinese influence.[106] Should Japan

[101] O'Neil, Andrew. *Asia, the US and Extended Nuclear Deterrence: Atomic Umbrellas in the Twenty-First Century*. New York: Routledge, 2013, p. 51.
[102] Tanter, Richard and Peter Hayes. "Beyond the Nuclear Umbrella: Re-Thinking the Theory and Practice of Nuclear Extended Deterrence in East Asia and the Pacific." Pacific Focus 26, no. 1 (2011), http://onlinelibrary.wiley.com/doi/10.1111/j.1976-5118.2011.01053.x/abstract (accessed March 20, 2016), p. 6.
[103] O'Neil, Andrew. *Asia, the US and Extended Nuclear Deterrence: Atomic Umbrellas in the Twenty-First Century*. New York: Routledge, 2013, p. 77.
[104] Bush, Richard C. *The U.S. Policy of Extended Deterrence in East Asia: History, Current Views, and Implications*. Washington, D.C.: The Brookings Institution, 2011, p. 7.
[105] O'Neil, Andrew. *Asia, the US and Extended Nuclear Deterrence: Atomic Umbrellas in the Twenty-First Century*. New York: Routledge, 2013, p. 77.
[106] Goh, Evelyn. "How Japan Matters in the Evolving East Asian Security Order." International Affairs 87, no. 4 (2011), http://onlinelibrary.wiley.com/doi/10.1111/j.1468-2346.2011.01009.x/abstract (accessed February 26, 2016).

ever lose confidence in the U.S. nuclear security umbrella, estimates on how quickly Japan could develop its own nuclear arsenal are as short as within a year.[107] Thus, Japan could credibly produce nuclear weapons if it loses confidence in U.S. commitment to extended deterrence.

Current U.S. Posture Regarding Extended Deterrence in the Asia-Pacific

The U.S. continues to view extended deterrence as a necessary component of its commitments to the Asia-Pacific. Because of this, the U.S. continues to enhance and modernize conventional military capabilities in Asia, even while cutting back on other aspects of the global U.S. military posture.[108] The U.S. is also committed to maintaining and modernizing the nuclear triad for extended deterrence commitments and signaling purposes, although this signaling is likely to increasingly rely on heavy bombers and nuclear-capable fighter-bombers, rather than submarine-launched cruise missiles (SLCMs) or ballistic missile submarines (SSBNs), which have historically been the most active leg of the triad in the Asia-Pacific.[109] From the U.S. perspective, dual-capable aircraft that are globally deployable are more effective forms of signaling than the SSBNs, as they allow a display of collective resolve with the U.S. acting jointly with allies against nuclear threats.[110] It is unlikely that the U.S. will shift away from maintaining the triad in the near future, and U.S. regional allies in Asia continue to see the triad as vital to ongoing U.S. commitment to extended deterrence.[111]

Challenges to the Current U.S. Nuclear Posture

Mutual Vulnerability

Whether or not to accept or acknowledge mutual vulnerability with China has been debated for many years now. Similar to the U.S.-Russian nuclear relationship, accepting mutual vulnerability with China would mean accepting that the adversary has a secure second-strike capability and is not completely vulnerable to a preemptive strike. That the U.S. is vulnerable to China is not a new idea. A 2009 task force chaired by former Secretary of Defense William Perry and Former National Security Adviser Brent Scowcroft concluded, "mutual vulnerability with China- like mutual vulnerability with Russia - is not a policy choice to be embraced or rejected, but rather a strategic fact to be managed with priority on strategic stability.[112]" Indeed, mutual vulnerability was a *strategic fact* over half a decade ago, however it is just recently that the U.S. has seriously started to consider accepting it. Both the U.S. and China have the capability to survive a preemptive strike and to order a second-strike retaliation. This makes it clear that the U.S. and China are indeed mutually vulnerable.

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[107] Bush, Richard C. *The U.S. Policy of Extended Deterrence in East Asia: History, Current Views, and Implications.* Washington, D.C.: The Brookings Institution, 2011, p. 10.
[108] *Quadrennial Defense Review 2014*. Washington, D.C.: U.S. Department of Defense, 2014, p.16.
[109] Bush, Richard C. The U.S. Policy of Extended Deterrence in East Asia: History, Current Views, and Implications. Washington, D.C.: The Brookings Institution, 2011, p. 6.
[110] Roberts, Brad. *The Case for U.S. Nuclear Weapons in the 21St Century*. Stanford: Stanford University Press, 2016, p. 220.
[111] Roberts, Brad. *The Case for U.S. Nuclear Weapons in the 21St Century*. Stanford: Stanford University Press, 2016, p. 92.
[112] Perkovich, George. 2015. "Regional Nuclear Dynamics" *Carnegie Endowment for International Peace*, February 25, http://carnegieendowment.org/2015/02/25/regional-nuclear-dynamics/i2y1

Despite this, the U.S. remains reluctant to publicly accept mutual vulnerability. Many in the U.S. claim that accepting vulnerability will lead to increased Chinese aggression in the region, as America's hands will be tied. Admitting vulnerability, it is also argued, would make U.S. allies in the region nervous and they may start to question U.S. commitment. Others, however, strongly believe that admitting mutual vulnerability will lead to strategic stability with China, like it did with the Soviet Union. They argue that as long as America does not accept it, China will assume the U.S. is attempting to ensure its superiority, leading China to further develop its own nuclear program. Recent developments in China's nuclear posture appear to lend credibility to the latter argument.

Missile Defense Systems

In the wake of North Korea's fourth nuclear test in January of 2016 and its satellite launch in February, the U.S. and South Korea agreed to officially hold talks about deploying the Terminal High Altitude Area Defense (THAAD) system, which targets high-altitude missiles, to South Korea.[113] This is for the stated purpose of protecting the South Koreans from an attack by North Korea. However, China is not convinced that the U.S. motivations of installing THAAD in South Korea are purely defensive and view it as a measure of Chinese containment in line with the broader American Rebalance to Asia policy. [114]

China's concern over the THAAD is two-fold. First, it is concerned that the deployment at a base in South Korea would indicate further commitment to U.S. presence in the region, and could potentially lead to Japan employing similar missile defenses. Second, and more importantly, China is concerned about the technology contained within the THAAD systems, specifically the X-band radar. The X-band radar is designed to track incoming missiles, and has a range well beyond the Korean Peninsula that could reach China.[115] Further, while the THAAD in South Korea would most likely be unable to stop a Chinese missile attack on the U.S. homeland, it could potentially give early tracking data to missile defenses in the U.S.[116] This is seen as another sign that the U.S. will continue to refuse mutual vulnerability with China. The Pentagon has tried to ease Chinese concerns, stating a missile defense system in South Korea "would be focused solely on North Korea" and that they "don't believe that it should pose any sort of concern to the Chinese"; However, China remains uneasy despite these assurances.

Denuclearization as THE Endgame

The singular endgame for the U.S. regarding North Korea's nuclear program has always been denuclearization. To this end, the U.S. has refused to recognize North Korea as a nuclear weapons state and refuses to do so for the foreseeable future. In its many attempts to see this resolution come to fruition, the U.S. has deployed an array of strategies for over three decades,

[113] Shalal, Andrea and Phil Stewart. "China Cites Concerns on U.S. Missile Defense System in South Korea." Reuters. http://www.reuters.com/article/us-usa-china-north-korea-idUSKCN0VY2C9 (accessed March 6, 2016).
[114] Kaplan, Michael. "US Missile Defense System Near North Korea? China Concerned Over Anti-Rocket Technology." International Business Times. http://www.ibtimes.com/us-missile-defense-system-near-north-korea-china-concerned-over-anti-rocket-2297956 (accessed March 6, 2016).
[115] Shalal, Andrea and Phil Stewart. "China Cites Concerns on U.S. Missile Defense System in South Korea." Reuters. http://www.reuters.com/article/us-usa-china-north-korea-idUSKCN0VY2C9 (accessed March 6, 2016).
[116] Lyon, Rod. "The Hard Truth about THAAD, South Korea and China." National Interest. http://nationalinterest.org/blog/the-buzz/the-hard-truth-about-thaad-south-korea-china-15295?page=show (accessed March 6, 2016).

including a mix of cooperative (roughly $400 million in energy aid) and coercive strategies (stringent international sanctions) without success in permanently stopping the progress of North Korea's nuclear program. Now that it is clear that North Korea possesses nuclear capabilities and is intent on expanding its program, the U.S. may soon have to explore the suitability of other endgames, such as accepting the North as a *de facto* nuclear state.

While preventing nuclear proliferation is a worthy policy that the U.S. should continue to pursue, it may have to consider that a state's pursuit of nuclear weapons is not necessarily a rogue action or an arbitrary defiance of international norms, but that it can in fact be a rational decision. As it relates to North Korea specifically, nuclear weapons are seen as a genuine component of its national security and regime survival. Consider the fact that in the last two and a half decades, North Korea has seen one of its historical benefactors disappear when the Soviet Union dissolved in 1991, and watched South Korea emerge as a prosperous society that is economically and conventionally superior. It was also placed on George W. Bush's "Axis of Evil" list along with Iran and Iraq and soon thereafter witnessed what happened to Saddam Hussein's regime. Then it saw Muammar Gaddafi regime's fall in Libya, even after it had given up its nuclear ambitions in exchange for sanctions relief. From this perspective, North Korea's belief that its national security is in jeopardy is not entirely unreasonable. This in no way absolves North Korea of its provocations, its atrocious human rights record, nor is it meant to lay blame on the U.S. for making North Korea feel insecure. Instead, it is to simply recognize that the United States might have to reconsider diverging from the singular negotiation position of denuclearization if North Korean leaders perceive nuclear weapons as so pivotal to regime survival.

Options for Extended Deterrence in the Asia-Pacific

Extended deterrence in the Asia-Pacific faces developing challenges in the resurgence of China and the development of a North Korean nuclear arsenal. In addition, the extension of deterrence through bilateral relations in Asia further complicates the U.S.' ability to demonstrate commitment and assure its allies. Because of this, there are three options that the U.S. could consider to address extended deterrence challenges in the changing security environment of the Asia-Pacific.

- Broaden and Develop Forward Posture: Counter Chinese and North Korean actions aggressively with the intent of assuring U.S. allies.
- Assume an Accommodating Posture: Address Chinese and North Korean actions through diplomatic approach with the intent of decreasing tensions in the region.
- Maintain a Mixed Approach: Address Chinese and North Korean with increase military presence while fostering and enhancing bilateral and multilateral agreements in the region to decrease tensions in the region at the same time.

Option #1: Broaden Forward Posture

This option would strengthen the U.S. conventional posture in the Asia-Pacific with the objective of bolstering American assurances to its allies and partners in the region. There are four steps to this approach. First, the U.S. would not recognize mutual vulnerability with China. Second, it would deploy the THAAD to South Korea. Third, it would refuse to negotiate with

North Korea on anything less than denuclearization. And fourth, it would increase U.S. conventional presence in the region.

The strength of this approach is that it would show that China and North Korea cannot leverage their nuclear weapons to pressure the U.S. into adjusting its posture to be favorable to them. Deploying the THAAD specifically shows that the U.S. will not allow China to influence the American security posture in the Asia-Pacific. Further increasing the U.S. presence in the region, perhaps by negotiating for U.S. bases in India and Vietnam, would demonstrate strong U.S. commitment to the region.

The weakness to this approach is that, while assuring U.S. allies, it could raise tensions in the region even further. Previous U.S. actions led to the creation of China's nuclear program and its military modernization of the last two decades. Therefore, instead of deterring China and North Korea, an aggressive U.S. posture could cause them to become more belligerent in the future and hurt U.S. allies, exactly what the posture was attempting to prevent.

Option #2: Assume Accommodating Posture

The more moderate option would focus on decreasing tensions in the region with the aim to increase regional security and stability. It would achieve this through a four-step approach. First, it would accept mutual vulnerability with China. Second, it would not deploy the THAAD to South Korea. Third, the U.S. would accept North Korea as a *de facto* nuclear state. And fourth, it would decrease the U.S. conventional presence in the region.

