ABSTRACT
The world is at the start of a new nuclear arms race, with the demise of important arms control agreements and increasingly robust nuclear weapons modernization and expansion plans by multiple countries. As such, the international community is searching for ideas that could change this trajectory and reinvigorate arms control. This article explores one of these ideas: to limit and eliminate nuclear-armed cruise missiles, whether delivered by air, sea, or land. Many countries and non-governmental organizations have developed this concept over the past several years. At times referred to as “cruise control,” it is seen by many who have explored the issue to be attractive, feasible, and likely to be in the mutual interests of many nations.

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Introduction
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This article explores one of these ideas: to limit and eliminate nuclear-armed cruise missiles, whether delivered by air, sea, or land. Many countries and non-governmental organizations have developed this concept over the past several years. At times referred to as “cruise control,” this concept has proven attractive for its ability to help reduce risks of nuclear miscalculation and unintentional escalation, and for its tailored focus on a class of nuclear weapons that few countries have and no countries truly need.

This article starts by setting the stage of the general status of nuclear weapons modernization and arms control trends today. It then explores the growing focus on nuclear-armed cruise missiles, their dangers, their current status in possessing countries’ nuclear forces and in international arms control discourse, and the benefits of developing approaches to achieve an end to these weapons.

The Status of Nuclear Arms Control
To frame how debate on limiting and eliminating nuclear-armed cruise missiles has emerged, it is important to describe the general context of trends regarding nuclear
weapons. This must include modernization programs of relevant countries on one hand, and the state of arms control and disarmament efforts on the other.

**Nuclear Weapons Programs**

The world is in the early stage of a new nuclear arms race. While many nuclear-armed states made great progress for years in reducing the numbers and roles of nuclear weapons and agreeing to win-win mutual restraint measures, that trend has now been reversed. As relevant to this paper, the United States and Russia gain most attention given their world-largest nuclear arsenals and currently-robust modernization and expansion programs.

Russia has in recent decades gone through expected modernization of its nuclear arsenal in line with its arms control agreements. However, the country more recently ratcheted up its plans and related rhetoric. In March 2018, Russian President Vladimir Putin lauded the country’s planned and new nuclear weapons capabilities in a long speech to his nation. This included his announcement of a new nuclear-powered cruise missile and a nuclear-powered unmanned underwater delivery vehicle that could carry a nuclear warhead (Putin 2018a).

While the United States had long been on a bipartisan trajectory of reducing the roles and numbers of nuclear weapons, its 2018 *Nuclear Posture Review* (NPR) and subsequent policy and budget decisions took the nation in a dramatically different direction. This includes expanding into several new nuclear weapon capabilities, and bringing back past nuclear weapons that were wisely taken out of service by prior presidents. Examples include a new low-yield modification for a submarine-launched ballistic missile warhead, resurrecting nuclear-armed submarine-launched cruise missiles, and beginning research on a non-nuclear ground-launched cruise missile (which likely could be modified for nuclear use). After the Trump administration announced it may withdraw from the Intermediate-Range Nuclear Forces (INF) Treaty in October 2018, it began working to accelerate the development of the ground-launched cruise missile. Shortly after the U.S. withdrawal and effective end of the INF Treaty, the United States announced a test of this new cruise missile in August 2019.

For the United States, other dangerous trends began emerging before the Trump administration but were expanded significantly under his authority. One of the most worrying is the deliberate blurring of conventional and nuclear deterrence and warfighting concepts (Parthemore 2019). In one example, several years ago U.S. policy makers and military planners began adopting the idea of using nuclear weapons to “restore deterrence” in cases where it has been lost, including potentially before an adversary first uses nuclear weapons. This type of approach was seen as particularly relevant in warfighting scenarios related to North Korea, though the discourse carried implications for others. The United States was not alone in this rationale, as this was seen as a response to what American leaders feared was a similar “escalate to de-escalate” approach to nuclear weapons use scenarios by Russia.

Another kind of nuclear/conventional blurring is the increasing threat to use nuclear weapons in retaliation for non-nuclear attacks. The 2018 NPR stated that the United States would hedge its nuclear deterrence posture against strategic attacks via cyber means or chemical or biological weapons (U.S. Department of Defense 2018, 37–38).
Though U.S. policy had long held open the possibility for nuclear weapons use in response to non-nuclear strategic attacks, the 2018 NPR took a much sharper, more deliberate path in elevating the concept.

The actions by Russia and the United States pulling toward a new arms race are disturbing enough. Moreover, both countries are trying to pull China more into the arms control mix despite its significantly lower numbers of nuclear weapons (although it has significantly developed its conventional weapons capabilities); this is not in itself negative unless these countries are using it as a stalling technique or excuse to tear down previous progress in arms control.

