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Recalibrating Arms Control for Emerging Technologies

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Recalibrating Arms Control for Emerging Technologies

The utility of arms control today is highly contested. Over the last decade, most arms control mechanisms came under increased stress due to intensifying great power competition, growing non-compliance concerns, and the development of new strategic military capabilities. As a result of these pressures, several arms control treaties have collapsed and negotiations to replace them have stalled. Skeptics argue that arms control has run its course, adversaries cannot be trusted, and imposing restraint has no place in this competitive environment. Meanwhile, advocates of arms control argue that exactly because of this risky and competitive environment, it is vital to pursue arms control. They see it as a useful tool to manage competition and a helpful mechanism to preserve a favorable balance in military capabilities. This understanding is actually very close to how the concept of nuclear arms control was originally conceived by Thomas C. Schelling and Morton H. Halperin in 1961. In their seminal work "Strategy and Arms Control," they argued that pursuing arms control is not incompatible with deterrence; in fact, both concepts are tools to achieve the same national security objectives.[1]

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While arms control is generally seen as a cooperative mechanism, it has always included elements of competition. Great powers have often used arms control to codify their advantages and sustain their military-technological competitiveness. Defining arms control as a competitive process is a useful framework for emerging technologies. Since these capabilities have the potential to provide important disruptive benefits, great powers have invested much time and effort into technology innovation, hoping to exploit these benefits. As a result, emerging technologies are now critical to how great powers operate their conventional and nuclear forces,[2] and it has become virtually impossible to separate arms control from competition in the new military domains. Therefore, any strategy that pursues cooperation must also consider the broader implications for military advantage and deterrence.

The arms control toolkit includes a rich variety of mechanisms such as legally binding treaties, political commitments, normative and behavioral standards, risk reduction, confidence- and security-building measures, and export control. This paper makes the case that the existing toolkit can be recalibrated to manage competition in emerging technologies. This requires shifting the mindset from quantitative visions to more qualitative approaches to reduce the risk of unintended conflict while allowing, not eliminating, competition. In practice, this means that arms control should not be geared towards limiting the development of emerging technologies and preventing their deeper integration; rather, it should focus on putting up guardrails to constrain the most destabilizing applications of these technologies. The first section of this article explains the analytical approach to emerging technologies and provides a brief overview of the different arms control tools that have been successfully used in the past. The next part applies these tools to the different categories of emerging technologies by introducing a few illustrative examples. The last section puts the focus on the current security environment and outlines the main conditions for arms control success.

Arms control can be recalibrated to manage competition in ET, not limit their development

Defining the Framework of Analysis

There are many interpretations of emerging technologies. While broad interpretations include technologies such as 3D printing or killer robots, more narrow interpretations focus on capabilities that could produce strategic effects.[3] Since this analysis is primarily focused on the arms control toolkit which has been

successfully used in the nuclear domain, this paper employs a narrow definition of emerging technologies that includes artificial intelligence and big data analytics, AI-enabled cyber operations, space assets and space weapons, modern integrated air and missile defense systems (IAMDS), autonomous systems, directed energy weapons, hypersonic weapons, and quantum technologies. These non-nuclear strategic capabilities have the potential to destabilize the nuclear domain, and they have already introduced multiple new pathways to nuclear use. Given their growing influence on strategic arms control and deterrence, it has become very difficult to look at nuclear issues in isolation from these new technologies.

An additional consideration for this paper is how we view the relationship between emerging technologies and existing arms control frameworks. In this regard, there are two different approaches. The first one considers these capabilities as enablers of arms control. Emerging technologies—especially those which support intelligence, surveillance, and reconnaissance (ISR) tools—are already used to strengthen arms control monitoring and verification mechanisms such as the use of AI in object identification in satellite imagery and pattern recognition, or the application of AI-enabled big data analytics to process information faster.[4] While the potential benefits of leveraging these tools for arms control are numerous,[5] this paper follows a different analytical approach. Given the new escalatory risks that emerging technologies have introduced, this paper considers these technologies not as enablers of arms control, but instead as subjects of arms control.