The strength of this approach is that accepting mutual vulnerability could eliminate the ambiguity of the U.S. position regarding this issue, allowing China to feel more secure. This in turn could lead China to slow down or stop its modernization programs, as this ambiguity has been a justification for China's nuclear modernization in recent years. Furthermore, reducing U.S. conventional presence and rejecting the deployment of THAAD could improve relations with China because it shows that the U.S. is not pursuing a policy of encirclement against China.

The weakness of this option is that it would most likely backfire regarding North Korea, as the leadership could see it as weak, prompting them to push for more concessions. It could also weaken the U.S. assurance posture since allies could view U.S. concessions as a result of successful North Korea coercion. If U.S. allies are not confident in the U.S. commitment to their security, they could take steps to ensure their own security, perhaps by building their own nuclear weapons.

Option #3: Maintain Mixed Approach

This proposed mixed approach would work to assure U.S. allies of its commitment to their security while also trying to decrease tensions in the region. It would do this through a different four-step approach. First, it would accept mutual vulnerability with China. Second, it would deploy the THAAD to South Korea. Third, it would refuse to negotiate with North Korea on anything less than denuclearization. And fourth, it would keep the U.S. conventional presence in the region, but without expanding to more foreign bases.

The strength of this approach is that it tries to incorporate the best of the other two approaches: it would work to allay Chinese insecurity while still assuring U.S. allies and holding firm against North Korea's nuclear program. If successful, it would be the best of both worlds. The U.S. would keep its traditional bases in Japan and South Korea and new bases in Australia and the Philippines, but it would not seek more foreign bases. This would make China feel less vulnerable,

but the U.S. would also be able to demonstrate ongoing commitment to its allies. By deploying the THAAD to South Korea and not negotiating with North Korea regarding anything other than denuclearization, the U.S. would also show it cannot be unduly influenced into acting against its interests.

The weakness of maintaining a mixed approach is that it seems to be reacting to specific components differently and not as an overall cohesive posture. For instance China might view the U.S. accepting mutual vulnerability and then turning around and deploying the THAAD to South Korea as contradicting signals. This posture could be viewed as inconsistent and confusing for both adversaries and allies in the region.

MIDDLE EAST
IRAN

Since the Iranian Revolution in 1979, Iran has been a persistent national security challenge. With the development of its nuclear and missile programs, Iran has become a chief concern for American foreign policy. The U.S. and its regional allies have feared that a nuclear-armed Iran would become emboldened and would seek to further assert itself throughout the region. The U.S. has also feared that if Iran were to acquire a nuclear weapon, it would result in a regional nuclear arms race. In an effort to prevent Iran's nuclear program from going further and to assuage its regional allies, the U.S. was a part of the Joint Comprehensive Plan of Action (JCPOA), a landmark deal to significantly reduce Iran's ability to produce a nuclear weapon. Despite this deal, concerns remain. With conflicting interests on nearly every other issue, U.S.-Iranian relations have more or less stagnated. At the same time, U.S. regional allies fear that the deal will bring about an U.S. rapprochement with Iran, leading the U.S. to commit less to the security of its allies. Going forward, the U.S. will have to balance its efforts to cooperate with Iran with continual assurances to its allies that it is committed to their protection. Furthermore, the U.S. will have to contend with the idea that a nuclear-armed Iran is still possible in the future.

National Strategy

Iran's regime seeks to preserve its control over the state and to expand its power and influence throughout the Middle East while attempting to weaken and exclude the U.S. from the region. Tehran also seeks to project power throughout the Middle East and to defend Shias in other Sunni-ruled Gulf countries. Consequently, Iran's relations with several Sunni-Arab states threaten the stability of the region as Iran seeks to challenge the status quo and acquire the power and prestige it feels it deserves. This has materialized in missile programs, defiance of the IAEA, and the support of proxies throughout the Middle East.[117]

Developments and Capabilities

Iran does not currently possess nuclear weapons. However, before the signing of the JCPOA, Iran's nuclear program was developing at an alarming rate. In 2010, it was discovered that Iran had been enriching large sums of uranium of up to 20 percent U-235, which could have

[117] Cordesman, Anthony H.; Nerguizian, Aram;Mausner, Adam; Alsis, Peter and Adam Seitz, "U.S. and Iranian Strategic Competition: Introduction," CSIS, https://issuu.com/csis/docs/120319_cordesman_iran_bk1?e=0/1539811 (accessed April 20, 2016).

then been further enriched to weapons-grade uranium. Iran's progress was so substantial that it had already produced enough U-235 to fuel a number of nuclear weapons. Its break out time was estimated as low as 2-3 months. However, Iran's compliance with the JCPOA has greatly reduced its enrichment capabilities by severely limiting the size of its stockpile, in addition to putting limits on the technology necessary for enrichment. Assuming that Iran will remain compliant, its nuclear capabilities will be restricted for at least the next fifteen years.

Although Iran's nuclear capabilities are forestalled for the near future, Iranian missile capabilities are still considered to be extensive and robust. Tehran is known to possess an assorted variety of ballistic and cruise missiles of various sizes and ranges. According to one report, "Iran's forces range from relatively short-range artillery rockets…to long-range missiles that can reach any target in the region and the development of booster systems that might give Iran the ability to strike at targets throughout."[118] Its shorter-range rockets are not considered to be of much utility outside of thwarting a direct invasion, however if these rockets are provided to groups like Hamas and Hezbollah, Iran would be able to indirectly attack Israel and project its power throughout the region.[119] Iran is also known to possess an abundant amount of medium range ballistic missiles (MRBM) and intermediate range ballistic missiles (IRBM). Although there is uncertainty about their numbers, accuracy, and ranges, it is estimated that its various missiles likely range from about 2,000-5,000 kilometers.[120] This means that Iranian missiles could reach potential targets throughout the Gulf, the entirety of Israel, and even parts of Europe. Finally, Iran is not thought to currently possess ICBM capabilities, but there are concerns about its proven capability to successfully launch multiple satellites into space. While there hasn't been any indication that it has made efforts to develop ICBMs, satellite launch capabilities could potentially be utilized to develop ICBMs in the future.[121]

Iran's Theory of Victory

Iran does not have a nuclear weapons capability to deter the U.S. in the event of a conflict and is incapable of defeating U.S. forces in a conventional war. The combined forces of the U.S. and regional allies outmatch Iran's navy and air forces. Therefore, Iran is forced to find other means to safeguard its interests. Currently, Iranian strategy is to utilize its missile forces to impose attritional costs on the U.S. and its regional allies in a 'war of intimidation'. In such a conflict, Iran would launch its missiles in a series of volleys or salvos in the general direction of population centers and military installations.[122] While Iran's missiles are not believed to be overly accurate, the psychological impact of such launches could be enormous.[123] The fear of unannounced barrages over a number of days could so disrupt operations or damage military and infrastructure facilities long enough to have a significant political impact. Even before the outbreak of war, Iran's ability to launch a large volume of missiles over a period of days with little warning gives Iran leverage and makes such missiles a weapon of intimidation.[124] Importantly, this 'war of

[118] Katzman, Kenneth. *Iran, Gulf Security, and U.S. Policy*. Washington, D.C.: Congressional Research Service, 2016, p. 25-26.
[119] Ibid.
[120] Ibid.
[121] Ibid.
[122] Cordesman, Anthony H. *Iran's Rocket and Missile Forces and Strategic Options*: CSIS, 2014.
[123] Ibid.
[124] Ibid.

intimidation' strategy allows Iran to achieve its political aims without directly confronting the U.S. or allied forces.

The U.S. must also consider Iran's theory of victory if it ever does obtain nuclear weapons capability. It is difficult to predict how aggressive Iran would become in exploiting its nuclear capability if it did acquire nuclear-armed missiles. Iran has so far been cautious in initiating any use of force that might threaten the survival of the regime. Its best strategy would be to limit its use of nuclear missile forces to pressure, deter, and intimidate. It is highly unlikely that the Iranian regime plans to actually use a nuclear weapon in an offensive attack. Both of the obvious targets, the United States and Israel, have a second-strike nuclear arsenal capable of threatening the regime's survival. However, nuclear weapons could deter foreign military strikes against the Iranian homeland, making the Iran's use of conventional military force abroad less risky.[125]

EXTENDED DETERRENCE IN THE MIDDLE EAST

As in Europe and Northeast Asia, the U.S. is committed to the protection of numerous allies and interests in the Middle East. As it relates specifically to Iran, the U.S. has a vested interest in the protection of the six Gulf States that make up the Gulf Cooperation Council (GCC). These states are Saudi Arabia, Kuwait, Bahrain, Qatar, the United Arab Emirates, and Oman. Due to a number of religious, cultural, and political differences, the members of the GCC have long had an adversarial relationship with Iran and believe that it actively works to destabilize their monarchies and seeks regional hegemony. Although the U.S. is not formally committed to their defense, its informal commitments are readily apparent. The U.S. stations over 20,000 troops throughout GCC territories; most prominent is the headquarters of the Navy's Fifth Fleet in Bahrain. In addition, the U.S. has conducted dozens of bilateral and multilateral joint-military exercises, sold hundreds of American aircraft and a number of THAAD missile defense systems to GCC members, and signed arms deals worth billions of dollars, including a $60 billion deal with Saudi Arabia in 2010.[126] Furthermore, President Obama hosted a summit in May of 2015 for the GCC leaders to further assure them of American commitment in the midst of American negotiations with Iran over its nuclear program. At the conclusion of the summit, a joint statement read that the leaders of the U.S. and the GCC,

> "…Underscored their mutual commitment to a U.S.-GCC strategic partnership to build closer relations in all fields, including defense and security cooperation…and to deter and confront external aggression against our allies and partners. In the event of such aggression or the threat of such aggression, the United States stands ready…for the defense of our GCC partners."[127]

Given these assurances, it is likely that the U.S. would come to the defense of GCC member states in the event of a conflict with Iran, even if it were not formally obliged to do so.

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[125] Sherrill, Clifton W. "Why Iran Wants the Bomb and what it Means for US Policy." Nonproliferation Review 19, no. 1 (March, 2012): 31-49, https://www.nonproliferation.org/wp-content/uploads/npr/npr_19-1_sherrill_iran_bomb.pdf. (accessed March 26, 2016).

[126] "Assessing the Global Operating Environment: Middle East." The Heritage Foundation. http://index.heritage.org/military/2015/chapter/op-environment/middle-east (accessed February 19, 2016).

[127] "*U.S.- Gulf Cooperation Council Camp David Joint Statement*." The White House. https://www.whitehouse.gov/the-press-office/2015/05/14/us-gulf-cooperation-council-camp-david-joint-statement (accessed February 16, 2016).

OPTIONS

Although Iran does not currently possess its own nuclear arsenal, and is theoretically prevented from doing so in the immediate future, it still significantly impacts U.S. nuclear posture in the Middle East. Because of this, there are three options that the U.S. could pursue to continue to deter Iranian aggression and persuade Iran to adhere to the terms of the JCPOA.

- Extend the Nuclear Umbrella over the GCC: Signal to Iran and to the GCC that Iran will not be able to credibly threaten nuclear usage against the GCC.
- Ensure Effective Implementation of the JCPOA: Work with international organizations and individual countries (specifically, China and Russia) to enforce snapback sanctions if Iran is found noncompliant
- Incorporate Iran into Global Nuclear Security Discussions: Invite Iran into the global community and provide Tehran with more opportunities to interact with potential partners.

Option #1: Extend the Nuclear Umbrella over the GCC

No member of the GCC currently possesses nuclear weapons; and a nuclear-armed Iran may be able to threaten, intimidate, and push its regional interests in a way that they would be unable to counter. In turn, there is an ongoing debate that that a nuclear-capable Iran might trigger a sort of nuclear arms race in the Persian Gulf as the GCC would look to counter the Iranian threat.[128] This is of particular concern regarding Saudi Arabia, whose wealth and struggle for regional dominance provides it with strong incentives to counter an Iranian nuclear threat with a nuclear capability of its own. To assuage these fears, it is in U.S. interests to consider opening up a nuclear umbrella to the GCC territories.

Similar to the one extended in Northeast Asia, a nuclear umbrella for the Gulf States would serve two primary functions. The first is that it would deter Iran from threatening nuclear use against the GCC. With a nuclear umbrella over the GCC, the U.S. signals to both Iran and the GCC that Iran will never be able to actually use its nuclear weapons without a significant response from the U.S. The second benefit is that by assuring the GCC that the U.S. is committed to their protection, it reduces the need for them to produce their own nuclear weapons. In turn, this greatly diminishes the possibility of a nuclear arms race in the region.

