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China and the New Strategic Nuclear Arms Race: The Forces Driving the Creation of New Chinese Nuclear Delivery Systems, Nuclear Weapons, and Strategy

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This study is available on the CSIS web site at: https://bit.ly/2K7pO9X. This study is a major expansion and revision of a previous Burke Chair study that examines the changes taking place in Chinese nuclear delivery needs and their impact on China's stockpiles of nuclear weapons and weapons designs. It drew on a wide range of official open-source reporting, as well as a range of outside sources, including the Federation of American Scientists, Arms Control Association, IISS, SIPRI and analysts like Hans M. Kristensen and Robert Norris to examine these developments.

The original study argued that a focus on China's expanding global influence, conventional forces, missile forces, emerging ASAT and cyber capabilities – and role in the South China Sea – had led much of the analysis of Chinese military developments to ignore the key uncertainties surrounding its stockpile of nuclear weapons, and the fact that China is developing all the elements of a far more advanced strategic nuclear Triad – along with improved theater delivery system and missile defenses.

It concluded that this lack of attention to the fundamental changes taking place in China's nuclear forces had several explanations. They were partly the result of the fact that the other symbols of China's emergence as superpower – like the situation in the South China Sea – were far more visible and seen as far more urgent. They were partly the result of the fact that China was slow to expand its nuclear missile forces and create a real Triad. And, partly a result of the fact that past estimates of its total holdings of nuclear weapons were so low – roughly at the level of British and French forces – and far below the levels held by the United States and Russia.

This expanded version of the study focuses on the interactions between the improvements in Chinese nuclear forces and those taking place in U.S. and Russian nuclear forces. Rather than focusing on current Chinese nuclear developments, it summarizes the major changes taking place in U.S. nuclear forces as a result of the Nuclear Posture Review, and the changes taking place in Russian forces as reported in open-source material and by President Putin.

The study now indicates how China's emerging nuclear forces may be driven by the major changes that are taking place in U.S. and Russian nuclear forces. It shows that the period of comparatively low nuclear tension between the U.S. and Russia that occurred after 1992 began to end in 2014. Since then, both countries have gradually moved away from mutual efforts to reduce nuclear weapons and forces. Both the U.S. and Russia have announced major nuclear weapons and delivery system modernization programs that impact every element of their triads of ICBMs, SLBM, and air-delivered weapons – as well as the ability to use lower-yield nuclear weapons against theater military targets.

When the recent developments in U.S. and Russian nuclear forces are compared to recent official U.S. reporting on China's nuclear delivery systems, they indicate that what used to be a U.S-Russian strategic and theater nuclear arms race is becoming a contest between three superpowers and not just two. Over the next decade, the emergence of far more capable Chinese nuclear forces will be driven by the changes in U.S. and Russian forces, and fundamentally reshape the nuclear balance, arms control, and the risks of actual nuclear warfare between three competing nuclear

superpowers

These ongoing changes in China's nuclear capabilities help explain why the new U.S. national security and defense strategies, announced in 2017 and 2018, acknowledged the growing importance of China's nuclear forces. The U.S. Nuclear Posture Review issued in early 2018 also focused on the emerging Chinese threat. Similarly, they explain why the latest threat reports by the Director of National Intelligence and the Director of DIA also highlighted the broad trends in Chinese nuclear developments.

The latest Department of Defense report on Chinese military power provides a great deal of detail on the developments in Chinese delivery systems – although it does so in a wide-range of different places in the report and does not address changes in China's nuclear weapons stockpile and design of its nuclear weapons. It makes it clear that China is completing the development of new ICBMs, SSBN and SLBMs, and bombers that will give it all the elements of a Triad to make it directly competitive with that of the U.S. and Russian forces, as well as the potential to create far more capable tactical and theater nuclear forces and missile defenses.

Some of these Chinese systems are already being deployed. All seem likely to enter service in significant numbers during the coming decade – a decade where China may become a peer competitor in conventional forces to the U.S. in the Pacific, outpace Russia's conventional military forces, and emerge as a true economic superpower.

At the same time, the report shows that there are still serious gaps in open source reporting on Chinese nuclear forces. As has just been noted, far more attention is paid to China's delivery systems than to its holding of nuclear weapons. The report also shows that public estimates that indicate China only has a low stockpile of nuclear weapons have always been uncertain, and current estimates are based largely on a limited amount of now dated open-source reporting by the U.S. intelligence community. These estimates have never been fully explained and defined, and many provide only most limited detail.

