

Nuclear Arms Control in an Evolving World: Evaluating the Effects of Emerging Technologies on Strategic Stability

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ABSTRACT

The United States and Russia have not signed a new nuclear arms control agreement in a decade and the New START Treaty is set to expire next year if not extended. The development of so-called disruptive nuclear weapons technologies, such as hypersonic and autonomous capabilities, not explicitly addressed under existing treaties further complicates bilateral negotiations to reach agreement on a future for nuclear arms control. In this paper, we develop a set of criteria to assess the disruptiveness of these technologies and evaluate their implications on potential arms control mechanisms. We review historic and theoretical motivations for pursuing bilateral arms control and analyze the U.S. and Russian nuclear postures through public government documents. We consider three potential mechanisms for future nuclear arms control agreements and argue in favor of a U.S.-Russia co-sponsored treaty in an international forum to constrain the deployment of those nuclear technologies assessed to be disruptive to strategic stability.

KEYWORDS: Arms control; nuclear weapons; strategic stability

1. Introduction

Since the end of World War II, the world has seen major shifts in nuclear tensions between Russia and the United States. Both countries put a major emphasis on the negotiation of arms control treaties during periods of greater hostility and new technological development. However, in the thirty years since the collapse of the Soviet Union, nearly all bilateral arms control treaties signed by the United States and Russia have broken down. The last remaining agreement, the New START Treaty, will expire if not renewed by February 2021. Since the negotiation of New START a decade ago, progress in new strategic weapon delivery technologies and China's rise as a nuclear power have threatened existing concepts of strategic nuclear stability. The expansion of warfare in the domains of cyber and space and renewed development of low-yield nuclear weapons have further complicated the separation of conventional and nuclear forces. Although the New START Treaty continues to constrain the world's two largest nuclear powers, there are doubts as to whether a bilateral agreement on traditional nuclear technologies can still address fundamental issues of strategic stability. All of these questions play into the negotiations surrounding the renewal of the New START Treaty, but reveal deeper questions about the future of arms control.

Past nuclear arms control treaties have achieved significant reductions in each nation's nuclear weapons stockpile. The resulting increases in bilateral strategic intelligence from inspection regimes, restrictions in the development and testing of new nuclear technologies, and persistent dialogue have done much to establish global strategic stability. However, developments in the last few years have threatened to change the underlying conditions in the strategic relationship between the U.S. and Russia. The existence of nuclear capabilities unaddressed by these treaties, repeated claims by both sides of treaty violations, and a changing security landscape prompt the

need for reconsideration of the existing nuclear arms control regime. Because of the fundamentally changed conditions and rapidly evolving technology, there is a need to structurally reconsider the underpinnings of strategic stability. Rapid technological change will alter the strategic balance between states and require policymakers to reimagine arms control regimes.

Such reconsideration must begin with a discussion of Russian and U.S. policies and postures toward nuclear weapons and the impact of new technologies on existing and future regimes. The factors that underpin arms control deserve a second look to determine whether it is new technologies that have shaped competition in the New START era, or whether the competitive environment and the players in it have fundamentally changed. Through a better understanding of how each country perceives new technologies and the competitive environment, we will be able to assess whether new delivery technologies are challenging existing arms control regimes or whether those regimes are more likely challenged by changes in the U.S. or Russian understanding of strategic stability doctrines.

2. History of U.S.-Russia Bilateral Arms Control

In analyzing the effects of new nuclear-related technologies on strategic stability and nations' willingness to pursue arms control, much information can be gleaned from previously negotiated arms control agreements. Examining the history of bilateral arms control agreements between the two nations in the nuclear age enables a better understanding of the strategic environment in which Russia and the United States currently operate. This history can be divided into three parts: the Cold War era of bipolarity, the post-Cold War era of American unipolarity, and the current multipolar international order.

2.1 Cold-War Era Arms Control

After the United States detonated the first nuclear weapons at Hiroshima and Nagasaki, the USSR sought nuclear arms and soon successfully developed one of their own. Following Soviet development of a nuclear weapon, the United States and USSR asserted their bipolar dominance over world affairs, proceeding to engage in a nuclear arms race. Within two decades, thousands of nuclear warheads had been manufactured, hundreds of nuclear tests had been conducted, and several conflicts had nearly gone nuclear. To avoid further escalation of an arms race, the two nations eventually established that it was mutually beneficial to agree to limits on their respective strategic nuclear forces.

