

Missile Defenses and Strategic Nuclear Arms Control

Technology and Policy Challenges

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Missile defenses continue to pose technical and policy challenges to issues of US-Russia and North Atlantic Treaty Organization (NATO)–Russian security policy. For opponents of ballistic missile defense (BMD), such systems destabilize the soundness of Russo-American deterrence. To address this concern, as well as others, at the 2010 Lisbon summit, NATO and Russian leaders agreed to seek common ground on European missile defenses. However, the return of Vladimir Putin to the Russian presidency in 2012 marked a new assertiveness in Russian foreign and defense policy, including arms control. Russia's occupation and later annexation of Crimea in March 2014 caused the United States and NATO to suspend, at least temporarily, military-to-military cooperation with Russia, including discussions about European missile defenses.¹ Prospects for agreement on missile defenses, or on further reductions in US and Russian operationally deployed strategic nuclear weapons in a post–New Strategic Arms Reduction Treaty (START), appeared dismal following the Ukrainian crisis.

In the discussion that follows, we first consider some of the political and military background pertinent to the relationship between Russian and American strategic nuclear arms limitations and missile defense. Second, we perform analyses for several cases

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of candidate “New START-minus” agreements allegedly under study by the Obama administration, including the possible implications of missile defenses for deterrence stability under post–New START reductions. Third, we draw conclusions about how ambitious the United States and Russia can be in reducing strategic nuclear forces, not only in terms of their own security and defense requirements but also with respect to the need for involvement of other nuclear weapons states.

Nuclear Arms Reduction and Missile Defenses

President Obama has reportedly tasked the Pentagon to develop planning scenarios for further reductions in American strategic nuclear forces. These scenarios include three options for further cuts in the numbers of operationally deployed strategic nuclear weapons, below New START levels: 1,100; 800; or 400 weapons.² The range of options provides for small, medium, and large departures from New START limits. The most ambitious among these options will also require cooperation between Russia and the United States as well as among other nuclear weapons states. Whereas, for example, one might imagine the United States and Russia reaching agreement on a limit of 1,100 or 1,000 deployed strategic nuclear weapons without third- or “nth”-party participation, the political baggage for more drastic limitations would be a hard sell within the American and Russian national security establishments—unless, or until, other nuclear weapons states were brought into the agreement. The departure from a two-sided to a multisided negotiating forum for nuclear arms reductions presents both political and military challenges to governments, especially for their defense planners and arms control negotiators.

Evaluation of the political or military value of missile defenses in current and prospective policy terms requires that we acknowledge new possibilities and new dangers.³ Compared to their weaponry of the Cold War era, the United States and Russia now have smaller numbers of operationally deployed strategic nuclear devices. In addition, antimissile defense technologies are of interest not only to the United States and, potentially, Russia but also to other states that feel threatened by the spread of ballistic missiles outside Europe. For example, although its government would prefer not to join the ranks of nuclear weapons states or enter into a regional nuclear arms race, Japan is nevertheless very interested in antimissile defenses. It is already cooperating with the United States in developing and deploying theater missile defenses for its state territory and contiguous waters. This stance is not unreasonable from Japan’s perspective, considering its proximity to North Korea, China, and other Asian nuclear powers. On the one hand, for countries like Japan or South Korea, missile defenses might provide an alternative “deterrent by denial” instead of a nuclear deterrent by threat of unacceptable second-strike retaliation. Antimissile defenses could also serve as an insurance policy against accidental launches or unauthorized rogue attacks. On the other hand, missile defenses have also complicated the Russo-American relationship with respect to the eventual prospects for nuclear arms control and disarmament. At first, President George W. Bush’s announcement in 2001 to withdraw from the Anti-Ballistic Missile Treaty did not draw returning fire from the

government of President Putin. To the contrary, in 2002 the United States and Russia concluded the Strategic Offensive Reductions Treaty (SORT), which called for the two states to reduce their numbers of operationally deployed intercontinental weapons to within a range of 1,700 to 2,200 each by 2012. Of course, SORT was later superseded by New START, but SORT was an intriguing way station. Unlikely bedfellows from the standpoint of political ideology, Bush and Putin nevertheless accomplished significant nuclear reductions with SORT, compared to previous levels. They did so despite Russia's clear policy statements then and subsequently that its strategic nuclear deterrent was the military backbone of its international security and great-power status.⁴

During the second terms of presidents Bush and Putin, however, the political winds shifted, and Russia used the diplomatic demarche over the Bush plan to deploy elements of a US global missile defense system in Poland and the Czech Republic. Russia's objections to Bush's European missile defense plan were as much political as they were military. Russia disliked the presence of US missile defenses so close to its borders and in a former Soviet satellite that Russia regarded as part of its sphere of special interest. The years 2007 and 2008 were also times of jockeying for power and position within the Kremlin as the arrangements for succession to President Putin were being worked out. Putin's administration took a hard line against American missile defenses in Europe until the departure of the Bush administration and the arrival of the Obama administration, along with its "reset" policy. As Pavel Podvig has noted, "As it turns out, missile defense is a very personal subject for the Russian president, who spoke passionately about it during his recent campaign. This passion, however, serves a pragmatic political purpose: It paints a picture of Russia as under siege, which helps deflect challenges to the legitimacy of the Russian political system."⁵