The history of arms control provides a rich toolkit to manage competition between the great powers.[6] These mechanisms can be grouped into many different categories based on the number of participants (unilateral, bilateral, or multilateral), geographic scope (local, regional, or global), time frame (limited or indefinite), complexity (single issue or comprehensive), and form (formal or informal). Since arms control measures can have almost any combination of the above characteristics, there is an immense variety of options when it comes to choosing the right framework. Most arms control mechanisms share some common security benefits such as establishing channels of communication in times of crisis and conflict, enhancing transparency and predictability, avoiding costly arms races, and preventing the militarization of certain technologies. At the same time, there are additional unique advantages associated with each option.

To this end, the most influential choice is whether one pursues a formal or an informal approach. Formal arms control mechanisms are codified in legally binding agreements, which includes treaties and executive agreements.[7] These tools provide two unique advantages: enforceability and verifiability. Without the legal framework provided by these agreements, sharing sensitive information

would be difficult, onsite inspections would be problematic, dispute resolution mechanisms would not be in place, and abandoning commitments would be easier, which undermines trust in adversary compliance, particularly when arms control is pursued in a competitive environment as it is today. However, applying these measures to emerging technologies also comes with challenges. For example, in areas where counting rules are applicable, such as warheads and delivery systems, these agreements remain highly desirable. However, some emerging technologies—especially enabling technologies—simply resist traditional verification mechanisms. Many of these capabilities cannot be counted, on-site inspections are not applicable, and monitoring through national technical means is practically impossible.[8] Certain emerging technologies are also dual use, which means that states are unlikely to agree to blanket bans on their application. Besides, formal agreements are difficult to negotiate, and they usually require a lengthy bargaining process between the participating states. Due to the ratification requirements, domestic politics and legislative debates can often hinder progress, and these measures are also less flexible in the face of the rapidly changing security environment.

The most influential choice is whether one pursues a formal or informal approach

The alternative pathway is pursuing informal arms control mechanisms. These tools have four main benefits over formal agreements: faster negotiating time, easier implementation which does not require ratification, lower costs due to the lack of complex verification and monitoring mechanisms, and increased flexibility to respond to unforeseen technological changes. Emerging technologies are rapidly developing capabilities, and in many cases it is difficult to foresee all aspects of their military application. Therefore, more flexible and adaptable mechanisms may be desirable to cover certain categories of emerging technologies. Especially in times when formal arms control is in a crisis, these measures can provide some quick wins, help to involve new actors in the process, and rebuild trust towards arms control. At the same time, informal mechanisms usually lack verification measures, which makes it more challenging to detect non-compliance and publicly share concerns without revealing sensitive intelligence gathering techniques. Since informal measures do not create legal obligations, it is also more challenging to use international legal remedies to punish non-compliance and rally allies to condemn or sanction the state that is in violation of a political commitment. Informal measures are also less durable because states can easily reverse or simply ignore their commitments in response to unexpected changes in the security environment. Yet, the informal arms control toolkit includes a wide array of mechanisms which

have successfully advanced arms control objectives in the nuclear domain for decades.

Since the concept of emerging technologies is such a broad category, it is highly unlikely that a blanket arms control solution could cover all these capabilities in one agreement. Instead, arms control mechanisms will have to be tailored to specific technologies, applications, or effects. The complexities associated with these capabilities also require flexibility and a more holistic approach in arms control policy. Formal and informal measures can work in tandem to advance the same objectives and close the most dangerous pathways to nuclear use. The next section matches these tools to specific categories of emerging technologies and provides a few illustrative examples for their potential application.

Applying the Old Toolkit to the New Problem

Despite the difficulty of applying counting rules to most emerging technologies, there are a few areas where it is still possible to negotiate central limits and implement the necessary verification measures. Although codifying such agreements is possible in both formal and informal frameworks, legally binding treaties would provide the highest confidence in compliance, and they could also facilitate more intrusive verification measures.

Formal Arms Control Measures

In emerging technologies, there are two key areas where these types of formal agreements could play an important role. The first area is hypersonic weapons. The United States, Russia, and China are all engaged in developing them. However, unlike its adversaries, US hypersonic weapons are designed to be conventionally armed.[9] These systems carry escalatory risks for two main reasons. First, their short time-of-flight compresses decision times and could increase crisis stability risks, and second, their unpredictable flight path creates uncertainty about the target, which could increase the chances of miscalculation or unintended escalation in a crisis or conflict.[10]

> There are two key ET areas where formal agreements could play an important role