The Strategic Arms Limitation Treaty (SALT) I was the first of these agreements, signed in 1972, limiting the number of nuclear-capable ground- and sea-based missile platforms and leading to the Anti-Ballistic Missile (ABM) Treaty, which limited antiballistic missile defenses [U.S. Department of State]. In the outcome of SALT I talks, a joint statement between American President Nixon and Soviet President Brezhnev highlighted the need to “provide for a more stable strategic balance in the next several years than would be possible if strategic arms competition continued unchecked” [The White House, 1972]. They did note however that the SALT I and ABM Treaty were a “first step” and did not “close off all avenues of strategic competition.” In the preamble to the ABM Treaty, the two nations noted their interest in signing the agreement in order to curb an arms race, decrease the risk of nuclear war, create more favorable negotiating conditions for future agreements, mind obligations under the Treaty on the Non-Proliferation of Nuclear Weapons, and relax international tensions. These same motivating factors were mentioned in the signed, but not ratified, SALT II agreement, with an additional commitment to “exercise restraint in the development of new types of strategic offensive arms” [USA and USSR, 1979]. As can be seen in Figure 1, the U.S. stockpile plateaued and began a

slight decrease during this period, while the USSR nuclear weapons stockpile continued to increase [Kristensen and Korda, 2019].

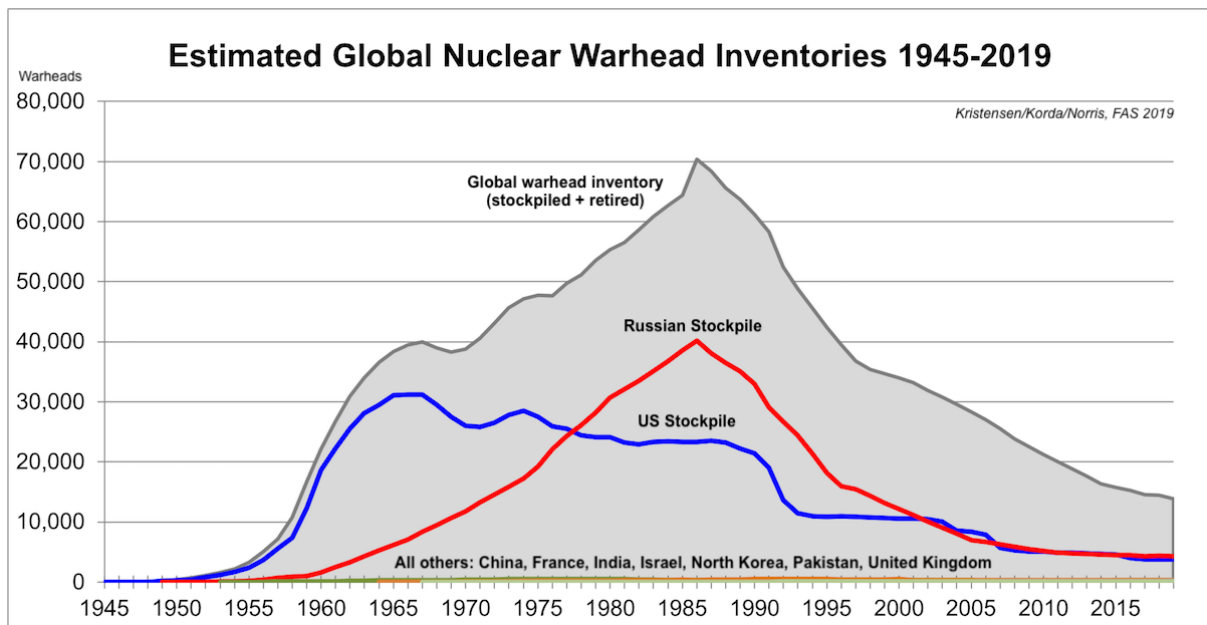


Figure 1.