With their continually-fluctuating security environment, India and Pakistan also raise concerns. Both are expanding their nuclear arsenals and diversifying their nuclear capabilities. Adding to this grave situation are North Korea’s nuclear and missile tests. This leaves very few countries, such as France and the United Kingdom, that are holding relatively level in their nuclear arsenals and policies.

Building tension on top of these deliberate decisions to expand the world’s nuclear weapons dangers, the state of arms control efforts to arrest and reverse this course currently looks bleak. The world is witnessing the crumbling of past successes in reigning in nuclear dangers. The end of the long-successful INF Treaty stands as an historical example. Perhaps even more stark is the Trump administration’s withdrawal from the Joint Comprehensive Plan of Action (JCPOA) to significantly set back Iran’s nuclear capabilities and pathways to weaponization. This unjustified decision occurring just three years after the JCPOA was concluded sent a strong chill to the international community. Other countries have since used this withdrawal from arms control treaties in criticizing that the United States is no longer trustworthy in nuclear negotiations.

Luckily, these trends in arms racing and proliferation can be reversed. Often just below the surface, many experts and countries are setting the stage for a more stable future in which greater progress in arms control and disarmament will once again be possible.

**Arms Control**

There are areas of general agreement beginning to emerge on what the future of arms control will look like. For example, future arms control regimes must include more countries and must better bring together nuclear weapon states and non-nuclear weapon states. Additionally, they are likely to appear in a wider range of more flexible formats than in the past. Finally, most countries seem to be aligned on the need for new arms control efforts to strengthen the NPT.

First, the future of arms control must be more globalized than its past, in which Soviet and then Russian bilateral agreements with the United States dominated arms control discourse and implementation. Before their recent shifts to a new arms race, these countries conducted world-changing work in reducing the world’s largest nuclear stockpiles. As they still possess the world’s largest nuclear arsenals, both countries also still have an obligation to find a path back to further reductions – and both should begin by ceasing actions that destroy what remains of existing stabilizing measures and unconditionally extending the New START treaty five years to 2026.

Even so, both countries face security dilemmas that require looking beyond U.S.-Russia and Russia-NATO dynamics in considering arms control concepts. More
important, the security of both countries would benefit by many nuclear risk reduction measures that should also appeal to other countries. For example, working to eliminate the ambiguity that exists between certain nuclear and conventional systems would reduce the odds of unintentional escalation to nuclear conflict for any nuclear-armed countries. This is as important for stability in South and East Asia, for example, as it is between the United States and Russia.

Additionally, the bilateral paradigm for nuclear weapons reductions has long underappreciated the contributions the rest of the world has already made toward arms control. The NPT itself stands as a pillar in that regard, as it has helped to reduce the attractiveness of nuclear weapons for most countries. Five other treaties serve as the foundation for nuclear-weapon free zones that limit both the attractiveness and the potential use scenarios for nuclear weapons around the world. Still other treaties and declarations by individual nations seek to further limit the spread of nuclear weapons and reduce their utility (United Nations Office for Disarmament Affairs, n.d.a). Countries that have grappled with the effects of nuclear detonations such as Japan, Kazakhstan, and the Marshall Islands have long led international diplomatic and legal efforts to reduce nuclear weapons threats.

Second, more globalized approaches to arms control will warrant a wider variety in the types of agreements that are made, and some may offer more flexibility. Fully binding, verifiable legal agreements will maintain an important role, especially for any future nuclear agreements tailored to a few specific countries. Yet if more parties are involved in a particular agreement, it may take the form of a political agreement rather than a legally-binding treaty – at least at its inception. Future arms control constructs must focus on types of nuclear weapons or qualitative capabilities, and not focus solely on limiting numbers of nuclear weapons. And while large, sweeping nuclear arms control agreements that incorporate many weapon systems may still be developed, the world is likely to see more tailored approaches that focus on reducing singular, specific nuclear threats.

There are several positive aspects to greater diversity in arms control agreements. Verification may be easier in some cases. The involvement of more participants can help work around political tensions and trust deficits that inevitably arise between many nuclear-armed states. Small, more tailored arms control steps may be easier to develop than robust, complex treaties and therefore be faster in reducing specific nuclear weapons threats. Concluding such agreements may therefore show positive momentum that builds trust and gives countries greater confidence in diplomacy.