The open-source material that does compare delivery systems also still has serious limits. Most such reporting focuses only on the number and types of Chinese, U.S. and Russian strategic delivery systems – not their nuclear armament, overall technical performance, and probable use in warfare. Such reporting does not clearly identify the Chinese, U.S. and Russian theater and tactical systems that may use nuclear weapons.

Similarly, almost all open-source material on Chinese strategy only addresses China's official statements about nuclear doctrine and strategy, and not how China's probable actual warfighting needs and capabilities will be driven by the changes taking place in U.S. and Russian nuclear forces.

Finally, most open source material focuses only on China and not on net assessments of the changing balance of Chinese, U.S., and Russian forces and their war fighting capabilities. The reporting on Chinese military forces by the Office of the U.S. Secretary of Defense cited in the study does show that China is already emerging as a far more serious nuclear weapons power than in the past and is improving the design of many of its nuclear delivery systems in ways that will make them competitive with U.S. and Russia systems.

However, open-source reporting does not provide any picture of how the nuclear balance is likely to change over time. It does not attempt to assess how much of a build-up will take place in Chinese nuclear weapons and delivery systems, what new warfighting and deterrent capabilities and

weapons China will acquire, how China's nuclear posture and strategy will evolve, and whether China will seek a nuclear posture closer to parity with the United States and Russia. It does not compare probable vulnerability to counter force attacks, the need for launch on warning or under attack, or the impact of missile defense and other technical developments on "assured destruction."

The U.S. now needs to fully reassess Chinese nuclear forces as the forces of a future peer competitor – both for military and arms control purposes. It also needs to address the evolving U.S.-Chinese-Russian nuclear balance – as well as the impact of China's changing capabilities on theater warfare. The U.S. is entering an era when it must give the same priority to deterring China's nuclear forces as to deterring Russia's, and when U.S. arms control efforts must break out of their current focus on U.S.-Russian nuclear forces and address those of China as well.

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Chinese Nuclear Weapons Development

Official unclassified or open-source reporting on Chinese nuclear weapons and delivery systems is limited. Many of the details of China's nuclear weapons program remain unclear – no useful current reporting exists on the size and nature of China's nuclear stockpiles and most reporting on new delivery systems is vague and generic. Many of the assessments that are available involve sharply contested data and assessments.

What is clear is that China has gone through different cycles of urgency in creating and modernizing its nuclear forces. Until recently, these were largely limited and reactive – dealing with China's changing perceptions of the need to provide enough survivable deterrence to the threats from the U.S. and Russia – the two nuclear super powers. This situation, however, seems to be changing as China becomes a superpower on its own – surpassing Russia in many areas of military capability and posing a rising challenge to the United States.

Russian Aid and an American Threat

China's initial strategy to deal with the nuclear threat from the U.S. in the period after Mao was to consolidate control of the mainland to rush the creation of a massive complex of tunnels and shelters – a "Great Redoubt" – to use try to ride out a U.S. nuclear attack. Some sources time Mao's decision to create China's nuclear weapons as late as the Taiwan Strait Crisis over the Quemoy and Matsu Islands in 1954-1955. It seems more likely, however, that Mao began to consider such an effort no later than the discovery that the U.S. had considered a nuclear option during the Korean War.

In any case, China proceeded to build a nuclear weapons capability. China began building uranium-enrichment plants in Baotou and Lanzhou in 1958, created a plutonium facility in Jaquan, and completed the Lop Nur nuclear test site by 1960. China's strategy through the early 1960s was to work with Russia to slowly build China's limited technology base to the point where China could create nuclear weapons. It is doubtful that China could have made the progress it did without major Russian aid.[1]

China became a proven nuclear weapons power when it tested its first fission weapon in October 1964 – at a time when it still saw its primary threat as coming from the United States. It then made rapid progress in weapons design and was able to test its first fusion or boosted weapon in June 1967. It tested a 3-4 megaton fusion weapon in an atmospheric test on November 17, 1967 – only a little over three years after its first test. It tested some 22 weapons and devices before it suspended its active test efforts. Its last test was an underground test of a small 2-5 KT weapon on May 21, 1996.[2] China then signed the Comprehensive Test Ban Treaty (CTBT) that same year.