One way to reduce these dangers is to include hypersonic weapons under formal arms control mechanisms, such as the New START Treaty. Although the agreement does not cover weapons that fly on a ballistic trajectory for less than 50 percent of their flight—which includes hypersonic glide vehicles (HGVs) and hypersonic cruise missiles—Article V states that parties can bring

up "a new kind of strategic offensive arm" in the Bilateral Consultative Commission and potentially include them under the treaty provisions. In cases when hypersonic glide vehicles are launched from intercontinental ballistic missiles (like Russia's *Avangard* HGV), the New START Treaty provisions are applicable. Although Russia suspended its participation in the New START Treaty in February 2023, a new legally binding agreement could address at least some of the challenges posed by hypersonic weapons. For example, a new START follow-on agreement could explicitly include intercontinental-range, ground-launched, boost-glide missiles (regardless of their payload),[11] or a separate agreement could be crafted to codify a legally binding cap on HGVs in each country's arsenal.[12]

The second area where legally binding agreements could prove useful for managing emerging technology risks is modern integrated air and missile defense systems. IAMDS are usually mentioned under emerging technologies because modern systems benefit from advancements in technology in many different regards. These are increasingly networked systems that incorporate advanced sensors for better performance. Developments are also underway to explore the utility of new technologies such as directed energy weapons (DEWs) to intercept incoming threats. For President Putin's Russia, missile defense has become a dominant focus in arms control, and he has repeatedly demanded legally binding limits on these systems as a precondition to further talks on nuclear reductions.[13] While numerical limits on interceptors are unlikely to be accepted by the United States, focusing on transparency and predictability is feasible. For example, former administrator of the National Nuclear Security Administration Linton Brooks made a proposal for a legally binding treaty that would require the United States and Russia to exchange plans for the numbers and locations for future deployments of ballistic missile defense interceptors over a specific timeframe (e.g., ten years). Under this agreement, the two sides would be required to update these declarations annually, and they would commit to not change them without ample prior notice (e.g., three years).[14] Such an agreement would not address all of Russia's missile defense concerns, but it could be a stepping stone to move out of the current deadlock.

Informal Arms Control

These mechanisms can be grouped into five main categories: 1) political commitments (either unilateral or negotiated);[15] 2) normative approaches and behavioral arms control designed to codify best practices (especially among like-minded states);[16] 3) risk reduction measures;[17] 4) confidence- and security-building measures (CSBM);[18] and 5) export control.[19] While each of these categories have some distinct features, there are many overlaps among them.

Political Commitments. While AI and other cyber capabilities are mostly resistant to formal arms control measures (due to their dual-use nature, the lack of effective verification options, and the lack of political will), there are many options to apply informal tools in these domains. Using historical examples, Jacquelyn Schneider from the Hoover Institution argues that technological revolutions are more likely to lead to war among states when they introduce new vulnerabilities which provide opportunities for opponents to exploit.[20] As emerging technologies increase the reliance of militaries on centralized networks and digital information, there will be more incentives for adversaries to target those systems.

The most escalatory situation among these scenarios is attacking another state's nuclear command, control, and communications (NC3) systems. Modern NC3 systems rely on computers for almost every aspect of their operations. Penetrating and infiltrating these systems in a crisis could generate "use-'em-before-you-lose-'em" pressures and incentivize launching nuclear weapons early. These attacks could also undermine the credibility of information provided by computer systems and push a state to overreact or misjudge a situation.[21] To address these threats, states could make a political commitment on a bilateral or multilateral basis that they are not going to launch any kind of cyber operations against each other's nuclear forces or NC3 systems. While such a commitment would be difficult to verify, compliance could be encouraged through deterrence by punishment, whereby any violation of this commitment would meet with a response in kind.[22]

Political commitments could also be used to manage certain risks in outer space. A generally underappreciated but very dangerous threat vector to nuclear escalation involves attacks against another state's early warning satellites in high-altitude orbits. These satellites play a critical role in enabling nuclear operations. Therefore, any attack or inadvertent threat against them could be seen as a prelude to a nuclear attack and would probably provoke an escalatory response. While it remains hard to attack these satellites with ground-based weapons, co-orbital weapons could destroy these satellites by colliding with them or using a kinetic or non-kinetic standoff weapon (such as electromagnetic pulses, high-powered lasers, or high-powered microwaves).

