DeepCuts

Deep Cuts Working Paper
No. 14, October 2021

MISSILE DEFENSE AND THE OFFENSE-DEFENSE RELATIONSHIP

By Andrey Baklitskiy, James Cameron and Steven Pifer

Executive Summary

- The U.S.-Russia Strategic Stability Dialogue, agreed by presidents Joseph Biden and Vladimir Putin at their June 2021 summit, has begun. It presumably is addressing the range of issues affecting strategic stability, including reductions in and limits on strategic offensive nuclear forces as well as questions related to missile defense.

- Three phases have defined the history of missile defense: the era of unrestrained offense-defense competition prior to the negotiation of the 1972 Anti-Ballistic Missile (ABM) Treaty; the period of arms control between 1972 and 2002, during which both defenses and strategic offensive forces were limited; and the current era of unrestrained defenses and controlled strategic offensive forces, from 2002 to the present.

- After more than six decades of missile defense investments, strategic offensive forces retain a significant and enduring edge over defensive systems. While progress has been made in defending against shorter-range ballistic missiles and their warheads (which travel at considerably lower velocities than strategic ballistic missile warheads), at no point during any of the three periods has the United States or the Soviet Union/Russia been able to produce a defensive system that has held any short- or medium-term prospect of negating the strategic offensive forces of the other, either on its own or in combination with a counterforce first strike.

- The concerted effort since 2002 by Washington and NATO to develop their missile defense capabilities against the long-range ballistic missile threats posed by North Korea and Iran has enjoyed only limited success, and the viability of the U.S. homeland defense against Pyongyang's relatively small and unsophisticated nuclear arsenal is still doubtful. Russia's incremental improvements to its defensive system around Moscow do not pose a significant threat to the U.S. strategic nuclear capability.

- Nevertheless, the prospect of longer-term improvements to U.S. and Russian missile defenses continues to be a source of uncertainty that exercises considerable influence on the force sizing and development of new capabilities, particularly for Russia and the European nuclear powers, France and the United Kingdom. The limited available evidence suggests that China shares similar concerns regarding the viability of its deterrent against new defensive systems. Russian and Chinese planners appear to fear a future U.S. counterforce attack conducted primarily, or even solely, with advanced, high-precision conventional weapons that would disable a major portion of their strategic forces, leaving the remainder to have to penetrate U.S. missile defenses.

- For Russia, the prospective long-term threat to its forces posed by the improvement in U.S. defenses and nuclear and conventional counterforce capabilities has prompted it to develop new "exotic" systems designed to ensure its retaliatory capacity, including the Avangard boost-glide vehicle, the Poseidon long-range nuclear uncrewed underwater vehicle (UUV) and the Burevestnik nuclear-powered cruise missile. Russia has also expressed significant reservations about further cuts to its strategic offensive forces through arms control, if missile defenses remain unconstrained.

- France and the United Kingdom have been historically far more sensitive to developments in the Moscow ABM system given their smaller and less technologically advanced nuclear arsenals. Both powers have continued to ensure the long-term viability of their deterrents against prospective Russian improvements through the introduction of improved warheads (France) and planned increases in maximum stockpile size (UK).

- China's smaller arsenal means that Beijing may be even more sensitive to developments in U.S. missile defense policy than Moscow. China's recent apparent expansion of the number of its intercontinental ballistic missile (ICBM) silos may in part stem from anxieties regarding the viability of its deterrent against prospective U.S. missile defenses, although the motivation for and extent of an expanded ICBM force are still unclear at the time of writing.

- Thus, the current era of unrestrained missile defenses since 2002 has seen the deployment of defensive systems of limited short- and medium-term technical potential, combined with considerable anxiety from four of the five recognized nuclear powers that longer-term technological developments may pose a risk to their forces, stimulating their qualitative and quantitative augmentation. This has resulted in a paradox: even as they remain broadly ineffective against all but the most limited threats, strategic missile defenses nevertheless exert a destabilizing influence on the global nuclear balance.[1]

- A number of measures, primarily between the United States and Russia, could help to limit the uncertainty over future missile defense capabilities by placing more explicit restraints on today's limited missile defenses so that they cannot expand into systems that could put the retaliatory capability of any of the five nuclear powers at risk.

- These steps could include confidence-building measures, such as transparency agreements and reciprocal observation of missile defense interceptor tests, a ban on space-based missile defense interceptors, clearer unilateral explications of the extent and limits of both Washington and Moscow's missile defense plans, as well as negotiated limits on missile defenses on either a legally or politically binding basis.

- Given their long-standing interest in missile defenses designed to counter only limited threats and the risks that an offense-defense competition could pose both to stability in the North Atlantic area and the viability of European members' nuclear arsenals, U.S. NATO allies should do all they can to support these efforts.

Context: Strategic Stability, Missile Defense and Arms Control Dilemmas

At their summit meeting in Geneva on June 16, 2021, U.S. President Joseph Biden and Russian President Vladimir Putin agreed to a Strategic Stability Dialogue between their two countries. These talks are now underway and will presumably address the full range of issues related to strategic stability, including strategic ballistic missiles and missile defense.

One possible result could be a negotiation on an agreement regarding reductions in and limits on nuclear weapons that would follow on to the New Strategic Arms Reduction Treaty (New START), which will expire in 2026. New START currently limits only deployed strategic warheads. But the Biden administration has indicated that it would like to pursue a bilateral negotiation with Russia covering all U.S. and Russian nuclear warheads – strategic and non-strategic, deployed and non-deployed.

Russian officials in the past have indicated missile defense as one of their priorities for the Strategic Stability Dialogue and possibly for future negotiation. Thus far, Washington has shown no interest in such a negotiation. Should Moscow insist on inclusion of missile defense in a broader agreement or series of agreements on strategic stability, the Biden administration would face a tough decision: is the American and allied interest in constraining Russian offensive capabilities, including non-strategic nuclear weapons, so intense that it would be prepared to accept some limits on missile defense?

Any potential linkage between limits on offensive and defensive forces would be one in which European NATO members would take a strong interest. Russia has focused in the past on the potential threat it sees from NATO's missile defense installations in Europe, designed to defend allies and NATO forces from a potential threat from Iran. U.S. capabilities form the technical core of the NATO system, but given their integration into the Alliance-wide missile defense effort, any U.S. moves to limit its defenses in Europe would require the consent of its NATO allies. Both the United States and NATO have expressed particular interest in limits on Russian non-strategic nuclear weapons. Some, perhaps many, allies would argue for accepting some missile defense restrictions if they were necessary for a broader package of strategic stability measures that would also include limits on Russian non-strategic nuclear warheads.

It is thus an important moment to reassess the role and contribution of missile defense to deterrence and strategic stability and options for its limitation. This involves evaluating the technical progress of missile defense programs and efforts to limit them over the past 60 years, as well as the current status of today's capabilities. It is also necessary to assess the interrelationship between the offensive and defensive forces and policies of the United States, Russia and Europe, and their impact on strategic stability. Taking these factors into account, it will be possible to propose options for transparency and limitation measures that balance whatever the contribution that missile defense can make to deterrence with the contributions that agreed limitations and other measures can make to ensure a stable relationship between the United States, NATO and Russia.

Background: Missile Defense and Offense-Defense

Offense-Defense in the 1960s

The race in strategic offensive nuclear forces between the United States and Soviet Union was in full swing by the mid-1960s. Both countries had begun adding intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs) to arsenals that already included long-range strategic bombers. The combination of ICBMs in hard-

At their summit meeting in Geneva on June 16, 2021, U.S. President Joseph Biden and Russian President Vladimir Putin agreed to a Strategic Stability Dialogue between their two countries. These talks are now underway and will presumably address the full range of issues related to strategic stability, including strategic ballistic missiles and missile defense.

ened silos and SLBMs on board submarines operating under the world's oceans meant that each country had a survivable second-strike capability; neither could launch a first strike against the other's nuclear forces with any confidence that it could destroy enough to prevent a devastating nuclear counterstrike.

In 1964, U.S. Secretary of Defense Robert McNamara introduced the concept of "assured destruction", centered on the idea of deterrence: persuading an adversary that the risks and costs of its potential action far outweighed any gains it might hope to achieve. Large numbers of strategic nuclear forces capable of surviving a strike by the other side raised the prospect of enormous risks and costs. McNamara believed that the ability of U.S. strategic forces, even after a Soviet first strike, to hold at risk (and, if necessary, destroy) 20-33 percent of the population of the Soviet Union and 50-75 percent of its industrial base would prove sufficient to deter a Soviet nuclear attack on America.[2]

As the Soviets matched U.S. capabilities in strategic forces, strategists began to talk of a situation of "mutual assured destruction". Ideas began to emerge about strategic stability, a concept that American strategists broke into two parts. Crisis stability referred to a situation in which the incentives for the United States or Soviet Union to use nuclear weapons first, even in a crisis or a conventional conflict, were minimized. The possession of *survivable* strategic nuclear forces thus enhanced stability. Arms race stability referred to a situation in which neither side had an incentive to engage in a major, expensive build-up of new weapons. Soviet strategists tended to define strategic stability in broader terms but generally came to accept the U.S. view.

Early Soviet Missile Defense Systems

The development of anti-ballistic missile (ABM) systems, missiles that could intercept incoming ICBM and SLBM warheads, added new complexity. The Soviet military's interest in ballistic missile defense began in the 1950s. The general feasibility of the concept was tested on the experimental ballistic missile defense System A, which in 1961 used a fragmentation warhead to successfully intercept an R-12 intermediate-range ballistic missile (IRBM).[3] After proof of concept was achieved, the Soviet military considered and pursued a number of missile defense projects: the A-35 missile defense system to protect Moscow and the surrounding industrial region, the S-225 point defense system, the Aurora territorial defense system and – the most ambitious one – the Taran (Ram) global ABM system to protect the whole of Soviet territory.[4]

Taran was specifically supported by Communist Party's First Secretary Nikita Khrushchev but was seen as unrealistic and a waste of resources by other high-ranking officials and chief designers. After Khrushchev's removal in 1964, the project was suspended. Project Aurora was canceled in 1967, as it was impossible to implement with then-existing radar and computing capabilities. The Soviets only eventually finalized the A-35 Moscow ABM system.

In November 1964, the military paraded the Galosh, a nuclear-armed ABM interceptor, under development to defend Moscow as part of the A-35 system. The Galosh exo-atmospheric interceptor – it would intercept ballistic warheads outside the atmosphere – carried a warhead with a yield of 2-3 megatons.[5]

Early U.S. Missile Defense Systems

At about the same time, some in the U.S. intelligence community believed that an air defense system near Tallinn, Estonia (then part of the Soviet Union) had capabilities to intercept strategic ballistic missile warheads. The combination of the Galosh and Tallinn systems gave rise to concern in Washington that the Soviets intended to build a large-scale ABM system to defend population centers. U.S. interest in ABM systems, which also dated back to the 1950s, increased. Moreover, the Pentagon decided to develop and deploy multiple independently-targetable reentry vehicles (MIRVs), which would allow an ICBM

U.S. capabilities form the technical core of the NATO system, but given their integration into the Alliance-wide missile defense effort, any U.S. moves to limit its defenses in Europe would require the consent of its NATO allies.

or SLBM to carry multiple warheads capable of striking separate targets, increasing the ability of U.S. ICBMs and SLBMs to overwhelm Soviet ABM defenses.[6]

In 1967, the Johnson administration proposed the Sentinel ABM system to defend American cities against an attack by Chinese ICBMs. The "light" Sentinel system would not have had the numbers to defeat a Soviet ballistic missile attack. Critics wondered whether it could lay the basis for expansion to a "heavy" system and thereby give the Soviets incentives to increase their strategic ballistic missile forces. However, two years later, the Nixon administration proposed the Safeguard system, primarily designed to defend ICBM silos against Soviet attack.[7] Defending silos and making ICBMs more survivable was seen as enhancing strategic stability. The Safeguard system consisted of two types of ABM interceptors: Spartan missiles, armed with a five-megaton nuclear warhead, for exo-atmospheric interception, and shorter-range Sprint missiles, carrying one-kiloton warheads, to engage warheads after they had entered the atmosphere. Because of its short range, Sprint was more appropriate for point rather than area defense.[8]

Strategic Stability and Missile Defenses

The MIRV and ABM systems posed challenges for both crisis and arms race stability. MIRVs increased the number of warheads on each side, and the possibility to eliminate multiple adversary warheads by using just one or two warheads to destroy a MIRVed ICBM in its silo – possibly carrying three to ten warheads, depending on the ICBM type – could raise incentives to conduct a first strike in a crisis. As for ABM systems, if one side deployed credible strategic missile defenses, it might be tempted in a crisis to launch first against the other's strategic forces (nuclear command and control nodes, ICBM silos, SLBM-carrying submarines in port, strategic bomber bases, etc.) and then use its missile defenses to blunt a degraded retaliatory strike. The side without missile defenses might also be tempted to launch first, facing a "use them or lose them" situation and calculating that it could do far more damage to the other side in a first strike than if it absorbed a strike and had to retaliate with surviving strategic forces, which would have to face the other's missile defenses. A similar logic held if both sides had missile defenses.