A significant weakness of this option is that the U.S. would likely have to create a more formal security relationship with the GCC and as it stands today, the GCC is ill prepared to create such a formal structure. Extending a formal U.S. security umbrella over the Gulf would require guarantees in the form of defense pacts with GCC states, or with the GCC as a whole, which would likely have mutual or collective self-defense provisions.[129] For multilateral defense organizations to be effective, they require close integration among the members. However, there are currently substantial impediments to further integration. The primary concern is that the majority of the military capabilities of GCC states belong to Saudi Arabia, and because many member states are

[128] Saunders, Emily Cura and Bryan L. Fearey. "The Least Bad Option? Extending the Nuclear Umbrella to the Middle East." Comparative Strategy 33, no. 2 (April, 2014), https://www.researchgate.net/publication/262576456_The_Least_Bad_Option_Extending_the_Nuclear_Umbrella_to_the_Middle_East (accessed April 19, 2016).

[129] Goldman, Zachary K. and Mira Rapp-Hooper, "Can a New NATO Deter Iran," The Diplomat, July 31, 2012, , http://thediplomat.com/2012/07/can-a-new-nato-deter-iran (accessed April 19, 2016).

wary of Saudi domination, they may be reluctant to entrust their future security to a Saudi-dominated regional body. In 2010, Saudi Arabia alone accounted for nearly 40 percent of total military expenditures for the Middle East region and also accounted for approximately two-thirds of the GCC's total active duty military forces, along with nearly half of its combat capable aircraft.[130] Understandably, other Gulf States may fear that any truly integrated regional defense organization will be dominated by Saudi Arabia, and have thus far resisted Riyadh's efforts to more tightly integrate the GCC.[131]

Option #2: Ensure Effective Implementation of the JCPOA

The JCPOA is intended to ensure that Iran's nuclear program can only be used for purely peaceful purposes and does not produce a nuclear weapon. Of course, it is within the U.S.' best interests to ensure that the JCPOA is effectively implemented. To ensure this effective implementation, the JCPOA includes a number of rewards for Tehran's compliance to the deal and a number of provisions to punish Tehran if it is found to be noncompliant.

The first step to assuring Iran's compliance to the JCPOA is to reward Iran for its cooperation. In exchange for Iranian cooperation, the U.S., European Union (EU), and United Nations Security Council (UNSC) agreed to lift the broad sanctions that had been applied to Iran for years. For its part, the U.S. agreed to allow the sale of commercial passenger aircraft and related parts and services, to cease its efforts to reduce Iran's crude oil sales, and to terminate a number of Executive Orders that had forbidden transactions with Iran's financial institutions.[132] The EU agreed to lift a number of similar sanctions that had targeted Iran's oil and gas, precious metal, shipping, and banking sectors.[133] These sanctions were lifted "simultaneously with the IAEA-verified implementation of agreed nuclear-related measures by Iran."[134] Finally, the UNSC passed Resolution 2231 which served as the UNSC's formal endorsement of the JCPOA. Importantly, it also terminated the six previous UNSC resolutions that had severely sanctioned Iran for its nuclear and ballistic missile program.[135] While the implementation of the JCPOA is still in its early stages, it is important to note that Iran has thus far been compliant. On December 28, 2015, Iran completed one of the deal's first requirements when it shipped 25,000 pounds of low-enriched uranium to Russia. This step alone is believed to have automatically increased Iran's "breakout time" to twelve months or more.[136]

The second step to assuring Iran's compliance to the JCPOA is to punish Iran if it is found to be noncompliant with the deal. The JCPOA contains a number of verification measures that are designed to quickly detect an Iranian attempt to "break out"—covertly or otherwise—and build a nuclear weapon. In addition to increasing the number of inspectors in Iran, the JCPOA dictates that the IAEA will also monitor the stored Iranian centrifuges and related infrastructure for fifteen

[130] Ibid.
[131] Ibid.
[132] Joint Comprehensive Plan of Action, U.S.-U.K.-Fr.-Rus.-Ch.-Ger.-E.U.-.Iran, July 14, 2015.
[133] Ibid.
[134] Ibid.
[135] United Nations Security Council, "Resolution 2231 (2015)," accessed April 24, 2016, http://www.un.org/en/sc/2231/.
[136] Kenneth Katzman, *Iran, Gulf Security, and U.S. Policy* (CRS Report No. RL32048) (Washington, DC: Congressional Research Service, 2016), 20, https://www.fas.org/sgp/crs/mideast/RL32048.pdf.

years and will be permitted to monitor its uranium mills for up to twenty-five years.[137] Critically, Iran also pledged to implement the Additional Protocol to its IAEA safeguards agreement. The Protocol provides the IAEA with additional verification measures that allow it to have broader access into Iran's nuclear program including increased physical access for the IAEA and improved administrative arrangements.[138] There are also a number of provisions in place that allow the IAEA to bring forward any suspicions or questions it might have related to Iran's undeclared facilities. According to one report,

> "If the agency has concerns about a particular site, the agency will provide Iran with the reasons for its concerns…Iran must then respond to the IAEA's request… If the explanation does not satisfy the IAEA, it can request access to the site. Iran can take some steps to protect sensitive information if, for instance, the inspection is on a military facility. But ultimately, it is up to the IAEA to determine if the access is sufficient."[139]

In the event of the IAEA determining that the provided access is insufficient, there are measures in place to resolve the dispute. In particular, if a dispute cannot be resolved between the two alone then the JCPOA's Joint Commission, a body of representatives from each of the P5+1 states and Iran, would be consulted. The consultation will help advise each party on how to settle the issue and will inherently bring any suspicious activity to the UNSC's attention. In the event that Iran is then found to be non-compliant, the UNSC resolutions that had been lifted by UNSC Resolution 2231 would be re-imposed or 'snapped-back' into place.[140]

Although the incentives and punishments of the JCPOA are clearly outlined by the agreement, the U.S. could take three steps to further strength compliance with the agreement. First, the U.S. could work with other P5+1 actors to ensure that no major international actor aids Iran in breaking the agreement. For example, the U.S. could consider discussions with Russia and China reinforcing the importance of limiting arms sales to Iran if it is found to violate the agreement; likewise, the U.S. should consider discussions with the EU about preparations for diversifying its oil and natural gas supplies, if sanctions against Iran must be implemented again. Second, the U.S. could threaten to unilaterally re-impose sanctions against both U.S. and foreign companies with U.S. assets that transact with Iran. Although these measures acknowledge that the U.S. ability to unilaterally punish Iran through financial measures has limitations, the re-imposition of U.S. sanctions alone can still have a substantial financial impact on Iran's economy. Third, if Iran does not comply with the JCPOA and aggressively pursues its nuclear program, the U.S. could publicly justify a military response to Iran's international defiance.

Option #3: Incorporate Iran into Global Nuclear Security Discussions

While the JCPOA is set up to prevent Iran from acquiring nuclear weapons for a number of years, it also recognizes Iran's right to a peaceful nuclear program. This means that Iran will be allowed to maintain its nuclear infrastructure and a limited supply of nuclear materials. This fact alone makes Iran a permanent player in nuclear security issues. If Iran ever acquires nuclear

[137] Kenneth Katzman and Paul K. Kerr, *Iran Nuclear Agreement* (CRS Report No. R43333) (Washington, DC: Congressional Research Service, 2016) 9-11, https://fas.org/sgp/crs/nuke/R43333.pdf.
[138] "Additional Protocol: What is the Additional Protocol?" last modified February 25, 2016 https://www.iaea.org/safeguards/safeguards-legal-framework/additional-protocol.
[139] "Section 3: Understanding the JCPOA," last modified August 10, 2015, http://www.armscontrol.org/reports/Solving-the-Iranian-Nuclear-Puzzle-The-Joint-Comprehensive-Plan-of-Action/2015/08/Section-3-Understanding-the-JCPOA.
[140] *Iran Nuclear Agreement*, 20.

weapons, its role as a nuclear player would become more significant. Therefore, another option is for the U.S. to consider incorporating Iran into the various international summits, forums, and institutions that are routinely held to help promote international cooperation, enhance dialogue, and exchange ideas on nuclear security issues.

Bringing Iran into the international dialogue on nuclear security has two primary advantages. The first advantage is that it provides Iran with more opportunities to exchange ideas with the international community and bolster cooperation. Theoretically, the more Iran participates in such international summits and forums and is able to interact with the international community, the more each side will understand one another.[141] This understanding is fundamental to building mutual trust. Ultimately the aim is to help Iran to become a responsible stakeholder in global nuclear security. By building ties with members of the nuclear security community, Iran could be persuaded to adhere to established international laws and norms and may less likely to continue to pursue weapons or to use nuclear weapons for anything short of existential defense.

The second advantage to this option is that it allows Iran to discuss nuclear issues without having to work directly with the U.S. Despite significant cooperation in implementing the JCPOA, Iran still views the U.S. as a hostile foreign power. Shortly after the JCPOA was signed, Iran's Supreme Leader Ayatollah Ali Khamenei explicitly stated that, "Even after this deal our policy towards the arrogant U.S. will not change. We don't have any negotiations or deal with the U.S. on different issues in the world or the region."[142] However, if Iran is invited to participate in international forums and summits, the U.S. and Iran could perhaps find opportunities to discuss nuclear-related issues on a multilateral basis, allowing Iranian leadership to maintain the narrative with domestic audiences that it is not working directly with the United States.

However, there is a glaring weakness to this option. Despite Iran's historic cooperation in previous nuclear-related institutions, this did not stop Tehran from dismissing international norms and behavior when it originally decided to develop its nuclear program. Most notably, Iran is a participant to the Nuclear Non-Proliferation Treaty (NPT) and has been since it signed and ratified the NPT by February of 1970.[143] Unsurprisingly, Iran was found to be noncompliant with the NPT's safeguards obligations in 2003, and continued to be noncompliant until the recently agreed upon JCPOA in 2015.[144] This demonstrates the risk of assuming that participation in well-regarded international institutions will naturally result in trust building and compliance with international norms for nuclear security and nonproliferation.

DISCUSSION

Changes in the global security environment demonstrate that state-based strategic threats continue to dominate U.S. security strategy and extended deterrence concerns. An increasingly

[141] Slaughter, Anne-Marie, "International Relations, Principle Theories," Max Planck Encyclopedia of Public International Law, https://www.princeton.edu/~slaughtr/Articles/722_IntlRelPrincipalTheories_Slaughter_20110509zG.pdf (accessed April 20, 2016), p. 4-5.

[142] Morello, Carol, "Ayatollah says nuclear deal will not change Iran's relations with U.S.," The Washington Post, https://www.washingtonpost.com/world/national-security/ayatollah-says-nuclear-deal-will-not-change-irans-relations-with-us/2015/07/18/7470b531-ff12-4913-81e1-21101130fbdd_story.html (accessed February 18, 2016)

[143] "Signatories and Parties to the Treaty on the Non-Proliferation of Nuclear Weapons," Federation of American Scientists, http://fas.org/nuke/control/npt/text/npt3.htm (accessed April 19, 2016).

[144] "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran," IAEA Board of Governors, https://web.archive.org/web/20071025173821/http://www.iaea.org/Publications/Documents/Board/2003/gov2003-75.pdf (accessed April 20, 2016).

assertive Russia and China, and emerging nuclear capable states like North Korea all pose unique extended deterrence challenges that must be addressed by future administrations. In addition, the case of Iran demonstrates that nuclear proliferation continues to present a very real threat to the security environment of U.S. allies throughout the world. Because of this, there are a number of concluding policy options that the U.S. could consider when framing its overarching nuclear posture and strategy going forward.