A possible arms control solution to this problem is a political commitment by the United States, Russia, and China to establish keep-out zones around high-altitude satellites. The participating states could agree not to maneuver their satellites within a certain minimum distance (researchers at the Carnegie Endowment for International Peace propose 700 kilometers) of another participant's high-altitude satellites.[23] Such a measure could mitigate the inadvertent dangers of repositioning operations, and in the case of a deliberate attack, keep-out zones would also buy some time before the attacking satellite could

close in on its target. Additionally, such an arms control agreement would underline the dangers of attacking high-altitude satellites to everyone else who is outside the scope of the agreement.

Normative and Behavioral Arms Control. Although the above proposals include elements of behavioral arms control (meaning that they set out certain behavioral standards to reduce nuclear risks), there are much broader normative efforts underway both in the cyber and in the outer space domains.[24] In February 2023, the US State Department issued a "Political Declaration on Responsible Military Use of Artificial Intelligence and Autonomy."[25] This broad set of measures reflects best practices that the United States unilaterally decided to implement for AI systems, hoping that others would also join. Guidelines such as "maintain human control and involvement for all actions critical to informing and executing sovereign decisions concerning nuclear weapons employment" were clearly designed with the intention to reduce nuclear escalatory dangers associated with the application of emerging technologies. While these measures are difficult (or even impossible) to verify, they could help create social expectations that normalize certain behaviors and render other practices unacceptable. When norms are championed by influential actors and they gain international traction, there is a chance that over time they could mature and become institutionalized globally.[26] These arms control approaches take time, and their effects might not be immediate, but they could make significant contributions in the long run.

In general, these types of unilateral declarations are useful tools to demonstrate restraint and flag certain dangerous behaviors, but mitigating the dangers associated with emerging technologies will also require multilateral engagement—particularly among nuclear weapon states.

Risk Reduction. Risk reduction mechanisms provide many useful options to put down the building blocks of more advanced multilateral arms control solutions. However, the success of these efforts will largely depend on coming to an agreement over the most dangerous applications of emerging technologies. Therefore, cooperative risk reduction measures should start with fostering a better understanding of the risks associated with emerging technologies. This requires a mechanism for regular dialogue between nuclear possessors. Efforts could utilize existing institutions and forums to advance such discussions—the P5, for example, could create a separate working group to discuss the effects of emerging technologies and the threat perceptions associated with these capabilities.[27] States could also leverage broader

Risk reduction efforts should start with fostering a better understanding of ET risks

multilateral fora which bring together nuclear weapon states with non-nuclear weapon states to discuss risks and set out a list of concrete steps for the future. The Creating an Environment for Nuclear Disarmament (CEND) initiative and the Stockholm Initiative are two possible venues to have such a dialogue.[28]

These multilateral fora could identify a menu of options for risk reduction and encourage states to commit to these measures. However, due to different threat perceptions, asymmetries in strategic postures, and ambiguous nuclear thresholds, nuclear possessors have very diverse perspectives about the value of different risk reduction measures. Bridging these gaps could require creative solutions. The Nuclear Security Summit series from 2010 to 2016, for example, introduced the mechanism of "gift basket" diplomacy[29] which allowed states to pick and choose which measures they were willing to sign up for. Applying such mechanisms in risk reduction would introduce much-needed flexibility, and it could help to get even the more skeptical states involved in the process.

Risk reduction efforts can take many forms. Some of them require collaboration, while others can be implemented unilaterally. For each nuclear possessor, a useful first step could include establishing risk reduction centers and setting up risk reduction stakeholders within key government departments to better understand the nature of threats originating from emerging technologies. Additional unilateral steps could include efforts to improve the resilience of military systems and critical infrastructure as well as efforts to strengthen deterrence.

In this regard, nuclear armed states should harden NC3 systems and processes by implementing safeguards, adding redundancies, and enhancing procedures to build more resilience against cyber threats.[30] To limit the consequences of incidental attacks against space-based communication assets, states could also host small communication transponders for nuclear operations on satellites used for other purposes.[31] On the deterrence side, nuclear armed states should clarify with declaratory policy statements their escalatory thresholds and red lines to make sure that their adversaries understand the dangers of attacking NC3 systems and critical infrastructure. The credibility of these deterrence threats could be further improved by developing the right escalation management tools and capabilities.