A related worry dealt with arms race stability. The best way to defeat the other side's ABM system was to deploy more ICBM and SLBM warheads in order to overwhelm it. MIRVed missiles offered a less expensive way to add strategic nuclear warheads than building more single-warhead ballistic missiles. Still, if both sides proceeded, the result would be a costly arms race, likely with neither side gaining a net security improvement.

Soviet officials did not at first agree with this logic, in part due to the traditional Russian belief in defense. Soviet Premier Alexei Kosygin's refusal to accept the link between defensive and offensive systems at the 1967 Glassboro Summit with U.S. President Lyndon B. Johnson set back the beginning of the U.S.-Soviet Strategic Arms Limitation Talks (SALT).[9]

SALT I and the ABM Treaty

After a couple of false starts, the U.S.-Soviet SALT negotiations began in late 1969. Seven negotiating rounds produced the ABM Treaty and Interim Offensive Arms Agreement, signed by President Richard Nixon and General Secretary Leonid Brezhnev in Helsinki on May 26, 1972.

The ABM Treaty prohibited both the United States and the Soviet Union from deploying a nationwide ABM system.[10] Each side was allowed to deploy one ABM site with no more than 100 ABM interceptor launchers and 100 ABM interceptors near its capital and a second site, again with no more than 100 ABM interceptor launchers and 100 ABM interceptors, near an ICBM field. The treaty placed limitations on radars at the ABM interceptor sites and otherwise

Crisis stability referred to a situation in which the incentives for the United States or Soviet Union to use nuclear weapons first, even in a crisis or a conventional conflict, were minimized. The possession of survivable strategic nuclear forces thus enhanced stability. Arms race stability referred to a situation in which neither side had an incentive to engage in a major, expensive build-up of new weapons.

The MIRV and ABM systems posed challenges for both crisis and arms race stability.

required that future radars be at "locations along the periphery of [the country's] national territory and oriented outwards"[11], where they could be used for early warning purposes but could not provide direction to ABM interceptors. A 1974 protocol to the treaty restricted each country to just one ABM interceptor site. The Americans chose to have their site at the Grand Forks ICBM field in North Dakota while the Soviets chose to have their site protecting Moscow.

The Interim Offensive Agreement limited the two countries' ICBM and SLBM launchers.[12] It froze the number of U.S. and Soviet ICBM launchers (silos) at the levels deployed or under construction as of July 1, 1972 and froze the number of U.S. and Soviet SLBM launchers (missile tubes on ballistic missile submarines) at the number deployed or under construction as of May 26, 1972. That gave the Soviets an advantage in the numbers of ICBM and SLBM launchers, but that was offset by two factors: the U.S. lead in MIRVed ICBMs and SLBMs meant that the United States had more ballistic missile warheads, and the United States had more strategic bombers, which were not constrained by the Interim Offensive Agreement.

Picture: Launch LGM-30 Minuteman III, by U.S. Air Force photo - http://www.af.mil/News/Photos.aspx?igphoto=2000597905, Public Domain

The ABM Treaty limited ABM interceptors so tightly that, for practical purposes, strategic missile defense fell out of the offense-defense equation. Given the large number of ICBM and SLBM warheads the United States and Soviet Union deployed – numbering in the thousands in the early 1970s – each had more than enough to exhaust the other's strategic missile defenses. Moreover, those warhead numbers would grow as each side replaced single-warhead ICBMs and SLBMs with MIRVed missiles. Under the 1990 data exchange made in the context of the 1991 Strategic Arms Reduction Treaty (START), the United States had 8,210 accountable warheads on its ICBMs and SLBMs, while the Soviet Union had 9,416. START required each side to reduce to no more than 4,900 accountable ICBM and SLBM warheads.[13]

> **The ABM Treaty limited ABM interceptors so tightly that, for practical purposes, strategic missile defense fell out of the offense-defense equation. Given the large number of ICBM and SLBM warheads the United States and Soviet Union deployed – numbering in the thousands in the early 1970s – each had more than enough to exhaust the other's strategic missile defenses.**

The U.S. development in the late 1960s of a MIRVed ICBM (the Minuteman III) and a MIRVed SLBM (the Poseidon) prompted a significant redesign of the Soviet A-35 system. By the time the negotiation of the ABM Treaty had begun, the Soviets had pretty much concluded that a global ballistic missile defense system was impossible and focused on protecting the capital, using the A-35 system, which became operational in 1971. The Soviet military maintained and modernized the system, with the nuclear-armed A-350R interceptor entering service in 1978 as part of the A-35M system and remaining in operation until 1990.[14] The Soviets kept within the ABM Treaty's limits of 100 interceptors and 100 launchers.

The U.S. military activated the Safeguard ABM site in North Dakota with 30 Spartan and 70 Sprint interceptors in April 1975. It became fully operational five months later. However, Congress did not approve additional funding, and the site was deactivated in February 1976. The associated perimeter-acquisition radar continued to operate for early warning purposes.[15]

Challenges to the ABM Treaty

The ABM Treaty faced two primary challenges in the 1980s. First, in 1983, the United

States charged that the Soviets had violated the treaty by building a large phased-array radar at Krasnoyarsk; it should have faced south but instead was oriented toward the east, giving it a long view over a large part of the Soviet Far East. Washington regularly pressed Moscow on the violation. In 1989, the Soviets conceded that, while intended for early warning purposes, the Krasnoyarsk radar was a violation of the ABM Treaty. They subsequently tore it down.[16]

The second, broader challenge to the ABM Treaty also began in 1983, when President Ronald Reagan announced the Strategic Defense Initiative (SDI, promptly dubbed "Star Wars"). Reagan sought the ability to defend the American homeland and allies against a large-scale Soviet ballistic missile attack and base U.S. and allied security on defense rather than the threat of nuclear retaliation. SDI launched a variety of research programs, including "hit-to-kill" technologies for ground-based interceptors to destroy incoming warheads and space-based interceptors – called "smart rocks" – to destroy ICBMs and SLBMs in their boost phase and space-based X-ray lasers that could be directed at multiple warheads or ballistic missiles in their boost phase. The very concept of SDI, a nationwide defense, contradicted the ABM Treaty, and some proposed technologies, such as space-based systems, would have constituted specific treaty violations.

The George H. W. Bush administration, which followed Reagan at the end of the Cold War in 1989, downsized the SDI program for two reasons. First, it recognized that the new defense technologies would be more difficult and more costly to develop than anticipated. The Bush administration thus in 1991 announced the Global Protection against Limited Strikes System (GPALS), which aimed for a combination of ground- and space-based kinetic interceptors that could defend against a limited strategic ballistic missile attack. Second, the experience of the first Gulf War in 1991 revealed the difficulty that U.S. forces had in defending against Iraqi SCUD missiles, leading to a reorientation of U.S. missile defense efforts to focus on shorter-range missile threats.[17]

Following the collapse of the Soviet Union at the end of 1991, a memorandum of understanding was worked out under which Russia, Belarus, Kazakhstan and Ukraine would collectively take on the Soviet Union's rights and obligations under the ABM Treaty. Mindful of the threat posed by short-range Iraqi SCUD ballistic missiles, the United States developed theater missile defense systems such as the Patriot Advanced Capability-3 (PAC-3) and Terminal High Altitude Area Defense (THAAD) interceptors. The challenge of intercepting theater ballistic missiles was less than that of intercepting ICBM and SLBM warheads because the theater missiles and their warheads traveled at slower velocities and lower altitudes.

Russian officials, however, grew concerned that these theater missile defenses might have capabilities against ICBMs and SLBMs. While the ABM Treaty did not constrain theater missile interceptors that had not been "tested in an ABM mode", the treaty did not define "tested in an ABM mode". U.S.-Russia negotiations resulted in September 1997 in the ABM Treaty Demarcation Agreement. It specified that theater missile interceptors would not be subject to the ABM Treaty's limits as long as their velocity did not exceed three kilometers per second and they were not tested against targets with a velocity greater than five kilometers per second and with a range in excess of 3,500 kilometers.[18]

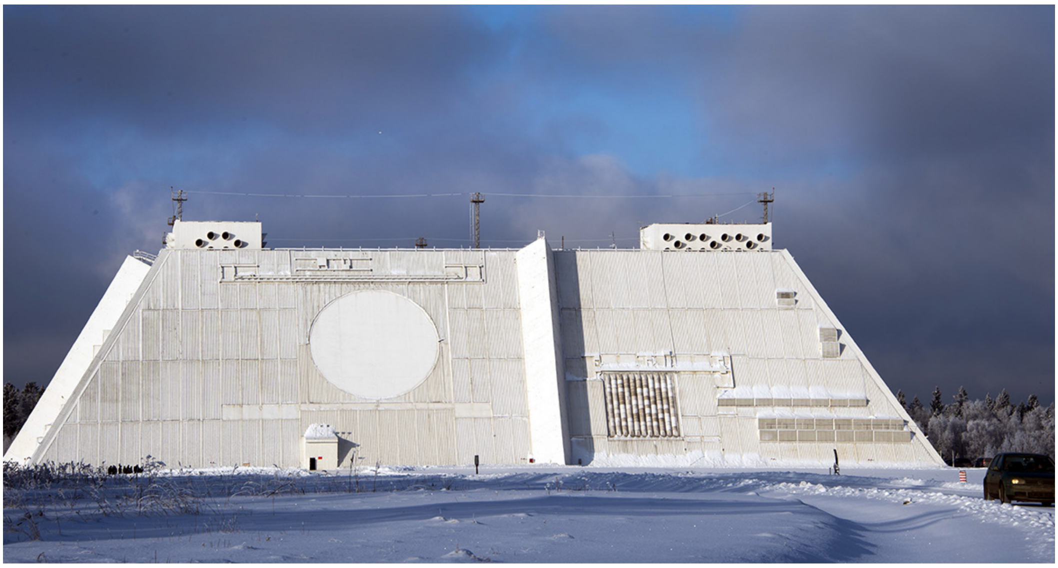
The National Missile Defense Act of 1999 declared that U.S. missile defense policy was to "deploy as soon as is technologically possible an effective National Missile Defense system capable of defending the territory of the United States against *limited* [italics added] ballistic missile attack (whether accidental, unauthorized, or deliberate)".[19] At about the same time, the Clinton administration began investigating missile defense architectures to provide for a limited homeland defense, including deploying up to 250 ground-based interceptors between a site in Alaska and the old Safeguard site in North Dakota. This would have contravened the ABM Treaty, though the large number of Russian strategic ballistic missile warheads would still have sufficed to overcome 250 interceptors. U.S. officials sought to persuade their Russian counterparts to negotiate changes to the ABM Treaty. The Russians, however, did not engage and President Vladimir Putin declined President Bill Clinton's direct appeal in June 2000.[20] In his final six months in office, Clinton decided to leave the decision on a national missile defense to his successor.

The End of the ABM Treaty and its Aftermath

The George W. Bush administration took office in January 2001 intending to do something about missile defense and determined not to let the ABM Treaty stand in its way. In December 2001, the administration gave the required six months' notice of its intention to withdraw from the treaty. The Russian government disagreed and wished to maintain the treaty, but it did not object with any vigor. The United States formally withdrew in June 2002.

As a result, for the first time in 30 years, U.S. (and Russian) missile defenses no longer were limited. Motivated by concern about potential North Korean and Iranian ICBMs (which had not yet been developed), the Bush administration launched the Ground-Based Mid-Course Defense (GMD) system to deploy 44 ground-based interceptors (GBIs) in Alaska and California, with the first achieving operational status in 2004. The GBI three-stage interceptor missiles, supported by a variety of radar and satellite-based infrared capabilities, carry an exo-atmospheric kill vehicle that uses an infrared "seeker" to guide the kill vehicle into the incoming warhead and destroying it by collision ("hit-to-kill").[21]

U.S. withdrawal from the ABM Treaty was followed by Russia's withdrawal from the 1993 Strategic Arms Reduction Treaty (START II), which had not yet entered into force. Among other things, START II would have banned all MIRVed and heavy ICBMs – an objective pursued by U.S. negotiators in the belief that limiting ICBM forces to single-warhead missiles would present less attractive targets in a crisis and thereby enhance strategic stability. START II had previously encountered resistance in Moscow, given the Russian military's interest in maintaining some MIRVed ICBMs, but



Picture: Russias 9th Missile Defense Division's missile defense system (DON-2 Radar), By Mil.ru, CC BY 4.0, https://commons.wikimedia.org/w/index.php?curid=66165410 the U.S. decision to leave the ABM Treaty proved the final nail in START II's coffin. The U.S. military later moved unilaterally to de-MIRV all of its ICBMs.

The Bush administration also planned to deploy ten two-stage GBI variants at a third site in Poland, supported by a radar based in the Czech Republic, with a focus on potential Iranian ICBMs. Washington negotiated bilateral agreements with the Polish and Czech governments on hosting elements of the U.S. missile defense system rather than working through NATO (the decision to host a radar provoked some political controversy in the Czech Republic).