To many countries, these benefits may not outweigh the fact that the United States and Russia still hold significantly larger stocks of nuclear weapons than any other country in the world. This is a fair argument. However, the reality is that both countries now seek to open arms control agreements to include others. Russia has pushed to make the INF Treaty global for years, and the Trump administration in the United States has now fully embraced the desire to bring China into the New START Treaty.

As we have written in the past, it is not a workable approach to expect countries such as China to accede to current U.S.-Russian bilateral arms control treaties (Parthemore and Weber 2019). This is due to very different security needs and in part because, thankfully, past nuclear treaties have been expansive in the scope of types of weapons included, and many have focused on reducing massive nuclear stockpiles.
However, future arms control agreements may be different. Even if they are negotiated bilaterally, they may be narrower in scope and structured in ways that other countries are more likely to see the benefit in joining. It is also fully possible that future arms control deals will include many parties from the start, as they may be scoped to focus on the needs of multiple countries that agree on specific steps that are in their mutual security interests. Though no existing treaties should be scrapped because others do not join, negotiators of future arms control agreements should at minimum consider how they may be made more attractive to other parties over time.

Third, future arms control agreements must work to bring together nuclear weaponspossessing states and other nations. This may include countries that do not yet have specific types of nuclear weapons but are willing to refrain from developing them if others do the same. Such an approach may be global, or they may take on a regional character if neighboring nuclear weapon-possessing countries agree that certain nuclear capabilities would be especially destabilizing to the status quo.

It may also extend to those countries that have no nuclear weapons at all. While there are obvious technical limits to their nuclear weapons knowledge, many such nations could bring practical skills and benefits to arms control deals. Many have capabilities in areas that could contribute to monitoring and verification activities, or have nuclear personnel who could be further trained to assist in such actions. Even for countries with no nuclear weapons and no current intention to develop them, making political commitments of support for arms control agreements (and potentially contributing resources toward maintaining the strength and enforcement of such agreements) can serve as an important mechanism for bolstering norms of nonproliferation and disarmament.

Finally, there is increasing recognition that preserving the NPT system is critical and urgent. This includes such rhetoric from heads of government and other top officials from nuclear weapon-possessing countries such as China and Russia. Many other nations have vocally weighed in to this end in the context of the pending 2020 NPT Review Conference.

While the future may be brighter for arms control, the nuclear weapons status quo has proven unacceptable to most of the world’s nations and many of its citizens. In part to signal their rejection of the increasing turn toward new nuclear weapon capabilities by several possessing states, dozens of countries and civil society groups teamed together to develop and promote the Treaty on the Prohibition of Nuclear Weapons (colloquially called the “ban treaty”), which opened for signature in 2017. An act that stemmed in part from the long-running focus on the humanitarian consequences of nuclear dangers highlighted by Japan and others, the ban treaty now has 70 signatory countries (United Nations Office for Disarmament Affairs, n.d.b.). It is disputed whether this movement strengthens or detracts from the NPT process.

While the NPT-designated nuclear-armed states rejected this approach, it has amplified the clear and pressing need for developing new, concrete steps that would renew arms control and contribute to disarmament progress. There are many options for what such steps could look like.

In early 2019, nuclear expert and retired U.K. Rear Admiral John Gower posited a pathway toward eventual nuclear disarmament that maximizes strategic stability as reductions occur. This model shows strategic, politically-controlled nuclear weapons as the longest enduring given that they may be able to be governed with greater restraint
and transparency, and lower inherent misperception risks. Prior to that countries could reassert full high-political control of all nuclear weapons and remove tactical system. First steps should therefore focus on limiting and eliminating the most destabilizing types of nuclear weapons, beginning with dual-capable conventional/nuclear capabilities and nuclear-armed cruise missiles (Gower and OBE 2019, 6).

**The Case for Focus on Nuclear Armed Cruise Missiles**

Over the past several years, a new arms control concept focused on nuclear-armed cruise missiles has gained significant attention. These weapons are seen by many as particularly destabilizing and carrying a higher risk of causing nuclear weapons use via miscalculation or misinterpretation.

The most often-cited reason nuclear cruise missiles are seen as especially dangerous is the ambiguity they would bring to conflict scenarios. If a country sees one incoming from an opponent that has both nuclear and conventional cruise missiles, the recipient would not be able to distinguish whether a nuclear attack was underway.

This is inherently troubling, but is made more so by the rapid reaction time in which a nation may have to decide whether to respond as if a nuclear attack is incoming – if the cruise missile attack is detected at all. Unlike ballistic missiles, cruise missiles are difficult to detect in part due to their low flight altitudes and can lack of a clear signature that they have been launched. These attributes make them excessively difficult to defend against as well.