Further negotiations during the late Soviet period were fruitful in producing binding agreements to reduce national nuclear weapons stockpiles. The development and threat of deployment of intermediate range missiles and tactical nuclear weapons in Europe increased worries about strategic nuclear stability in Russia. Increased Russian worries about the U.S. had a qualitative advantage, and in Europe developed into fear of a disabling strike. After a period of time and changes in leadership, that fear led to a period of detente. That heightened tensions led to the negotiation of the Intermediate Range Nuclear Forces (INF) Treaty is of note. Signed in 1987, the INF Treaty banned ground-based nuclear missiles with ranges of 500-5,000 kilometers. The INF Treaty was the first bilateral treaty between the United States and Soviet Union to ban an entire class of strategic offensive arms [USA and USSR, 1987]. Implementation of the INF Treaty resulted in a rapid reduction in U.S. and Russian nuclear weapons stockpiles of nearly 3,000 warheads by 1991.

2.2 Post-Cold-War Arms Control

In 1991, the bipolarity presided over by the United States and USSR superpowers collapsed with the fall of the Soviet Union, which resulted in “America’s unipolar moment” [interview with Suslov] in which the United States was more able to enforce its demands for arms reduction on Russia and focus on limiting the spread of nuclear capabilities to other states. Although much of U.S. nuclear security policy during this time focused on limiting proliferation of nuclear material in the former Soviet Republics, the United States continued to explore new nuclear arms control agreements with the Russian Federation [USA and Russia, 1993].

The first arms control treaty between the United States and Russia to enter into force following the dissolution of the Soviet Union was START I, which made further limits to the deployed delivery vehicles limited under SALT [Arms Control Association, 2019]. By specifically limiting the number of deployed delivery vehicles, corresponding roughly to the number of deployed warheads, START I continued the trend of stockpile reductions, while reversing a trend of increasing deployed vehicles despite the overall reductions.

The preamble of the START Treaty signed in 1991 makes brief mention that “the interests of the Parties and the interests of international security require the strengthening of strategic stability,” but provide no further context. In contrast, the text of the New START Treaty gives explicit description of the motivations for pursuing further bilateral arms control, expanding on those mentioned in the treaties previously discussed. Newly referenced motivations include forging a new strategic partnership based on mutual trust, openness, predictability and cooperation; aligning nuclear postures; preserving continuity in reductions and limitations of nuclear arms; enhancing predictability and stability; and creating an adapted, simplified, and less costly mechanism for verifying treaty compliance.

In the 21st century, these agreements continued with the Strategic Offensive Reductions Treaty (SORT) and New START Treaty. These treaties moved to more direct limits on nuclear arms, limiting the deployment of nuclear warheads, instead of their delivery vehicles. The New START Treaty, signed in 2010 and which entered into effect in 2011, is the last bilateral nuclear arms control treaty between the United States and Russian Federation. Both the U.S. and Russia met the implementation deadline of February 2018 and have been in compliance with the treaty to present [U.S. Department of State, 2019]. The New START Treaty has the most rigorous technical verification regime of any nuclear arms control agreement in history, giving both nations a dozen-and-a-half annual opportunities to send inspectors to the other nation’s nuclear facilities.

A U.S. government report detailing the reasons that continued implementation of the New START Treaty is in the U.S. national security interest highlights that “provisions in the New START Treaty provide predictability, transparency, and unique insight with respect to Russian nuclear forces and planning as Russia continues to modernize its strategic nuclear forces. In so doing, it moderates strategic competition” [U.S. Department of State, 2018]. However, although the New START Treaty provides information to both the United States and Russia on the nature of the other nation’s strategic nuclear forces, it does not include transparency of nuclear technologies not covered by the Treaty, including autonomous capabilities, tactical nuclear forces, etc. The Treaty recognizes the incompleteness of its provisions and stipulates that “when a Party believes that a new kind of strategic offensive arm is emerging,” the issue can be raised for bilateral consideration.

2.3 Current State of Bilateral Arms Control

The key takeaways of this historic analysis are that the United States and Russia previously recognized the destabilizing nature of new types of strategic offensive arms and that recent agreements have focused on achieving stability through greater transparency and openness. At the time of the INF Treaty signing in Washington, the United States and USSR combined nuclear stockpile consisted of ~70,000 warheads; today, as a result of arms control agreements between the two nations, that number has fallen to under 15,000.