Confidence- and Security-Building Measures. The next category of informal arms control is confidence- and security-building measures. As with other mechanisms, there are many applications for these tools to manage risks associated with emerging technologies. In missile defense, for example, the United States could work with Russia to address some of their concerns about the European missile defense system. One of Russia's main concerns is that the SM-3 interceptors that are being deployed in the European Phased Adaptive Approach (EPAA) could be used to catch Russian ICBMs and undermine Russia's nuclear deterrent. This missile defense plan was put forward by the Obama administration to defend

Europe from missile threats from rogue states, and it includes the deployment of land-based interceptors in Romania and Poland which are the primary sources of Russian complaints. To address misconceptions and alleviate concerns, the United States could invite Russian observers to a flight test of an SM-3 Block IB interceptor and an SM-3 Block IIA interceptor, allowing them to use their own equipment to measure the burnout speed of the interceptors.[32] This could help to prove that these interceptors do not pose a threat to Russian ICBMs because they have insufficient burnout speed to catch those missiles. Although such a transparency measure would not address all of Russia's concerns with US missile defense developments, or even all the concerns associated with the EPAA, it could catalyze additional measures to address other Russian concerns.

Another example for a confidence- and security building measure could be a notification system for missile tests and space launches. In peacetime, the escalatory dangers of these activities are minimal, but in a crisis or war, preparations for a missile test or space launch could be mistaken for a preparation to attack and they could spark a preemptive strike or hasty military response. A notification system could help to reduce these dangers.[33]

Export controls are a potential tool to limit an adversary's access to emerging technologies

Export Controls. The last informal arms control mechanism which could help manage the risks of emerging technologies is export controls. In the post-Cold War period, export control mechanisms have primarily focused on preventing weapons of mass destruction (WMD) proliferation and terrorism. However, since Russia's invasion of Ukraine, export controls are increasingly seen as a potential tool to limit an adversary's access to and development of emerging technologies.[34] Strategic competition is becoming the engine of this new approach to export controls. These mechanisms have multiple possible applications for different categories of emerging technologies.

In AI and machine learning, export controls could focus on the training data and trained models in relation to specific military or WMD end uses, and they could also include hardware specifically designed for running machine learning algorithms in military systems. Strengthening controls in these areas could help to delay (and even degrade) adversary technological advancements that are aimed to exploit the benefits of emerging technologies for military advantage. In the aerospace and space industry, states could implement military end use controls to stop certain transactions to adversary states and strengthen controls at universities and research institutes.

As Russia and China are specifically targeted by Western export controls, existing multilateral export control regimes—where Russia and China are participating states—are not the primary venues to push this agenda. However, the United States must consider the broader implications of its policies, because these global mechanisms are still important tools to curtail WMD proliferation and terrorism. Therefore, Western efforts to contain Russian and Chinese technological advancements must be balanced against the desire to maintain the functioning of multilateral export control regimes.[35]

These examples provide two important takeaways. First, there is no "silver bullet" in the arms control toolkit—no single mechanism is able to address all the threats which emerging technologies pose. In each domain, solutions will need to be tailored to the specific problem. Second, there is a broad set of formal and informal measures which could all play a constructive role in a comprehensive arms control strategy. Each one of these measures has its own unique strengths and weaknesses. Some require cooperation among states, while others can be implemented unilaterally. The biggest challenge is not the technical difficulty of these issues or the lack of solutions, but the amount of political bandwidth which states are willing to invest in exploring these arms control options. The next section will provide a few general observations about the requirements for arms control success and how states can work together to create these conditions in the coming years.

Creating the Conditions for Arms Control Success

There is a rich and rapidly growing literature on emerging technologies and arms control. There is also a host of creative ideas on how states can improve arms race, crisis, and first-strike stability. However, progress is unlikely until two key obstacles are addressed.

Progress is unlikely until two key obstacles are addressed

Overcoming Obstacles

The first problem is the lack of trust between major powers. Both Russia and China are skeptical about US intentions in their respective regions and tend to hold worst-case assumptions about their adversary. Russia believes that the United States seeks a first-strike capability to coerce Russia into accepting US hegemony in the international system. Every new weapons program that the United States pursues is seen as proof of the US desire to defeat Russia. Missile defense and conventional precision strike are at the center of these fears.[36] Meanwhile, the United States believes that Russian interference with democratic elections in Western countries and its

repeated aggression against neighboring countries are all part of a deliberate strategy to undermine democracies and ultimately destroy the rules-based international order. Given Russia's poor track record in arms control compliance, many in the United States argue that Russia is not a trustworthy partner and pursuing cooperation is a waste of time. This has not only made it more difficult to deal with Russia on the diplomatic front, but it has also increased the burden for future treaties to detect cheating and enforce compliance.[37]