Even a conventional cruise missile strike by countries possessing nuclear variants would therefore either catch a targeted country by surprise or leave it with very little decision-making time. If detection occurs, the country’s leaders would have to decide in minutes whether to launch a counter-attack immediately or absorb the attack first to see whether it was nuclear or conventional. In October 2018 President Putin of Russia drove home the stakes of excessively-short response times:

“Only when we know for certain – and this takes a few seconds to understand – that Russia is being attacked we will deliver a counter strike. This would be a reciprocal counter strike. Why do I say ‘counter’? Because we will counter missiles flying towards us by sending a missile in the direction of an aggressor” (Putin 2018b).

The threat of surprise attack via nuclear-armed cruise missiles may equally disturb some basic tenets of strategic stability. For example, some believe these weapons are more likely to be used in conflict to take out an adversary’s command and control systems or other assets that are critical to its ability to launch a retaliatory strike. The ability of nuclear-armed states to respond to nuclear attack against them has long been held as an important aspect of relatively stable deterrence, adding to the worry that countries are increasingly undermining that tenet. And as Russian expert Vladimir Baranovsky wrote in 2018:

“Theoretically, uncertainty could also be interpreted as promoting more stable deterrence (for instance, if there are doubts on the expected results of a first strike against the opponent). But in practice, worst case scenarios tend to prevail in calculations and assessments related to vital security issues. Because nuclear-armed cruise missiles could play a role in delivering a decapitating first strike against the nuclear command and control infrastructure, the cost of uncertainty in a crisis could be enormously high” (Baranovsky 2018).
These severe risks have fueled the currently-debated cruise control idea, which builds on a strong historical foundation. The landmark INF Treaty set an important precedent by focusing on types of nuclear weapons that were viewed as uniquely heightening escalation risks and other security challenges. Other past U.S.-Soviet/Russian nuclear negotiations considered including measures to numerically limit or ban some types of nuclear-armed cruise missiles.

In fact, until recently, the world was already on a trajectory of eliminating nuclear-armed cruise missiles, even though it was not a singular, deliberate plan. The INF Treaty eliminated U.S. and Soviet nuclear ground-launched cruise missiles. In 1991, with the Presidential Nuclear Initiatives, U.S. President George H.W. Bush removed U.S. sea-launched nuclear cruise missiles from forward deployment, and President Barack Obama later fully retired them. The United Kingdom made a strategic decision for its nuclear arsenal to omit nuclear-armed cruise missiles because, as then-Secretary of State for Defence Philip Hammond wrote,

“A cruise-based deterrent would carry significant risk of miscalculation and unintended escalation. At the point of firing, other states could have no way of knowing whether we had launched a conventional cruise missile or one with a nuclear warhead. Such uncertainty could risk triggering a nuclear war at a time of tension” (Hammond 2013).

Over these decades, other countries such as China also showed restraint in not developing stocks of nuclear-armed cruise missiles, and so today, only three countries have known stockpiles of nuclear-armed cruise missiles: the United States, Russia, and France.

The start of the current wave of cruise control discussions originally assumed that the trajectory of these dangerous weapons disappearing would continue, and it was intended to build on that progress. Unfortunately, a different path is beginning to emerge today. This makes a cruise control approach even more important, as it would serve as a mechanism of both halting and reversing a pending expansion in these dangerous weapons.

As mentioned previously, Russia and the United States are both planning a new wave of nuclear-armed cruise missiles. Russia has been testing and fielding a new ground-launched cruise missile system. Since 2014, the United States has openly accused Russia of this system being designed for ranges banned by the INF Treaty (U.S. Congressional Research Service 2019), an issue that remained under dispute between the two countries as that treaty met its end. For the United States, the Trump administration is intent on bringing back nuclear-armed sea-launched cruise missiles, as well as the aforementioned ground-launched cruise missile systems that may someday be nuclear-capable.

Even more worrisome, some of these countries’ new nuclear cruise missile plans would introduce new capabilities. This certainly risks altering the expectations and dynamics that have contributed to tense but sustained strategic stability in the past. For Russia, this includes a new nuclear-powered and nuclear-armed cruise missile intended to evade missile defenses via long-sustained flight, and the Poseidon nuclear-capable underwater delivery system that by many definitions could be considered a cruise missile.