However, little progress in bilateral arms control discussions has been made since the negotiation of New START. The United States has recognized that an era of great power competition has returned, and its national security strategy and willingness for bilateral negotiations reflect this change [Trump, 2017]. As Russia and China began to assert their military and political interests in the mid-2000s, the United States, for its part, began to walk away from bilateral arms control measures, citing emerging global threats and Russian treaty violations [Bush, 2001, Trump, 2019b]. The United States eventually abrogated the ABM and INF treaties, considered by Russian foreign policy thinkers to be two of the three key pillars of maintaining nuclear stability between the United States and Russia [Kosachev interview].

The so-called third pillar of nuclear stability, the New START Treaty, will expire in February 2021 at the beginning of the next U.S. presidential term. Russian President Vladimir Putin has consistently indicated Russian willingness to agree to a 5-year extension of the Treaty before then [Reuters Editorial, 2019]. President Trump has discussed the extension in some meetings with the Russian government, but has not committed to extending the Treaty, and has indicated a desire to include China in novel, multilateral arms control negotiations [Trump, 2019a]. Until recently, both the United States and Russia have shied away from developing new technologies under the existing treaty regime. However, with the Trump Administration seeking to be released from bilateral commitments it sees as limiting its ability to compete with China, and Russia seeking an increased role in international security policy, these developments may put the New START Treaty and willingness for future bilateral arms control measures at risk.

3. Motivations for Arms Control

Having discussed the history of arms control agreements between the United States and Russia, an important follow up question to ask in seeking to evaluate the future of arms control is what motivated the two countries to pursue limitations on their own national defense programs. Here, insight can be gleaned from the theoretical basis for arms control and in the interests specified within joint statements accompanying historic arms control agreements.

3.1 Theoretical Basis for Arms Control

Because states have limited resources to expend on defense and security, and those options are further constrained by political interests and bureaucratic inertia, trade-offs must be made. States could, for example, pursue arms control as a means to allocate precious resources to other aspects of defense that are more pressing, or free up resources for use in developing the civilian economy [Rider, 2009]. Throughout the Cold War, the United States and Soviet Union existed in a bipolar world, and to a great extent focused competition between themselves. After the dissolution of the Soviet Union, the bipolar world arguably emerged into a brief “unipolar moment” for the United States. Over the past twenty years, that unipolar moment has transformed into a multipolar world with the emergence of China as a rising superpower with greater influence on the international order.

A multipolar world offers drastically different decisions and trade-offs for policymakers in all countries. First, a change in polarity impacts the effectiveness of arms control regimes. In a bipolar environment, where both states are nuclear armed, states face trade-offs in the adaptation of new strategies and implementation of new weapons. Any increase in relative power comes at a relatively high economic cost. States compete against each other, but do so indirectly through proxy conflict. Therefore, a sort of strategic balance is maintained, as neither state is able to drastically alter the balance of power. If an arms control regime exists in a bipolar world, states face a prisoner’s dilemma. Each state can choose to cooperate or compete. If both states choose to cooperate, the arms control regime is maintained, and strategic stability is ensured in the framework of the particular program. If both states choose to compete, the arms control regime is damaged. However, with rigorous verification protocols, and the marginal benefit from any potential advantage achieved from competing (“cheating”), and the desire to achieve legitimacy amongst international audiences, there is little incentive to break with a regime once it has been negotiated.

In a multipolar world, many states compete for power in the international system. States are more likely to pursue marginal increases in power, as a small increase in technological capability increases power relative to all other actors. States may still enter into arms control compacts, but some actors have incentives to violate them. Extending the prisoner’s dilemma to a multipolar

world, it is easier to understand why states are not always incentivized to comply with an existing regime. States, wishing to increase their relative power, can choose to compete. Those that compete are able to increase their relative power and catch up to more developed states, and there are fewer risks if they are caught. Furthermore, there are fewer incentives to participate in arms control regimes as a rising regional power. Verification challenges mean that regimes are more fragile than in a bipolar or unipolar system. Finally, the logistics and difficulties of negotiating new frameworks, which may require unilateral or asymmetric negotiations between unequal partners, make constructing new forms of arms control prohibitively time-consuming [Gowa, 1989].

3.2 Strategic Stability

How then do Russia and the U.S. fit into the new multipolar system? First, it is important to note that the system retains elements of the bipolar world. As previously discussed, Russia and the U.S. still maintain many more nuclear weapons and delivery systems than their closest numerical competitor, China. Following the assessment of nations' motivations to pursue arms control, the viewpoints of the U.S. and Russia regarding the current state of global strategic competition, and the role of nuclear weapons in that competition, must be evaluated.