This development raised concern in Moscow, where Russian officials asserted that the Poland-based GBIs would pose a threat to Russian ICBMs, and missile defense became one of the more difficult issues on the bilateral U.S.-Russia agenda. Putin proposed that the United States and Russia cooperate on missile defense, offering to share data from Russian radars oriented toward Iran. U.S. officials welcomed the proposal but, in the end, nothing came of it. Washington wanted the Russian radars to complement the planned U.S. missile defense in Europe; Moscow saw the Putin offer as a substitute for the GBIs in Poland and radar in the Czech Republic.[22]

However, the Obama administration decided in September 2009 not to go forward with the deployment of GBIs in Europe. It decided to replace the Bush administration's plan with the "European Phased Adaptive Approach", which thus constituted the core of NATO's missile defense system against the putative Iranian missile threat. That approach, which turned U.S. missile defense in Europe into a NATO program, envisaged four phases.

Phase 1: the U.S. Navy would begin deploying in European waters Aegis warships equipped with SPY-1 radars and Standard Missile-3 (SM-3) Block IA missiles capable of intercepting short- and medium-range ballistic missile warheads. The SM-3 uses an infrared seeker and hit-to-kill technology to destroy warheads in their mid-course phase of flight. An AN/TPY-2 radar would be sited in Turkey, oriented toward Iran. The first U.S. Aegis warship deployed to the Mediterranean Sea in 2011.

Phase 2: the U.S. Navy would deploy an Aegis Ashore facility in Romania equipped with an SPY-1 radar and 24 SM-3 Block IB missiles with an improved kill vehicle. The site became operational in 2016.

Phase 3: the U.S. Navy would deploy an Aegis Ashore facility in Poland equipped with an SPY-1 radar and 24 SM-3 Block IIA missiles with a higher velocity than the SM-3 Block IA or IB and capable of engaging intermediate-range ballistic missile warheads. The target for making the site operational was 2018, postponed to 2020, but that has again slipped. The Aegis Ashore facility in Poland, like the one in Romania, will come under NATO command.

Phase 4: the U.S. Navy would deploy in Poland SM-3 Block IIB missiles with a higher velocity than the SM-3 Block IIA and thus an enhanced capability to engage medium- and intermediate-range ballistic missile warheads and a limited capability to engage ICBM warheads. The Obama administration cancelled Phase 4 in 2013.[23]

The Russians raised missile defense during the 2009-2010 negotiation of the New Strategic Arms Reduction Treaty. In the end, New START did not limit missile defenses, other than prohibiting ICBM silos from being converted to hold missile interceptors, but the treaty's preamble did state:

> "Recognizing the existence of the interrelationship between strategic offensive arms and strategic defensive arms, that this interrelationship will become more important as strategic nuclear arms are reduced, and that current strategic defensive arms do not undermine the viability and effectiveness of the strategic offensive arms of the Parties"[24]

The federal law on New START ratification passed by the Russian parliament listed circumstances under which Russia might withdraw from New START. Those circumstances included "the deployment by the United States of America, another state or a group of states of an anti-missile defense system capable of significantly reducing the effectiveness of the strategic nuclear forces of the Russian Federation".[25] New START entered into force in 2011, and on February 3, 2021 the United States and Russia extended it until February 2026.

Current Missile Defense Capabilities

U.S. Missile Defenses

The U.S. military currently fields missile defense interceptors to engage intercontinental ballistic missile warheads and shorter-range ballistic missile warheads. This section looks at ground-based interceptors as well as SM-3, SM-6, THAAD and PAC-3 interceptors.[26]

GBIs. The U.S. Army operates the Ground-Based Mid-Course Defense with 44 ground-based interceptors, housed in silos in Alaska and California, to provide defense of the U.S. homeland against an ICBM attack. These missiles use hit-to-kill technology and are intended to intercept ICBM warheads in the mid-course phase of their flight, that is, after the warheads have separated from their booster and before they reenter the atmosphere. In 2019, the Department of Defense ended the Redesigned Kill Vehicle program, which was intended to provide a more reliable kill vehicle for the GBIs, due to technical and cost issues.

The Pentagon now intends to build a new interceptor, referred to as the Next Generation Interceptor. Up to 20 could be deployed by 2030, which would raise the total number of GBIs to 64.[27]

The GBI reportedly has been successful in 11 of 19 tests over the past 20 years (the Bush administration's rush to deploy a missile defense capability meant that GBIs were deployed before their development and test program had been completed). In June 2017, the Missile Defense Agency stated that the GMD system had "demonstrated capability" to engage a small number of ICBM-class targets using "simple countermeasures"[28]. However, critics of the program have charged that the GBI tests were not conducted in a realistic manner.

SM-3s/SM-6s. The Standard Missile-3 has three variants (Block IA, Block IB and Block IIA), originally intended to defend against short-, medium- and intermediate-range ballistic missile warheads in the mid-course phase of their flight. The U.S. Navy plans to have 59 Aegis warships equipped to carry the SM-3 by 2024. In addition, 24 SM-3

Block IB interceptors are deployed in Romania, and 24 SM-3 Block IIA interceptors are to be deployed in Poland. The Aegis Ashore site in Romania houses the interceptors in Mk-41 launchers – as will the site in Poland. These are the launchers used by U.S. Navy warships to house SM-3s. Russian officials note that Mk-41 launchers on warships can carry a variety of weapons, including sea-launched cruise missiles, and have expressed concern that Aegis Ashore launchers also might house offensive missiles.

U.S. Navy warships are also armed with SM-6 missiles, which have a considerably shorter range than SM-3 missiles and are designed to engage aircraft, cruise missiles and ballistic missiles in the terminal phase of their flight (in the atmosphere). The SM-6 uses a fragmentation warhead to destroy the target. The SM-3 and SM-6 test program has been significantly more successful than the GBI program. As of early 2017, SM-3 and SM-6 missiles had successfully intercepted targets in 40 of 49 tests.

THAAD. The Terminal High Altitude Area Defense interceptor, operated by the U.S. Army, uses hit-to-kill technology and is intended to intercept short- and medium-range ballistic missile warheads, both in their mid-course and terminal phases of flight. From 2006 to 2019, THAAD interceptors recorded 15 intercepts in 15 tests, one of which was against an intermediate-range ballistic missile target.

The Missile Defense Agency is exploring the ability of the SM-3 Block IIA and THAAD interceptors to engage ICBM warheads, which could offer an additional layer of homeland defense against warheads not destroyed by GBIs.
In November 2020, a U.S. Navy warship launched an SM-3 Block IIA and successfully intercepted a target "representative" of an ICBM warhead.[29]

PAC-3. The U.S. Army operates the Patriot interceptor, including the Patriot Advanced

Russian S-300V Air Defence System, by Vitaly V. Kuzmin - http://vitalykuzmin.net/?q=node/459, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=20263346

Capability-3. The PAC-3 employs hit-to-kill and blast fragmentation technology to engage aircraft, cruise missiles and short-range tactical ballistic missiles.

Russian Missile Defenses

A-135 System. Even before the A-35 system entered service around Moscow, work began on a new system to succeed it – the A-135 – which aimed to withstand and defend against an attack with "a limited number of missiles fully equipped with penetration aids".[30] The system originally envisaged three long-range launcher complexes located 600-800 kilometers from Moscow with three shorter-range launcher complexes in the vicinity of the city. This would have pushed the interception range to a distance of 800-1,200 kilometers from the capital. However, the ABM Treaty permitted only one deployment area centered on the capital with a radius of no more than 150 kilometers, which limited the system's originally planned capabilities. The testing of the A-135 was successfully completed in 1990, and it fully entered service in 1995.

According to open-source information, when the A-135 ABM system was completed, it included a Don-2N battle management radar and two types of nuclear-armed interceptors: 68 shorter-range 53T6 (Gazelle) missiles for interception within the atmosphere and 32 longer-range 51T6 (Gorgon) missiles for exo-atmospheric interception.[31] The 51T6 interceptors reportedly were retired in 2006.[32] (The 2019 U.S. Missile Defense Review mentioned 68 interceptors near Moscow.[33])

The A-135 system comes under command of the 1st Special Purpose Air Defense and Missile Defense Army. The system is currently undergoing modernization with new interceptors being developed and tested. According to Russian experts, tests of the modernized 53T6M interceptor are close to completion. The new interceptor is rumored to be conventionally armed and capable of kinetic intercept ("hit-to-kill").[34] Additionally, according to Russian officials, modernization of the A-135M version will increase the range and quality of detection and tracking of targets by a factor of two. The goal is to have the system operational in 2022.[35] There is no indication that Russia will increase the number of the interceptors above the original design as a result.

S-300/S-350/S-400. Russia also employs a wide range of mobile air and missile defense assets, including different modifications of the S-300, S-350 and S-400 systems (the last variant constitutes the majority of Russian mobile missile defense systems; more than 70 percent of anti-missile regiments are equipped with it).[36] However, those interceptors are not capable of and are not tasked with strategic missile defense but focus instead on intercepting enemy aircraft, cruise missiles and shorter-range ballistic missiles. For example, in the 1st Air Defense and Missile Defense Army, S-400s, S-300PM2s and Pantsyr-S shorter-range systems form the S-50M system of Moscow's air defense, separate from strategic ballistic missile defense of the capital.[37]

S-500. The newest S-500 Prometheus system is expected to be initially deployed in 2021 (or the first half of 2022) and mass produced and delivered in 2025. It will be able to intercept aircraft, unmanned aerial vehicles and hypersonic objects.[38] However, its main role will be to intercept intermediate-range ballistic missile warheads, as well as ICBM warheads in the terminal phase and under certain conditions in the mid-course phase.[39] In order to accommodate different missions, Prometheus will be equipped with two types of interceptors – shorter- and longer-range ones – and it will also have several different radars. There are no official published technical specifications for the S-500, but it is believed to have a range of up to 600 kilometers with a maximum altitude of around 200 kilometers.[40] No publicly known exo-atmospheric tests of the S-500 have been conducted, which makes its strategic ABM and possible anti-satellite (ASAT) capabilities theoretical for the moment.

Russian media cites unnamed defense sources suggesting that the S-500 will have a unified interceptor with the A-135M system.[41] While this seems unlikely (the 53T6M is a rather large missile, so making it mobile for the S-500 system would require development of a new, yet unseen transporter-erector-launcher vehicle), it is clear that the S-500 will operate together with the A-135M in the Moscow region. Most likely, the S-500 will not replace the S-400 as the main Russian mobile ballistic missile defense system in the foreseeable future; the two systems will co-exist together with a new S-350, which has shorter range but is cheaper and has more fire power. The first S-500 interceptors will be delivered to units protecting key facilities, including the capital.

Finally, very little is known about another system undergoing trials – the Nudol. The system appears to be mobile and is said to be capable of intercepting ballistic missiles outside of the atmosphere, as well as targeting space objects in low Earth orbit.[42] While the U.S. Space Force has stressed the Nudol's ASAT capability, the system has yet to perform a physical intercept.

Other Missile Defense Capabilities

China deploys Russian-built S-300s and S-400s, which give it some capability to defend against shorter-range ballistic missiles. The Chinese military has also tested a domesticallyproduced missile interceptor, the HQ-19, which is intended to engage medium-range ballistic missile warheads during the mid-course phase of their flight (exo-atmospheric). The HQ-19 reportedly has begun entering service. U.S. officials believe the Chinese are also developing a capability to engage intermediate-range and intercontinental-range ballistic missile warheads, though they do not see that capability achieving initial operating capability until the late 2020s.[43]

No European state has yet acquired an independent defensive capability against medium- and long-range missiles. Allied participation in NATO Formidable Shield missile defense exercises involving defense against such targets has been limited to providing sensor data to a U.S. Aegis destroyer, which has performed the intercept. Current European systems are directed against short-range missiles only. Romania, Poland and non-NATO Sweden have either purchased or committed to purchase Patriot PAC-3 for use against tactical ballistic missile threats. The French, Italian and British Royal Navy have acquired the European-built Aster 15 and 30 missiles for the Horizon, Orizzonte and Type 45 air-defense destroyers, while France and Italy have acquired the Aster 30 for their land forces. Both the Aster 15 and 30 are effective against short-range missiles only (up to 600 kilometers range). France and Italy are developing a new version of the Aster 30, the Aster 30 Block 1NT, which will have a capability against medium-range ballistic missiles with ranges of up to 1,500 kilometers. Britain has also expressed interest in the missile but has not committed to purchasing it. The new Aster Block 2 will allegedly extend the Aster family's capability to missiles of up to 3,000 kilometers range, but this is still in the very early stages of development.[44]

The United Kingdom announced in 2015 that it would develop a new ground-based radar to further contribute to European missile defense, but the radar will not begin operations until the mid-2020s at the earliest.[45] France has similar, somewhat more advanced, plans for a ground-based Ballistic Missile Defense (BMD) radar, the DRTLP.[46] However, deployment of this system also seems to be some way off.