The U.S. LRSO, or long-range standoff nuclear air-launched cruise missile that is now in early development, is another example. While the United States has a nuclear-armed air-launched cruise missile (the ALCM) today, the new LRSO is reported to incorporate
several significant new capabilities. As we wrote in *Bulletin of the Atomic Scientists* in early 2019:

“Its features include improved accuracy, stealth capabilities, a longer range, and larger numbers, since the US Air Force has announced its intention to procure 1,000-to-1,100 of them. The intention to field the LRSO on the new B-21 Raider stealth bomber also raises concerns, as this would create for the first time the capability to launch stealthy, extended range nuclear cruise missiles from a stealth aircraft” (Weber and Parthemore 2019).

Although the U.S. government casts the LRSO as a replacement program for the ALCM, the rest of the world seems less convinced. In our work, we have encountered significant numbers of officials and experts who consider the LRSO a new nuclear weapon. It can therefore be counted as a major part of the current cycle of Russian-U.S. racing to outpace the other’s nuclear arsenal capabilities – a race that could also challenge continued strategic stability regarding China.

Unfortunately, while this is a reflection of the extremely strained security environment the world is experiencing today, there is little to no need for either country to expand its nuclear weapons capabilities in this manner. The United States and Russia both have formidable nuclear deterrents and significant conventional and asymmetric offensive and defensive capabilities that make these new and reinstituted systems unnecessary. This is one attraction of cruise control: it offers a way for these countries to walk back from the current arms race and discontinue spending on new but redundant capabilities.

The world also appears to be on the edge of a spread in nuclear-armed cruise missile programs. In particular, India and Pakistan have tested nuclear-capable cruise missiles and may soon decide to expand on these tests into full programs to develop and hold stocks of these weapons. The international community already harbors great concerns over these countries’ doctrines for nuclear weapons use and the potential use of their weapons short of the highest-level political instruction. The offensive-defensive balance between these countries, and with neighboring China, already raise serious concerns for the future of nuclear stability in this region. Spreading the ambiguity and other challenges of nuclear-armed cruise missiles to this geography would be extraordinarily troubling.

At the same time, several countries are growing their arsenals of conventionally-armed cruise missiles and expanding their capabilities in this area; though this article does not propose limiting or controlling these weapons, the growing emphasis countries place on these conventional weapons is one reason it is so important to elevate arms control concepts focused on reducing nuclear-armed cruise missile risks. China and Russia have been expanding their conventional cruise missile arsenals, with the United States now appearing to head in the same direction. Russia and the United States are also opening a new geographic dynamic regarding these weapons, as they now claim intentions of expanding capabilities for deploying cruise missiles in the Arctic without specifying whether or not they intend for these systems to be conventional-only.

Conventionally-armed cruise missiles are also in use more commonly than is often recognized, showing how muddled the global landscape of these weapons can be. As the U.S. 2019 *Missile Defense Review* noted, “Since 2015, Russia has demonstrated its advanced cruise missile capability by repeatedly conducting long-range precision strikes
into Syria” (U.S. Department of Defense 2019, VI). The United States has likewise launched conventional Tomahawk cruise missiles and its extended range Joint Air-to-Surface Standoff Missile (a conventional air-launched cruise missile) into Syria in recent years (Mizokami 2018). India and Pakistan test cruise missiles on a semi-routine basis, including variants that could reportedly carry nuclear payloads. Iran has long tested cruise missiles that some worry could be nuclear-capable if Iran moves to develop nuclear weapons (though Iran disputes this at times) (Shalal 2017). Even the Houthis in Yemen have been launching cruise missile attacks, though they are certainly conducted with backing by other nations.

Finally, missile defense systems could fuel greater cruise missile dangers for several reasons. Currently such systems focus on ballistic missiles because, as noted earlier, the flight paths and other characteristics of cruise missiles make them so difficult to defend against. This may drive countries to favor cruise over ballistic missiles for expanding their nuclear and/or conventional stockpiles. If these trends manifest, it will further complicate the offense-defense balances for any countries in question and further drive arms-racing behavior.

These alarming patterns are already on the horizon in both Europe and Asia, if they are not stopped. Russia’s treaty-violating deployment of ground-launched, intermediate-range conventional cruise missiles is driving NATO to reconsider its missile defense policies and posture (Barnes 2019). Though China is not the target of U.S. missile defenses based in South Korea, their deployment may increase the salience for China to increase its cruise missile development. Such a move would be tremendously concerning for Japan, South Korea, the United States, and others. Some news reports also indicate that India’s growing interest in nuclear-armed cruise missiles is in part driven by China’s ballistic missile defense capabilities.

The dangers inherent in this situation are clear. The unique attributes of nuclear-armed cruise missiles outlined above, and emerging trends toward their expansion, create a landscape of heightened nuclear risks that is reaching around the world.