Similarly to Russia, China is also worried about US intentions in its zone of influence. China believes that the US refusal to openly declare a mutual vulnerability relationship (a recognition that both states have second-strike forces able to retaliate and inflict unacceptable damage in the event of a nuclear first strike) is proof that the United States seeks absolute security in the region. Chinese refusal to accept US invitations to discuss strategic stability is partly due to the general suspicion over applying Cold War terminology (such as "deterrence," "security dilemma," or "strategic stability") to describe their relationship. China sees these engagement efforts as a US plot to increase Chinese vulnerabilities and limit their modernization programs.[38] On the US side, China's opaque military doctrine and its ongoing open-ended strategic modernization efforts provide a lot of uncertainty and anxiety about the future of their relations.

In this environment, the only way to restore trust and dispel these worst-case assumptions about each other is to establish a sustained dialogue between the parties. The Strategic Stability Dialogue (SSD) could be a good starting point. Although strategic discussions between the United States and Russia have taken place for many decades, the SSD framework was only proposed in June 2021 at a high-level meeting between President Biden and President Putin in Geneva. This series of meetings included both plenary sessions and technical working groups, aiming to find areas of cooperation to reduce the risks of nuclear war and to lay the groundwork for future arms restraints. The two sides only convened three times before the meetings came to a halt after Russia invaded Ukraine in February 2022. A big advantage of this framework is that it is not as rigid as an official treaty negotiation, thus it could allow more flexibility to address broader issues affecting the strategic relationship, and it could also facilitate very specific technical discussions in the designated working groups.[39] However, simply gathering in a room is not enough. All sides need to have a clear set of objectives, and some structure is needed to pursue these goals over the course of multiple meetings.

To gain something from these discussions, there are at least three sets of criteria that should be met. First, the United States should identify areas where Russia and China have misunderstood US intentions (such as regional missile defense deployments) and try to set the record straight. Second, the United States should be ready to listen to better understand Russian and Chinese threat perceptions and how its adversaries see the strategic relationship.[40]

Third, all sides should be ready to discuss where they see the primary escalatory dangers in the new military domains. Although this would be a modest starting point, it would at least open the door to future broader dialogues.

Multilateral discussions in the P5 framework should also mimic these goals, and the agenda should be broadened to include emerging technologies. This could happen either in the framework of a designated working group, or at least in the framework of existing discussions about nuclear doctrine. If the great powers think that emerging technologies affect strategic stability and make it harder to cooperate and reduce nuclear dangers, it is their obligation under the NPT Article VI commitment (which requires them to work toward general and complete disarmament) to discuss these risks.[41]

The second main obstacle to arms control success is the lack of political willingness in most countries to negotiate restraints in emerging technologies. The United States, Russia, and China are already engaged in a competition to maximize the benefits of emerging technologies. Both Russia and China emphasize the importance of integrating all available capabilities in their toolkit. In peacetime, emerging technologies play a crucial role in information confrontation and undermining the US alliance system. In crisis and war, emerging technologies provide new options for kinetic and non-kinetic attacks and thereby support escalation management.[42] While the United States also tries to maximize the advantages of emerging technologies, there are concerns that integrating these capabilities could blur the lines between conventional and nuclear conflict and reduce the firebreaks between them.[43] The Biden administration has repeatedly expressed an interest in pursuing mutual restraint in emerging technologies,[44] but Russia and China are more focused on chasing strategic advantages. As a result, competition is likely to remain part of great power relations for the foreseeable future, but it does not rule out cooperation.