Tilting Away from Russia and Towards the U.S.

The focus of the Chinese program shifted in the late 1960s, when China broke with Russia and shifted towards improved relations with the United States. The perceived threat to China from the U.S. lost much of its urgency after the U.S. withdrew from Vietnam in 1968, and a rapprochement began between the U.S. and China that culminated in the signing of the Shanghai Communiqué in February 1972.

In contrast, China distanced itself from the Former Soviet Union (FSU) after the death of Stalin, and tensions with Khrushchev rose sharply between 1958 and 1959. Russia and China ended their military and technology cooperation program in 1959. Russia halted all nuclear cooperation in July

1960 and withdrew all of its nuclear technicians and advisors from China. Tensions between China and the FSU continued to rise during the1960s, the FSU's invasion of Czechoslovakia helped peak China's concern over Russian intervention, and a seven-month-long, undeclared Chinese-Russian border war took place in 1969.

From 1970 to 1991, China focused on developing nuclear forces that could both deter the United States and Russia. It continued to develop and improve its delivery systems and nuclear weapons and carried out a major espionage effort to acquire stealth technology, means of improving missile accuracy, and possibly the details of the design of U.S. nuclear warheads. These may eventually have included the W88, which is used to MIRV the Trident D-5 ballistic missile. The W88 is an advanced and relatively small and low weight 478-kiloton thermonuclear systems with some hard-target kill capability.

However, the urgency of the Chinese nuclear build-up seems to have declined with time. The U.S. no longer appeared to be an active nuclear threat, and Russia showed little interest in a nuclear conflict with China. The U.S. and Russia also shifted from a massive nuclear arms race to a steadily growing emphasis on reductions in strategic nuclear arms and missile defense efforts.

Although the reporting involved is uncertain, some sources report that, “China has not declared officially that it has ended HEU and plutonium production for weapons, but it is believed to have done so. Production of HEU was stopped in 1987 and that of plutonium by about 1990.”[3] Other sources indicate that China may have created covert Plutonium reactors, and/or Uranium centrifuge facilities, but such reports do not seem to be supported with enough detail to be more than suspicions.

The break-up of the FSU then seems to have further reduced China's concern about the Russian nuclear threat. China and Russia signed a Sino-Soviet Border Agreement in 1991. From roughly 1991 to the Russian invasion of the Ukraine in 2014, China could focus on its civil development and the modernization of its regional conventional and missile forces.

During this period, Chinese espionage efforts yielded significant nuclear weapons, missile, and stealth technology from the U.S. and other powers, but China still had little incentive to engage in a major nuclear arms race. If anything, China's priority *seemed to be* to ensure its relatively limited existing forces were sufficiently protected and dispersible so neither the U.S. nor Russia could carry out a successful first strike, and there was enough mutual assured destruction capability so that U.S. or Russia could not confront China without China's being able to destroy at least 10-20 major U.S. or Russian cities even after a first strike on China.

China's Rising Nuclear Power Program

China also developed a major nuclear power program, although the program only began to acquire a major scale after 2013. There does not seem to be any detailed reporting of links between China's nuclear weapons programs and its nuclear power programs. There has been speculation, however, that China might use some of its growing uranium and plutonium reserves to acquire far more fissile material and weapons than most sources estimate. Such speculation seems to come largely from the fact China has the *potential* for such increases because of rapid progress in expanding its use of nuclear power, and is seeking to create a nuclear fuel cycle that will generate additional material – rather than from any clear indicators that it is actually doing so.

Reporting by the Energy Information Administration (EIA) of the U.S. Department of Energy provide a good picture of China's current plans,[4]