Current Policy and Offense-Defense Combinations

U.S. Missile Defense Policy

The Missile Defense Act of 1999 set the objective of U.S. missile defense policy as "defending the territory of the United States against limited ballistic missile attack". The act was greatly influenced by the July 1998 release of the report of the Commission to Assess the Ballistic Missile Threat to the United States. The Commission's report asserted that North Korea and Iran could within five years develop an ICBM capable of striking the United States. A failed August 1998 North Korean attempt to use a three-stage rocket to put a satellite in orbit seemed to underscore the commission's assertion.

The Bush administration abandoned the ABM Treaty in 2002 and, citing concerns about rogue state ICBMs, rushed to deploy GBIs (as of July 2021, North Korea had developed a rudimentary ICBM capable of reaching the United States, first flight-tested in 2017; Iran does not have such a capability). The Obama administration continued the U.S.-based GBI program. Both the George W. Bush and Obama administrations made clear, however, that U.S. missile defenses could not compete with Russian strategic ballistic forces and were not intended against Russia. Secretary of Defense Robert Gates testified to Congress in May 2010:

> "Under the last [Bush] administration, as well as under this one [Obama], it has been the United States policy not to build a missile defense that would render

The Missile Defense Act of 1999 set the objective of U.S. missile defense policy as "defending the territory of the United States against limited ballistic missile attack".

useless Russia's nuclear capabilities. It has been a missile defense intended to protect against rogue nations, such as North Korea and Iran, or countries that have very limited capabilities. The systems that we have, the systems that originated and have been funded in the Bush administration, as well as in this administration, are not focused on trying to render useless Russia's nuclear capability. That, in our view, as in theirs, would be enormously destabilizing, not to mention unbelievably expensive."[47]

The Trump administration's 2019 Missile Defense Review embodied the idea of defenses that could protect the U.S. homeland against "a limited ICBM attack" mounted by a rogue state while noting that, in a conflict, those defenses would be used to defend against attack from any country. The review indicated that U.S. missile defenses were not intended against Russian or Chinese strategic ballistic missiles. It stated: "The United States relies on nuclear deterrence to prevent potential Russian or Chinese nuclear attacks employing their large and technically sophisticated intercontinental missile systems."[48]

For the United States, continuing to rely on nuclear deterrence vis-à-vis Russia and China as opposed to trying to defend against a major Russian or Chinese ballistic missile attack makes eminent sense in the current circumstances. Staying within the New START limits, Russia can deploy more than 1,400 warheads on its deployed ICBMs and SLBMs as opposed to 44 U.S. GBIs at present. China has a smaller strategic ballistic missile force, but its currently estimated 130 warheads on ICBMs capable of reaching the continental United States and 48 SLBM warheads would still overwhelm the U.S. GMD system. The U.S. military at present lacks the numbers of GBIs to mount a serious defense against a determined Russian or Chinese ballistic missile attack, even if the interceptors had high probabilities of successful intercepts.

However, U.S. missile defense plans could change in the future. The 2019 Missile Defense Review conducted by the Trump administration described a range of advanced technologies for examination and possible development, including giving the SM-3 Block IIA the capability to defend against ICBM threats, equipping F-35 aircraft with interceptors that could engage ballistic missiles during their boost phase, developing a Multi-Object Kill Vehicle to increase the GBIs' ability to intercept multiple warheads, adding additional GBIs beyond 64, developing high-energy lasers that could destroy ballistic missiles during their boost phase and space-based interceptors. That 2019 review stated at multiple points that the United States "will not accept any limitation or constraint on the development or deployment of missile defense capabilities needed to protect the homeland against rogue missile threats".[49]

The Biden administration's position on possible constraints on missile defense remains to be seen. The administration has launched a review of its missile defense policy as part of the National Defense Strategy that it hopes to complete in early 2022.

Future technologies will require time to mature, and some may not develop into deployable capabilities. The SM-3 Block IIA is the furthest along, though a single successful test against an ICBM-class target does not establish a reliable capability. Moreover, in a conflict, U.S. Navy warships carrying SM-3 Block IIA interceptors presumably would be deployed forward, escorting aircraft carriers or Marine amphibious units, or conducting independent operations – far away from U.S. coasts, where they would need to be in order to provide an effective defense of the U.S. homeland. This may not assuage Russian or Chinese concerns. The situation could change in Russian and Chinese eyes were the U.S. military to develop a reliable SM-3 Block IIA capability against ICBM and SLBM warheads and then deploy a large number of those interceptors on land in the United States.

However, U.S. missile defense plans could change in the future. [...] The administration has launched a review of its missile defense policy as part of the National Defense Strategy that it hopes to complete in early 2022.

It is important to note that offensive capabilities are not standing still. The 2019 Missile Defense Review cited increasing challenges posed by "new ballistic missile systems [that] feature multiple independently targetable reentry vehicles (MIRV) and maneuverable reentry vehicles (MaRV), along with decoys and jamming devices" as well as "advanced cruise missiles and hypersonic missile capabilities".[50] Russia has already equipped some ICBMs with the Avangard hypersonic glide vehicle which, after being boosted into space, turns down and "glides" along the upper atmosphere. That makes it more difficult to track. Moreover, the Avangard can maneuver to further complicate the task of any defensive system.

In sum, while pursuing a vigorous missile defense program, the U.S. military seems to believe that it lacks and will for some time to come lack the capabilities necessary to defend effectively against an ICBM or SLBM attack that Russia or China could mount against the U.S. homeland. U.S. homeland missile defense programs remain focused on rogue state threats such as North Korea. The United States cannot now mount a serious defense in the offense-defense competition with Russia or China.

U.S. Perceptions of Competitor Defenses

While Russia and China have expressed concern about U.S. missile defense developments, the U.S. military has, until recently, seemed more relaxed about the missile defense capabilities possessed or being developed by Russia (the Moscow ABM system, S-400 and S-500) or those that might be deployed in the future by China. U.S. military planners seem to show little concern about the ability of U.S. ICBMs and SLBMs to hold targets in Russia and China at risk. That likely reflects both the number of U.S. strategic warheads and the kinds of penetration aids that would be used in conjunction with them.

The Pentagon has noted that Russia and China are developing new missile defense systems – the S-500 and 51T6 follow-on exo-atmospheric interceptor for Russia and the HQ-19 and a mid-course interceptor for China – that would have "good" capabilities against intermediate-range ballistic missile warheads and "future potential" against ICBM and SLBM warheads. Senior Pentagon officials also have recently made some assertions about the difficulty that Minuteman III ICBMs might have in penetrating future adversary defenses, but it is unclear how real that concern is or when in the future that concern might become real. Is this a 2030 problem or a problem much further down the road? The assertions are being made at a time when the Pentagon seeks funding for a new ICBM as opposed to extending the service life of the Minuteman III.

This relative lack of concern about the capabilities of Russian and Chinese missile defenses to intercept U.S. ICBM and SLBM warheads could explain in part the lack of enthusiasm in Washington for negotiating limits on missile defense. (Another reason is that almost all Republicans in Congress would likely object in principle to constraints on missile defense, even if those constraints would still permit a limited national missile defense.)

Russian Missile Defense Policy

Russian strategic planning documents do not address the issue of defending the country from a nuclear attack. As mentioned earlier, this threat is supposed to be deterred by Moscow's nuclear arsenal. However, the documents do address some of the less specific scenarios, where missile defense is mixed with air defense. For example, the Russian Military Doctrine lists among the military threats "impeding the work of the systems of government and military command of the Russian Federation, impairing the functionality of its strategic nuclear forces, early warning systems, space control systems".[51] Therefore, the task

In sum, while pursuing a vigorous missile defense program, the U.S. military seems to believe that it lacks and will for some time to come lack the capabilities necessary to defend seriously against an ICBM or SLBM attack that Russia or China could mount against the U.S. homeland.

of the military is said to "provide air-space defense of the most important sites of the Russian Federation and to be ready to fend off air-space attacks".[52]

While this would include the A-135 strategic missile defense system around Moscow, it would treat it as just one additional asset to protect the most important systems of government and military command and control. From this point of view, the issue of the United States increasing the capability of its ICBMs and SLBMs to penetrate missile defenses would not change the basic calculations and would not require a major response. There is little to no discussion of U.S. ICBM/SLBM attacks against Russian territory in the Russian military and expert literature. It does not seem that this issue preoccupies officials in Moscow, and there seems to be no concerted effort to work on damage limitation, at least as reflected in publicly available official documents.

The offensive scenarios which are broadly discussed involve some kind of (primarily) conventional attack against Russian forces (including strategic forces, command and control and early warning systems), which would involve superior conventional forces, high-precision weapons (cruise missiles, boost-guide vehicles) and some combination of other assets like artificial intelligence (AI)-controlled swarms of unmanned aerial vehicles (UAVs).[53]

Those scenarios draw from real-life experiences such as U.S. high-precision strikes or combat UAVs in Syria and are reflected in the capabilities of new Russian systems (increasing the missile load in the S-350 and equipping the S-500 with different types of missiles for different targets) and the force structure (using shorter-range systems such as the Tor M2KM to protect the longer-range systems). Thus, while Russian ballistic missile defense capabilities are indeed increasing, it does not seem that they are aimed at and organized in a way to degrade the U.S. – or, for that matter, French and British – strategic offensive potential. However, Moscow's focus on defense from "real-life" threats such as cruise missiles would be detrimental to the air leg of the U.S. triad – aircraft equipped with gravity bombs and air-launched cruise missiles (ALCMs).

It is hard to imagine a potential nuclear conflict between Moscow and London or Paris which would not involve Washington and vice versa. It is thus safe to assume that Russian designers developed the country's missile defense assets with combined NATO nuclear forces in mind. This would increase the number of potential incoming targets by additional SLBMs (French M51s and British Trident IIs) and ALCMs (French ASMPAs).[54]

Russian Perceptions of the U.S. and NATO Defenses

From Moscow's perspective, U.S. missile defense remains a well-funded, constantly evolving, open-ended enterprise. While it currently is not capable of having significant impact on the Russian strategic nuclear deterrent, its future development cannot be predicted.

The Ground-Based Mid-Course Defense system with GBIs in the continental United States has experienced considerable problems and will most likely remain of questionable reliability until the re-designed Next Generation Interceptor enters service, planned for the end of the decade. At the same time, the successful testing of an SM-3 Block IIA missile against an ICBM warhead-class target in 2020 opened the specter of having dozens of U.S. Aegis ships equipped with many – perhaps 50 – interceptors each. Moreover, putting the Aegis system ashore has been considered as both an additional layer to bolster GBIs and as a way to lift the burden from the Aegis ships. In addition to the existing two Aegis Ashore sites in Europe, funds have been proposed to assess the ability of the Aegis/SM-3 system for continental U.S. defense, and Aegis Ashore systems have been suggested for Guam and Hawaii. Japan is co-developing the SM-3 Block IIA with the United States but recently decided that it would not deploy the interceptor on land in an Aegis Ashore mode.

From Moscow's perspective, U.S. missile defense remains a well-funded, constantly evolving, open-ended enterprise. While it currently is not capable of having significant impact on the Russian strategic nuclear deterrent, its future development cannot be predicted.

Washington also considers using THAAD for the atmospheric intercept of ICBM warheads by integrating it into a multilayered system together with GBIs and SM-3 Block IIAs. This could require modification of both the THAAD seeker and booster.

The Trump administration also showed some interest in boost-phase intercept of ballistic missiles. The 2019 Missile Defense Review stated that:

> "As rogue state missile arsenals develop, the space-basing of interceptors may provide the opportunity to engage offensive missiles in their most vulnerable initial boost phase of flight, before they can deploy various countermeasures […] DoD will undertake a new and near-term examination of the concepts and technology for space-based defenses to assess the technological and operational potential of space-basing in the evolving security environment."[55]

The same document noted the potential of the F-35 for "shooting down adversary ballistic missiles in their boost phase"[56] when equipped with a new or modified interceptor.

Finally, the U.S. military is exploring the contribution of offense weapon systems to missile defense systems. Thus, the Department of Defense is developing concepts such as "left of launch intercept", i.e. the destruction of missile defense interceptors before they take flight. This raises the question of whether it is even possible to discuss limits on defense without broad limits on offensive weapons.

This means that Russian military planners face many, perhaps too many, unknowns regarding the future development of the U.S. ballistic missile defenses in order to confidently assess their possible future impact on Russian strategic nuclear forces. This could affect Russian readiness to consider future reductions in strategic nuclear forces. Indeed, Moscow could refuse to agree to any further nuclear reductions if missile defense is not addressed in some manner.