Cruise Control Progress and Next Steps

For these reasons, the idea of limiting and eventually eliminating nuclear-armed cruise missiles has been building for years. While the idea was discussed in government channels previously, it was publicly introduced in new form around 2015 with a Washington Post op-ed calling for the United States to end its new nuclear air-launched cruise missile program and to lead an international movement away from these weapons (Perry and Weber 2015). In 2016, Switzerland and Sweden submitted a proposal to the UN Open-Ended Working Group recommending:

“That States initiate or engage in a process to reduce risks associated with nuclear armed cruise missiles” and “that such a process could include actions to limit, prevent deployment of and lead to a ban on all nuclear armed cruise missiles, regardless if they are launched from the sea, air or ground. These actions could be taken by States on a unilateral, bilateral, plurilateral or multilateral basis” (United Nations 2016).

Many other countries have been privately and publicly exploring how to pursue the concept. In 2016, notes from a meeting of experts convened by the Governor of Hiroshima recommended:
We propose that there be international negotiations on the prohibition of the development and acquisition of long-range cruise missiles with nuclear warheads to bridge the gap between nuclear states and non-nuclear states and open a new round of negotiations to reduce the risk of nuclear war” (Hiroshima Round Table 2016).

Meanwhile, the United Nations Institute for Disarmament Research (UNIDIR) has included the concept in several major studies (Podvig, Snyder, and Wan 2018; Borrie, Caughley, and Wan 2017). Other private government- and academic-led discussions have examined the possibilities for verifying cruise missile-focused arms control agreements. Dozens of reports, articles, and studies have been published exploring the benefits, challenges, and implementation requirements of steps taken toward cruise missiles being solely armed with conventional warheads. In October 2018, the U.S. Council on Strategic Risks (CSR) and international partner think tanks co-hosted a Track 1.5 dialogue on the future of arms control in Oslo, Norway, where many U.S., European, Russian, and Asian experts and officials agreed that cruise control may be one of the more viable concepts for future progress (Weber and Parthemore 2018).

This is just a brief snapshot of the discourse. These efforts and others have expanded upon the rationale for pursuing an end to nuclear-armed cruise missiles and the array of options that may exist for carrying the concept forward.

A complete end to nuclear-armed cruise missiles would have to include all delivery mechanisms: those launched by air, ground, and sea. There may be scenarios by which countries reduce and eliminate these types over a staggered timeframe. For example, eliminating all sea-launched nuclear cruise missiles may be an easier step to start with given the numbers involved and alternative weapons with similar capabilities. France may wish to develop plans to expand conventional air capabilities before it would consider ending its nuclear air-launched cruise missile program. However countries may prioritize these weapons, nuclear cruise missiles by all delivery systems have numerous alternatives that make it possible to remove these systems from service in ways that preserve deterrence (and make that deterrence more stable).

Cruise control could proceed with various types of agreements. One of our recommended first steps has been a combination of nuclear weapons-possessing states and those that do not have such weapons making a political pledge to work toward an end to this class of nuclear weapons. Such an agreement could mark the beginning of a process to encourage countries that possess these weapons to develop a path to relinquishing them, and pressuring countries that could develop stocks of such weapons not to do so. Such a process would be particularly powerful if it included both countries allied to the United States, and those that hold strong relations with Russia.

There are other ways smaller groups of countries could act in unison. Nuclear weapon-possessing states that do not yet have nuclear-armed cruise missiles could jointly agree not to develop them. This may be an option that is in the mutual interests of India, Pakistan, and China, and it would help showcase the leadership of Indo-Pacific nations in global nuclear affairs.

In general, it would be positive to see a comprehensive agreement or a patchwork of deals that both limit the spread of nuclear-armed cruise missiles and work toward

\[1\text{Hosting organizations were the Toda Peace Institute, Norwegian Institute of International Affairs, Chatham House, Clingendael Institute, and the Council on Strategic Risks.}\]
eliminating existing stocks. For the latter, of course, the United States and Russia must play leading roles.

Steps toward eliminating this class of nuclear weapons could also come via unilateral action by one or more countries. Toward the end of President Barack Obama’s administration in the United States, debate grew over a plan to unilaterally end the LRSO program. Prior to the nuclear plan changes the Trump administration introduced, this would have marked the United States moving toward the full end of nuclear-armed cruise missiles in its arsenal. As dozens of analyses have noted, this would have shown the United States as being in a position of high confidence and strength. Reasons include its other still-extensive nuclear capabilities and excellent conventional alternatives such as the Joint Air-to-Surface Standoff Missile, which has an extended range option, is interoperable with allies, and is solely conventional (and therefore does not introduce the previously-discussed ambiguity issues) (Parthemore 2017).