> Although nuclear generation is a small portion of the country's total power generation portfolio, China is actively promoting nuclear power as a clean, efficient, and reliable source of electricity generation. China generated 106 TWh of nuclear power in 2013, making up only 2% of total net generation. However, the country rapidly expanded its nuclear capacity in the past few years, which will likely boost nuclear generation in the next few years. China's net installed nuclear capacity was more than 23 GW as of April 2015 after the country added ten reactors with more than 10 GW since the beginning of 2013...
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> ...All of China's nuclear plants are located along the east coast and southern parts of the country, but China plans to assess the construction of inland facilities, according to its latest energy strategy plan. By April 2015, Chinese companies were constructing an additional 23 GW of capacity, more than one-third of the global nuclear power capacity currently being built. These plants are slated to become operational by 2019 and roughly double China's current capacity.[135] Several more facilities are in various stages of planning.
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> Following Japan's Fukushima Daiichi nuclear accident in March 2011, China suspended government approvals for new nuclear plants until safety reviews of all facilities were completed and a safety framework was approved by the State Council. New plant approvals and construction resumed in October 2012, and the commissioning of new capacity has steadily increased. China's government plans to boost operational nuclear capacity to 58 GW and to have 30 GW of capacity under construction by 2020...As part of this effort, the government is encouraging private investment in nuclear project development and a more expeditious approval process for currently proposed facilities.
>
> China also intends to build strategic and commercial uranium stockpiles through overseas purchases and continue to develop domestic production in Inner Mongolia and Xinjiang. Also, China is developing nuclear fuel reprocessing facilities expected to come online by 2017, according to the World Nuclear Association...

As noted earlier, it is not clear that China halted production of weapons grade Uranium and Plutonium. The International Panel on Fissile Materials (IPFM) does, however, provide a useful estimate the possible interactions between China's military and peaceful power programs: [5]

> China has produced highly enriched uranium (HEU) for weapons in two complexes: The Lanzhou gaseous diffusion plant (Plant 504) and the Heping gaseous diffusion plant (Plant 814). It also used these enrichment plants to produce HEU for its research reactors and LEU for naval reactors. The Heping plant continues to operate...The total amount of weapon-grade HEU in China's stockpile is estimated to be 14±3 tons.
>
> China operates three civilian centrifuge enrichment plants at Hanzhong in Shaanxi province (Plant 405), Lanzhou in Gansu province (Plant 504), and Emeishan in Sichuan province (Plant 814). These plants produce LEU for civilian purposes.
>
> ...China has produced plutonium for weapons at two sites: The Jiuquan Atomic Energy Complex (also referred as Plant 404) near Yumen in Gansu province and the Guangyuan plutonium production complex (Plant 821), located at Guangyuan in Sichuan province. The plutonium production reactor at Jiuquan is believed to have been shut down in 1984. The reactor at Guangyuan probably stopped plutonium production by 1989.
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> China's two plutonium production reactors produced an estimated 3.2±0.6 tons of weapon-grade plutonium. Of this amount, about 360 kg of plutonium is estimated to have been consumed in China's nuclear tests and lost in production. The current inventory of weapon-grade plutonium is therefore estimated to be 2.9±0.6 tons.
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> China reported its first separated civilian plutonium in its declaration to the IAEA that reflected the status of plutonium holdings as of the end of 2010. At the time, the declared amount was 13.8 kg. By the end of 2016 this amount increased to 40.9 kg.

At the same time, any speculation about the use of such stockpiles must take account of the fact that China joined the International Atomic Energy Agency in 1984. China acceded to the NPT in 1992. It then declared it would voluntarily put its civilian nuclear facilities under IAEA safeguards in 1985 and signed the Agreement between the People’s Republic of China and the IAEA for the Application of Safeguards in China in 1988. China signed the Protocol Additional to the IAEA Safeguards Agreement in December 1988. It formally completed the domestic legal procedures

necessary for the Additional Protocol to enter into force in and in March 2002 – becoming the first nuclear-weapon state where the Additional Protocol took effect.[6] China has since regularly repeated its commitment to the full implementation of the NPT.[7]

Rising U.S. and Russian Strategic Nuclear Competition after 2014

The U.S. and Russian nuclear arms race never ended during this period, despite major cuts in their nuclear stockpiles. Even at the peak of U.S. and Russian cooperation, the U.S. and Russia continued to modernize their nuclear weapons designs, improve delivery system accuracy and reliability, change penetration aids and the mix of such aids and warheads, and alter nuclear yields and factors like fusing and height of burst. These changes were rarely made public and many were highly classified. The rate of such modernization also varied sharply by warhead and bomb type and by related delivery system – which often made a given system's initial performance characteristics a poor indication of its evolving capabilities.