The Obama reset led to the conclusion of the New START agreement on offensive force reductions and to a temporary thaw in US-Russia and Russia-NATO relations on the issue of missile defenses.⁶ But the thaw was temporary, and animosity over this issue returned in 2011–12 as the Obama missile defense plan for Europe became clearer in its implications and as American and Russian presidential elections loomed larger.⁷

US secretary of defense Chuck Hagel announced in 2013 that the Pentagon planned to cancel plans for the fourth phase of the European Phased Adaptive Approach, regarded as the one most objectionable to Russia as a potential neutralizer of its nuclear deterrent. Neither President Putin nor his military leadership was mollified by this decision. Russia continued to demand either a change in the American plan or a Russian level of involvement and participation in designing the European BMD system that satisfied its nervous military leaders and politicians as to NATO intentions and capabilities. Russian leaders have indicated that if they are dissatisfied with respect to European missile defenses, Russia will decline further cooperation in offensive nuclear arms reductions and possibly deploy missiles capable of launching nonstrategic nuclear weapons closer to Russia's borders with NATO.⁸ A presentation by the Russian General Staff to a conference in Moscow in the spring of 2012 summarized the differences between Russian and NATO proposals. As Stephen J. Blank has pointed out, influential Russian policy makers

and military analysts have regarded past US-Russia dialogue on strategic nuclear arms control as a net “positive” for several reasons. First, it helps commit the United States to an arms control paradigm of mutually assured destruction or assured retaliation based on offensive forces. Second, it projects the global impression of US-Russia nuclear parity regardless of the ups and downs of Russia’s military modernization. Third, the impression of nuclear-strategic parity with the United States has spillover diplomatic benefits that support Russia’s self-portrait for international audiences.⁹ That portrait emphasizes Russia’s status as a major power in the emerging multipolar international system that will eventually displace a unipolar American dominance of the post-Cold War years. Although it might seem contradictory, according to some interpretations of international relations theory, in this case the second point supports the third. The appearance of nuclear-strategic parity supports Russia’s perceived quest for a multipolar international system in which the United States is less influential and Russia more so.

A related technical issue in a two-sided NATO-Russia deployment of advanced antimissile and air defenses is the problem of defense suppression. To contribute to deterrence by denial, defenses would have to be survivable against preemptive attack by defense suppression forces.¹⁰ Like defenses, those forces could be based (at least theoretically) in a variety of ways, including on land, at sea, in the air, or in space—depending on the state of weapons technology and launchers. In a two-sided deterrence competition with respect to strategic nuclear forces, each side will estimate the survivability of its offensive forces, strategic antimissile and air defenses, and defense suppression forces.¹¹ With present technology, defense suppression missions might be carried out by antisatellite weapons based terrestrially or airborne; by kinetic or cyber attacks on the command, control, communications, and intelligence systems supporting defenses; or by submarine-launched ballistic missiles or stealthy cruise missiles ahead of later and larger attacks on forces.

If either side’s defenses were perceived as vulnerable to prompt defense suppression, a situation of mutually reinforcing fears of antidefensive first strikes might lead to mistaken or deliberate strikes against the other side’s defenses—or against its defense suppression weapons, arguing that those weapons constitute a standing threat to defenses designed to protect one’s own values, not to harm others. As Secretary of Defense Ashton B. Carter observes,

A BMD deployment is itself a prime target, and the system is clearly useless if it can easily be destroyed. The BMD need not be absolutely survivable, but the offense must pay a high enough price to destroy the defense that such a tactic is unattractive. The defense can of course defend itself, but attack on the defense remains for most deployment schemes the most effective tactic for the offense and hence the weakest link in the defense.¹²

Thus, a relationship of deterrence or dissuasion between two powers with strategic nuclear forces, defenses, and defense suppression forces might yield multiple operational and strategic approaches.

Regardless of the military and technical obstacles to NATO-Russia cooperation on missile defenses and nuclear arms reductions, political factors may be even more important. The policy statements of Russian leaders continue to speak of NATO as a danger to national security.¹³ Russia is especially sensitive to NATO's reach into former Soviet—and now extended Russian—security space, where Russia claims a privileged interest.¹⁴ These sensitivities to NATO visibility in post-Soviet space that borders or is near to Russia extend to any plans for NATO land-based interceptors, radars, or other components of a European missile defense plan. As Jacob W. Kipp comments, the distinction between Russian “reform of the armed forces” and “military reform” is closely related to the issue of future war as Russian military forecasters see it:

On the one hand, reform of the Armed Forces refers to the transformation of the military forces belonging to the Russian Ministry of Defense and involves both downsizing the force and transforming it into a force that will meet the needs and requirements of Russia in the post-Cold War era. Military reform, on the other hand, is a more all-embracing process which encompasses all the military and paramilitary formations of the Russian state and addresses the core political, economic, and social questions attached to raising, sustaining, training, arming, deploying, and employing the military as an element of Russian national power.¹⁵

Therefore, in the minds of some risk-averse Russian military planners, missile defense nullification technologies might constitute a necessary part of their deterrent, despite US claims that present BMD technologies are directed only toward regional threats such as those posed by Iran and North Korea. Russia has also responded with offsetting or balancing moves, including plans for offensive weapons with BMD countermeasures, and improvements in Russian antimissile and air defense systems already deployed.¹⁶

NATO-Russian cooperation on missile defense is a necessary condition for the two entities' improved collaboration on nuclear nonproliferation. Although Russian and American perspectives on preventing the spread of nuclear weapons are not identical, they are potentially convergent on some important issues. Russia does not want to encourage such a spread in general but takes a selective approach to dealing with miscreant potential or actual proliferators. The United States, though, is more likely to oppose categorically the entry of any new states into the club of nuclear weapons states and insists on reversing North Korea's membership.

These differences in perspective are not necessarily insurmountable obstacles to Russo-American cooperation on nuclear nonproliferation. US-Russia disagreements are likely to be more about tactics than about the seriousness of the threat posed by a nuclear Iran or by other Middle Eastern states reacting to an apparent Iranian nuclear weapons capability. Here the missile defense issue intersects with the nonproliferation concerns of both the United States and Russia. The United States sees the European missile defense system as contributing to nonproliferation by discouraging the spread of nuclear weapons without requiring aggressive counterproliferation measures—such as the bombing of nuclear weapons complexes and nuclear infrastructure or the imposition of regime change by military intervention. Russia fears that a NATO missile defense system “good enough”

to deter or deflect an attack from Iran or other regional nuclear powers could grow into a larger system capable of nullifying its deterrent.

This three-way entanglement among offensive nuclear arms reductions, antimissile defenses, and nonproliferation posed challenges to US-Russian and Russian-NATO security cooperation during President Obama's second term. How steep is this mountain? The next section discusses the parameters of alternative post-New START regimes and their implications.

Analysis and Methodology

Measuring the Problem

Nuclear arms control is an aspect of military strategy and national security policy, not a thing in itself. US and Russian decisions about nuclear arms reductions also have implications for other states in the international system—especially for current or aspiring nuclear weapons states. On the one hand, the gap between American and Russian capabilities and those of everyone else helps to impose some predictability and discipline on international practices related to arms control and nonproliferation. On the other hand, the continuing reliance by the United States and Russia on nuclear weapons and nuclear deterrence encourages other nuclear weapons states to move cautiously on disarmament. It also advertises the putative value of nuclear weapons for deterrence, defense, and diplomacy.

Could Russia and the United States, given favorable political conditions, reduce their numbers of operationally deployed strategic nuclear weapons below New START levels and still fulfill their national security objectives? The obvious answer to this question is maybe. However, the question “how far?” is complicated. The step from the New START upper limit of 1,550 deployed warheads to some 1,000 is an incremental one that would presumably involve no major changes in roles, missions, or force structure. Below that level, to a limit of 800 or 400 deployed weapons, difficult trade-offs may ensue for military planners and for proponents of further accomplishments in nuclear arms control and disarmament.

We examine in more detail the implications of US-Russian strategic nuclear force reductions to various levels in the analysis that follows.¹⁷ Notional force structures for the period 2018–20 are posited for the two states, and those force structures are subjected to nuclear force exchange modeling.¹⁸ Each state is assigned a balanced triad of strategic nuclear forces deployed on intercontinental ballistic missiles, submarine-launched ballistic missiles, and heavy bombers. The performances of each Russian and American force for each level of deployment are analyzed under each of four operational conditions: (1) forces are on generated alert and launched on warning of attack (Gen/LOW), (2) forces are on generated alert and riding out the attack before retaliating (Gen/RO), (3) forces

are on day-to-day alert and launched on warning (Day/LOW), and (4) forces are on day-to-day alert and riding out the attack (Day/RO).

For each simulation at benchmark maximum deployment levels of 1,550; 1,000; or 500 strategic nuclear weapons for each state, an alternative scenario is postulated with missile defenses added into the equation for both states. This step poses considerable challenges to the investigator since no one really knows how well strategic antimissile weapons will perform against prospective attackers. For heuristic purposes, we assigned each state a combination of antimissile and anti-air defenses capable of a range of attrition against attacking offenses: Phase I defenses successfully intercept or otherwise deflect at least 20 percent of opposed second-strike retaliating warheads; Phase II defenses, at least 40 percent; Phase III, at least 60 percent; and Phase IV, at least 80 percent

Data Analysis and Findings

Figures 1–6 summarize the forces in the analysis and the outcomes for each of the nuclear force exchanges. Figures 1 through 3 show the numbers of retaliating warheads for maximum deployments of 1,550; 1,000; and 500 warheads, respectively, without defenses. Figures 4 through 6 add antimissile and anti-air defenses (combined) into the equation using the model previously described.