Learning from the Pre-Nuclear Era

These competitive dynamics and the revisionist agendas of President Putin and President Xi bear many parallels with great power relations in the 1920s. Arms control did not seem likely then, but states still managed to codify limits on capabilities that were the most important symbols of their military might because they were motivated by the desire to prevent another war after World War I and wanted to avoid a costly arms race. Thus, the key lessons of the 1921-1922 Washington Naval Conference could provide useful guidance for the current environment.[45]

The 1921-22 Washington Naval Conference could provide useful guidance for today

First, arms control very often reflects force structure decisions that states have already made beforehand (in this case, budgetary constraints in the United States, United Kingdom, and Japan had already imposed limits on shipbuilding programs). Second, it is not only the size of forces that matters, but also production capacity. Third, arms control does not automatically improve political relations, nor does it have to in order to be useful. Fourth, arms control sometimes creates unintended negative consequences because it does not necessarily stop competition between states, it might just shift the focus of it (in this case, the competition shifted from battleships and aircraft carriers towards improved auxiliary ships). Another possible negative consequence is that arms control measures can create limits and restraints beyond the explicitly intended scope of the agreement. The Washington Naval Agreement created an atmosphere of wishful thinking in both the United States and the United Kingdom that further agreements would follow. Thus, these two states did not even build up to the allowed treaty limits and naval modernizations were generally underfunded. This neglect undermined the Western powers' ability to deter when Japan embarked on a more competitive path in the 1930s.

Each of these four lessons have important implications for emerging technologies. First, the low-hanging fruits for successful arms control measures could be found in areas where states have already decided not to pursue certain capabilities. In the case of the United States, for example, there is a commitment not to pursue nuclear-equipped hypersonic weapons, not to conduct destructive, direct-ascent, anti-satellite missile tests, and not to deploy a Fractional Orbital Bombardment System (FOBS). The reason why it is worth codifying these decisions in some kind of arms control framework is that it can help to stigmatize certain destabilizing capabilities and behaviors and prevent or discourage adversaries from pursuing them.

Arms control proposals will also have to take into account how states evaluate their long-term ability to compete. While a state might possess an advantage in one area, if the other side has an overall better capacity to build up, there could be room for negotiations. Currently, the great powers have asymmetric advantages in production capacity in many areas. For example, Russia and China have clearly demonstrated that they are able to rapidly increase their nuclear forces, while the United States is struggling to maintain its current arsenal. At the same time, the United States enjoys a marked advantage in the manufacturing of advanced semiconductors which are necessary for AI and other leading-edge computing technologies. These asymmetric advantages influence how the great powers perceive their relative strength and the overall military balance, which is an important factor in their approach to arms control.

The next implication of the Washington Naval Conference is that states must approach arms control with realistic expectations. Arms control is about limiting the risks associated with certain technologies, not about changing the nature of

political relations. Since arms control in itself is not likely to put an end to great power competition, states have to be mindful of the possible negative outcomes. This includes taking into account the broader spillover effects to competition in other areas, and the consequences for their own ability to adapt to unexpected changes in the security environment.

Pathways Ahead

Looking into the future, there are two possible pathways ahead for the United States and its allies. First, they could develop an arms control proposal (which could include a whole suite of measures to address different aspects of the emerging technology problem set) and invite Russia and China to join.[46] Multilateralization could be an idea worthy of exploring given that Russia has long demanded the inclusion of all nuclear weapon states in arms control talks, and China might also be more willing to negotiate in a multilateral framework where it faces less direct pressure. Such a grand proposal could include unilateral measures to lead by example, as well as bilateral and multilateral mechanisms. Since there is no single tool that will address every problematic aspect of emerging technologies, these efforts should be pursued simultaneously, matching the right arms control solution to the different emerging technology risks on a case-by-case basis.

The main argument for such a strategy is that even if adversaries are not ready to negotiate, from a US and allied perspective it is important to have an agenda for arms control. This is advantageous for domestic reasons, such as maintaining bipartisan support for modernization efforts, as well as for diplomatic ones. Demonstrating a continued commitment to arms control strengthens the US diplomatic stance in global forums and institutions such as the Non-Proliferation Treaty (NPT). Besides, it is useful to do the intellectual homework to figure out what kind of arms control strategy would be beneficial to the United States and its allies.

The negative side of such an approach is that it is very unlikely to succeed as long as Russia and China are convinced that they have significant military advantages and that they can outcompete the United States. This is why the lesson of the Washington Naval Treaty on strong production capacity and long-term competitiveness is so important—if adversaries no longer believe that they can outcompete the United States, the balance is more likely to tip towards cooperative strategies and arms control.