U.S. Response/ Modernization

Modernization of the nuclear triad is an urgent concern for U.S. national security, considering parts of the U.S. nuclear arsenal are already beyond their intended service lives. As detailed previously, both China and especially Russia have performed substantial modernizations to their nuclear arsenals. If the United States considers the modernization of the entire triad as essential to deter evolving capabilities from China and Russia, it will have to absorb a considerable financial cost. The Congressional Budget Office (CBO) estimates that it will cost a total of $160 billion to modernize the triad and associated nuclear weapons between 2015-2024.[145] The specific costs to upgrade SSBNs, ICBMs, and bombers are, respectively, $83 billion, $26 billion, and $40 billion in the next decade.[146] More comprehensive estimates increase the projected numbers up to $348 billion within the next decade for the following items: 1) strategic nuclear delivery systems and weapons ($160 billion); 2) non-strategic nuclear delivery systems and weapons ($8 billion); 3) nuclear weapons laboratories and their supporting activities ($79 billion); 4) nuclear-related command, control, communications, and early-warning systems ($52 billion).[147]Furthermore, the total cost of modernizing the triad, in conjunction with funding for nuclear weapons research and improvements in nuclear command and control, could exceed $1 trillion in the next three decades.[148] This means that it is important to assess and prioritize modernization, and balance the costs of modernization against the nuclear capabilities of peer competitors such as Russia.

Recommendation/Option: Modernize All Three Legs

Since 2010, Russia has made substantial commitments to modernize all three legs of its nuclear triad. It plans to deploy road mobile ICBMs with multiple warheads, develop a new class of nuclear-capable subsonic bombers known as the PAK-DA, and has already begun the production of the new Borei class nuclear-powered ballistic submarine.[149] Ultimately, the motivation behind the Russian modernization is that a robust strategic nuclear force ensures Russia's status as a great power and ensures its security vis-à-vis the United States.[150] Russia's modernizations have established an advanced nuclear force. Reacting to this, USSTRATCOM commander Admiral Cecil Haney called for U.S. modernization stating, "We are fast approaching

[145] *Projected Costs of U.S. Nuclear Forces, 2015 to 2024*: Congressional Budget Office, January 22, 2016.
[146] Ibid.
[147] Wolfsthal, Jon. *The U.S. Trillion Dollar Nuclear Triad: The U.S. Strategic Nuclear Modernization Over the Next Thirty Years*. Monterrey, CA: James Martin Center for Nonproliferation Studies, January 7, 2014.
[148] Ibid.
[149] Kristensen, Hans M. and Robert S. Norris. "Russian Nuclear Forces, 2015." The Bulletin of the Atomic Scientists 71, no. 3 (November 27, 2015), http://thebulletin.org/2015/may/russian-nuclear-forces-20158299 (accessed February 27, 2016).
[150] Kristensen, Hans M. and Robert S. Norris. "Russian Nuclear Forces, 2015." The Bulletin of the Atomic Scientists 71, no. 3 (November 27, 2015), http://thebulletin.org/2015/may/russian-nuclear-forces-20158299 (accessed February 27, 2016), p. 3.

the point where [failing to modernize these elements] will put at risk our safe, secure and effective and ready nuclear deterrent, potentially jeopardizing strategic stability."[151]

Although Chinese strategic forces remain smaller and of much less influence on the U.S. strategic nuclear posture than those of Russia, China is also undertaking substantive modernizations to its ICBM arsenal and is further advancing its submarine fleet toward nuclear capability. These developments indicate that the U.S. should remain committed to modernizing all three legs of its nuclear triad in order to maintain strategic stability and parity with Russian capabilities.

Even though modernization of the U.S. triad is already underway, it is important to consider the priority in which the U.S. modernizes each leg of the triad. Modernization is an expensive and time-consuming endeavor, and it is important that the U.S. prioritizes its modernization efforts so that it avoids the risk of delays or even cancellations because of future budget changes. The United States must first prioritize the modernization of its aging nuclear bomber fleet with the research, development, and production of the long-range penetrating LRS-B bomber and the continual modernization of the current B-2 and B-52 fleet to meet evolving capabilities.[152] Forward deployed in Europe or even the Asia-Pacific, modernized bombers could prove particularly useful as a strong symbol of assurance to allies. Second, the U.S. should prioritize the modernization of its submarine fleet with the production of the SSBN (X) submarines. These submarines will feature a variety of upgrades that will enable them to remain the most secure component of the U.S. secure second-strike guarantee; for example, these submarines will be equipped with an electric-drive propulsion train, unlike current models, which will ensure improved stealth capabilities.[153] Third, the U.S. must upgrade its ICBM arsenal. Improving command and control capabilities and replacing the older W78 warheads with newer, more powerful W87 warheads, will help ensure that Russian or Chinese improvements in their ICBMs will not challenge U.S. capabilities.[154]

Although this report calls for modernization priorities, it also advocates retaining and eventually modernizing all three legs of the triads. SLBMs remain a crucial part of the arsenal because of their survivability, while bombers are useful for signaling because of the ability of commanders to recall them at the last moment. Retaining both SLBMs and bombers has received relatively little resistance in U.S. security policy. However, there remains a substantial debate on the necessity of the ICBM as a part of the U.S. nuclear arsenal. Former Secretary of Defense William Perry and others argue that the improved accuracy of SLBMs have eliminated the necessity for ICBMs.[155] However, there are also arguments in favor of retaining ICBMs. The presence of ICBMs adds to the security of the U.S. homeland and central deterrence by making it nearly impossible for any adversary to take out all U.S. nuclear weapons in a splendid first strike.

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[151] Pellerin, Cheryl. "Stratcom Chief Talks Nuclear Deterrence, Modernization." U.S. Department of Defense. http://www.defense.gov/News-Article-View/Article/644215/stratcom-chief-talks-nuclear-deterrence-modernization (accessed March 2, 2016).

[152] "U.S. Nuclear Modernization Programs." Arms Control Association. https://www.armscontrol.org/factsheets/USNuclearModernization (accessed February 12, 2016).

[153] O'Rourke, Ronald. *Navy Ohio Replacement (SSBN[X]) Ballistic Missile Submarine Program: Background and Issues for Congress*: Congressional Research Service, March 31, 2016, p. 8.

[154] "U.S. Nuclear Modernization Programs." Arms Control Association. https://www.armscontrol.org/factsheets/USNuclearModernization (accessed February 12, 2016).

[155] Sedge, Hope H. "Former SecDef: Remove ICBMs From Nuclear Triad," Military.com, http://www.military.com/daily-news/2015/12/18/former-secdef-remove-icbms-from-nuclear-triad.html (accessed April 22, 2016).

With its silos hardened against nuclear blasts, an attacker would have to multiple warheads against each silo to ensure its destruction, which adds a further layer of security to the U.S. secure second-strike posture.

To counter Russian modernization of its non-strategic nuclear arsenal, the U.S. should, in turn, upgrade its gravity bombs and non-strategic aircraft. Modernization of the B61-12 gravity bomb will allow U.S. forces to strike targets more effectively and provide options for lower yields to reduce collateral damage. Concerning non-strategic aircraft, nuclear scholar Matthew Kroenig argues that current bomber capabilities could not reach Eastern Europe without refueling; furthermore, they would face stiff odds of penetrating Russian air defenses.[156] Thus, the non-strategic aircraft modernization should focus on modernizations of the existing B-52 fleet in the near term and focus on the development of the new LRS-B, which has a longer range and better penetration ability.[157]

Broader Strategic Messaging and Global Zero

Despite the increasing roles for conventional weapons in U.S. nuclear deterrence and planning, the United States should reconsider promoting nuclear abolition within its strategic documents. Achieving a "global zero" in nuclear weapons is highlighted in the 2010 NPR.[158] However, the practicality of achieving global zero continues to be debated, particularly in deterrence literature. The key question is the possibility of replacing nuclear extended deterrence with conventional deterrence. The U.S. commitment to a global zero appears to be more of a "you first" policy than it is an initiative spearheaded by U.S. leadership. For example, despite claiming an ultimate goal of achieving global zero, the 2010 NPR also stated, "as long as nuclear weapons exist, the United States will sustain safe, secure, and effective nuclear forces."[159]

Skeptics of global zero argue that nuclear parity is an important factor in being able to successfully dominate any potential nuclear escalation crisis; this would mean that the U.S. might be able to reduce its nuclear arsenal, but that the U.S. should avoid ever allowing its nuclear capabilities to fall below those of its adversaries.[160] With Russia becoming increasingly assertive in Eastern Europe, it is important to consider the implications the global zero narrative has upon extended deterrence and assurance. The U.S. drawing back its nuclear forces in Europe to work towards global zero, or even stating this goal in its nuclear doctrine would undermine its ability to signal collective resolve among NATO states. Furthermore, discussion of moving towards global zero in conjunction with discussion of modernization for U.S. nuclear forces may create the appearance of contradictory visions for future U.S. nuclear posture, complicating credibility on multiple levels. Therefore, global zero should be a part of the U.S. overall global posture.

The aim of moving towards global zero is admirable. It would also seem like a very sudden and concerning reversal if the U.S. completely abandoned the concept. The argument here is that it should not be directly discussed in planning documents as it complicates the directives and

[156] Kroenig, Matthew. "Facing Reality: Getting NATO Ready for a New Cold War." Survival: Global Politics and Strategy 57, no. 1 (30 January, 2015), https://www.iiss.org/en/publications/survival/sections/2015-1e95/survival--global-politics-and-strategy-february-march-2015-4c22/57-1-04-kroenig-3009 (accessed April 5, 2016), p. 63.
[157] "U.S. Nuclear Modernization Programs." Arms Control Association. https://www.armscontrol.org/factsheets/USNuclearModernization (accessed February 12, 2016).
[158] *The Nuclear Posture Review*. Washington, D.C.: U.S. Department of Defense, 2010, p.iii.
[159] *The Nuclear Posture Review*. Washington, D.C.: U.S. Department of Defense, 2010, p. v.
[160] Kroenig, Matthew. "Nuclear Superiority and the Balance of Resolve: Explaining Nuclear Crisis Outcomes." *International Organization* 67, no. 41 (2013), p. 169.

rhetoric within the nuclear posture. While there is room to move towards a sole use policy for U.S. nuclear weapons, it is perhaps best for global zero discussions to take place outside of official planning documents.

GLOBAL NUCLEAR SECURITY

The 2010 NPR made nuclear terrorism and nuclear proliferation central areas of concern, stating in the executive summary and introduction that, "today's most immediate and extreme danger is nuclear terrorism," and highlighting the prevention of nuclear terrorism and nuclear proliferation as the top priority for the U.S.[161] It is important to place the threat of nuclear terrorism in a comprehensive context. Most forms of nuclear terrorism are low probability, high consequence scenarios. Thus, although the threat should not be inflated, it is nonetheless important to recognize the various vulnerabilities and risks in order to assess where our greatest efforts should be focused.

The report looks to enhancing cooperation with Russia on nuclear security as a fundamental move toward achieving this goal. However, the prospects for cooperation with Russia have declined significantly in recent years. Russia has withdrawn from the Cooperative Threat Reduction program (CTR) as well as other cooperation programs and violated the

[161] *The Nuclear Posture Review*. Washington, D.C.: U.S. Department of Defense, 2010, p. 3.

Intermediate-Range Nuclear Forces Treaty (INF). In light of these developments, the various strategies for nuclear security set forth in 2010 must be reevaluated. Primary among these was the "lock down" of nuclear materials, weapons, and technology.

Despite the deteriorating relationship with Russia, progress has been made on bolstering non-proliferation norms and securing nuclear materials and technology around the globe. The JCPOA has created an opportunity to slow and perhaps reverse Iran's nuclear ambitions, and no other state—other than North Korea, which already possesses limited nuclear capabilities—has expressed interest in proliferating. The series of nuclear summits established by President Obama, concluded in March of this year, led to various agreements to consolidate and eliminate Highly Enriched Uranium (HEU) and separated Plutonium. However, there are various areas where more work is needed. For instance, further securing nuclear facilities at home and abroad from cyber related attacks, theft, or sabotage is crucial not only to preventing non-state groups and others from accessing nuclear materials for terrorism and proliferation opportunities, but to ensure the credibility and survivability of our nuclear infrastructure.

The possible impact of a successful cyber-attack on the U.S. nuclear infrastructure could be substantial. However, as technology specialist Clay Wilson noted in a 2008 Congressional Research Service report, non-state actors, such as Al Qaeda and the so-called Islamic State (ISIL), are more interested in body counts and flashy demonstrations of power than nuanced projections of U.S. strategic vulnerabilities.[162] Therefore, the most likely threat in this arena is from adversarial state actors, not terrorists.