Notably, verifying an end to nuclear-armed cruise missiles is feasible— a first-order question regularly raised by governments who have explored this arms control option. The technical feasibility of verifying whether certain weapons or delivery systems include nuclear warheads has long been established. Going back to 1989, experts began to challenge what was then a common refrain that verifying limits or an end to nuclear-armed cruise missiles (particularly those launched by sea) would be too complicated. To counter this misunderstanding, a small group posited a “specific arms control option: a ban on nuclear SLCMs [sea-launched cruise missiles] of all ranges, with no constraint on conventional SLCMs” (Lewis, Ride, and Townsend 1989). They devised a plan by which U.S. and Soviet SLCMs could be verified as non-nuclear through inspection, tagging, and sealing at a special verification facility; plus monitoring of the movement of weapons to and from such facilities. They described a layered approach, including challenge inspections and assuming both countries’ use of national technical means, that would deter cheating and increasing the odds of catching any militarily significant issues.

A year later the Jasons, a prestigious American nuclear and defense advisory group, examined verification options for arms control arrangements that included bans on air- and sea-launched cruise missiles, also finding feasible options for both (Drell, et al. 1990). Of course, the INF treaty established verification measures for ground-launched cruise missiles, which may be modified for future agreements that ban nuclear variants but allow such conventional systems.

In 2018, building on this history, UNIDIR developed options for verifying the absence of nuclear weapons in specific locations and circumstances. This concept’s utility extends to a world in which countries would seek to verify that cruise missiles are conventional-only (Podvig, Snyder, and Wan 2018). Other government and academic units have likewise explored the verification subject as well. Some arrangements could include staff from non-nuclear weapon states if done in a manner that is mindful of protecting classified nuclear weapons design information. As trust is always a central challenge, the more countries that were to participate in the arrangements being verified, the easier it may be to find inspectors acceptable to the countries being inspected (e.g., if political problems arose between the United States and Russia while a future agreement were in force, inspectors from other countries party to the arrangement could serve those functions).
All of this goes to show that an end to nuclear-armed cruise missiles is more of a political challenge than a technical one. Its prospects should not be hindered by the excuse that such an arms control measure would be too difficult to verify.

Reducing and eliminating nuclear-armed cruise missiles would be an important step toward reducing the risks of nuclear warfare occurring. Yet it is still a relatively small step. These are two of the many reasons why experts and officials around the world have increasingly considered this measure.

Another benefit would be that it holds the possibility for including nuclear weapon-possessing states that remain outside of the NPT. For India and Pakistan, they would need only to forego developing stockpiles of nuclear cruise missiles rather than eliminating parts of their current arsenals (if such an agreement were made in the near-term, before either country develops full programs for these weapons). Bringing non-NPT states into arms control discussions will always be extremely difficult, but this is one area where India and Pakistan may see mutual security and budgetary benefits from the arrangement. It may also be a way for them to show they are responsible nuclear stakeholders – something very meaningful to both countries as they continue to seek legitimacy and participation in bodies such as the Nuclear Suppliers Group.

Additionally, there is a chance this approach may help recover from the damage of the United States and Russia ending the INF Treaty. Both countries have pushed to include other countries in this treaty, most recently with the U.S. insistence on incorporating China. As mentioned before, it is likely not a workable proposition to universalize the INF Treaty in its current form. Yet notably, the chief concern regarding China and other countries is their expanding capabilities in conventional ground-launched cruise missiles, not nuclear weapons in this class. It would be a positive step for all three countries to consider an agreement to start by preventing a new proliferation in nuclear-capable ground-launched cruise missiles of any range.

Finally, there are risks to inaction against current trends related to nuclear-armed cruise missiles. Foremost, as the concerns described in this article imply, continuing expansion of nuclear-armed cruise missile capabilities by even a small group of countries will increase the odds of miscalculation and misunderstanding among nations and may heighten risks of nuclear weapons use. If not reversed, current trends regarding this class of nuclear weapons will continue to fuel the arms-racing trajectory now adopted by Russia and the United States.

For the United States, equally important is the chance that inaction against nuclear-armed cruise missiles will perpetuate political divergence with some of its close allies. Beginning with plans for the U.S. LRSO program that launched several years ago, many of its allies began worrying that the United States was not adhering to its stated vision of reducing the roles of nuclear weapons. Several U.S. allies have rising anti-nuclear weapons sentiment among their publics, and for some that sentiment has been stoked by the United States driving toward new nuclear weapon capabilities (most of which are cruise missile-based). Russia, of course, is keen to leverage this tension between public views in allied nations and American policy trends (Parthemore 2016).