U.S. and Russian nuclear relations became far tenser and more confrontational, however, after Russian seized Crimea and then invaded Western Ukraine in 2014 – a shift that inevitably had a major impact on a China that was now beginning to emerge as the world's third superpower and held ambitions to become a peer competitor to the United States. Efforts to move towards zero nuclear weapons were replaced by something approaching a return to the Cold War; by plans for a major modernization of the strategic nuclear triad in each country; and by growing U.S. and Russian concerns over intermediate-range missile forces, development of low-yield, precision long-range strike systems, and improved strategic bombers.

In 2018, President Putin publicly announced a new set of Russian nuclear modernization priorities, including possible hypersonic, low-yield delivery systems, and long-range nuclear torpedoes, Russia is developing a new PAK-DA bomber, new ALCMs, a new Borei-A class SSBN and modified SS-N-32 SLBMs, improved new ICBMs including a mobile version of the SS-27 II and SS-X-29 to replace the SS-18, new SRBMs, and other modernization efforts.[8]

The U.S. announced its own new program by issuing a Nuclear Posture Review (NPR) on February 2, 2018. This program continued the existing elements of the Obama Administration's modernization plan and called for a wide-range of additional steps. The U.S. plan called for production of the new Columbia-class SSBN, the near-term development of a low-yield submarine-launched ballistic missile (SLBM), the longer-term development of new nuclear submarine-launched cruise missile (SLCM); the development and production of a new B-21 strategic bomber; a new Long-Range Standoff Weapon (LRSO) ALCM fleet, and a new Ground-Based Strategic Deterrent (GBSD) ICBM to replace the now 40-year-old Minuteman. China can scarcely have ignored the fact this program was so large that it was estimated to cost $1.2 trillion.[9]

Growing U.S. and Chinese Strategic Competition: New U.S. Strategies

U.S. and Chinese relations also deteriorated as China is emerged as major world power and potential rival, modernized the other aspects of its military forces, and created growing capabilities to challenge U.S. naval and air power in the Pacific. The creation of artificial "fortress" islands in the South China Sea – efforts to enforce Chinese claims areas around Japan, and Korea, and extending to the Philippines – shifted U.S. and Chinese relations from an emphasis on cooperation to a growing emphasis on confrontation

The New U.S. National Security Strategy

These developments led the U.S. to issue a new *National Security Strategy,* signed by President Trump in December 2017 that made China one of two major threats the U.S. had to counter in planning its military forces:[10]

> China and Russia challenge American power, influence, and interests, attempting to erode American security and prosperity. They are determined to make economies less free and less fair, to grow their militaries, and to control information and data to repress their societies and expand their influence... after being dismissed as a phenomenon of an earlier century, great power competition returned. China and Russia began to reassert their influence regionally and globally. Today, they are fielding military capabilities designed to deny America access in times of crisis and to contest our ability to operate freely in critical commercial zones during peacetime. In short, they are contesting our geopolitical advantages and trying to change the international order in their favor.
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> China, Russia, and other state and nonstate actors recognize that the United States often views the world in binary terms, with states being either "at peace" or "at war," when it is actually an arena of continuous competition. Our adversaries will not fight us on our terms. We will raise our competitive game to meet that challenge, to protect American interests, and to advance our values... The United States must retain overmatch— the combination of capabilities in sufficient scale to prevent enemy success and to ensure that America's sons and daughters will never be in a fair fight. Overmatch strengthens our diplomacy and permits us to shape the international environment to protect our interests.
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> To retain military overmatch the United States must restore our ability to produce innovative capabilities, restore the readiness of our forces for major war, and grow the size of the force so that it is capable of operating at sufficient scale and for ample duration to win across a range of scenarios. We must convince adversaries that we can and will defeat them—not just punish them if they attack the United States. We must ensure the ability to deter potential enemies by denial, convincing them that they cannot accomplish objectives through the use of force or other forms of aggression.