CYBERSECURITY

Role of Cyber security

Cyber capabilities have evolved exponentially in recent years, making it nearly impossible for government defenses to counter developing offensive cyber capabilities. Reducing vulnerabilities to military command and control systems, nuclear facilities, and the overall nuclear infrastructure, however, is a challenge that must be met. Failing to do so could have implications for U.S. nuclear capabilities, central and extended deterrence, and U.S. vulnerability to nuclear terrorism.

Because of the potential impact of a cyber attack, improving cyber capabilities remains a growing focus for the U.S. military. However, these efforts have largely remained unilateral. U.S. collaborative and cooperative cyber efforts with allies in Europe and the Asia-Pacific are currently limited.[163] Given the very real danger posed by the current and developing cyber capabilities of

[162] Wilson, Clay. *Botnets, Cybercrime, and Cyberterrorism: Vulnerabilities and Policy Issues for Congress*: Congressional Research Service, 2008, p. 19; Swartz, Jon. "Cyberterror Impact, Defense Under Scrutiny." USA Today. http://usatoday30.usatoday.com/tech/news/2004-08-02-cyber-terror_x.htm (accessed February 28, 2016).
[163] Pellerin, Cheryl. "Stratcom Chief Talks Nuclear Deterrence, Modernization." U.S. Department of Defense. http://www.defense.gov/News-Article-View/Article/644215/stratcom-chief-talks-nuclear-deterrence-modernization (accessed March 2, 2016); *Quadrennial Defense Review 2014*. Washington, D.C.: U.S. Department of Defense, 2014, p. 33.

states like Russia, China and North Korea, the U.S. is focused almost entirely on its defensive posture against cyber-attacks and the use of cyber as an aid to conventional military operations.[164] Currently, the U.S. is not deeply considering the potential of cyber as a threat to extended deterrence strategy. In addition, U.S. defensive cyber measures remain inadequate to face current and future international threats, despite the known dangers posed by targeted cyber-attacks on key infrastructure, communications and vital information systems.

The potential for these attacks to do real damage is exemplified in various known attacks, such as the 2010 Stuxnet attacks against Iranian nuclear facilities and the 2012 Red October cyber-attacks, which targeted international diplomatic and government agencies.[165] However, despite a keen sense of vulnerability to these attacks, the U.S. has not devoted sufficient attention to cyber security in its nuclear reviews.[166]

Crisis Escalation Vulnerabilities

Although cyber-attacks could cause significant damage to critical infrastructure and nuclear facilities, a cyber-attack could also potentially escalate a pre-existing military crisis into a nuclear one, or damage the credibility of U.S. nuclear capabilities. Both of these scenarios could have significant secondary consequences for central and extended nuclear deterrence objectives.

A cyber-attack could escalate an existing military conflict by: targeting critical infrastructure, stealing government information, or disrupting communications channels, which a government would require for successful crisis management in the event of nuclear escalation.[167] 'Infowar' style targeting of government information and communications systems could cause a crisis to escalate through the creation and dissemination of misinformation and miscommunication. Similar events have happened in the past, such as in the 1962 Cuban Missile Crisis and the 1983 satellite warning system malfunction at the command center for the Soviet Union's Oko nuclear early-warning system. In both cases, the reporting of false information nearly resulted in the use of nuclear weapons.[168] Although the U.S. is attempting to address these cyber security concerns with initiatives such as the EINSTEIN program, which attempts to implement broad spectrum cyber security measures across U.S. government departments, the potential for cyber-attacks to escalate an international military dispute through infowar or to deteriorate U.S. nuclear crisis management and coordination capabilities, remains significant.[169]

Nuclear Infrastructure Vulnerabilities

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[164] *Quadrennial Defense Review 2014*. Washington, D.C.: U.S. Department of Defense, 2014, p. X.

[165] GReAT, "Cyber Attacks Investigation," Kaspersky Lab, https://securelist.com/analysis/publications/36740/red-october-diplomatic-cyber-attacks-investigation (accessed March 5, 2016).

[166] Friedberg, Ivo, Florian, Skopik, Giuseppe, Settanni and Roman Fiedler. "Combating Advanced Persistent Threats: From Network Event Correlation to Incident Detection." *Computers & Security* 48, (2015), p. 35-37. ; *The Nuclear Posture Review*. Washington, D.C.: U.S. Department of Defense, 2010.

[167] Cimbala, Stephen J. "Nuclear Crisis Management and "Cyberwar": Phishing for Trouble?" *Strategic Studies Quarterly* 5, no. 1 (2011): 117, http://www.au.af.mil/au/ssq/2011/spring/cimbala.pdf (accessed March 03, 2016), p. 124.

[168] Adamsky, Dmitry. "The 1983 Nuclear Crisis – Lessons for Deterrence Theory and Practice." *Journal of Strategic Studies* 36, no. 1 (2013), http://www.tandfonline.com/doi/full/10.1080/01402390.2012.732015. (accessed February 23, 2016).; Zegart, Amy B. "The Cuban Missile Crisis as Intelligence Failure." *Policy Review* Oct/Nov, no. 175 (2012).

[169] U.S. Department of Homeland Security. "Einstein." U.S. Department of Homeland Security. https://www.dhs.gov/einstein (accessed March 5, 2016).

Risks to nuclear infrastructure posed by advances in cyber technology have been compounded by decades of neglect of nuclear facilities that have left them increasingly vulnerable. During a Senate Armed Services Committee hearing in 2013, Gen. C. Robert Kehler, then the head of U.S. Strategic Command (USSTRATCOM), stated that he is, "…very concerned with the potential of a cyber-related attack on our nuclear command and control and on the weapons systems themselves."[170] A year later, Secretary of Defense Chuck Hagel conducted his own review of our nuclear forces, and publicly called for major improvements and investments for our nuclear infrastructure.[171]

Many U.S. command and control and nuclear security systems are point-to-point hardwired and are a mix of off-the-shelf and one of a kind hardware and software, which makes them less vulnerable to hacking, but not entirely impenetrable.[172] The Department of Defense (DoD) is confident that no cyber-attack could cut off the president from the nuclear forces and controls. However, the 2013 Defense Science Board (DSB) report "Resilient Military Systems and the Advanced Cyber Threat," made note of several possible vulnerabilities and inherent threats to the survivability of our nuclear command, control, and communication (C3) systems as well as the nuclear triad itself. The report expands the standard definition of survivability—the ability to withstand a nuclear attack—to include the ability to withstand a sophisticated cyber-attack. It underscores that this new level survivability is vital to our strategic deterrent forces because, "…the basic characteristics of the traditional U.S. nuclear deterrent incorporates survivability as a basic precept; now the U.S. must add survivability in the event of a catastrophic cyber-attack on the country as a basic precept."[173] Therefore, U.S. policymakers must take into account the new cyber environment as the U.S. modernizes its nuclear infrastructure and review nuclear security.

The DSB report also made a case for a cyber deterrent as a means to counter the current threat given our current vulnerabilities. It found that,

> "…The full spectrum cyber threat represented by a Tier V-VI [state-sponsored] capability is of such magnitude and sophistication that it could not be defended against. As such, a defense-only strategy against this threat is insufficient to protect U.S. national interests and is impossible to execute. Therefore, a successful DoD cyber strategy must include a deterrence component."[174]

If a state-sponsored hacking group or dedicated non-state terrorist organization could successfully pull off a sophisticated cyber-attack inspired by or surpassing the Stuxnet attack, the results could have grave political and psychological impacts upon the U.S. domestic population. Similar to the use of a dirty bomb or radiological explosive device (RED), an attack on a nuclear facility within

[170] Farnsworth, Timothy. "Study Sees Cyber Risk for U.S. Arsenal." Arms Control Association. https://www.armscontrol.org/act/2013_04/Study-Sees-Cyber-Risk-for-US-Arsenal (accessed March 1, 2016).
[171] Hagel, Charles. "Statement on the Nuclear Enterprise Review & Reforms." U.S. Department of Defense, http://www.defense.gov/News/Speeches/Speech-View/Article/606634/statement-on-the-nuclear-enterprise-review-reforms (accessed March 7, 2016).
[172] Caylor, Matt. "The Cyber Threat to Nuclear Deterrence," War on the Rocks, http://warontherocks.com/2016/02/the-cyber-threat-to-nuclear-deterrence (accessed March 27, 2016); Chamales, George. "A New Approach to Nuclear Computer Security." Nuclear Threat Initiative. http://www.nti.org/media/pdfs/A_New_Approach_to_Nuclear_Computer_Security.pdf?_=1445875704&_=1445875704 (accessed March 11, 2016).

[173] *Resilient Military Systems and the Advanced Cyber Threat*: U.S. Department of Defense, 2013, p. 50.
[174] *Resilient Military Systems and the Advanced Cyber Threat*: U.S. Department of Defense, 2013, p. 48.

the homeland would spark panic that none of our facilities are secure, that those who live near the facilities are at imminent risk, and perhaps most powerfully, that our nuclear systems are vulnerable. This message would do major damage to our nuclear deterrent and our extended deterrence worldwide.

The Stuxnet worm—which first became public in 2010—physically destroyed Iranian nuclear centrifuges by disrupting the speed at which they were running.[175] Adam Segal, a cyber security expert with the Council on Foreign Relations, stated in 2012 that this attack demonstrated that even isolated, specialized systems are vulnerable: "…even in secure systems, people stick in their thumb drives, they go back and forth between computers. They can find vulnerabilities that way. If people put enough attention to it, they can possibly be penetrated."[176] Therefore, the number and kind of vulnerabilities to our nuclear security infrastructure have greatly expanded in recent years.

The consequences of cyber vulnerability to our nuclear security go beyond the immediate damage of a facility. Deterrence policy, as described by Thomas Schelling, Scott Sagan, and Charles Glaser, relies upon credibility as a cornerstone of successful deterrence alongside capability and communication.[177] While these academics disagree on the specifics of the ideal formula for meeting strategic deterrence challenges, it is critical that our ability use our nuclear infrastructure are not doubted by allies or adversaries. If doubt about these capabilities is raised, it could undermine both central and extended deterrence, resulting in either an attack from a competitor, or even proliferation of nuclear weapons to states currently under our nuclear umbrella.

OPTIONS

Option One: Continue the efforts to improve government and military cyber defenses.

The U.S. could work to increase coordination between national agencies, including the Department of Homeland Security (DHS) and the Federal Bureau of Investigation (FBI). As the lines between cybercrime and cyber-terrorism become increasingly blurred, the U.S. will need its various departments to be able to better coordinate and communicate with one another. Ideally, such an increase in coordination could better allow for various agencies to share vital intelligence,

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[175] *Stuxnet was the first successful attack of its kind. The knowledge that a cyber-attack can cause physical damage to equipment and infrastructure is now undeniable, opening the the way for future hackers to develop capabilities previously thought impossible. Sean McGurk, the Department of Homeland Security's Acting Director of the National Cybersecurity and Communications Integration Center called the attack a "game-changer" for the defense of national critical infrastructure.*
While Stuxnet is thought to have been the result of a concerted state-sponsored effort, the cyber domain has a much lower barrier to entry than any other weapons system. The primary limiting factor for a group seeking sophisticated offensive cyber capabilities is personnel and time. It requires smart, focused individuals constantly working to find and take advantage of vulnerabilities. Terrorist networks have already demonstrated their intent to gain this capability—computers seized from Al Qaeda in 2003 showed growing offensive cyber knowledge well before developments like Stuxnet hit the internet. It is thus conceivable that a group out there today is working towards these goals.

[176] Koebler, Jason. "U.S. Nukes Face Up to 10 Million Cyber Attacks Daily." http://www.usnews.com/news/articles/2012/03/20/us-nukes-face-up-to-10-million-cyber-attacks-daily (accessed March 10, 2016).

[177] Schelling, Thomas C. *The Strategy of Conflict* Cambridge: Harvard University Press, 1960; Glaser, Charles L. *Analyzing Strategic Nuclear Policy*: Princeton University Press, 1990; Sagan, Scott Douglas. *Moving Targets: Nuclear Strategy and National Security*: Princeton University Press, 1989.

increasing the likelihood that a major cyber attack is detected before it is too late. The U.S. could also continue to develop effective cyber security measures through programs such as EINSTEIN and increase funding for detecting and addressing the vulnerabilities of U.S. nuclear infrastructure to cyber attacks.