Moreover, lack of progress toward nuclear arms reductions and the dearth of new arms control efforts will continue to weaken the NPT-based system (in the absence of alternative pathways in the direction of disarmament arising quickly). Though the NPT does not commit nuclear-armed states to specific disarmament timelines, it does
require progress in that direction. The majority of the world’s nations have taken action to show their frustration with the slow pace of progress and potential regression now on the doorstep. If faith in the treaty’s power continues to decline, global governance and norms regarding nuclear weapons could see further significant disruption. For the reasons this article outlines, nuclear cruise control is the best option in the near term to restore confidence that the NPT-centric regime can continue to meet the needs of all of its signatories.

Conclusion

For all of the reasons explored in this article, the future of arms control should contain an end to nuclear-armed cruise missiles as one of its near-term steps. All countries with these weapons today are experiencing budget pressures and expansive competing defense priorities in conventional capabilities, cyber, space, training and readiness, and other areas. Most important, the benefits to each country’s security and strategic stability among them would benefit greatly by removing the risky dynamics these weapons introduce.

It is urgent to continue building on recent years of international dialogue regarding arms control options that could focus on or include cruise control. There is momentum in this conversation that serves as a great advantage to all countries seeking steps for reducing nuclear risks. As previously recommended, this should include “individuals focused on deterrence, disarmament, regional affairs and bilateral relations” in relevant countries, as:

“Too often, nuclear conversations are carried out within the deterrence and disarmament communities but not between them, and not with officials charged with governing broader defense relationships and foreign affairs. This complicates the ability of the United States and other countries to set optimal national-level decisions” (Singh and Parthemore 2015).

Pursuing this option cannot stand alone. It would be best for the United States and Russia to extend the New START treaty which may otherwise expire, risking further escalation of today’s arms race. As John Gower described, key countries need to gain more common understanding of what constitutes strategic stability and what types of nuclear weapons capabilities are perceived as most destabilizing; this bridge-building must include relevant parties across Asia, Europe, and the Americas. Finally, cruise control should be part of a drive to rebuild the space between conventional and nuclear warfighting concepts in order to help prevent escalation to nuclear warfare in the event of conflict.

In sum, the successful enactment of the cruise control agenda will reduce the risk of nuclear war, especially the potential use of such weapons in so-called limited nuclear war on the territory of states bordering Russian and China, and reverse the dangerous nuclear arms race now underway.

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Notes on Contributors

Honorable Andy Weber is a Senior Fellow at the Council on Strategic Risks. Weber has dedicated his professional life to countering nuclear, chemical, and biological threats and to strengthening global health security. His US government service included five-and-a-half years as the Assistant Secretary of Defense for Nuclear, Chemical and Biological Defense Programs. He was a driving force behind Nunn-Lugar Cooperative Threat Reduction efforts to remove weapons-grade uranium from Kazakhstan and Georgia and nuclear-capable MiG-29 aircraft from Moldova, to reduce biological weapons threats, and to destroy Libyan and Syrian chemical weapons stockpiles. In addition, he coordinated US leadership of the international Ebola response for the Department of State. Prior to joining the Pentagon as Advisor for Threat Reduction Policy in December 1996, Mr. Weber was posted abroad as a US Foreign Service Officer in Saudi Arabia, Germany, Kazakhstan, and Hong Kong. He serves on multiple boards and is a member of the Council on Foreign Relations. His twitter handle is @AndyWeberNCB.

Christine Parthemore is the Director of the Center on Strategic Weapons at the Council on Strategic Risks. She has also been an adjunct professor in the Global Security Studies program at Johns Hopkins University since 2010. In 2016 she was a Council on Foreign Relations International Affairs Fellow in Tokyo, where she researched Japan’s approach to international civil nuclear cooperation. Prior, she served as the Senior Advisor to the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs in the U.S. Department of Defense, an office that covered research and development, acquisition, treaty compliance, and international partnership programs in addition to the Nuclear Weapons Council. Her countering-weapons of mass destruction work spanned from projects to destroy chemical weapons to biosecurity capacity-building programs with partner countries. Parthemore has worked at various think tanks and contributed to two best-selling nonfiction books. With extensive experience in Asia, the Middle East, and Europe, Parthemore has testified before Congress, spoken at the United Nations, authored or coauthored dozens of written works, and lectured at universities in the United States, Vietnam, and China. You can follow her on Twitter @clparthemore.

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