The New U.S. National Defense Strategy

In February 2018, the U.S. Secretary of Defense, Jim Mattis, followed up by issuing a new *National Defense Strategy* that called for U.S. military plans that would focus on U.S. perceptions of a potential Chinese threat:[11]

> Inter-state strategic competition, not terrorism, is now the primary concern in U.S. national security. China is a strategic competitor using predatory economics to intimidate its neighbors while militarizing features in the South China Sea... China is leveraging military modernization, influence operations, and predatory economics to coerce neighboring countries to reorder the Indo-Pacific region to their advantage.
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> ...As China continues its economic and military ascendance, asserting power through an all-of-nation long-term strategy, it will continue to pursue a military modernization program that seeks Indo-Pacific regional hegemony in the near-term and displacement of the United States to achieve global preeminence in the future. The most far-reaching objective of this defense strategy is to set the military relationship between our two countries on a path of transparency and non-aggression... Long-term strategic competitions with China and Russia are the principal priorities for the Department, and require both increased and sustained investment, because of the magnitude of the threats they pose to U.S. security and prosperity today, and the potential for those threats to increase in the future.
>
> ...The Department will modernize the nuclear triad—including nuclear command, control, and communications, and supporting infrastructure. Modernization of the nuclear force includes developing options to counter competitors' coercive strategies, predicated on the threatened use of nuclear or strategic non-nuclear attacks.

Growing U.S. and Chinese Strategic Competition: The 2018 Nuclear Posture Review

The U.S. gave China's emerging nuclear forces a far higher priority than in the past in the Nuclear Posture Review (NPR) released in February 2018. Unlike most other U.S. official reporting, the NPR provided the data shown in **Figure One** that illustrates the rate at which the nuclear weapons efforts of other powers were out-pacing those of the United States, and fully recognized the fact that China's nuclear posture was changing dramatically in ways that helped drive the changes and improvements in U.S nuclear forces summarized earlier.

As such, the portions of the unclassified edition of the NPR that address China – and that are scattered throughout a long technical document – are worth quoting at length:[12]

> China, too, is modernizing and expanding its already considerable nuclear forces. Like Russia, China is pursuing entirely new nuclear capabilities tailored to achieve particular national security objectives while also modernizing its conventional military, challenging traditional U.S. military superiority in the Western Pacific. (p. I)
>
> ...While the United States has continued to reduce the number and salience of nuclear weapons, others, including Russia and China, have moved in the opposite direction. They have added new types of nuclear capabilities to their arsenals, increased the salience of nuclear forces in their strategies and plans, and engaged in increasingly aggressive behavior, including in outer space and cyber space. North Korea continues its illicit pursuit of nuclear weapons and missile capabilities in direct violation of United Nations (U.N.) Security Council resolutions. Iran has agreed to constraints on its nuclear program in the Joint Comprehensive Plan of Action (JCPOA). Nevertheless, it retains the technological capability and much of the capacity necessary to develop a nuclear weapon within one year of a decision to do so. (p. III)
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> There now exists an unprecedented range and mix of threats, including major conventional, chemical, biological, nuclear, space, and cyber threats, and violent non-state actors. These developments have produced increased uncertainty and risk. (p. III)
>
> The United States does not wish to regard either Russia or China as an adversary and seeks stable relations with both. We have long sought a dialogue with China to enhance our understanding of our respective nuclear policies, doctrine, and capabilities; to improve transparency; and to help manage the risks of miscalculation and misperception. We hope that China will share this interest and that meaningful dialogue can commence. The United States and Russia have in the past maintained strategic dialogues to manage nuclear competition and nuclear risks. Given Russian actions, including its occupation of Crimea, this constructive engagement has declined substantially. We look forward to conditions that would once again allow for transparent and constructive engagement with Russia. (p. VI)
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> Nevertheless, this review candidly addresses the challenges posed by Russian, Chinese, and other states' strategic policies, programs, and capabilities, particularly nuclear. It presents the flexible, adaptable, and resilient U.S. nuclear capabilities now required to protect the United States, allies, and partners, and promote strategic stability. (p. VI)
>
> . Nevertheless, global threat conditions have worsened markedly since the most recent, 2010 NPR. There now exist an unprecedented range and mix of threats, including major conventional, chemical, biological, nuclear, space, and cyber threats, and violent non-state actors. International relations are volatile. Russia and China are contesting the international norms and order we have worked with our allies, partners, and members of the international community to build and sustain. Some regions are marked by persistent disorder that appears likely to continue and possibly intensify. These developments have produced increased uncertainty and risk, demanding a renewed seriousness of purpose in deterring threats and assuring allies and partners. (p. 2)
>
> While the United States has continued to reduce the number and salience of nuclear weapons, others, including Russia and China, have moved in the opposite direction. Russia has expanded and improved its strategic and non-strategic nuclear forces. China's military modernization has resulted in an expanded nuclear force, with little to no transparency into its intentions. North Korea continues its illicit pursuit of nuclear

weapons and missile capabilities in direct violation of United Nations (U.N.) Security Council resolutions. Russia and North Korea have increased the salience of nuclear forces in their strategies and plans and have engaged in increasingly explicit nuclear threats. Along with China, they have also engaged in increasingly aggressive behavior in outer space and cyber space. (P .2-3)