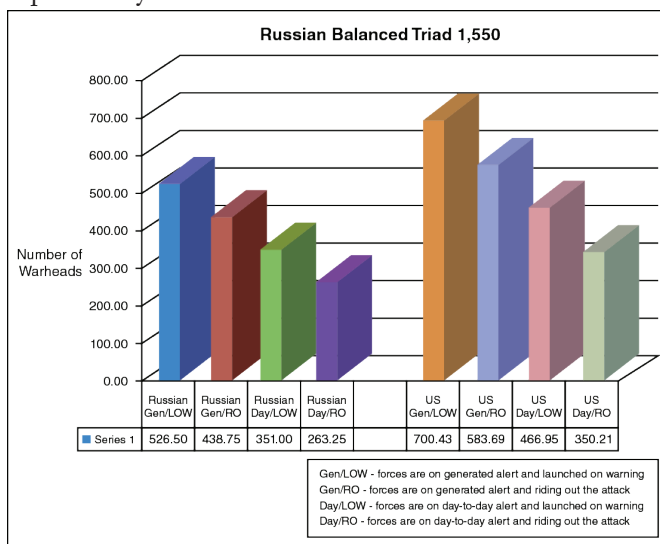


Figure 1. US-Russia surviving and retaliating warheads: 1,550 deployment limit

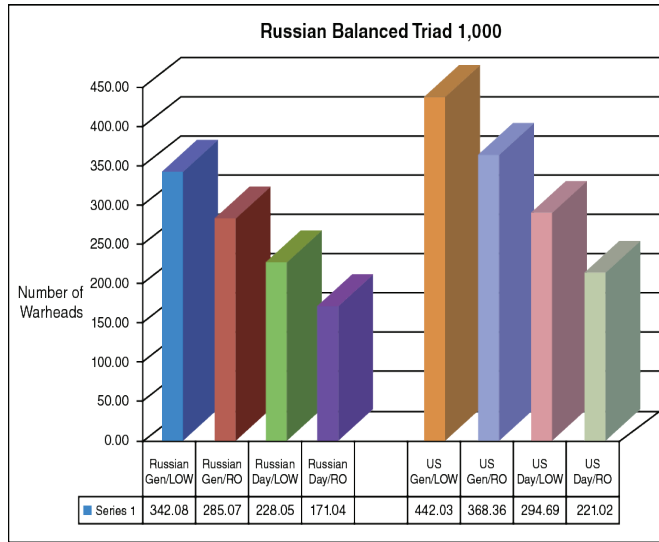


Figure 2. US-Russia surviving and retaliating warheads: 1,000 deployment limit

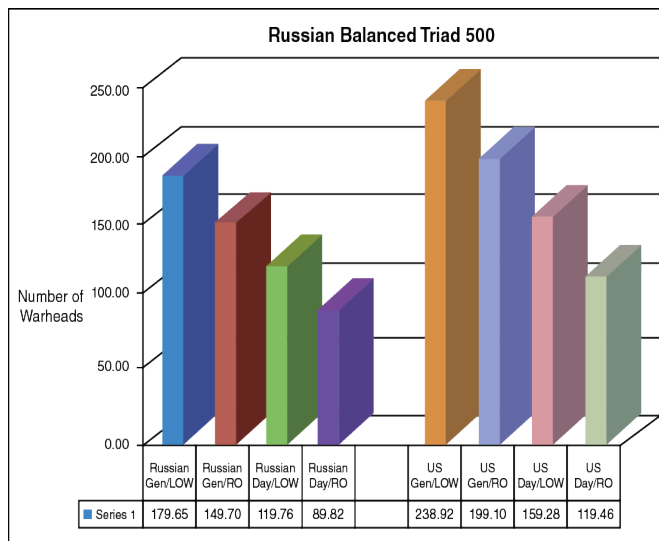


Figure 3. US-Russia surviving and retaliating warheads: 500 deployment limit

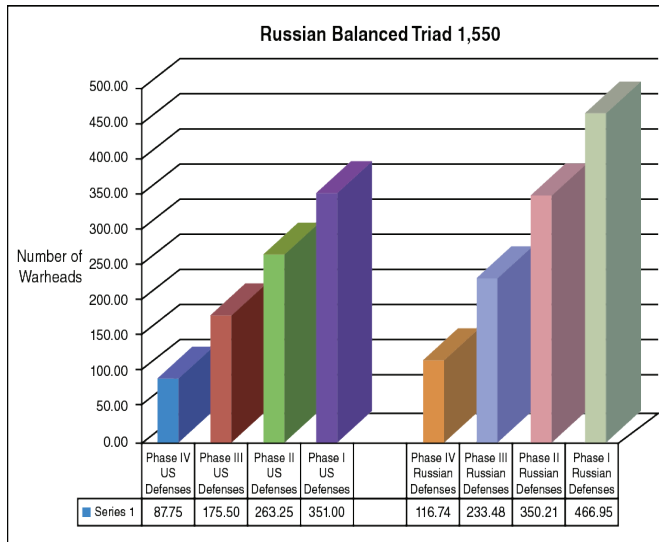


Figure 4. US-Russia surviving and retaliating warheads versus defenses: 1,550 deployment limit