Most Russian strategic planning documents (e.g. the National Security Strategy,[57] Basic Principles of State Policy on Nuclear Deterrence,[58] Basic Principles of State Policy on Military Naval Activities for the Period until 2030[59]) reference missile defense in the U.S. context and mark U.S. missile defenses as a threat or at least a risk. As the Russian Military Doctrine put it, the military risk from "the development and deployment of strategic ABM systems" lies in "undermining global stability and upsetting the existing balance of forces in the nuclear and missile sphere".[60]

Moscow's thinking on strategic missile defense is fully framed in the offense-defense relationship. Nuclear war can only be deterred by "the presence in the Armed Forces of the Russian Federation of combat-ready forces and means that are capable of inflicting guaranteed unacceptable damage on a potential adversary through employment of nuclear weapons in any circumstances".[61] If the other side increases its missile defense capabilities, it follows that Russia must respond to maintain that capability to inflict unacceptable damage.

After Washington withdrew from the ABM Treaty in 2002 and announced its plans to develop a national missile defense, Moscow invested in new offensive capabilities that would be able to defeat the U.S. defenses. As Russia was constrained by arms control limitations and its difficult economic conditions, it could not offset the potential imbalance numerically. It instead decided to proceed with development of several so-called "exotic" systems, which would provide new ways of defeating missile defenses: the Avangard boost-glide vehicle, the Poseidon intercontinental nuclear-powered and nuclear-armed uncrewed underwater vehicle (UUV) and the Burevestnik nuclear-powered and nuclear-armed cruise missile. Some of these would not look too surprising for a Cold War scholar. Avangard, for example, was based on the Albatros ICBM, on which the Soviet Union had started to work in the late 1980s partly as a response to U.S. missile defense advancements and SDI.[62] Revelation of the host of new Russian systems on March 1, 2018 led to a certain restoration of the status quo from Moscow's point of view. However, with no limits on future U.S. ballistic missile defense developments, the larger offense-defense challenge in bilateral relations remains, and the issue is far from closed.

While the current situation seems more or less stable, it does not appear sustainable in the long run. For one thing, the offense-defense arms race will continue. The reason Moscow had new offensive systems to present in 2018 was that it started developing them a decade or more beforehand. The Avangard, Poseidon and Burevestnik would probably negate any advantages the United States might hope to achieve because of the GBIs and SM-3 Block IIAs. But this means that, in order to stay ahead of the curve for the next decade, Russia would need to be investing significant resources in new, secret programs now. It also means that Moscow will continue following closely U.S. military developments and try to foresee which of the current research and development projects will prove successful and need to be countered. All of this wastes limited resources, which both sides could use for other purposes. These dynamics multiplied by the uncertainty about the competitor's plans and capabilities may also lead to development of systems which could be unnecessary or unusable.

It should also be noted that the competition does not only stay in the nuclear offense-defense framework. Its effects are spilling over to other military spheres, fueling secondary arms races. For example, the development of hypersonic boost-glide vehicles and hypersonic air-launched ballistic missiles by Russia was in large part prompted by the progress of U.S. missile defenses. The perceived "hypersonic gap" pushed Washington to invest more in developing its own hypersonic weapons. China followed suit because it shared the Russian belief in their anti-missile defense's value and because it could not ignore the development of new types of weapons by other major powers. As a result, India, France, Britain and others have thrown their hats in the ring, though it is not clear how such new weapons would fit into their force structure and military operations.

Hypersonic defense of course followed hypersonic offense, starting a new offense-defense competitive cycle. The U.S. Missile Defense Agency initiated the development of a concept to protect against regional hypersonic threats. And Russian President Putin has announced that Moscow is working on an "antidote to the future hypersonic weapons of other countries".[63]

It should also be noted that the competition does not only stay in the nuclear offense-defense framework. Its effects are spilling over to other military spheres, fueling secondary arms races.

Chinese Perceptions of U.S. Defenses

Chinese strategic nuclear forces are much smaller than those of the United States or Russia (though the recent discovery of what appear to be missile silo fields in western China raises questions about the future size of Chinese strategic forces). Now and for the near term, however, the same offense-defense problems that Moscow faces are even more acute for Beijing. China has not previously built its deterrent with the goal of achieving nuclear parity with the United States or Russia, believing that a smaller "lean and effective" nuclear force would suffice. However, with growing tensions between Washington and Beijing, and the United States having left arms control treaties and investing in new technologies (including missile defense), those calculations may be changing. Unlike Russia, Beijing is not constrained by arms control treaties and is free to balance the threat it perceives to its nuclear deterrent with a numerical build-up, which could be currently happening though the details are still unclear.[64]

Moreover, Russia and China are not military allies and cannot count on each other in case of war with the United States. This means that each country must plan for its own military operations. Deterring the United States with the capability to inflict unacceptable damage would require that Russia and China by themselves have to be able to overcome U.S. missile defenses. Washington must take this "triangle" into account when making decisions about its offensive and defensive capabilities; a U.S. decision to develop forces with regard to Russia could prompt a Chinese reaction as well as a Russian reaction, just as a U.S. force decision with regard to China might prompt a reaction from Russia as well.

European Missile Defense Policy

European NATO states' participation in a limited NATO BMD against threats from the southwest of Europe (read Iran) has been the most important element of their missile defense policy. Through NATO's missile defense system, European states have been able to maintain a hedge against a significant Iranian missile threat, though it should be noted that Iranian ballistic missiles currently have a maximum range of 2,000 kilometers. This means they could not reach targets in central, western or northern Europe.[65] By participating in the NATO system, European states have also secured participation in and knowledge of U.S. missile defense capabilities, while at the same time limiting the chances of a destabilizing offense-defense race on the continent and assuring the continued viability of the British and French nuclear deterrents.

Picture: Maintenance Check on a PAC-3 missile: , By U.S. Army - http://www4.army.mil/armyimages/armyimage.php?photo=11606, Public Domain

Since 2002, European states have contributed to NATO's common missile defense efforts, designed to defend them and NATO forces deployed in Europe. In 2010, the Alliance announced its intention to develop a NATO missile defense capability, to defend NATO "populations and territories against ballistic missile attack as a core element" of its collective defence, with the Obama administration's European Phased Adaptive Approach forming the core of that system.[66]

European allies make a variety of contributions to NATO missile defense. Romania and Poland host Aegis Ashore sites, while Turkey hosts another radar. The command center is located at Ramstein Air Force Base in Germany. Four Aegis BMD-capable destroyers are homeported at Rota, Spain. Other allies contribute through developing their forces' capability to operate as nodes in the NATO BMD network. Formidable Shield 2021, NATO's biannual missile defense exercise, saw the participation of Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Spain and the United Kingdom, as well as the United States.[67] In addition to NATO BMD, the United Kingdom hosts the RAF Fylingdales early warning radar, which operates as part of the U.S. ballistic missile early warning system (BMEWS) network and contributes to the GMD defense of the United States.[68]

These missile defense activities have been strictly limited by policy and budget. Since 2010, NATO has emphasized that "affordability and technical feasibility" would be key metrics in assessing the system's design. NATO has made clear its missile defense system is designed to "defend against potential threats emanating from outside the Euro-Atlantic area." Prior to 2014, NATO offered to cooperate with Moscow on missile defense and since then it has maintained its position that NATO's system "is not directed against Russia and will not undermine Russia's strategic deterrence."[69] Such a policy has helped limit the prospects of an offense-defense race on the European continent.

European allies make a variety of contributions to NATO missile defense. Romania and Poland host Aegis Ashore sites, while Turkey hosts another radar. The command center is located at Ramstein Air Force Base in Germany.

As noted above, no European state has acquired an independent defensive capability against medium- and long-range missiles. Neither of Europe's nuclear powers, the United Kingdom and France, have integrated missile defense into their national deterrent postures to the same extent as the United States. London and Paris retain their traditional emphasis on the infliction of unacceptable damage with their offensive forces, both on Russia and smaller powers. France perhaps has gone the furthest in acknowledging the role of missile defenses as a "complement" to deterrence, but Paris fundamentally relies on its nuclear forces for deterring threats to France's vital interests.[70]

While generally successful, this approach has not been without its problems. First, Moscow has not taken NATO's stated policy at face value, accusing it of deploying a system with some or a nascent capability against Russian missile forces. In 2019, the Russian Ministry of Defense announced the deployment of Iskander-M short-range missiles to the exclave of Kaliningrad, likely in part to hold at risk the Aegis Ashore site under construction in Poland. Western analysts have cited an improved capability to target NATO missile defenses as one potential reason for Moscow's development of the 9M729/SSC-8 cruise missile. In turn, deployment of the 9M729 could add to pressures for additional European missile defense capabilities. Although no such steps have been announced, in February 2020 NATO Secretary General Jens Stoltenberg suggested that Russia's deployment of the 9M729 could lead to changes in the Alliance's missile defense posture, though he in all likelihood was referring to NATO's capabilities to engage tactical ballistic and cruise missiles, not ICBMs.

In view of the cost of such an undertaking for European governments, Allies would most likely decide to upgrade the existing U.S.-led NATO missile defense system incrementally. The SM-3 Block IIA interceptor scheduled for the new Aegis Ashore site in Poland already represents a potential increase in the capabilities of the NATO system, given the United States' successful test against an ICBM warhead-class target in November 2020.

NATO is currently drafting a new strategic concept which is expected to be ready by the next summit in summer 2022, and is developing the NATO 2030 project. In this context, the United States and its allies will need to consider what role missile defense will play in the Alliance's deterrence and defense posture and what role, if any, arms control might play regarding missile defense. NATO almost certainly will develop its capabilities to defend against shorter-range ballistic and cruise missiles (as will Russia). But missile defense capabilities against intermediate- and strategic-range ballistic missiles will continue to be a source of particular contention with Moscow.

European states should recognize that attempts to limit damage from long-range Russian offensive forces by increasing NATO or national missile defense capabilities are likely to be ineffective or even counterproductive. Russian planners are prone to overestimate any system's capabilities – as they have already overrated the potential of NATO's existing system. This would trigger an increase in the number of warheads assigned beyond what could be judged as necessary to saturate any NATO effort and therefore a net increase in the destruction that NATO states would receive in the event of escalation.

European states should recognize that attempts to limit damage from long-range Russian offensive forces by increasing NATO or national missile defense capabilities are likely to be ineffective or even counterproductive.

European Perceptions of Russian Defenses

Lowering the risk of an offense-defense race through an explicitly limited NATO missile defense effort has helped both of Europe's nuclear powers to maintain an assured retaliatory capability against Russia. London and Paris have been concerned for a long time that Moscow could compromise the viability of their deterrents. Soviet and Russian missile defense efforts have constituted a pacing threat for both the United Kingdom's and France's offensive nuclear capabilities for over 50 years. The United States has been able to overcome Soviet defensive systems with relative ease, given the size and sophistication of its strategic offensive forces. By contrast, the United Kingdom and France during the Cold War expended significant resources to ensure that their smaller and less technologically advanced forces could penetrate missile defenses around Moscow. London feared that the first Soviet operational defensive system, the A-35, could compromise the viability of its submarine-based force. In reaction, the United Kingdom developed Chevaline, a multiple reentry vehicle (not independently-targetable) and penetration aid package for its Polaris missiles, costing approximately £1 billion in then-current prices.[71] France's MIRV program was also in large part a response to the Moscow ABM system. According to French analyst Bruno Tertrais, during the 1980s, France considered it "necessary, roughly speaking, to reserve the entire endowment of [a French] SSBN for the saturation of Soviet defenses".[72]

In the post-Cold War period, both Britain and France have been able to reduce their nuclear forces while maintaining the ability to penetrate the Moscow missile defense system. France reduced its SLBM warheads from 384 in 1994 to currently about 240, while Britain reduced its operationally available SLBM warheads from about 300 in the 1990s to 120 by 2010.[73] While lowering warhead numbers, both states have introduced more capable SLBMs, the U.S. Trident D5 for the UK, and the M45 and M51 for France. France has also recently deployed an upgraded warhead, the "tête nucléaire océanique" (TNO), which has "stealthier" characteristics than its predecessors, presumably in part to reduce its visibility to missile defense radars.[74]

In short, since the end of the Cold War, Russia's maintenance of its defensive system around Moscow at existing levels, combined with the introduction of more capable forces, has allowed both of Europe's nuclear powers to reduce their number of SLBM warheads while maintaining an assured retaliatory capability. NATO's limited missile defense system, combined with the modest efforts of Britain, France and other European states in this field, has indirectly contributed to this by limiting the potential for an offense-defense race in Europe.

Future improvements in the Moscow ABM system are highly likely to meet with a response from the United Kingdom and France if they have the potential to threaten the viability of the two powers' retaliatory capabilities. There is evidence that the prospect of improved Russian missile defenses has already had an impact on the UK's nuclear posture. London announced in its 2021 Integrated Review that it would raise the cap on its total stockpile to 260 warheads, an increase of 16 percent on its previous cap of 225 warheads and 40 percent on its prior target of 180 warheads by the mid-2020s. London will also no longer give information on operational warheads or the number deployed on its SSBNs. The Review was oblique on exactly what prompted this decision, but when pressed on the rationale behind the increase, UK Defence Secretary Ben Wallace cited Russian investment in improved missile defenses as a threat to the credibility of the UK's deterrent.[75] This suggests that because of Russian defensive capabilities London had found it impossible to strike a balance between maintaining an effective deterrent and taking further steps toward disarmament by reducing its nuclear warhead stockpile as planned.