... As a result, the 2018 NPR assesses recent nuclear policies and requirements that were established amid a more benign nuclear environment and more amicable Great Power relations. It focuses on identifying the nuclear policies, strategy, and corresponding capabilities needed to protect America, its allies, and partners in a deteriorating threat environment. It is strategy driven and provides guidance for the nuclear force structure and policy requirements needed now and in the future to maintain peace and stability in a rapidly shifting environment with significant future uncertainty.

The current threat environment and future uncertainties now necessitate a national commitment to maintain modern and effective nuclear forces, as well as the infrastructure needed to support them. Consequently, the United States has initiated a series of programs to sustain and replace existing nuclear capabilities before they reach the end of their service lives. These programs are critical to preserving our ability to deter threats to the Nation. (p. 3)

... China has continued to undertake assertive military initiatives to create “facts on the ground” in support of its territorial claims over features in the East and South China Seas.

Russia and China are pursuing asymmetric ways and means to counter U.S. conventional capabilities, thereby increasing the risk of miscalculation and the potential for military confrontation with the United States, its allies, and partners. Both countries are developing counter-space military capabilities to deny the United States the ability to conduct space-based intelligence, surveillance, and reconnaissance (ISR); nuclear command, control, and communications (NC3); and positioning, navigation, and timing. Both seek to develop offensive cyberspace capabilities to deter, disrupt, or defeat U.S. forces dependent on computer networks. Both are fielding an array of anti-access area denial (A2/AD) capabilities and underground facilities to counter U.S. precision conventional strike capabilities and to raise the cost for the United States to reinforce its European and Asian allies and partners. (p. 6-7)

...While nuclear weapons play a deterrent role in both Russian and Chinese strategy, Russia may also rely on threats of limited nuclear first use, or actual first use, to coerce us, our allies, and partners into terminating a conflict on terms favorable to Russia. Moscow apparently believes that the United States is unwilling to respond to Russian employment of tactical nuclear weapons with strategic nuclear weapons. (p. 6-7)

The United States does not wish to regard either Russia or China as an adversary and seeks stable relations with both. We continue to seek a dialogue with China to enhance our understanding of our respective nuclear policies, doctrine, and capabilities; to improve transparency; and to help manage the risks of miscalculation and misperception. The United States and Russia have in the past maintained strategic dialogues to manage nuclear competition and nuclear risks. Given Russian actions, including its occupation of Crimea, this constructive engagement has declined substantially. The United States looks forward to a new day when Russia engages with the United States, its allies, and partners transparently and constructively, without aggressive actions and coercive nuclear threats. (p. 6-7)

Nevertheless, this review candidly addresses the challenges posed by Russian, Chinese, and other states’ strategic policies, programs, and capabilities, particularly nuclear, and the flexible, adaptable, and resilient U.S. nuclear capabilities required to protect the United States, allies and partners. (p. 7)

...Consistent with Chinese President Xi’s statement at the 19th Party Congress that China’s military will be “fully transformed into a first tier force” by 2050, China continues to increase the number, capabilities, and protection of its nuclear forces. While China’s declaratory policy and doctrine have not changed, its lack of transparency regarding the scope and scale of its nuclear modernization program raises questions regarding its future intent. China has developed a new road-mobile strategic intercontinental ballistic missile (ICBM), a new multi-warhead version of its DF-5 silo-based ICBM, and its most advanced ballistic missile submarine armed with new submarine-launched ballistic missiles (SLBM). It has also announced development of a new nuclear-capable strategic bomber, giving China a nuclear triad. China has also deployed a nuclear-capable precision-guided DF-26 intermediate-range ballistic missile capable of attacking land and naval targets. As with Russia, despite criticizing U.S. homeland missile defense—which is directed against limited missile threats—China has announced that it is testing a new mid-course missile defense system, plans to develop

> sea-based mid-course ballistic missile defense, and is developing theater ballistic missile defense systems, but has provided few details. (p. 10)