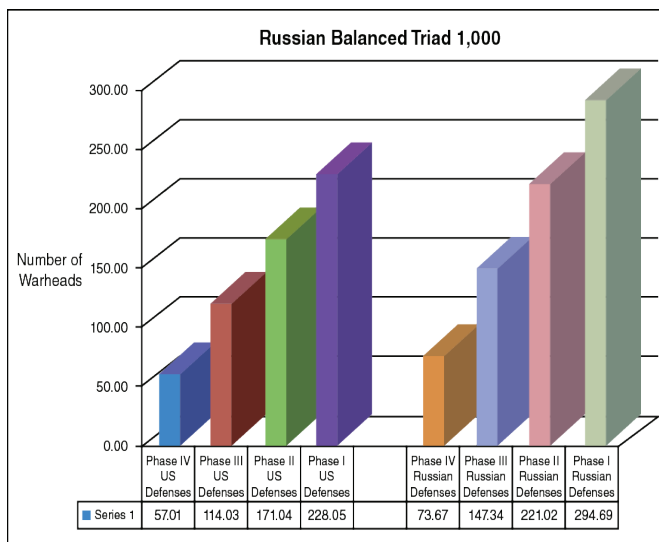


Figure 5. US-Russia surviving and retaliating warheads versus defenses: 1,000 deployment limit

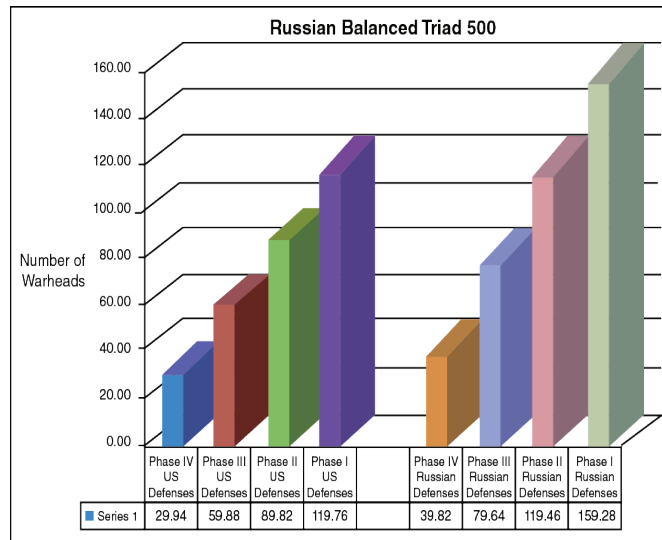


Figure 6. US-Russia surviving and retaliating warheads versus defenses: 500 deployment limit

If these are the relevant numbers, what inferences do they suggest? First, both Russia and the United States can fulfill their deterrent and defense missions at deployment levels below New START-agreed figures. Even the 500-weapon limit for the two states includes a considerable amount of retaliatory destruction, especially if weapons are concentrated against cities or other “soft” targets. Second, force structures do matter. The mix of land- and sea-based missiles and bombers deployed by either state can contribute to crisis and deterrence stability or detract from it. In particular, when survivability depends upon launch on warning, the potential for nuclear crisis instability increases. For Russia, this fact makes it imperative that its sea-based nuclear deterrent be rebooted with the construction of a new class of ballistic missile submarines and with a reliable new submarine-launched ballistic missile—as called for in past and present plans.

Third, as forces descend the ladder from 1,550 to 500 operationally deployed weapons, the options for nuclear target planners will be progressively more restricted. A deployed force at or below 500 weapons invites an almost exclusive focus on counter-city or countervalue targeting. Target plans emphasizing the killing of people instead of the destruction of opposing forces might be repugnant on ethical grounds. A possible alternative to counter-city targeting is to emphasize the targeting of defense-related and other critical infrastructure. An infrastructure-emphatic targeting plan would still kill many civilians but perhaps not so deliberately as would attacks targeted against populations.

Fourth, the United States or Russia will require some persuading to agree to reductions below the 1,000 operationally deployed strategic nuclear weapons limit unless the additional reductions are discussed on a multilateral basis that includes the other nuclear weapons states. The United States and Russia will have mixed motives in this regard: on the one hand, improving the security of their relationship and disposing of unnecessary nuclear weapons; on the other hand, maintaining their role as the dominant nuclear

weapons states unless, or until, other countries have committed to serious and verifiable reductions of their own. Bringing the major nuclear weapons states of Asia into this multilateral agreement will be crucial.