Option Two: Further explore the potential for cyber capabilities to contribute to U.S. extended deterrence credibility.

The U.S. could incorporate cross-domain deterrence into is policy and defense plans. For example, the U.S. could link a cyber-attack on any aspect of the nuclear apparatus to strategic response options. Essentially, this option would allow for the U.S. to consider implementing a kinetic response to a cyber-attack, significantly raising the price for the attacker. This would be a major shift in policy from the usual in-kind response to cyber attacks. However, connecting cyber attacks to other strategic response options could raise the cost for initiating a cyber attack against the United States to a direct conventional confrontation, which could deter cyber attacks in the future.

NUCLEAR TERRORISM AND PROLIFERATION

Terrorism Threat Assessment

In addition to cyber-attacks, the threat posed from non-state actors who seek to possess nuclear weapons or nuclear materials is also a concern. The rise of non-traditional groups like ISIL and Al Qaeda has increased fears of a possible act of nuclear terrorism. There are differing views on how worried the U.S. should be. Some, like Graham Allison, think a nuclear terrorist attack is almost inevitable and will be devastating. On the other end of the spectrum are threat deflators like John Mueller who do not think such an attack would have a major impact. In the middle of these two are more widely accepted views put forward by Michael Levi and others that recognize the gravity of the nuclear terrorism threat but also the many ways that the U.S. can address this danger. What is fundamentally important to any analysis of the threat posed to the U.S. by nuclear terrorism is that it can happen in many forms and methods and the U.S. has varying levels of vulnerability to each of these forms.

Nuclear terrorism could include (1) the theft or purchase of an intact nuclear weapon, (2) theft or purchase of fissile material and components for non-state actors to build their own nuclear weapon, (3) the use of a radiological dispersal device (RDD) aka “dirty bomb” or (4) an attack or sabotage of a nuclear site.[178]

The first category—the theft or purchase of an intact nuclear weapon—is potentially terrifying, but the steps a group would have to accomplish to undertake such an attack are prohibitively difficult. Any nuclear weapons state is unlikely to sell such a weapon to a terrorist organization, as the threat of retaliation against them is so severe. Even rogue states that vehemently oppose the U.S. and have strong ties to terrorist organizations would not give or sell

[178] Ferguson, Charles D., William C. Potter, and Amy Sands. *The Four Faces of Nuclear Terrorism* New York: Routledge, 2005.

nuclear weapons to non-state actors.[179] In addition, the costs of maintaining nuclear weapons programs are high, and once a state has handed off a weapon, it can no longer control where or how it gets used. These factors make it unlikely that selling an intact weapon to a non-state group would ever benefit a state.[180] It is likely that the only scenario where these deterrents would fail is if a rogue regime felt its very existence were in danger, such as an invasion from another more powerful state. In such a situation, the regime would have nothing to lose by handing off a weapon. Short of such a drastic scenario, it is unlikely any regime would willingly give nuclear weapons to non-state actors.

The likelihood of the theft of an intact weapon is lower than other risks, and it prevented by securing the weapons. This is why many worry about Russian non-strategic nuclear weapons in Russia and in former Soviet states. While the U.S. Congress approved providing funds to the newly christened Russian Federation to move and secure its strategic nuclear weapons after the fall of the Soviet Union, this Cooperative Threat Reduction program (CTR) was not renewed by Russia in 2014. There was also never a program established specifically to handle NSNWs and according to the Nuclear Threat Initiative, Congressional Research Service, and declassified Central Intelligence Agency (CIA) reports, the actual number of Russian non-strategic weapons remains uncertain.[181] Some experts speculate that not even Russia is aware of the number and location of all its non-strategic nuclear weapons and materials it has deployed around Europe and Central Asia.[182]

The fear of a black market in complete nuclear weapons, however, does not reflect the evidence today.[183] ISIL alludes to having the ability to purchase nuclear weapons or materials from corrupt insiders in Pakistan according to the May 2015 issue of its Dabiq Magazine, but nuclear security experts like Mark Fitzpatrick of the Institute for Strategic Studies argue it is unlikely this is a real threat currently.[184] However, the A. Q. Khan network demonstrated that insiders can proliferate technology—and possibly materials—through underground markets.[185] Fortunately,

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[179] Castillo, Jasen J. "Nuclear Terrorism: Why Deterrence Still Matters." *Current History* 102, no. 668 (2003), p. 431.

[180] Jenkins, Brian Michael. *Will Terrorists Go Nuclear?* Amherst, N.Y.: Prometheus Books, 2008, p. 143.

[181] "Five Nations Believed to Hold Nonstrategic Nuclear Bombs, Experts Say." Nuclear Threat Initiative. http://www.nti.org/gsn/article/five-nations-seen-possessing-roughly-2800-nonstrategic-nuclear-weapons-experts-say/ (accessed April 11, 2016);

[182] [182] Saradzhyan, Simon. *Russia's Non-Strategic Nuclear Weapons in their Current Configuration and Posture: A Strategic Asset Or Liability*: Harvard Kennedy School, Belfer Center for Science and International Affairs, 2010.

[183] Jenkins, Brian Michael. *Will Terrorists Go Nuclear?* Amherst, N.Y.: Prometheus Books, 2008, p. 150; Fitzpatrick, Mark. *A Nuclear Trafficking Route to the Levant?*: International Institute for Strategic Studies, 08 October 2015.

[184] Saul, Heather. "Isis Claims it could Buy its First Nuclear Weapon from Pakistan within a Year." The Independent. http://www.independent.co.uk/news/world/middle-east/isis-claims-it-could-buy-its-first-nuclear-weapon-from-pakistan-within-12-months-10270525.html (accessed March 31, 2016); Fitzpatrick, Mark. *A Nuclear Trafficking Route to the Levant?*: International Institute for Strategic Studies, 08 October 2015; Crowder-Han, Minsu. *Debunking Nuclear Security Hype on the Eve of the Nuclear Security Summit*: The Bulletin of the Atomic Scientists, http://thebulletin.org/debunking-nuclear-security-hype-eve-nuclear-security-summit9214 (accessed March 25, 2016).

[185] Lawlor, Maj G. B. "The Black Sea: Center of the Nuclear Black Market." The Bulletin of the Atomic Scientists. http://thebulletin.org/black-sea-center-nuclear-black-market (accessed March 10, 2016); *IAEA Incident and Trafficking Database 2015 Fact Sheet*: International Atomic Energy Agency, 2015; "Illicit Trafficking in Weapons-Useable Nuclear Material: Still More Questions than Answers." NTI - Nuclear Threat Initiative. http://www.nti.org/analysis/articles/illicit-trafficking-weapons-useable-nuclear-material-still-more-questions-answers/ (accessed March 3, 2016).

the nuclear weapons available today are so complex that a terrorist cell would have trouble setting off one of these weapons even if it were able to steal or purchase it intact. They require expertise to use, maintain, or even to extract component materials.[186]

Similarly, it is not probable that a non-state actor could assemble a working nuclear weapon from components purchased or stolen. It would take an immense amount of technical skills and advanced equipment. This would require a number of successful high-risk thefts or purchases and the deliberate recruitment of known individuals with the necessary technical backgrounds. They would then need to assemble this weapon accurately and without any accidents. Moreover, while apocalyptic terrorist groups—like ISIL and Al Qaeda who see themselves as part of an all-encompassing global struggle—might have the willingness to take monumental risks to acquire nuclear material and manufacture some kind of nuclear device, these risks would likely prevent any specialist from assisting an outside group with any critical stage of the plot.[187] Assuming all of these hurdles are overcome, the group would then need to transport the weapon to its destination, which would present a whole new set of hurdles depending on the target.

A nuclear or radioactive weapon strong enough to do real damage would emit substantial radiation signatures and is at risk of being discovered at standard ports of entry to the country. Because of this, terrorists transporting nuclear materials or weapons would likely attempt to use less regulated methods of entry such as desolate areas along the Southern border. While the U.S. may not have total control over what crosses the U.S.-Mexican border, the cartels that operate throughout the border are well aware of all trafficking routes. While these organizations are not allies of the U.S., they have a strong incentive to prevent terrorists from using their access points. Cartels are intelligence criminal enterprises. Simply put, cooperation with a terrorist cell would be bad for business. If the cartels were found culpable of aiding a terrorist organization smuggle a nuclear weapon, they would face the full weight of U.S. anti-terrorism operations. The risk is not worth the reward. All this is to demonstrate while it is not impossible to smuggle a device or materials into the U.S., there would be numerous difficulties involved.

The third option—building and deploying an improvised nuclear device (IND) or a RED or dirty bomb—is more plausible than obtaining or building a complete nuclear weapon. However the impact of such a device would most likely be much smaller than what is pictured in most depictions of a nuclear attack. Consequently these weapons are often categorized as "weapons of mass disruption" because their effects would be more psychological than physical.[188] While it is worth maintaining security at ports and detection and reaction training for law enforcement, the likely consequences of this type of attack, combined with the difficult steps necessary for a group to complete prior to carrying it out, might not warrant the dedication of extensive additional national security or financial resources to this issue. However, this threat does call for increased consolidation and security of fissile material, especially Highly Enriched Uranium and separated Plutonium, as these would be the ideal sources for an RED.

The final category outlined is sabotage or attack on a nuclear site or facility. The United States has strong security at its various nuclear sites and receives top marks from the Nuclear Threat Initiative's ranking for its nuclear security.[189] However, emerging technologies and aging

[186] Jenkins, Brian Michael. *Will Terrorists Go Nuclear?* Amherst, N.Y.: Prometheus Books, 2008, p. 141.
[187] Levi, Michael A. *On Nuclear Terrorism* Cambridge, Mass.: Harvard University Press, 2007, p. 46.
[188] Levi, Michael A. and Kelly, Henry C. "Weapons of Mass Disruption." Scientific American. http://www.scientificamerican.com/article/weapons-of-mass-disruptio/ (accessed March 10, 2016).
[189] *"2016 NTI Nuclear Security Index Report." NTI - Nuclear Threat Initiative. http://www.nti.org/analysis/reports/2016-nti-nuclear-security-index-report/ (accessed April 1, 2016)*

nuclear infrastructure call for a re-evaluation of this issue. In particular, the threat posed by cyber-attacks conducted by both non-state actors, and especially state sponsored actors, is very serious today. This was highlighted during the IAEA 2013 International Nuclear Security Summit, the recent Nuclear Threat Initiative Nuclear Security Index, and has continued to gain attention as more and more studies are conducted on information technology security.[190]

A serious cyber-attack on a U.S. nuclear site requires a level of expertise not currently found in an average terrorist organization; however, groups like ISIL are increasingly acquiring cyber and technological expertise. In 2012, Thomas D'Agostino, then head of the National Nuclear Security Administration (NNSA), commented that the NNSA was seeing sophisticated attacks from non-state actors in addition to the onslaught of daily attacks from different state-sponsored hackers.[191]

While states have an advantage to some degree in generating offensive cyber-capabilities, capacity in the cyber realm is more about talented personnel than funding or material gains, which makes cyber more accessible to a broad range of actors. When the ability to build capacity is combined with vulnerabilities present in current U.S. cyber-security infrastructure, the threat of a non-state actor inflicting significant damage through a targeted cyber-attack is very real. It is important to note however, that the current cyber threat is still predominantly coming from state actors, with non-state actors ranking as a secondary danger.[192]

Under-secured Weapons and Materials

Concerns about under-secured nuclear materials and weapons have largely centered on sites in Russia. A 2016 CRS report on Non-strategic Nuclear Weapons stated that there are ongoing questions about, "…the safety and security of Russia's weapons and the possibility that some might be lost, stolen, or sold to another nation or group."[193] Secretary of Defense Robert Gates also echoed these same concerns in 2008 when he suggested that the Russian government did not know the numbers or locations of, "…old landmines, nuclear artillery shells, and so on."[194] The Russian government denied there were any unsecure or unaccounted weapons. Even if Russia could account for all of its non-strategic weapons, the 2016 CRS report also has concerns about NSNWs that remain at former Soviet deployment sites. According to the report, the Cooperative Reduction Program (CTR) never addressed these NSNWs, as the CTR was predominately focused on the strategic warheads.[195] According to Dr. Huban A. Gowadia, the director of the Domestic Nuclear Detection Office of the US Department of Homeland Security, the vast majority of special nuclear material interdicted in the U.S. or en route to the U.S. has originated from Russia or former

[190] *Cyber Security at Nuclear Facilities: National Approaches*: The Nuclear Threat Initiative and the Institute for Security and Safety (ISS) at the Brandenburg University of Applied Sciences, June 2015.
[191] Ibid.
[192] Wilson, Clay. *Botnets, Cybercrime, and Cyberterrorism: Vulnerabilities and Policy Issues for Congress*: Congressional Research Service, 2008 (accessed February 28, 2016).
[193] Woolf, Amy F. *Non-Strategic Nuclear Weapons*: Congressional Research Service, February 23, 2015.
[194] Pincus, Walter. "Gates Suggests New Arms Deal with Russia." The Washington Post. http://www.washingtonpost.com/wp-dyn/content/article/2008/10/28/AR2008102803314.html (accessed March 10, 2016).
[195] Woolf, Amy F. *Non-Strategic Nuclear Weapons*: Congressional Research Service, February 23, 2015.