Taking this recent UK decision, as well Anglo-French policy over the past half century as a guide, it is highly unlikely that either London or Paris will allow any improvements in Russian missile defense capabilities to compromise the integrity of their nuclear deterrent. Thus, any such step by the Russian government is likely to lead to further improvements to warhead and penetration-aid design and/or to increases in the number of operational warhead numbers. If the two powers overestimate the potential

Future improvements in the Moscow ABM system are highly likely to meet with a response from the United Kingdom and France if they have the potential to threaten the viability of the two powers' retaliatory capabilities.

of improved missile defenses, the result could be a net increase in the destructive capability of UK and French forces targeted on Moscow. At a minimum, the two European nuclear powers will preserve their current capabilities.

In sum, European states should recognize that neither NATO nor Russia will be able to construct an effective defense against long-range ballistic missiles. Any attempt to do so will lead the two sides to improve their arsenals in order to reestablish the strategic status quo ante. Such a development would lead to higher level of expenditures on both offensive and defensive systems and could, in the result of war, result in similar – if not more – damage to the continent of Europe. To avoid such a scenario, European NATO states should endorse and help pursue the suite of reciprocal data-exchange arrangements, confidence-building measures, and limitations outlined in the section below.

For the Foreseeable Future, Offense Wins

In 1985, two years after Reagan had announced the Strategic Defense Initiative, Ambassador Paul Nitze outlined three criteria by which a missile defense system should be judged. In short, it should be effective, survivable and cost-effective at the margins. The U.S. government adopted these criteria in explaining the SDI program, though some SDI supporters objected, fearing that no defense would meet the criteria, particularly that of cost-effectiveness at the margin.[76] Some opponents of the cost-effectiveness criterion interpreted it to mean that it had to be less expensive to add defenses than it would be to add additional warheads or other countermeasures, such as decoys.

Recent U.S. administrations have not reiterated those criteria or anything like them. They instead have justified U.S. homeland defenses on the need to defend against a rogue state such as North Korea. But defense resources are not unlimited and, at this point in time, the defense capabilities available to the United States are such that offense clearly wins the offense-defense competition.

Take the following scenario: China (or Russia or North Korea, for that matter) launches an ICBM with a single nuclear warhead at a city on the American west coast. Suppose that the ground-based interceptors perform as well as they have in test flights, that is, a single GBI would have a 55 percent chance of destroying the target. (Missile defense skeptics would argue that the assumption is generous because most GBI tests have been highly scripted.) Assuming that there is no design flaw or systemic problem in the GBIs, launching three GBIs at the warhead would produce a 91 percent chance of destroying it; launching four would raise the probability to 96 percent.

In 2013, the unit cost of a GBI was put at $75 million.[77] Later estimates put the cost at $65-70 million per unit (note that this is the cost of just the interceptor missile and kill vehicle, not associated costs such as the missile silo or supporting radars and other sensors). Taking the $65 million unit cost, attaining a 91 percent chance of destroying the incoming warhead would mean using three GBIs at a cost of $195 million.

The GMD system has the capability to "shoot, look, shoot" against an ICBM warhead, that is, it could launch one GBI and, if that missed, there would still be time to launch a second salvo. If the first GBI made a successful intercept, the cost of intercepting the warhead would have been just $65 million. If, however, the first GBI missed, three more interceptors would need to be launched to have a 91 percent chance of making the intercept, meaning the use of four GBIs at a cost of $260 million.

The addition of decoys adds a layer of complexity. Discriminating between a warhead and a decoy at present is very difficult, and GBI tests that have included decoys to date have not been realistic.[78] If three decoys accompanied the ICBM warhead, and U.S. sensors could not identify the warhead from the decoys, the GMD system would have to engage each of the four targets as if it were the warhead. Using the "shoot, look, shoot" mode described above, if the four GBIs launched in the first salvo all hit their targets, the cost in expended GBIs of destroying the warhead (and three decoys) would be $260 million. If all four missed, and a second salvo of 12 GBIs were launched in order to have a 91 percent chance of killing each target, including the warhead, the cost of the expended GBIs would be $1.040 billion.

In the best case, in which the GMD system had to engage just an ICBM warhead (no decoys), used the "shoot, look, shoot" mode, and successfully hit the warhead on the first try, the GBI cost would be $65 million. In any other scenario, with or without decoys, the cost of killing the warhead, or of having a 91 percent chance of doing so, would be multiples of $65 million – $1.040 billion in the worst case described above. China, Russia and North Korea each can build additional warheads and/or decoys for considerably less than $65 million, let alone $260 million or $1.040 billion. The cost per unit of an SM-3 Block IIA is $36.4 million; a bit more than one-half the cost of a GBI.[79] The SM-3 Block IIA is still being tested. But even if it is more reliable than the GBI against an ICBM warhead, adversaries could likely add additional warheads or decoys at significantly less cost.

The current dominance of nuclear offense over defense when it comes to strategic ballistic missiles and missile defense would seem to apply the other way as well. Nothing suggests that Russia has developed effective and cheap missile defense interceptors that would prove cost-effective in comparison to how the U.S. military could add additional nuclear warheads and/or penetration aids and other countermeasures to its ICBMs and SLBMs. If Moscow had concluded that its defenses could win the offense-defense competition, the Russians presumably would not be continuing to call for legally-binding constraints on ballistic missile defenses but would seek to exploit their advantage. The same would seem true of China.

All of this is not lost on the military. As Vice Chairman of the Joint Chiefs of Staff General John Hyten put it in 2021:

> "The defensive capabilities that we have been building tend to be very cost prohibitive on us. We need to come up with defensive capabilities that are cost imposing on the adversary, not cost imposing on us. And when our interceptor costs more than the weapon attacking us, that's a bad place to be. [...]That's where technology like directed energy has a huge potential to change the equation."[80]

While it cannot be excluded that some future technology, perhaps based on directed energy, might reverse the calculation, when it comes to strategic ballistic missiles, now and for the foreseeable future, offense beats defense. This is not an argument for having no capability to defend the homeland. For example, the Pentagon undoubtedly wants to deny North Korean ICBMs a "free ride" to targets in the United States, and cities are worth a lot. The Russian military desires some (thus far relatively limited) missile defense capability to protect Moscow. But with currently available technologies, getting into a large-scale competition, particularly with a peer competitor that aims to defend against more than a small number of ICBMs would appear to be a costly, unwise and ultimately losing proposition.

The U.S. government might prefer not to negotiate constraints on missile defense, but the Russian government could well insist on it, conditioning their readiness to negotiate reductions in and limits on nuclear forces on U.S. agreement to address missile defense. If Washington and Moscow could not resolve this question, the alternative could be arms races in both strategic offensive nuclear forces and missile defenses. These arms races would prove costly to both sides, destabilizing and quite possibly would not result in a net security gain for either. China, the United Kingdom and France might also get caught up in the arms races.

While it cannot be excluded that some future technology, perhaps based on directed energy, might reverse the calculation, when it comes to strategic ballistic missiles, now and for the foreseeable future, offense beats defense.

The U.S. government might prefer not to negotiate constraints on missile defense, but the Russian government could well insist on it, conditioning their readiness to negotiate reductions in and limits on nuclear forces on U.S. agreement to address missile defense. If Washington and Moscow could not resolve this question, the alternative could be arms races in both strategic offensive nuclear forces and missile defenses.

Possible Ways to Address Missile Defense

As it develops, the current U.S.-Russian Strategic Stability Dialogue could define the mandate(s) for specific negotiations aimed at achieving some kinds of constraints.[81] Washington has indicated its interest in a negotiation that would cover all U.S. and Russian nuclear warheads. Moscow appears to have in mind a broader approach, suggesting negotiations that would cover conventional as well as nuclear arms and defensive as well as offensive systems that could impact strategic stability. A key challenge for the two sides is how they will reconcile these different arms control priorities, especially in the current difficult state of bilateral relations and given their limited communications channels. If the United States and Russia were to agree, along with a new negotiation on limiting nuclear arms, to a negotiation dealing with missile defenses, they could pursue various different outcomes regarding missile defense, including one or more of the following possibilities:

Data exchanges. The sides could agree to exchange data on their respective missile defense capabilities. In 2013, Washington reportedly proposed an executive agreement on missile defense transparency to Russia under which the two countries would conduct annual data exchanges of the current numbers of key missile defense elements, such as interceptors (broken down by type) and radars, as well as the projected numbers for each year for the succeeding ten years. The objective was to give each side significant information about the other's missile defense capabilities, both current and planned, so that it could weigh whether those defenses presented a serious threat to its strategic ballistic missile force. The Russian government did not take up that proposal, but it could be worth revisiting.

The sides might also consider reviving earlier proposals for a venue, either physical or virtual, for exchanging information regarding launches of ballistic missiles and space launch vehicles derived from the respective early warning systems. This could build on the 1998 memorandum of understanding regarding a joint data exchange center agreed by the United States and Russia, though never implemented, or on the possibility discussed in 2011 for a jointly-manned NATO-Russian data fusion center that would combine early warning information from U.S., NATO and Russian sensors, which ultimately was neither agreed nor implemented. Such a venue for a data exchange, in addition to enhancing the parties' understanding of missile and space launch vehicle launches, could build confidence by promoting interaction between the sides' militaries.

Confidence-building measures. In 2011, the head of the U.S. Missile Defense Agency suggested a readiness to invite Russian experts to observe tests of the SM-3 so "that they can measure it themselves with their own systems".[82] The United States could reiterate that offer for those missile interceptors that lack the velocity to engage ICBM-class targets (this would presumably include the SM-3 Block IA and Block IB). The Russians could reciprocate, though the location of test ranges for missile defense interceptors might raise issues for monitoring tests.

Another confidence-building measure could entail reciprocal visits to NATO missile defense facilities (Aegis Ashore) and comparable Russian missile defense facilities. Among other things, such visits could, if they had some provision for viewing missile interceptors in the launchers, help to dispel Russian concerns that the Aegis Ashore launchers in Romania and coming in Poland contain offensive missiles instead of SM-3 interceptors.

Ban on space-based interceptors. Russia and China in 2014 proposed a ban on the placement of weapons in space. (The idea has not acquired traction in Washington, where U.S. officials have noted that, among other things, the proposal did not address the question of ground-based anti-satellite interceptors.) Interest has been expressed in space-based interceptors, especially for boost-phase intercept. However, no country appears to have a serious development program for such systems underway. This opens the possibility that the United States and Russia might agree to ban those systems, either on an indefinite basis or for a limited duration, say, 10-15 years.

A variant of this idea would entail a ban, either on an indefinite basis or for a limited duration, on placing ballistic missile interceptors on aircraft. This could be a more difficult proposition as, at least in the U.S. military, there appears to be a more tangible degree of interest in this concept, for example, as a means to defend against North Korean ICBMs.

Agreeing on the parameters of the U.S. missile defense system. A critical step to reaching any sort of U.S.-Russian agreement on missile defense would almost certainly require agreement that there exists a configuration for U.S. missile defense that is adequate for providing the country a degree of protection against a limited attack by a third nation such as North Korea but that does not pose a threat to Russian strategic missile forces. If such a configuration could be found and agreed with Moscow, Washington could stay within that configuration without going further, presumably allaying Russian concerns about threats to its strategic ballistic missile force. This configuration needs not be final and could be reassessed after an agreed interval of time. Such an understanding could be formalized through an executive agreement or even a legally-binding treaty. Moscow would likely have to agree to some parallel limitation regarding its missile defense capabilities.

Maintaining the current parameters of the NATO missile defense system. While NATO almost certainly will take steps to improve its capabilities to intercept Russian tactical ballistic and cruise missiles, it should not reorient its missile defense system toward engaging Russian ICBMs or SLBMs, either through a change in its existing declaratory policy or modifications to the technical capabilities of the system. The history of missile defense shows that any such undertaking would be extremely expensive and in all likelihood would be overwhelmed by Russian countermeasures, leading to the reestablishment of NATO Europe's vulnerability to a Russian strike, or a net deterioration in the amount of damage it would sustain in such a scenario.

Possible negotiated limits. With agreement on a mutually-acceptable configuration for missile defense, a variety of limitation regimes – either politically- or legally-binding – would become possible. They would, at least for a legally-binding agreement, require a change in attitude in the U.S. Congress, where sentiment in some quarters strongly opposes constraining missile defense.

One possibility would be a missile defense agreement of limited duration (the duration could be the same as that of a new agreement constraining U.S. and Russian nuclear arms). Such an agreement could cover established strategic ABM interceptors: U.S. GBIs and the Russian Moscow ABM system. Current U.S. plans envisage 64 GBIs by 2030, while the Moscow system now has 68 interceptors. An agreement limiting each side to no more than 125 strategic ABM interceptors would allow for roughly doubling the number of interceptors by each country. For the American side, that would more than deny North Korea a free ride but would still fall below the number of interceptors needed to seriously blunt a Russian (or, arguably, a Chinese) ballistic missile attack.