The mutual desire to maintain strategic stability is referenced in nearly all bilateral nuclear arms control treaties to date. However, the ideas captured by that term remain vague. While different definitions of strategic stability have been formulated in political science theory, national governments and their representatives are often even more ambiguous in their use of the term. Three components of strategic stability are generally accepted: crisis stability, arms race stability, and political stability [Colby and Gerson, 2013, Nye, 1986]. *Crisis stability* can be defined as the lack of incentive to attack in the case of a crisis, weighing the costs of a potential response. *Arms race stability* can be defined as the lack of incentive to build up a greater number of arms in the belief that it can provide an advantage over an adversary. *Political stability* can be defined as the lack of incentive to attempt regime change, due to the deterrent effects of an adversary's nuclear weapons [Nye, 1988].

Based on these three criteria, in order for a stable equilibrium of strategic nuclear forces to exist, the following conditions must hold true regarding those forces:

- (1) Transparent – the capabilities of a strategic competitor's nuclear forces must be well known by the other state, so that there is no uncertainty with regard to the types of nuclear arms possessed.
- (2) Predictable – in addition to communicating the types of nuclear arms possessed by a state, the possible impacts of those weapons must be communicated to other states to minimize related uncertainty.
- (3) Verifiable – sufficient time prior to detonation must be given to the target country to verify that an attack is indeed occurring, in order to conduct a response of perceived equal or greater magnitude.
- (4) Discriminatory – sufficient time prior to detonation must be given to the target country to ascertain that the attack is indeed nuclear, in order to conduct a response of perceived equal or greater magnitude.
- (5) Reliable – the beliefs of the attacker and the target in the attacker's nuclear forces must be that they will achieve their desired effect when used (i.e. not susceptible to defensive capabilities) and the fact that they are unable to be used without affirmation contributes to a time-lasting reliability in those forces.

Emerging technologies can be characterized as disruptive if they modify a state's previous analysis of the above qualities, as they pertain to an adversary's nuclear forces. A state's belief that a disruptive nuclear technology has emerged will lead to its own pursuit of developing that technology to match a competitor, to overtake them, or to pursue arms control to limit both countries' development of that technology.

The pursuit of novel strategic technologies is balanced by several factors. Each country grapples with the high development costs of technologies that would be disruptive enough to provide a significant strategic advantage. Furthermore, according to the doctrine of mutually assured destruction, nations need to deploy a sufficiently high number of strategic nuclear weapons to ensure complete destruction of the adversary in a retaliatory strike. A decision to develop new strategic capabilities that could threaten an adversary's retaliatory capacity would lead to the adversary's increased build-up and deployment of existing capabilities. This would likewise require increased investment to counter the adversary's build-up, putting strain on the resources available to develop new capabilities.

4. U.S. and Russian Nuclear Postures

4.1 U.S. Nuclear Posture

The Trump Administration's attitude towards strategic issues embraces the idea that the world is shifting towards greater multipolarity, as evidenced by its National Security Strategy and National Defense Strategy [Trump, 2017, Mattis, 2018]. The United States appears to be shifting to a strategy for greater competition in the nuclear realm, signaling that the United States would embrace both non-proliferation and nuclear competition. In 2018, the Department of Defense issued the Nuclear Posture Review conducted by the Trump Administration [U.S. Department of Defense, 2018], noting a "rapid deterioration of the threat environment since 2010" and highlighting new Russian and Chinese nuclear capabilities as contributing to an evolving and uncertain international security environment. Further emphasizing the return to strategic competition, the review postulates that Russian non-nuclear-related actions led to a substantial decline in constructive bilateral engagement and states a belief that current conditions do not allow for transparent and constructive engagement with Russia. Clearly, the lack of trust between the U.S. and Russia has developed simultaneously with an increase in the strategic reliance of Russia on China and progressive abrogation of treaties essential to strategic stability. The Review lists four critical roles of U.S. nuclear forces in U.S. national security strategy:

- (1) deterrence of nuclear and non-nuclear attack;
- (2) assurance of allies and partners;
- (3) achievement of U.S. objectives if deterrence fails; and
- (4) capacity to hedge against an uncertain future.