Fifth, missile defenses figure ambiguously into this mix of possibilities for Russian-American offensive nuclear force reductions. US missile defenses provide talking points for Russian politicians and defense hawks, but Russians should not deceive themselves by overselling the performances of emerging US defense technologies. For this decade, at least, the European Phased Adaptive Approach or the national missile defenses deployed in the continental United States can mitigate the consequences of small nuclear attacks. But exclusive theater or strategic antimissile defenses against larger attacks will require breakthroughs in technology development and in the affordable deployment of new weapons and new launch platforms. Doubtless there are some innovative ideas about missile defenses now incubating in research laboratories and think tanks.¹⁹ Nevertheless, the offense-defense arithmetic in nuclear scenarios does not favor the defender because even a few nuclear weapons can do so much infernal damage.

Conclusions

Missile defenses pose technical and policy challenges for nuclear deterrence and arms control, but they are not insurmountable. The technical aspect of missile defenses is whether they can continue to improve their performance envelopes and marginal-cost effectiveness, relative to offensive ballistic missiles and bomber-delivered weapons. US military planners already recognize that current and future long-range-strike platforms will be opposed by increasingly competent air and missile defenses. For example, prospective US opponents in Asia will seek to develop and deploy improved air and missile defenses as part of their antiaccess/area-denial (A2/AD) as countermeasures to the United States' Air-Sea Battle concept and policy-strategic "pivot" toward Asia.²⁰ According to the US Air Force's 2012 posture statement, "As A2/AD capabilities proliferate, our [U.S. Air Force] fourth-generation fighter and legacy bomber capability to penetrate contested airspace is increasingly challenged," and the procurement of a new penetrating bomber "is critical to maintaining our [U.S. Air Force] long-range strike capability in the face of evolving A2/AD environments."²¹ The US and its allies are also working to strengthen their own regional missile defenses in Asia and elsewhere against growing ballistic and cruise missile threats to the use of the air and space, maritime, and cyber commons. The A2/AD picture in Asia is but one illustration of the point that future missile defenses will be challenged, not only to improve their "hardware" relative to offenses but also to enhance their "software" for scenario expectations and flexible adaptation to unexpected contingencies.²² As a US Army study on integrated air and missile defenses has noted,

Adversary long-range precision attack doctrines, as demonstrated in numerous experiments and service-level wargames, have evolved from a low number of missile launches from static positions to large, complex salvos from mobile forces. Their complex preci-

sion strikes are typically supported by advanced electronic attack; offensive cyber capabilities; terrestrial and space-based intelligence, surveillance and reconnaissance (ISR); and attacks on US space-based capabilities.²³

With regard to strategic nuclear arms control, Russia and the United States could reduce their numbers of operationally deployed strategic nuclear weapons to 1,000 or even 500 and perhaps maintain stable deterrence based on second-strike retaliation. How far they can descend on this scale depends partly on the levels of political trust and military cooperation between Washington and Moscow. Mutual disarmament also depends upon the cooperation of other nuclear weapons states that may have to agree to freeze or reduce their own arsenals.²⁴ Missile defense technologies are considerably improved compared to their Cold War predecessors. However, missile defenses as proposed in the US Phased Adaptive Approach for Europe are not “game changers” for US-Russia strategic nuclear stability. Russian defense modernization will have more to do with the viability of its nuclear deterrent than will US and NATO missile defenses. Further, the missile defense issue should not be hijacked by ideologues or partisans in Washington or Moscow. Both political and technical cooperation between NATO and Russia is possible and, in fact, desirable—although probably delayed until Putin has departed from office.

Notes

1. “Opinion: US Pullout on Missile Defense Talks Won’t Impact Russia,” *RIA Novosti*, 3 April 2014, in *Johnson’s Russia List 2014*, no. 74 (3 April 2014).

2. Lawrence Korb and Alex Rothman, “Obama Plan to Reduce Nukes Is Good for Budget, Boosts Moral Authority on Global Proliferation,” *ThinkProgress* (blog), 15 February 2012, <http://thinkprogress.org/security/2012/02/15/426332/obama-plan-to-reduce-nukes-is-good-for-budget-boosts-moral-authority-on-global-proliferation/>. See also Arthur Blinov, “Obama’s Anti-nuclear Signal to Russia: The United States Suggests a Dramatic Reduction of Nuclear Warheads,” *Nezavisimaya Gazeta*, 16 February 2012, in *Johnson’s Russia List 2012*, no. 29 (16 February 2012).

3. Pertinent expert commentary on missile defenses as related to Russia and US arms control objectives appears in Jacob W. Kipp, “Russia’s Future Arms Control Agenda and Posture,” and Steven Pifer, “The Russian Arms Control Agenda after New START,” in *Russia and the Current State of Arms Control*, ed. Stephen J. Blank (Carlisle, PA: Strategic Studies Institute, US Army War College, September 2012), 1–62, 63–92, <http://www.strategicstudiesinstitute.army.mil/pdffiles/pub1119.pdf>.