The second possible pathway is a more aggressive one. In this case, the United States and its allies should identify the areas where achieving enduring strategic advantages is possible (and beneficial), and they should work together to achieve those. Once they have successfully improved their relative position vis-à-vis

Russia and China, they could propose an arms control agenda from a position of strength. The positive side of pursuing such an approach is that it is more likely that the United States and its allies can dictate the terms of a future agreement. At the same time, gaining temporary advantage with the sole purpose of negotiating it away is a difficult strategy to sell domestically.

Since none of these pathways are without a downside, the best course of action is likely somewhere in the middle. The Biden administration has been strongly committed to arms control solutions and put several proposals on the table, many of which touch on the issue of emerging technologies. These measures included formalizing a missile launch notification regime across the P5; maintaining a "human-in-the-loop" policy for command, control and employment of nuclear weapons; and setting up guardrails for managing the interplay between non-nuclear strategic capabilities and nuclear deterrence.[47] However, if the United States wants to get Russia and China to the negotiating table, it will probably also need to explore what it can do to strengthen deterrence and gain the necessary leverages to incentivize adversary cooperation in emerging technologies.

Rethinking Arms Control for Emerging Technologies

In the international community, there seems to be a consensus that strategic risks are on the rise. This is fueled by multiple factors: growing multipolarity; new arms race dynamics among the major powers; eroding arms control mechanisms; and an array of new strategic capabilities, the stability implications of which are still poorly understood. As a result of these trends, there is a growing possibility of accidental or inadvertent escalation. Emerging technologies are not the only source of these problems, but they are contributing to them. First, they are directly responsible for new potential pathways to nuclear use, and second, they have indirectly made it more difficult to manage relations through cooperation.

There is a growing possibility of accidental or inadvertent escalation

Unfortunately, there is no easy solution to control these technologies and to limit their negative effects. The term "emerging technologies" includes a wide range of capabilities at different stages of development. While in some cases the military applications of these technologies are clear and there are forums to address the concerns associated with them, in others the military implications are still unclear and there is a lack of venue or desire to discuss the effects of new technologies on the military balance.

Right now, the conditions for arms control do not seem to exist—in fact, they have been largely missing for fifteen years. While dialogue is useful and the United States should continue its attempts to engage Russia and China in high-level strategic stability discussions, the lack of progress in the past few years suggests that diplomatic engagement alone will not be enough. Thus, the United States and its allies will also need to embrace a more competitive pathway which includes strengthening deterrence, modernizing key capabilities, and building up the capacity for long-term competition. These two lines of effort should be pursued in tandem to create the conditions for arms control.

Once the basic conditions are in place, states must identify which specific emerging technology problems they want to resolve through arms control and what the right mechanism is for each specific case. Not all problems have a good arms control solution, especially in such a broad and vague area as emerging technologies. Therefore, the strategic arms control toolkit that was created to control nuclear weapons is not a direct blueprint for emerging technologies. Since the weapons attributes, modes of deployment, and potential applications are so different in many cases, the old toolkit may only cover part of the problem. The illustrative examples in this paper demonstrate that every past arms control mechanism can be applied to certain subsets of emerging technologies, but important gaps might remain. Thus, realistic expectations for arms control will have to be set and managed.

Another challenge is that arms control does not always create positive outcomes. As the Washington Naval Agreement demonstrated, the spillover effects of arms control can sometimes seriously undermine overall competitiveness. In emerging technologies, where so many of the capabilities are dual use, it is especially important to consider these broader consequences to avoid the trap of matching the wrong tools to the problem.

Arms control in the broadest sense includes all forms of military cooperation among adversaries with the goal of reducing the chances of war. Since the problems which arms control seeks to address are so manifold, the solutions must be tailored to the specific context. In a properly conceived arms control strategy, every tool can bring something to the table. Some of these measures allow for unilateral steps and leading by example, while others require cooperation with adversaries. The United States is already working with its allies to control many of these technologies and prevent its adversaries from accessing them. At a certain point, however, the major powers will have to start working together to address the unintended or undesired consequences of technology competition.

Altogether, arms control in emerging technologies is not simply about reducing numbers, instead it is about creating transparency and predictability to

reduce instabilities. While applying arms control concepts to emerging technologies evidently creates many technical difficulties, the primary problems are still political. Growing multipolarity has made it more difficult to apply a bilateral logic of parity to almost any problem, and it has also added new competitive dynamics. To manage these problems, the United and its allies need to rethink how deterrence, resilience, and arms control measures can work in tandem to support the same national security objectives.

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