Soviet states.[196] The seizure of such material is not always publicized, but there are no known underground sales of nuclear devices, including so-called suitcase weapons.[197] Thus, the more likely scenario for an act of nuclear terrorism is through the acquisition of nuclear material and creation of dirty bombs.[198]

The U.S. established the CTR in the early 1990s to assist Russia in moving and securing its nuclear warheads for strategic weapons within Russia. During this time the world experienced the most dangerous scenario for nuclear security: the collapse of a major nuclear state. The fall of the Soviet Union was a major event in global security, and the CTR was established to help avoid the theft and loss of material and weapons that were located across the USSR. According to the Nuclear Threat Initiative, the majority of HEU and other nuclear material on the loose today stems from thefts and losses from the 1990s shortly after the fall of the Soviet Union.[199] However, Russia chose not to renew the CTR in 2014.

The current relationship between the U.S. and Russia makes negotiating such programs, and getting funds approved for Russian assistance, very difficult. In early January 2015 it was announced that Russia halted many U.S.-Russian cooperation programs. This includes programs to facilitate nuclear security cooperation. Sam Nunn, the former Democratic senator from Georgia and an architect of the CTR, said that this development, "…greatly increases the risk of catastrophic terrorism."[200] It was reported that joint security work at eighteen Russian civilian facilities housing weapons material would cease, and another project at two facilities to convert HEU into a less dangerous form also has been stopped. Russia has also cancelled security upgrades for sites within Russia's primary "nuclear cities" where some of the largest stockpiles of HEU and plutonium are stored.[201] Russia added to tensions by boycotting the final nuclear security summit.[202] The window for limited cooperation is still open in some ways; for instance, Russian Foreign Minister Sergey Lavrov said that Russia intends, "…to focus on efforts to strengthen cooperation in the framework of the IAEA," and that they still plan to attend the IAEA conference later this year.[203]

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[196] Dr. Gowadia, Huban A. *Science and Policy Challenges in Homeland Security*. The Bush School of Government, Texas A&M, February 29, 2016.

[197] Levi, Michael A. *On Nuclear Terrorism* Cambridge, Mass.: Harvard University Press, 2007, p. 29; Sokov, Nikolai. "Russia's "Suitcase Nukes": A Reassessment." http://www.nonproliferation.org/russias-suitcase-nukes-a-reassessment/ (accessed March 3, 2016).

[198] *IAEA Incident and Trafficking Database 2015 Fact Sheet*: International Atomic Energy Agency, 2015; Mowatt-Larssen, Rolf. "Al Qaeda Weapons of Mass Destruction Threat: Hype Or Reality?" Harvard, Belfer Center for Science and International Affairs. http://belfercenter.ksg.harvard.edu/files/al-qaeda-wmd-threat.pdf (accessed March 3, 2016, 2016).

[199] "Illicit Trafficking in Weapons-Useable Nuclear Material: Still More Questions than Answers." NTI - Nuclear Threat Initiative. http://www.nti.org/analysis/articles/illicit-trafficking-weapons-useable-nuclear-material-still-more-questions-answers/ (accessed March 3, 2016).

[200] Bender, Bryan. "After Two Decades, US-Russia Nuclear Security Cooperation Becomes Casualty of Deteriorating Relations." The Boston Globe, January 19, 2015, , http://www.bostonglobe.com/news/nation/2015/01/19/after-two-decades-russia-nuclear-security-cooperation-becomes-casualty-deteriorating-relations/5nh8NbtjitUE8UqVWFIooL/story.html (accessed March 11, 2016).

[201] Ibid.

[202] Bunn, Matthew. "The Real Nuclear Nightmare when it Comes to U.S.-Russian Ties." http://nationalinterest.org/feature/the-real-nuclear-nightmare-when-it-comes-us-russian-ties-12102 (accessed March 3, 2016); Mohammed, Arshad and Kelly, Lidia. "Russia Told U.S. it Will Not Attend 2016 Nuclear Security Summit." http://www.reuters.com/article/us-nuclear-security-usa-russia-idUSKBN0IP24K20141105 (accessed March 8, 2016).

[203] Ibid.

This problem is further compounded by Russia's economic struggles as oil prices remain well below what the government needs to balance its budget. Without U.S. support, it is unlikely Russia will make much progress on the planned implementation of improved surveillance for storage sites and the detection of nuclear materials at ports and egress points in Russia to catch and deter smuggling.

International Nuclear Security Cooperation

President Obama instituted a series of nuclear security summits in 2010; the final in the series took place in Chicago at the end of March this year. These summits have included 53 nuclear states or states that house nuclear materials. Each country has made at least one national commitment to improve their domestic national security, and 90 percent of the participating states have issued statements outlining what steps will be taken to meet these security goals.[204]

In addition to increasing the information sharing and opening up important dialogues between nuclear states, the summits have made major steps towards decreasing the opportunities for nuclear terrorism and proliferation. For instance the summits led to the recovery or elimination of over 1,500 kg of HEU and separated plutonium, the reduction in the number of sites that house such materials, and the establishment of new training centers.[205] A number of states are also now implementing new nuclear security legislation, including China.[206]

The conclusion of the summits left much unfinished, however. For instance, the participating states were unable to reach an agreement on banning the use of HEU for research reactors and phasing out its use in civilian reactors.[207] This would significantly limit the number of sites where terrorists could acquire material as well as the number of sites from which materials and components can be illegally proliferated. It is also not clear if these summits will continue in the future. It is possible an international organization like the IAEA or the World Institute for Nuclear Security could incorporate the progress made within these meetings and establish some kind of regular dialogue moving forward.

OPTIONS

Option #1: Address the need to decrease the possibility of a terrorist group obtaining and deploying an IND.

The U.S. could continue to further limit the availability of nuclear materials. One goal that the recent nuclear summits were unable to fully accomplish was to agree to plans to ban production of HEU. Many countries have pledged to convert reactors to low-enriched uranium (LEU), and to consolidate what HEU they currently possess. These are positive steps. However, a substantial reduction of available HEU is possible in coming years only if the U.S. and others continue the

[204] McNamara, Joseph. *Nuclear Security Cooperation After the Summits at Risk*. Arms Control Association, March 23, 2016.
[205] McNamara, Joseph. *Nuclear Security Cooperation After the Summits at Risk*. Arms Control Association, March 23, 2016 ; Foy, Hubert. *What Path for Nuclear Security Beyond the 2016 Summit?*: The Bulletin of the Atomic Scientists, March 25, 2016..
[206] Zhang, Hui. *How China Needs to Improve its Legal Framework on Nuclear Security*: The Bulletin of the Atomic Scientists, March 24, 2016.
[207] Foy, Hubert. *What Path for Nuclear Security Beyond the 2016 Summit?*: The Bulletin of the Atomic Scientists, March 25, 2016.

discussion. With less HEU at risk of theft, the chances of a terrorist group making a powerful IND are substantially lower. Thus, the U.S. should continue both bilateral and multilateral discussions about banning the production of HEU.

Option #2: Make public overtures regarding its own nuclear security measures.

As with the U.S. unilateral draw down during the Cold War, our own actions could spur reciprocal actions by Russia if only to save face or gain political points. Such demonstrations of security could also help deter terrorists from attempting a nuclear attack on the U.S. by making such a feat appear prohibitively difficult. If this is accomplished, while terrorists may still seek to carry out an attack in a more accessible manner, it is unlikely to achieve the high consequences of a nuclear plot.

Option #3: Consider future arms agreements for NSNWs for the future

While current tensions may preclude immediate plans for future arms agreements, it has been said the varying sizes of non-strategic weapons make them extensively difficult to track and thus agreements on these weapons lack strong verification capabilities. Thus, the U.S. should consider discussions with Russia, whether through bilateral or multilateral forums, to implement arms agreements for NSNWs in the future. Although poor bilateral relations between the U.S. and Russia seem to preclude this possibility currently, the U.S. could consider building confidence from limited areas of cooperation to eventually bridge this discussion. An agreement between the U.S. and Russia, the two predominate nuclear powers, could also have implications for the NSNW arsenals of smaller nuclear powers, as well.

NUCLEAR CRISIS MANAGEMENT

Cold War era nuclear crises that took place between U.S. and Russia have received extensive attention and analysis. In addition, various planners and academics have examined possible regional crises involving the U.S. as an extender of deterrence. However, there remains a third scenario which has gone unaddressed in policy and literature. This is a crisis in which the U.S. is a third party state. Nuclear proliferation and technological advances are raising the global risk of this form of nuclear crisis, as smaller states are acquiring their own nuclear capabilities. The U.S. may not be able to avoid becoming involved in such a crisis. Regardless of official alliances, failing to do so could have catastrophic outcomes, particularly in the event of a nuclear crisis stemming from a military conflict. In addition, the results of the 2011 Fukushima accident in Japan prove that even well-equipped countries dealing with a nuclear crisis will likely require international and U.S. assistance.[208] Because of this rising threat, the U.S. should plan for managing nuclear crises involving two non-allied states. This section will discuss elements of crisis management in past nuclear crises utilizing the example of the 2001-2002 India-Pakistan standoff. It will then explore elements of the global order that present a high level of risk for

[208] *The Fukushima Nuclear Accident and Crisis Management: Lessons for Japan-U.S. Alliance Cooperation*. The Sasakawa Peace Foundation, 2012.

nuclear crises, and suggest three options that could inform a framework for nuclear crisis management going forward.

Patrick Morgan, an expert of regional security management, defines the onset of a crisis as a situation in which "…specific sources of hostile intent have been identified by one state with reference to another, threats have been exchanged, and responses must now be decided upon."[209] In such situations, the pressure to react quickly escalates as the actors involved have imperfect information about their adversary's intent and capabilities. Although each crisis situation will require a unique resolution, there are several lessons that have emerged from the history of crisis management: the importance of transparent communication, the need for increased time in decision making, and the necessity of politically-neutral resolution options.

Transparent Communication

Transparent communication is critical for signaling and avoiding misperceptions and therefore is an important element in avoiding unintended escalation. Although modern technological advances aid communications in many ways, these advances also present a significant risk for crisis escalation as communications systems become increasingly complex. Cyber-attacks could significantly compromise these systems. For example, Russia has employed advanced cyber capabilities that have jammed communications in Ukraine and Syria.[210] Colonel Jeffrey Church, the U.S. Army's chief of electronic warfare, notes that the United States has only managed to train a few hundred troops in this new arena, much less than China or Russia.[211] In the event of a conflict in which countries may target each other's communication nodes to impede the effectiveness of combat, the ability of the U.S. to communicate its intentions though signaling could be degraded.

Expanded Decision-Making Timelines

Expanded decision-making timelines are equally crucial to crisis management because time pressures often result in rapid and unplanned actions with unforeseeable consequences. One of the most famous examples of this is the escalation that led to the First World War. Advances in military technology and experience from conflicts in the late 19th century indicated that prompt mobilizations and attacks would lead to success in military conflicts. Reducing the pressure and incentives for leaders to act quickly would increase options for crisis management.