Nuclear deterrence requires a belief by the potential attacker that any offensive attack will not be net-positive in cost-benefit analysis, based on a potential nuclear response. As long as new technologies are incapable of sufficiently reducing the costs of a possible nuclear response to an acceptable threshold, their development should not affect the deterrent role of nuclear weapon possession. In contrast, the fourth role for U.S. nuclear forces stated above is the one most affected by new disruptive nuclear and non-nuclear technologies. Even in an uncertain future, the value of strategic nuclear forces still lies only in either deterring another actor or in achieving a military objective. The Nuclear Posture Review states that "the United States would only consider the employment of nuclear weapons in extreme circumstances to defend the vital interests of the United States, its allies, and partners."

The criteria for U.S. interest in arms control agreements are that they must not only enhance security, but also be “verifiable and enforceable.” The U.S. withdrawal from the INF Treaty was based on claims of unresolved Russian violations, and it can be assumed that a robust verification regime will be needed for any future arms control agreement negotiated by the current administration.

4.2 Russian Nuclear Posture

The nuclear posture of the Russian Federation is laid out in “The Military Doctrine of the Russian Federation,” most recently updated and published in 2014 [Federation, 2014]. This document explicitly defines deployed strategic missile defense systems as “undermining global stability and violating the established balance of forces related to nuclear missiles.” Further, the doctrine characterizes “high-precision and hypersonic weapons...[and] weapons based on new physical principles that are comparable to nuclear weapons in terms of effectiveness” as “characteristic features and specifics of current military conflicts.” The current doctrine states that “nuclear weapons will remain an important factor of preventing an outbreak of nuclear military conflicts involving the use of conventional arms.” In addition to nuclear-related tasks, the doctrine sees an objective “to resist attempts by some states or group of states to achieve military superiority through the deployment of strategic missile defence systems...or the deployment of strategic non-nuclear high-precision weapon systems.” The perceived imbalance in power of conventional forces between Russia and the combined forces of the United States and NATO is viewed as contributing to strategic instability.

General conditions for Russian use of nuclear weapons are specified in the Military Doctrine and specified in further detail in a recent June 2020 document entitled “Basic Principles of State Policy of the Russian Federation on Nuclear Deterrence” signed by President Putin [Putin, 2020]. These documents state that the use of nuclear weapons is reserved for “response to the use of nuclear and other types of weapons of mass destruction against it and/or its allies, as well as in the event of aggression against the Russian Federation with the use of conventional weapons when the very existence of the state is in jeopardy.” The Basic Principles document further explains that these conditions may include deployment “of missile defence systems..., non-nuclear high-precision and hypersonic weapons, strike unmanned aerial vehicles, and directed energy weapons.” That Russia would consider use of nuclear weapons in response to an attack “which would undermine nuclear forces response actions” demonstrates that the perceived ability of hypersonic weapons to reduce the effectiveness of a second-strike, even if non-nuclear, has an effect on strategic stability.

Differences between the American and Russian nuclear postures may contribute to different interpretations of the disruptive nature of emerging technologies. If the importance of a certain technology is valued differently as a result, the negotiation of any related arms control measures will be more challenging, and thus these differing interpretations can lead to greater strategic instability. It was presumably for this reason that the New START Treaty explicitly cited a desire to align the two nations’ nuclear postures.

5. Disruptive Technologies and Future of Arms Control

Disruptive technologies are those that fundamentally change a state’s strategic calculations. This change goes beyond a simple risk-benefit analysis, but comes after a system is developed and deployed based on a new technology. Based on the metrics provided in subsection 4.1, a disruptive technology in nuclear arms control is one that changes a state’s belief in the reliability of its nuclear weapons, in another country’s ability to discriminate between its nuclear and conventional capacities, or in another state’s ability to verify its use. Within this framework, we

will assess whether the following technologies meet the criteria of a disruptive nuclear capability: (i) hypersonic weapons such as the Russian-developed HGV, (ii) autonomous nuclear strike capabilities, and (iii) tactical nuclear torpedoes.

Hypersonic weapons have the potential to provide a state with the means of an assured strike without giving the enemy an opportunity to respond or an ability to detect the launch of the missile prior to its strike. Hypersonics have the potential to defeat all mitigation and counter-threat systems, and, if targeted against first-strike capabilities, would leave an adversary only with any survivable or mobile second-strike capabilities they possess. The Cold War belief in mutual assured destruction providing strategic stability requires that nuclear weapon states have an assured second-strike capability, preventing a disarming first strike and thereby maintaining first-strike stability.