4. Nikolai Sokov, “The New, 2010 Russian Military Doctrine: The Nuclear Angle,” James Martin Center for Nonproliferation Studies, Monterey Institute of International Studies, 5 February 2010, http://cns.miis.edu/stories/100205_russian_nuclear_doctrine.htm. See also Vladimir Putin, “Being Strong: National Security Guarantees for Russia,” *Rossiiskaya Gazeta*, 20 February 2012, <http://premier.gov.ru>, reprinted in *Johnson’s Russia List 2012*, no. 31 (21 February 2012); and “Russia Retains Right to Play Nuclear Card—Gen-Staff Chief,” <http://www.russiatoday.com>, in *Johnson’s Russia List 2012*, no. 29 (16 February 2012).

5. Pavel Podvig, “Point of Distraction,” *Russian Strategic Nuclear Forces* (blog), 1 June 2012, http://russianforces.org/blog/2012/06/point_of_distraction.shtml.

6. Treaty between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms (Washington, DC: US Department of State, 8 April 2010), <http://www.state.gov/documents/organization/140035.pdf>.

7. The Obama administration's European Phased Adaptive Approach to missile defense will retain and improve some technologies deployed by the George W. Bush administration but will shift emphasis to other interceptors, supported by improved battle management-command-control-communications (BMC3) systems and launch detection and tracking. See Karen Kaya, "NATO Missile Defense and the View from the Front Line," *Joint Force Quarterly*, issue 71 (4th Quarter 2013): 84–89. See also Association of the US Army (AUSA), *US Army Integrated Air and Missile Defense Capabilities: Enabling Joint Force 2020 and Beyond* (Washington, DC: Institute of Land Warfare, AUSA, May 2014); Steven J. Whitmore and John R. Deni, *NATO Missile Defense and the European Phased Adaptive Approach: The Implications of Burden Sharing and the Underappreciated Role of the US Army* (Carlisle, PA: Strategic Studies Institute, US Army War College, October 2013); LTG Patrick J. O'Reilly, USA, *Ballistic Missile Defense Overview, Presented to 10th Annual Missile Defense Conference* (Washington, DC: US Department of Defense, 26 March 2012), <https://mostlymissiledefense.files.wordpress.com/2013/06/bmd-update-oreilly-march-2012.pdf>; North Atlantic Treaty Organization, "NATO Ballistic Missile Defence (BMD)," fact sheet, North Atlantic Treaty Organization, 22 May 2012, http://www.nato.int/nato_static/assets/pdf/pdf_topics/20120520_media-backgroundunder_NATO_ballistic_missile_defence_en.pdf; and White House, Office of the Press Secretary, "Fact Sheet: U.S. Missile Defense Policy; a Phased, Adaptive Approach for Missile Defense in Europe" (Washington, DC: White House, Office of the Press Secretary, 17 September 2009), http://www.whitehouse.gov/the_press_office/FACT-SHEET-US-Missile-Defense-Policy.html. For critical assessment of US missile defense plans by expert scientists and other commentators, see Committee on an Assessment of Concepts and Systems for US Boost-Phase Missile Defense in Comparison to Other Alternatives, *Making Sense of Ballistic Missile Defense: An Assessment of Concepts and Systems for U.S. Boost-Phase Missile Defense in Comparison to Other Alternatives* (Washington, DC: National Research Council, National Academy of Sciences, National Academies Press, 2012), prepublication copy, <http://www.nap.edu/search/?term=Making+Sense+of+Ballistic+Missile+Defense%3A+An+Assessment+of+Concepts>; William J. Broad, "U.S. Missile Defense Strategy Is Flawed, Expert Panel Finds," *New York Times*, 11 September 2012, <http://www.nytimes.com/2012/09/12/science/us-missile-defense-protections-are-called-vulnerable.html>; Tom Z. Collina, "Failure to Launch: Why Did America Just Spend \$30 Billion on a Missile Defense System That Doesn't Work?," *Foreign Policy*, 13 September 2012, <http://foreignpolicy.com/2012/09/13/failure-to-launch/>; Philip Coyle, "The Failures of Missile Defense," *National Interest*, 26 July 2012, <http://nationalinterest.org/print/commentary/the-failures-missile-defense-7248>; and George N. Lewis and Theodore A. Postol, "A Flawed and Dangerous U.S. Missile Defense Plan," *Arms Control Today*, 5 May 2010, http://www.armscontrol.org/act/2010_05/Lewis-Postol.