Politically Neutral Resolution Options

Politically neutral resolution options lead to de-escalation far more rapidly than politically charged solutions that favor one side over the other. It is crucial to negotiate options that do not back either side into a corner from which there is no retreat.[212] For example, in the Cuban Missile

[209] Stokes, Mark. *Nuclear Weapons Security Crises: What does History Teach?*: Strategic Studies Institute, 2013, p. 65

[210] McLeary, Paul. "Russia's Winning the Electronic War." Foreign Policy. http://foreignpolicy.com/2015/10/21/russia-winning-the-electronic-war (accessed March 1, 2016).

[211] Ibid.

[212] Cimbala, Stephen J. "Nuclear Crisis Management and "Cyberwar": Phishing for Trouble?" *Strategic Studies Quarterly* 5, no. 1 (2011): 117, http://www.au.af.mil/au/ssq/2011/spring/cimbala.pdf (accessed March 03, 2016), p. 122.

Crisis President Kennedy offered Soviet Premier Khrushchev a way to reverse overextended missile deployments to Cuba without hurting the Soviet position. In exchange for the Soviets removing their missiles from Cuba, President Kennedy stated that the United States would not pursue further military aggression against Cuba and privately pledged he would dismantle Jupiter medium-range ballistic missiles deployed among NATO allies.[213] This option allowed both the United States and the Soviet Union to maintain their power positions while presenting a means to de-escalate a potential conflict. In potential future cases with states like Pakistan and India, it will also be critical that each can sell the resolution to their domestic populations politically, in order to ensure the same crises will not reemerge once the third party mediator is gone.

CASE STUDY: INDIA AND PAKISTAN

During the 2001-2002 India-Pakistan standoff, the U.S. employed all three crisis management tools to prevent the escalation of a highly volatile situation between two nuclear-armed states. After Lashkar-e-Taiba (LeT), a terrorist organization based in Pakistan, attacked the Indian Parliament in December of 2001, India mobilized troops along its border with Pakistan. Unsurprisingly, Pakistan responded in kind. Needing to address the growing crisis in South Asia, the Bush administration designated Secretary of State Colin Powell and Deputy Secretary Richard Armitage as the principal managers of the crisis.[214] Assigning two principal individuals to these roles helped to create clear lines of authority, which facilitated the U.S. decision-making process during the course of the crisis.

With Pakistani and Indian forces mobilized on each other's border and both states refusing to negotiate directly, the U.S. had to bridge the gap in communication to enable the two sides to resolve the conflict. For example, the United States strongly influenced Pakistani President Pervez Musharraf to publicly advocate for the elimination of LeT from Pakistan's borders, which gave India the public credibility necessary to de-escalate the conflict. Likewise, Powell and Armitage used diplomatic pressure and even the input of China and Russia, to buy more time for both sides to make decisions. Stimson Center co-founder Michael Krepon and former U.S. Intelligence Community expert on South Asia Polly Nayak argue that the mediation of the United States, the EU, Russia, and China lowered India's willingness to escalate the conflict.[215] These measures eventually allowed India and Pakistan to back down from their military positions and gave both an avenue for justifying these actions in the eyes of their domestic populations.

This example demonstrates the potential of planning and crisis management techniques to de-escalate a nuclear crisis situation, even when the U.S. is not a direct player in the standoff. There are two further implications for U.S. crisis management in the future. First, securing a means of communication between the United States and a potential crisis party will always be critical for any resolution. The United States had to play a decisive role in resolving the India-Pakistan nuclear crisis because both sides refused to communicate with each other without an intermediary. Second, the importance of establishing bilateral contacts is critical to finding specific parties for negotiation. For example, Krepon and Nayak argue that Indian officials were willing to listen to American advice in the crisis only because relations between the United States and India had

[213] Ibid.
[214] Krepon, Michael and Polly Nayak. *U.S. Crisis Management in South Asia's Peak Crisis*: Stimson Center, September 2006, p. 25.
[215] Ibid.

improved recently and embassy officials in both India and Pakistan had established useful contacts for managing the crisis.[216]

It is also important to consider the role that third parties could play in a future crisis management situation. For example, in the 2001-2002 crisis, China worked to restrain its traditional ally Pakistan while Russia had a similar restraining role on India, a country with which it has traditionally had warm relations. In future crises, it could prove crucially important to draw on the resources of third party actors to manage crisis situations. Although each specific conflict will require its own specific approach and resolution, these general principles could serve as a preliminary framework for the management of a crisis involving nuclear states.

OPTIONS

The current global nuclear status quo remains tense with both unresolved and emerging conflicts among nuclear powers. When considering the global order, possibilities for a nuclear crisis emerges from ongoing tensions between India and Pakistan, conflicts between the United States and Russia in Eastern Europe, and threats made by North Korea. Although only the 2001 India-Pakistan case study was examined, the lessons learned in the historical overview of crisis management and the implications of Southeast Asian crises provide insights into policy options for each scenario.

Options for Managing an India-Pakistan Crisis

Maintain and Improve Bilateral Individual Relationships

U.S. leaders must remain committed to establishing individual relationships with both high-level Indian and Pakistani officials. Like with Robert Gates and Colin Powell in the 2001-2002 crises, personal diplomacy from top U.S. officials has historically played an active role in resolving crises between India and Pakistan. Although cultivating personal relationships sounds intuitive, it takes intentional effort by all sides. For example, mistrust between Pakistan and the United States has remained high in recent years with the United States accusing Pakistan of harboring extremists; in turn, Pakistan has condemned U.S. drone strikes in its territory. Regardless of broader bilateral challenges, the United States must retain robust personal ties with both of these countries to ensure its ability to influence crises between them.

Improve Cooperation from Regional Allies

The U.S. ought to consider the likely involvement of other actors in the event of a conflict between India and Pakistan. These include traditional allies and even adversaries of the United States. For example, both the United Kingdom and Russia have warm diplomatic relations with India. In the past, leverage from other parties has proven helpful in increasing crisis stability between India and Pakistan, and the United States ought to consider regular discussions with allies of both of these states about crisis management techniques. Involving other parties in crisis

[216] Ibid.

management can greatly improve the chances of a politically neutral solution to the crisis by opening additional avenues for dialogue and internationalizing the conflict beyond the borders of India and Pakistan.

Option for Managing a U.S.-Russia Crisis

Improve Resilience of U.S. Communications Technologies

In the midst of a potential crisis between Russia and the United States, cyber capabilities add further risks to existing conventional or NSNW threats. The United States must ensure robust communication networks that would remain resilient in the face of cyber challenges so that U.S. forces can properly communicate with each other and accurately signal to their adversary. This will require further research and development concerning cyber vulnerabilities in communications technologies. Ideally, the U.S. government could work with carefully vetted private sector actors on improving these technologies. Furthermore, the United States and Russia could ideally rule out cyber-attacks against certain automatically escalatory targets, such as nuclear weapons infrastructure or even the other side's communications systems, to ameliorate future crisis situations. Although this seems unlikely in the short term with fraught relations between the U.S. and Russia, the U.S. could keep this option on the table for future discussions.

Option for Managing a Crisis on the Korean Peninsula

Coordinate Crisis Management Strategies on the Korean Peninsula with China and Russia

A crisis spearheaded by North Korea is likely to be the most difficult to manage. Communications between the United States and North Korea are already limited, and dialogue in a nuclear crisis may well have to go through Chinese or Russian intermediaries. In addition, North Korea would likely attempt to utilize cyber-attacks in conjunction with threats of nuclear attack and it is possible that U.S. communication networks would be targeted. Finally, the volatile nature of the North Korean regime means that it is likely that decision-making time for the U.S. would be short, and avenues for slowing down the crisis would be limited. Because of this, it is important that the U.S. carefully consider creating dialogues and avenues for cooperation with Russia and China in advance. Establishing a strategy for nuclear crisis management to deal with a North Korean nuclear strike, either threatened or actual, would be the most effective way of developing communication channels and maximizing decision making time available.

CONCLUSION

In light of global developments since 2010, it is important that U.S. policymakers return the focus of the next NPR to state threats. In particular, the developing capabilities of Russia, China, North Korea, and Iran pose ongoing challenges to the ability of the U.S. to extend deterrence and assure allies across the globe. While nuclear terrorism and nuclear proliferation remain serious concerns, they are considered to be low probability, high consequence events. Shifts in the nuclear and strategic postures of potential U.S. adversaries, however, could have very real consequences for U.S. and global security and will inform our own nuclear posture moving forward.

Most prominently, developments in Europe and Asia have created a need for the U.S. to assess how it would respond to nuclear threats or the actual use of nuclear weapons. In Europe,

the U.S. must determine the best way to counter Russia's assertiveness while addressing its "escalate-to-deescalate" doctrine, which threatens the use of nuclear weapons against a conventionally superior opponent. The U.S. should consider what conventional and nuclear capabilities it needs to deploy to Europe to deter Russia from ever seeking to utilize this doctrine. The threat of a nuclear conflict is also a concern in Asia, especially regarding the continued development North Korea's nuclear program. If a North Korean nuclear weapon is ever used, the U.S. must determine whether it would respond with nuclear or conventional arms. In both Europe and Asia, it is clear that the U.S. must weigh its nuclear and its conventional options to respond to nuclear threats. As both of these capabilities continue to play a prominent role in U.S deterrence, the U.S. should consider moving from a nuclear posture review to a *strategic* posture review.

Modernization efforts in Russia and China bring renewed attention to modernization efforts at home. This report outline options for this program that include the modernization of the U.S. NSNW arsenal in Europe to provide a broader range of options to potential Russian aggression. In Asia, the United States must consider responses to China's rapid nuclear modernization, especially in conjunction with broader concerns about its aggression in the East and South China Seas. For the United States, this debate largely rests on whether the United States will accept mutual nuclear vulnerability with China. Accepting mutual vulnerability has the benefit of inviting mutual nuclear stability, but it has the risk of emboldening Chinese aggression in the Asia-Pacific and undermining assurances to regional U.S. allies.

The JCPOA has eliminated the immediacy of the Iran nuclear threat, but concerns for the U.S. remain. The U.S. must first ensure that the JCPOA is effectively implemented. Even under the assumption that Iran does abide by its JCPOA's obligations, the U.S. must still consider a future nuclear Iran, as it is possible Iran will return to its nuclear ambitions at a later date. To hedge against this possibility, the report considers a number of options which most prominently features bringing the GCC under the U.S. nuclear security umbrella. This move would signal to Iran that it will gain no advantage from possessing nuclear weapons. Ideally, this would deter both Iran and American allies in the Middle East from pursuing nuclear weapons.

Although this report departs from the discussion of nuclear terrorism as the dominant threat to the United States. However, securing nuclear materials, weapons, and technology are fundamental to preventing acts of nuclear terrorism and proliferation and this work remains critical. Ultimately, this report supports the current plans to increase nuclear security at home and abroad and urges the government to continue these efforts.

An emerging and crucial element of nuclear security not addressed in 2010 but discussed in this report is the threat of cyber to the overall U.S. nuclear architecture. At home the U.S. needs to ensure that no cyber attack causes damage to a nuclear facility as such an attack could have wide ranging implications for U.S. nuclear security and the credibility of the U.S. nuclear force overall. Abroad, the United States must work with allies with advanced cyber capabilities to jointly improve cyber defenses in at U.S. facilities and worldwide

Finally, this report briefly outlines a framework for future U.S. nuclear crisis management. This includes transparent communication between all parties in a crisis situation, increasing decision-making time, and the creation of politically neutral de-escalation options that allow both sides to avoid politically unfavorable terms. The United States is a global leader, and whether or not it is a party to the conflict, it will need to be involved in the resolution of a nuclear crisis in order to maintain and bolster the non-use norm.

Overall, the fundamental conclusion of this research and report is that the future U.S. nuclear posture review must address shifting state capabilities and nuclear doctrines. Nuclear

security, including countering nuclear terrorism and nuclear proliferation, remains an important priority but should not determine the direction of our nuclear posture and development. Each region and crisis will need a tailored response as extended deterrence challenges are going to be a central obstacle to stability and security; however, these issues do not emerge in a vacuum. For example, the posture and rhetoric we use in Asia will have implications for the European and Middle Eastern theaters. It is critical that steps to mitigate a potential threat or crisis in one area do not undermine our posture in another. The challenge becomes designing a truly global nuclear posture that increases the security of the United States and the world.

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