Both Lieber and Press [2017] and Horowitz [2019] argue that autonomous weapons could threaten first strike capability by destroying command and control capabilities or by threatening the use of what were previously believed to be secure second-strike capabilities (e.g. SLBMs), and that the uncertainty in the current technological readiness of those capabilities for such objectives contributes to that instability. Autonomous weapons are those weapons that are activated outside of a traditional command and control system by an autonomous actor, designed to react to a specific set of circumstances. Traditionally, this capability was thought of as a deadman's switch (ala Dr. Strangelove). Snyder and Pelopidas [2019] note that there is currently no technical evidence that these systems could reliably (or even reasonably) achieve the technological requirements of such objectives. If a nation believes that it could develop these capabilities, its willingness to pursue arms control would then be based on the confidence of winning an arms race in developing these systems.

The United States, Russia, and China are all publicly pursuing the development and deployment of hypersonic weapons, but without a public stated belief that these weapons will have an effect on nuclear stability. As U.S. Undersecretary of Defense Griffin recently said regarding the potential adversarial use of hypersonic weapons, “our only response is either to let them have their way or to go nuclear. And that should be an unacceptable situation for the United States” [Mehta, 2018]. The sentiment expressed seems to indicate that the United States would not seek to respond in nuclear fashion to a technological mismatch in conventional forces. This is in stark contrast to Russian actions and statements that indicate their build-up of tactical nuclear forces and autonomous nuclear capabilities is in direct response to conventional force mismatch.

6. Case Study of Controls on Disruptive Military Technology

When a military technology is agreed to be detrimental to international security, whether for reasons of strategic stability or otherwise (e.g. moral abhorrence), there are different options with which to address the technology. A review of the historical technologies which meet these criteria may provide a foundation for policy recommendations to tailor a solution for today's disruptive technologies.

During World War I, the introduction of chemical warfare resulted in physical and psychological effects upon troops returning from the front lines and for the industrial workers who supported the war effort. The sheer devastation of the war could be epitomized by the visceral imagery – blistering of external organs – on young men returning from the front who had been affected. In the years to follow, nations came together to hold international conferences to address the future use of chemical weapons, including the Washington Conference (1921–1922) and Geneva Conference (1923–1925) [Fitzgerald, 2008]. The result was a product of the League of Nations: the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases,

and of Bacteriological Methods of Warfare. The Geneva Protocol, as it came to be known, recognized that these weapons were “justly condemned by the general opinion of the civilized world” and prohibited their use [League of Nations, 1925]. Later international conventions (e.g. 1972 Biological Weapons Convention and 1993 Chemical Weapons Convention) resulted in bans on the production of these weapons, expanding upon the previous ban on their use.

The political willingness to take action to limit this class of weapons came as a direct result of its use by nations on both sides of a global conflict. Similarly, following the first use of nuclear weapons during World War II, new international norms were established regarding their use. Although these norms are not backed by a governing document that holds status of international law, nuclear weapons states express high thresholds for use of nuclear weapons in their public policies, generally requiring that the core of the state itself be severely threatened. The post-WWII arms control regime has included bilateral bans on deploying certain classes of nuclear weapons (e.g. intermediate-range nuclear forces) as well as on certain defense systems (e.g. anti-ballistic missile defense), but, even then, research on both of these systems is not prohibited.

7. Implications for Future Nuclear Arms Control Regime

Disruptive technologies, by definition, will have a significant impact on arms control regimes, and are more likely to be developed in a competitive international system. However, arms control regimes, as they exist, can be adapted to address newly developed capabilities. Along with newly developed technologies that increase offensive capability, there are also new technologies in verification, which can be brought to bear to increase the likelihood of cooperation in arms control. New verification technologies can increase trust between parties and lead to diplomatic breakthroughs in other areas of international security.