A more ambitious agreement would seek to limit other interceptors, for example, the SM-3 Block IIA (particularly if continued testing and development establish that it has a reliable capability against ICBM and SLBM warheads) and the S-500, which has been advertised as having capabilities comparable to the SM-3 Block IIA and THAAD. This would prove far more difficult to negotiate, and any agreement would require a limit considerably above the 125 suggested above for just GBIs and the Moscow ABM system.

Iran for the present has no offensive ballistic missile with a range exceeding 2,000 kilometers (despite some concerns in the United States going back to at least the 1990s that Iran would develop an ICBM). In return for an appropriate Russian move on an issue of interest to the United States/NATO, they might agree that only SM-3 Block IB interceptors, not SM-3 Block IIAs, would be deployed at European Aegis Ashore sites.

Demarcation agreement. As a way to draw a line between "strategic" interceptors that would be constrained by an agreement and "non-strategic" interceptors that would not, the sides could return to the 1997 memorandum of understanding on demarcation, perhaps in an updated form.

A critical step to reaching any sort of U.S.-Russian agreement on missile defense would almost certainly require agreement that there exists a configuration for U.S. missile defense that is adequate for providing the country a degree of protection against a limited attack by a third nation such as North Korea but that does not pose a threat to Russian strategic missile forces.

That would entail limits on maximum burnout velocity for interceptors and range for target missiles.[83]

One of the big questions for any agreement will be whether the U.S. military succeeds in giving the SM-3 Block IIA (and THAAD) serious capabilities against ICBM and SLBM warheads and whether Russia develops comparable capabilities for its S-500. That will affect the kinds and numbers of interceptors that might be considered for limitation. It will not be an easy discussion.

The SM-3 issue is further complicated by the deployment of SM-3 missiles on U.S. warships. While the number of GBI silos and vertical launch cells in Aegis Ashore sites could be verified with national technical means of verification (NTM), the multi-mission role of Aegis-equipped warships and the fact that their Mk-41 launch cells can hold missiles other than SM-3s would mean that NTM could not provide a reliable count of SM-3s or SM-3 Block IIAs on board ships. Moreover, the U.S. Navy likely would seriously resist, as would the Russian Navy, any cooperative measures that would reveal the exact mix and load-out of weapons in the Mk-41 launch cells on individual ships.

China thus far has resisted U.S. proposals for strategic stability-type discussions, and Beijing has adamantly rejected negotiating limits on its nuclear forces, which at least at present are significantly smaller than those of Russia or the United States. It would be worthwhile for China, particularly as it expands its nuclear forces and develops its missile defenses, to engage with the United States, or perhaps with the United States and Russia in a trilateral format, on discussions regarding how offense and defense developments will affect stability.

The United States presumably will consult with the United Kingdom and France on these kinds of questions. The three countries plus Russia and China, the five permanent members of the United Nations Security Council, established a P-5 process on nuclear matters in 2009, though its results to date have been modest. At some point, that process might offer a venue for discussions about missile defense, the offense-defense relationship and strategic stability considerations.

Concluding Comments

After more than six decades of research – and nearly 20 years since the demise of the ABM Treaty removed any legal restraints on its development – missile defense continues to prove ineffective against the strategic offensive forces of the major powers while nevertheless exerting a destabilizing long-term influence on the strategic balance. Given this situation, it is in the interests of all the major powers to take steps to limit the growth of missile defense capabilities in a way that substitutes mutually agreed restraints for the current de facto limits imposed by long-standing technological challenges and budget constraints. This will help stabilize the offense-defense balance globally while sacrificing little in terms of real future defensive capability.

As the two most advanced nuclear powers, including in the defensive sphere, the United States and Russia have a special responsibility to take specific steps toward limiting the future growth of their missile defense systems. A mixture of confidence-building measures, bans on new technologies, clearer unilateral policy on future systems and reciprocal politically- or legally-binding limits would go a long way to stabilize the offense-defense balance between Washington and Moscow, as well as globally. Such limits will require ingenuity and flexibility from all interested parties in order to overcome the significant diplomatic, technological and political hurdles to new agreements. Yet the alternative course – of continued heavy investment in ineffective yet destabilizing defensive systems that, in turn, provoke increased investments in and expansion of strategic offensive forces – would be far more detrimental, both to the interests of Washington, NATO and Moscow and to the integrity of the global nuclear balance as a whole.

It would be worthwhile for China, particularly as it expands its nuclear forces and develops its missile defenses, to engage with the United States, or perhaps with the United States and Russia in a trilateral format, on discussions regarding how offense and defense developments will affect stability.

After more than six decades of research – and nearly 20 years since the demise of the ABM Treaty removed any legal restraints on its development – missile defense continues to prove ineffective against the strategic offensive forces of the major powers while nevertheless exerting a destabilizing long-term influence on the strategic balance.

Endnotes

1 Hans M. Kristensen, Matthew G. McKinzie, and Robert S. Norris, "The Protection Paradox," Bulletin of the Atomic Scientists 60, no. 2 (March 2004), 68-77.

2 Lawrence Freedman, The Evolution of Nuclear Strategy (New York: St. Martin's Press, 1983), 246.

3 This section draws on V.M. Kraskovskiy, et al., "The Shield of Russia: ABM Systems," [Schit Rossii: Sistemi Protivoraketnoi Oboroni,] Moscow, 2009, http://nasledie.ru/sites/default/files/Apl/doc/1/Shield_Of_Russia.pdf.

4 Ibid., 201.

5 "Galosh - Moscow System," GlobalSecurity.org, https://www.globalsecurity.org/wmd/world/russia/galosh.htm.

6 John Newhouse, Cold Dawn: The History of SALT (New York: Holt, Reinhart and Winston, 1973), 72-77.

7 Freedman, The Evolution of Nuclear Strategy, 336-337.

8 "Spartan ABM," Astronautix.com, accessed September 28, 2021, http://www.astronautix.com/s/spartanabm.html; "Sprint ABM," Astronautix.com, accessed September 28, 2021, http://www.astronautix.com/s/sprintabm.html.

9 Stanford Arms Control Group, International Arms Control: Issues and Agreements, eds. John H. Barton and Lawrence D. Weiler (Stanford, CA: Stanford University Press, 1976), 175.

10 The formal title is the "Treaty between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems." See text here: https://2009-2017.state.gov/t/avc/trty/101888.htm.

11 Ibid.

12 The formal title is the "Interim Agreement between the United States of America and the Union of Soviet Socialist Republics on Certain Measures with Respect to the Limitation of Strategic Offensive Arms." See text here: https://2009-2017.state.gov/t/isn/4795.htm.

13 Note that the accountable number was a maximum number; actual numbers likely were somewhat fewer. Data from "Memorandum of Understanding on the Establishment of the Data Base Relating to the Treaty between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms" as cited in Steven Pifer and Michael E. O'Hanlon, The Opportunity: Next Steps in Reducing Nuclear Arms (Washington, DC: Brookings Institution Press, 2012), 25, 212.

14 V.M. Kraskovskiy, et al., "The Shield of Russia," 16.

15 "Stanley Mickelson Safeguard Complex," Minutemanmissile.com, accessed September 28, 2021, https://minutemanmissile.com/safeguardcomplex.html.

16 Michael Krepon, "Krasnoyarsk: The Antecedent to the INF Treaty Violation?," Arms Control Wonk, November 10, 2019, https://www.armscontrolwonk.com/archive/1208406/krasnoyarsk-the-antecedent-to-the-inf-treaty-violation/.

17 Steven Pifer, "Missile Defense in Europe: Cooperation or Contention?," Brookings Arms Control Series, Paper No. 8, May 2012, https://www.brookings.edu/research/missile-defense-in-europe-cooperation-or-contention/, 7.

18 Amy F. Woolf, "Anti-Ballistic Missile Treaty Demarcation and Succession Agreements: Background and Issues," Congressional Research Service, April 27, 2000, https://fas.org/sgp/crs/nuke/98-496.pdf.

19 Greg Thielmann, "The National Missile Defense Act of 1999," Arms Control Association, 2009, https://www.armscontrol.org/act/2009-07/national-missile-defense-act-1999.

20 Strobe Talbott, The Russia Hand (New York: Random House, 2002), 379-395.

21 Missile Defense Project, "Ground-Based Mid-Course Defense (GMD) System," Missile Threat, Center for Strategic and International Studies, June 15, 2018, https://missilethreat.csis.org/system/gmd/.

22 Pifer, "Missile Defense in Europe," 10.

23 Kingston Reif, "The European Phased Adaptive Approach at a Glance," Arms Control Association, January 2019, https://www.armscontrol.org/factsheets/Phasedadaptiveapproach.

24 U.S. Department of State, "Treaty between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms," April 8, 2010, https://2009-2017.state.gov/t/avc/newstart/c44126.htm.

25 "Federal Law of January 28, 2011 No 1-FZ 'On the Ratification of the Treaty between the Russian Federation and the United States of America on Measures to Further Reduce and Limit Strategic Offensive Arms'," [Federal'nyy Zakon ot 28 Yanvarya 2011 N 1-FZ 'O Ratifikatsii Dogovora mezhdu Rossiyskoy Federatsiey i Soedinennymi Shtatami Ameriki o Merakh po Dal'neyshemu Sokrashcheniyu I Ogranicheniyu Strategicheskikh Nastupatel'nykh Vooruzheniy'] Rossiyskaya Gazeta, February 1, 2011, https://rg.ru/2011/02/01/snv-dok.html.

26 This section draws on Kingston Reif, "Current U.S. Missile Defense Programs at a Glance," Arms Control Association, last reviewed August 2019, https://www.armscontrol.org/factsheets/usmissiledefense.

27 Jen Judson, "Next-Gen Intercontinental Ballistic Missile Interceptor Estimated Cost? Nearly $18B," Defense News, April 27, 2021, https://www.defensenews.com/pentagon/2021/04/27/next-gen-intercontinental-ballistic-missile-interceptor-estimated-to-cost-nearly-18-billion/.

28 Kingston Reif, "Current U.S. Missile Defense Programs at a Glance".

29 Paul Sonne, "U.S. Military Tests Downing an ICBM from a Warship for first Time," The Washington Post, November 17, 2020, https://www.washingtonpost.com/national-security/us-missile-defense-test/2020/11/17/3778f050-28fe-11eb-b847-66c66ace1afb_story.html.

30 V.M. Kraskovskiy, et al., "The Shield of Russia," 260.

31 Victor Koltunov, Alexander Kubyshkin and Vladimir Stepanov, "Anti-Missile Defense: History and Current Trends" [Protivoraketnaya Oborona: Istoriya i Sovremennost], Moscow, 2010, http://mil.ru/files/Anti-ballistic/01_Rosatom, 15.

32 Anton Valagin, "To Vaporize the Warhead: Three Secrets of the Amur A-135 ABM System," [Isparit Boegolovku: Tri Sekreta Sistemy PRO A-135 Amur] Rossiyskaya Gazeta, February 17, 2020, https://rg.ru/2020/02/17/isparit-boegolovku-tri-sekreta-sistemy-pro-a-135-amur.html.

33 U.S. Department of Defense, "Missile Defense Review, 2019," https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR_Executive%20Summary.pdf.

34 "The Military Tested Modernized Interceptor of Ballistic Targets," Rossiyskaya Gazeta, November 26, 2020, https://rg.ru/2020/11/26/voennye-ispytali-modernizirovannyj-perehvatchik-ballisticheskih-celej.html.

35 Yuri Gavrilov, "A Fly Must Not Pass, How the Modernization of Moscow ABM System is Going," [Chtobi Mukha Ne Proletela. Kak Idet Modernizatsia PRO Moskvi] Rossiyskaya Gazeta, January 22, 2021, https://rg.ru/2021/01/22/kak-moderniziruiut-sistemu-pro-moskvy.html.

36 "Putin Announced a Successful S-500 Test," Lenta.ru, May 25, 2021, https://lenta.ru/news/2021/05/25/zrk/.

37 "The Sky over the Capital is Under Continuous Supervision" [Nebo Stolitsi Pod Neusipnim Kontrolem] Red Star, July 21, 2021, http://redstar.ru/nebo-stolitsy-pod-neusypnym-kontrolem/.

38 Anton Lavrov and Roman Kretsul, "The Rise of the 'Prometheus': The Work on the S-500 is Approaching Completion," Izvestiya, November 28, 2020, https://iz.ru/1093087/anton-lavrov-roman-kretcul/voskhozhdenie-prometeia-raboty-po-s-500-na-finishnoi-priamoi.

39 "The Developer Described the S-500's Capabilities" [Reazrabotchik Rasskazal o Vozmozhnostiah S-500] RIA Novosti, February 10, 2020, https://ria.ru/20200210/1564512668.html.