8. For additional perspective on this topic, see Daniel Wagner and Diana Stellman, "The Prospects for Missile Defense Cooperation between NATO and Russia," *Foreign Policy Journal*, 10 February 2011, <http://www.foreignpolicyjournal.com>, in *Johnson's Russia List 2011*, no. 24 (10 February 2011); and Stephen J. Blank, *Arms Control and Proliferation Challenges to the Reset Policy* (Carlisle, PA: Strategic Studies Institute, US Army War College, November 2011), 32–33, <http://www.strategicstudiesinstitute.army.mil/pdffiles/PUB1085.pdf>.

9. See Blank, *Arms Control and Proliferation Challenges*.

10. Paul K. Davis suggests that dissuasion by denial (DND) is the preferable term in "Toward Theory for Dissuasion (or Deterrence) by Denial: Using Simple Cognitive Models of the Adversary to Inform Strategy," RAND Working Paper WR-1027 (Santa Monica, CA: RAND National Security Research Division, January 2014), http://www.rand.org/pubs/working_papers/WR1027.html.

11. The topic of defense suppression receives more detailed treatment in Dean Wilkening et al., *Strategic Defenses and Crisis Stability* (Santa Monica, CA: RAND Corporation, April 1989), 35–40.

12. Ashton B. Carter and David N. Schwartz, eds., *Ballistic Missile Defense* (Washington, DC: Brookings Institution, 1984), 106.

13. Russia's 2010 military doctrine refers to "dangers" as well as "threats," whereas prior editions made reference only to threats. Although "dangers" might seem less menacing than "threats" to interested readers, the dangers mentioned are concrete and specific compared to the threats, the latter of a more general nature. Listed dangers include the desire of NATO to globalize its force potential and move its military infrastruc-

ture closer to the borders of Russia. See Marcel de Haas, "Russia's Military Doctrine Development (2000–10)," in *Russian Military Politics and Russia's 2010 Defense Doctrine*, ed. Stephen J. Blank (Carlisle, PA: Strategic Studies Institute, US Army War College, March 2011), 1–61, <http://www.strategicstudiesinstitute.army.mil/pdffiles/pub1050.pdf>.

14. For additional historical perspective on Russian military doctrine, see Jacob W. Kipp, "Russian Military Doctrine: Past, Present, and Future," in Blank, *Russian Military Politics*, 63–151. See also "The Military Doctrine of the Russian Federation," text, <http://www.Kremlin.ru>, 5 February 2010, in *Johnson's Russia List 2010*, no. 35 (19 February 2010).

15. Jacob W. Kipp, *Forecasting Future War: Andrei Kokoshin and the Military–Political Debate in Contemporary Russia* (Fort Leavenworth, KS: Foreign Military Studies Office, January 1999), <http://fas.org/nuke/guide/russia/agency/990100-kokoshin.htm>.

16. Nicholas Khoo and Reuben Steff, "‘This Program Will Not Be a Threat to Them’: Ballistic Missile Defense and US Relations with Russia and China," *Defense and Security Analysis* 30, no. 1 (March 2014): 17–28.

17. Force structures are the author's. For expert estimates, see Joseph Cirincione, "Strategic Turn: New US and Russian Views on Nuclear Weapons," *New America Foundation*, 29 June 2011, http://newamerica.net/publications/policy/strategic_turn; and Pavel Podvig, "New START Treaty in Numbers," *Russian Strategic Nuclear Forces* (blog), 9 April 2010, http://russianforces.org/blog/2010/03/new_start_treaty_in_numbers.shtml.

18. Grateful acknowledgment is made to Dr. James J. Tritten for the use of a model originally developed by him and modified by the author. Dr. Tritten is not responsible for any of the analysis or arguments here.

19. For example, a study by Global Zero discusses the possibility of missile defenses augmented by passive defenses (such as hardening and sheltering) and advanced US conventional missions against regional adversaries such as Iran or North Korea. See James Cartwright, *Modernizing U.S. Nuclear Strategy, Force Structure and Posture*, US Nuclear Policy Commission Report (Washington, DC: Global Zero, May 2012), http://www.globalzero.org/files/gz_us_nuclear_policy_commission_report.pdf.

20. For expert analysis, see Jeremiah Gertler, *U.S. Air Force Bomber Sustainment and Modernization: Background and Issues for Congress*, CRS Report for Congress, R43049 (Washington, DC: Congressional Research Service, 4 June 2014), <https://www.fas.org/sgp/crs/weapons/R43049.pdf>.

21. Department of the Air Force, *United States Air Force Posture Statement* (Washington, DC: United States Air Force, 2012), 15–16, cited in Gertler, *Bomber Sustainment and Modernization*, 5n17. For definitions of A2/AD capabilities, see Gertler, *Bomber Sustainment and Modernization*, 6n18.

22. Rebecca Slayton, *Arguments That Count: Physics, Computing, and Missile Defense, 1949–2012* (Cambridge, MA: MIT Press, 2013), 216–19.

23. AUSA, *Air and Missile Defense Capabilities*, 12.

24. On the need for a multilateral approach to nuclear arms reductions, see *ibid.*, 3–4.