Furthermore, the development and implementation of arms control is a way to discuss strategic stability and nuclear security on a bilateral basis. Without those discussions, both parties can develop and deploy new capabilities without a full and detailed understanding of how those capabilities will impact the strategic conception of their adversary. The example of chemical weapons demonstrates how the international community reacts when a dangerous capability is deployed and used to ill effect. The advanced capabilities that are being developed in both Russia and the U.S. might alter the strategic balance, with little public understanding that a shift has taken place. Based on the case study discussed above, several policy options remain for consideration by the United States and Russia in addressing emerging nuclear technologies:

- (1) **Extend the New START Treaty with additional provisions relating to limitations and constraints on emerging nuclear technologies.** By extending New START, both parties can buy more time to discuss new technologies, while still regulating the number of deployed warheads in both countries. Using New START renegotiations as a vehicle for discussing new technologies enables both sides to examine the newly developed technologies of the other and to gain crucial strategic intelligence.
- (2) **Negotiate a new bilateral arms control agreement to address emerging nuclear technologies.** New threats outside of previously negotiated regimes need to be addressed urgently. Even more importantly, emerging disruptive technologies need to be discussed *before* they are deployed in the field. Once capabilities are deployed, they are difficult to roll back, without significant cost and political pressure. A bilateral forum can allow for a more focused and productive conversation, without involving powers at other levels of development.
- (3) **Propose a new multilateral treaty in a chosen international forum to put constraints on the deployment of these emerging nuclear technologies and strengthen the non-proliferation regime.** Due to the proliferation of new technology, other states will soon

be able to develop advanced technologies that could alter the strategic balance. The U.S. should propose a new forum which can address some of the causes of strategic instability, including new nuclear technologies and cyber threats.

The New START Treaty, the subject of much current discussion as its expiration (or renewal) nears, does not cover the full suite of strategic forces requiring consideration in a discussion of nuclear power global competition and stability. Although both Russian and American officials believe that hypersonic weapons could fall under the scope of New START accountability [201, 2019, Thompson, 2019], the Treaty was not designed with their capabilities in mind. Furthermore, the nature of the agreement is a number-based constraint (on deployed nuclear warheads), rather than a class-based constraint, such as the INF ban on intermediate-range nuclear weapons. The disruptive aspects of hypersonics do not scale linearly with the number of weapons, but are inherent to the nature of the weapon. A single hypersonic weapon capable of penetrating an adversary's defenses before they have time to respond is enough to serve as a nuclear flashpoint. Similarly for autonomous weapons, the mere threat of a single "dead-hand" nuke could serve as an effective deterrent. For this reason, class-based weapons to address the specific technologies should be pursued outside of a numbers-based constraint, such as the New START Treaty. In addition, the velocities and guidance systems of the delivery systems are not limited under the New START Treaty, the very parameters that could be expected to be affected by hypersonic and autonomous capabilities, respectively.

The negotiation of a separate bilateral arms control agreement to address these new classes of strategic nuclear arms could take into account a class-based focus on the specific parameters of the emerging technologies currently under discussion. However, the shift from a bipolar to multipolar world, which was largely unaddressed in previous bilateral nuclear arms control agreements, will be left unaccounted for. If U.S. policy remains as stated in the Trump Administration's Nuclear Posture Review, factoring competition with China into decisions on U.S. nuclear modernization and force posturing, then a bilateral agreement with Russia will be insufficient to completely address U.S. security needs.

For these reasons, an international agreement of the nature discussed in the previous section is recommended in order to address a potential increase in strategic instability as a result of new strategic nuclear arms. The role of autonomous weapons in warfare has already prompted a larger debate, and, as a result, may be worthwhile of consideration in a broader context in international fora. Hypersonic weapons, largely discussed in terms of their relation to rapid delivery of intercontinental nuclear warheads, would likely require an agreement specific to the nuclear context.

8. Conclusion

Disruptive technologies have had significant impact on arms control regimes and the processes of armament and disarmament. In the past, the development of disruptive technologies has spurred arms races, causing states to over-invest in new forms of weaponry as a way to re-establish strategic balance. On the other hand, new technologies can also help states come to the table to establish new arms control institutions. The particulars of new technologies will become incredibly important in understanding the road that will be taken, as does the geopolitical situation and political understanding of strategic competition. How all of those factors play together will be the subject of intense speculation over the next few years. The United States seems to have found political consensus around the idea of great power competition, and is developing weapons that will allow it to compete along the furthest reaches of its national interests. If the United States and Russia are serious in maintaining strategic stability, they will

pursue a multilateral approach to limitations on new, potentially disruptive classes of nuclear weapons.

Acknowledgements

The authors would like to thank the SURF leadership and alumni advisors for their helpful feedback in the drafting of this paper.

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