40 Mikhail Khodarenok, "Home for 'Prometheus': Who Would be the First in Russia to Receive the S-500" [Dom Dlia «Prometeia»: Kto v Rossii Pervim Poluchit S-500] Gazeta.ru, July 29, 2021, https://www.gazeta.ru/army/2021/07/29/13812530.shtml.

41 Anton Lavrov and Anna Cherepanova, "'Prometheus' Will Get More Fire: The S-500 Will Receive New Interceptors," Izvestiya, June 3, 2021, https://iz.ru/1173752/anton-lavrov-anna-cherepanova/prometeiu-dobaviat-ognia-s-500-poluchit-novye-rakety-perekhvatchiki.

42 Mikhail Khodarenok, "'Nudol' and 'Prometheus': When Will the Army Receive the New Systems" [Nudol I Prometey: Kogda Armia Poluchit Novye Sistemy] Gazeta.ru, June 19, 2020, https://m.gazeta.ru/army/2020/06/19/13123189.shtml.

43 "China Flight-Tests Missile Interceptors," Arms Control Today, April 2021, https://www.armscontrol.org/act/2021-04/news-briefs/china-flight-tests-missile-interceptors.

44 "MBDA Aster 30 Block 1NT Missile Passed Preliminary Design Review," Naval News, January 30, 2019, https://www.navalnews.com/naval-news/2019/01/mbda-aster-30-block-1-nt-missile-passed-preliminary-design-review/; MBDA, "What the Block 1NT Brings to the Aster Family?," 2017, https://www.mbda-systems.com/wp-content/uploads/2017/01/2017-01-What-the-Aster-B1-NT-brings.docx.pdf; Pierre Tran, "France, Italy to Cooperate in Development of Aster Missile," Defense News, June 14, 2016, https://www.defensenews.com/digital-show-dailies/eurosatory/2016/06/14/france-italy-to-cooperate-in-development-of-aster-missile/.

45 UK Parliament "Ballistic Missile Defence: Radar. Question for the Ministry of Defence," July 4, 2017, House of Commons, https://questions-statements.parliament.uk/written-questions/detail/2017-07-04/2910.

46 Pierre Tran, "France Tests Radar to Detect and Track Ballistic Missiles, Satellites," Defense News, March 23, 2018, https://www.defensenews.com/intel-geoint/sensors/2018/03/23/france-tests-radar-to-detect-and-track-ballistic-missiles-satellites/.

47 As cited by John Kerry in the Senate Executive Report 111-6, "Treaty with Russia on Measures for Further Reduction and Limitation of Strategic Offensive Arms," October 1, 2010, https://www.govinfo.gov/content/pkg/CRPT-111erpt6/html/CRPT-111erpt6.htm.

48 "Missile Defense Review, 2019," vii.

49 Ibid.

50 Ibid.

51 "Military Doctrine of the Russian Federation," paragraph 14.

52 Ibid., paragraph 32.e.

53 For some of the latest examples of such scenarios see Viktor Murakhovskiy, "Protecting Elements of Strategic Nuclear Forces Against Attacks with High-Precision Weapons," [Prikritie Objektov Strategicheskih Yadernikh Sil ot Udarov Visokotochnogo Oruzhiia] Arsenal Otechestva, no. 4, 2021; and Yudin Vyacheslav, Mikhail Pavlushenko and Dmitry Gaevoy, "On The Issue of Choosing a Scenario for Protecting Elements of the Operational Construction of Strategic Missile Forces from High-Precision Weapons and UAV Attacks," [K Voprosu o Vibore Stsenaria Zaschiti Elementov Operativnogo Postroenia Obyedineniy RVSN ot Udarov VTO I BPLA] Strategicheskaya Stabilnost, no. 1, 2020, https://elibrary.ru/item.asp?id=42545829.

54 See Hans M. Kristensen and Matt Korda, "French Nuclear Forces, 2019," Bulletin of the Atomic Scientists, January 7, 2019, https://www.tandfonline.com/doi/pdf/10.1080/00963402.2019.1556003?needAccess=true&; Hans M. Kristensen and Matt Korda, "United Kingdom Nuclear Weapons, 2021," Bulletin of the Atomic Scientists, May 11, 2021, https://www.tandfonline.com/doi/pdf/10.1080/00963402.2021.1912309?needAccess=true.

55 "Missile Defense Review, 2019," xi.

56 Ibid.

57 "Russian National Security Strategy," 2021, http://static.kremlin.ru/media/events/files/ru/QZw6hSk5z9gWq0plD1ZzmR5cER0g5tZC.pdf, 12.

58 "Basic Principles of State Policy of the Russian Federation on Nuclear Deterrence," June 2, 2020, https://www.mid.ru/en/foreign_policy/international_safety/disarmament/-/asset_publisher/rp0fiUBmANaH/content/id/4152094, paragraph 12.b, 12.c.

59 "Basic Principles of State Policy of the Russian Federation on Military Naval Activities for the Period until 2030," 2017, http://kremlin.ru/acts/bank/42117, paragraph 25.b.

60 "Military Doctrine of the Russian Federation," 2014, https://rg.ru/2014/12/30/doktrina-dok.html, paragraph 12.g,

61 "Basic Principles of State Policy of the Russian Federation on Nuclear Deterrence," paragraph 10.

62 See for example: Pavel Podvig, "Avangard Begins Combat Duty," Russian Strategic Nuclear Forces, December 27, 2019, https://russianforces.org/blog/2019/12/avangard_begins_combat_duty.shtml; Pavel Podvig, "Russian Hypersonic Vehicle - More Dots Added to Project 4202," Russian Strategic Nuclear Forces, August 26, 2014, https://russianforces.org/blog/2014/08/russian_hypersonic_vehicle_-_m.shtml.

63 TASS, "Russia Working on 'Antidote' Against Other Countries' Future Hypersonic Weapon – Putin", December 17, 2020, https://tass.com/defense/1236669.

64 See for example: Hans M. Kristensen and Matt Korda, "China's Nuclear Missile Silo Expansion: From Minimum Deterrence to Medium Deterrence," Bulletin of the Atomic Scientists, September 1, 2021. https://thebulletin.org/2021/09/chinas-nuclear-missile-silo-expansion-from-minimum-deterrence-to-medium-deterrence/.

65 Michael Elleman, "The Iran Primer: Iran's Ballistic Missile Program," United States Institute of Peace, January 13, 2021, https://iranprimer.usip.org/resource/irans-ballistic-missile-program.

66 NATO, "Lisbon Summit Declaration," November 20, 2010, https://www.nato.int/cps/en/natolive/official_texts_68828.htm.

67 NATO, "Ballistic Missile Defence," June 7, 2021 https://www.nato.int/cps/en/natohq/topics_49635.htm.

68 "Commander of UK Space Command Visits RAF Fylingdales," June 3, 2021, https://www.raf.mod.uk/news/articles/commander-of-uk-space-command-visits-raf-fylingdales/.

69 NATO, "Brussels Summit Communiqué," June 14, 2021, https://www.nato.int/cps/en/natohq/news_185000.htm.

70 HM Government, Global Britain in a Competitive Age: The Integrated Review of Security, Development and Foreign Policy, CP 403, March 2021, 76-7, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/975077/Global_Britain_in_a_Competitive_Age-_the_Integrated_Review_of_Security__Defence__Development_and_Foreign_Policy.pdf; Bruno Tertrais, French Nuclear Deterrence Policy, Forces, And Future: A Handbook, Fondation pour la Recherche Stratégique, Recherches & Documents No.4/2020, February 2020, https://www.frstrategie.org/sites/default/files/documents/publications/recherches-et-documents/2020/202004.pdf, 37.

71 Kristan Stoddart, "The British Labour Government and the Development of Chevaline, 1974–79," Cold War History 10, No. 3 (August 2010):287-314, https://doi.org/10.1080/14682741003679375.

72 Tertrais, French Nuclear Deterrence Policy, 11.

73 Claire Mills, "Integrated Review 2021: Increasing the Cap on the UK's Nuclear Stockpile," UK Parliament Briefing Paper no. 9175, March 19, 2021, https://researchbriefings.files.parliament.uk/documents/CBP-9175/CBP-9175.pdf.

74 Hans Kristensen and Matt Korda, "French Nuclear Forces, 2019," 52; Claire Mills, "Integrated Review 2021."

75 Global Britain in a Competitive Age, 76f.; Helen Warrell and Sylvia Pfeifer, "UK Nuclear Warhead Increase Prompted by Russia's Missile Defence Capability," Financial Times, March 21, 2021, https://www.ft.com/content/a86e8ca8-365e-4774-b22c-fbdf12237935.

76 Strobe Talbott, Master of the Game: Paul Nitze and the Nuclear Peace (New York: Alfred A. Knopf, 1988), 217.

77 "Shielded from Oversight: The Disastrous U.S. Approach to Strategic Missile Defense, Appendix 6: The Ground-Based Interceptor and Kill Vehicle," Union of Concerned Scientists, July 2016, https://www.ucsusa.org/sites/default/files/attach/2016/07/Shielded-from-Oversight-appendix-6.pdf, 1.

78 David Wright, "Decoys Used in Missile Defense Intercept Tests, 1999-2018," Union of Concerned Scientists, January 2019, https://www.ucsusa.org/sites/default/files/attach/2019/01/Missile-Defense-Intercept-Test-Decoys-white-paper.pdf.

79 Tyler Rogoway and Joseph Trevithick, "Here is What Each of the Navy's Ship-Launched Missile's Costs," The War Zone, December 11, 2020, https://www.thedrive.com/the-war-zone/38102/here-is-what-each-of-the-navys-ship-launched-missiles-actually-costs.

80 "A Conversation with Vice Chairman of the Joint Chiefs of Staff General John E. Hyten," Brookings Institution, September 13, 2021, https://www.brookings.edu/events/a-conversation-with-vice-chairman-of-the-joint-chiefs-of-staff-general-john-e-hyten/.

81 See for example Greg Thielmann, "Incorporating Missile Defense in Strategic Arms Control", Deep Cuts Issue Brief #12, Hamburg, October 2020, https://deepcuts.org/files/pdf/Deep_Cuts_Issue_Brief_12-Missile_Defense_Strategic_Arms_Control_01.pdf.

82 Atlantic Council, "Transatlantic Missile Defense Conference," Transcript (Washington, October 18, 2011), as cited in The Opportunity: Next Steps in Reducing Nuclear Arms, 132.

83 "Agreement on Confidence-Building Measures Related to Systems to Counter Ballistic Missiles other than Strategic Ballistic Missiles," The Nuclear Information Project, September 26, 1997, https://fas.org/nuke/control/abmt/text/abm_cbm.htm.

Front page: Flight test of the Ground-Based Midcourse Defense System, January 2010 (Source: Missile Defense Agency), https://www.mda.mil/global/images/system/gmd/FTG06_085.jpg

About the Authors

Andrey Baklitskiy is a Senior Research Fellow at the Center for Advanced American Studies of the Institute of the International Studies at the MGIMO University of the Russian Foreign Ministry and a Consultant at PIR Center. He has previously been a Research Fellow at the Center for Global Trends and International Organizations of the Diplomatic Academy of the Russian Foreign Ministry, Visiting Research Fellow at the Center for Strategic and International Studies (CSIS), PIR Center's "Russia and Nuclear Nonproliferation" Program Director.

James Cameron is a Postdoctoral Fellow (Assistant Professor) in the Department of Political Science at the University of Oslo, where he is a member of the Oslo Nuclear Project. His research focuses on the history of arms control from the nineteenth century to the present and the lessons it holds for contemporary policy. He has previously been a postdoctoral fellow in the Department of War Studies at King's College London, at the Center for International Security and Cooperation (CISAC) at Stanford University and Yale University's International Security Studies.

Steven Pifer is a William J. Perry Fellow at the Center for International Security and Cooperation (CISAC) at Stanford University and a non-resident senior fellow with the Brookings Institution. He is a retired foreign service officer with over 25 years of experience with the State Department, where he worked on US relations with the former Soviet Union and Europe, particularly arms control and security issues. He served as US ambassador to Ukraine as well as at the US embassies in Warsaw, Moscow and London and on the National Security Council at the White House.

About Deep Cuts

The Deep Cuts Commission provides decision-makers as well as the interested public with concrete policy options based on realistic analysis and sound research. Since it was established in 2013, the Commission is coordinated in its deliberations by the Institute for Peace Research and Security Policy at the University of Hamburg (IFSH), the Arms Control Association (ACA), and the Primakov Institute of World Economy and International Relations, Russian Academy of Sciences (IMEMO, RAN) with the active support of the German Federal Foreign Office.

For further information please go to:
www.deepcuts.org
@deepcutsproject

Impress:
Institut für Friedensforschung und Sicherheitspolitik
an der Universität Hamburg (IFSH)
Beim Schlump 83
20144 Hamburg, Germany

Phone: +49 (0)40-86 60 77-21
Fax: +49 (0)40-866 36 15

Project Management
Maren Vieluf
Oliver Meier
Email: info@deepcuts.org