The NPR went further, and provided the following summary of how the U.S. was creating a "tailored" nuclear strategy to deal with China's emerging forces – although it rather curiously did not address the impact of China's nuclear developments on arms control, and any aspect of the U.S. and Russian START strategic and intermediate-range nuclear arms control treaties,[13]

> China's military modernization and pursuit of regional dominance have emerged as a major challenge to U.S. interests in Asia. It has adopted an increasingly assertive posture in disputes with its neighbors, many of whom are U.S. allies or partners. These encompass a variety of historical and border disputes, including over territorial boundaries, claims to contested island territory, and an island-building campaign in the South China Sea. China possesses nuclear warheads on protected ICBMs and SLBMs capable of reaching the United States and nuclear-armed, theater-range ballistic missiles capable of reaching U.S. territory, allies, partners, forces, and bases in the region. China's expanding non-nuclear military capabilities include space and cyber warfare capabilities that could decisively affect the outcome of a conflict.
>
> China is developing capabilities to counter U.S. power projection operations in the region and to deny the United States the capability and freedom of action to protect U.S., allied, and partner interests. Direct military conflict between China and the United States would have the potential for nuclear escalation. Our tailored strategy for China is designed to prevent Beijing from mistakenly concluding that it could secure an advantage through the limited use of its theater nuclear capabilities or that any use of nuclear weapons, however limited, is acceptable.
>
> The United States will maintain the capability to credibly threaten intolerable damage as Chinese leaders calculate costs and benefits, such that the costs incurred as a result of Chinese nuclear employment, at any level of escalation, would vastly outweigh any benefit.
>
> The United States is prepared to respond decisively to Chinese non-nuclear or nuclear aggression. U.S. exercises in the Asia-Pacific region, among other objectives, demonstrate this preparedness, as will increasing the range of graduated nuclear response options available to the President. Both steps will strengthen the credibility of our deterrence strategy and improve our capability to respond effectively to Chinese limited nuclear use if deterrence were to fail. The United States will also continue to seek a meaningful dialogue with China on our respective nuclear policies, doctrine, and capabilities in pursuit of a peaceful security environment and stable relations. (pp. 31-32)
>
> ... The U.S. commitment to our allies and partners in the Asia-Pacific region is unwavering. As in Europe, strong, cohesive alliances and credible deterrence measures are the most effective means of assurance in the Asia-Pacific region. However, North Korea, China, and Russia each present unique, and in some ways more complex, threats to our allies and interests in the Asia-Pacific region. Further, the perception and immediacy of these threats is unique to different allies.
>
> In addition, our alliance structure in Asia is different than it is in Europe. Rather than a single multinational alliance, in Asia we have a series of bilateral arrangements with varying degrees of multilateral cooperation across different missions. Our nuclear posture, too, is different. Following the Cold War, the United States removed all of its nuclear weapons based in Asia and instead relied on strategic nuclear capabilities, complemented by a sea-launched cruise missile (TLAM-N) to extend nuclear deterrence to our allies. With the retirement of the TLAM-N following the 2010 NPR, the United States currently relies almost exclusively on its strategic nuclear capabilities for nuclear deterrence and the assurance of allies in the region. For these reasons, consultation and cooperative arrangements in the Asia-Pacific region are appropriately different than those in Europe.
>
> To maintain credible extended deterrence and thus effective assurance in this complex environment, the United States will:
>
> › Maintain integrated, flexible, and adaptable U.S. nuclear and non-nuclear capabilities;
>
> › Continue to invest in missile defenses against North Korean missile threats;
>
> › Demonstrate with allies our joint commitment to deterrence through military exercises; and,

› Work with our allies to improve our shared understanding of nuclear dangers and corresponding deterrence requirements through continued consultative dialogues. (pp. 36-37)

These shifts in U.S. strategy recognized the fact that China had already become a major superpower in Asia and is almost certain to become one of the top three global military powers in the world during the next decade. They also at least tacitly recognized the reality that the period in which the nuclear forces of the U.S. and Russia were the key measure of global power was over. Every aspect of future strategic arms control efforts and nuclear deterrence and war planning now involves China as well as the U.S. and Russia. What is far less clear, however, is how China will choose to shape its strategic, theater, and tactical nuclear forces in response.

Figure One: Comparative Modernization of Nuclear Delivery Systems Since 2010

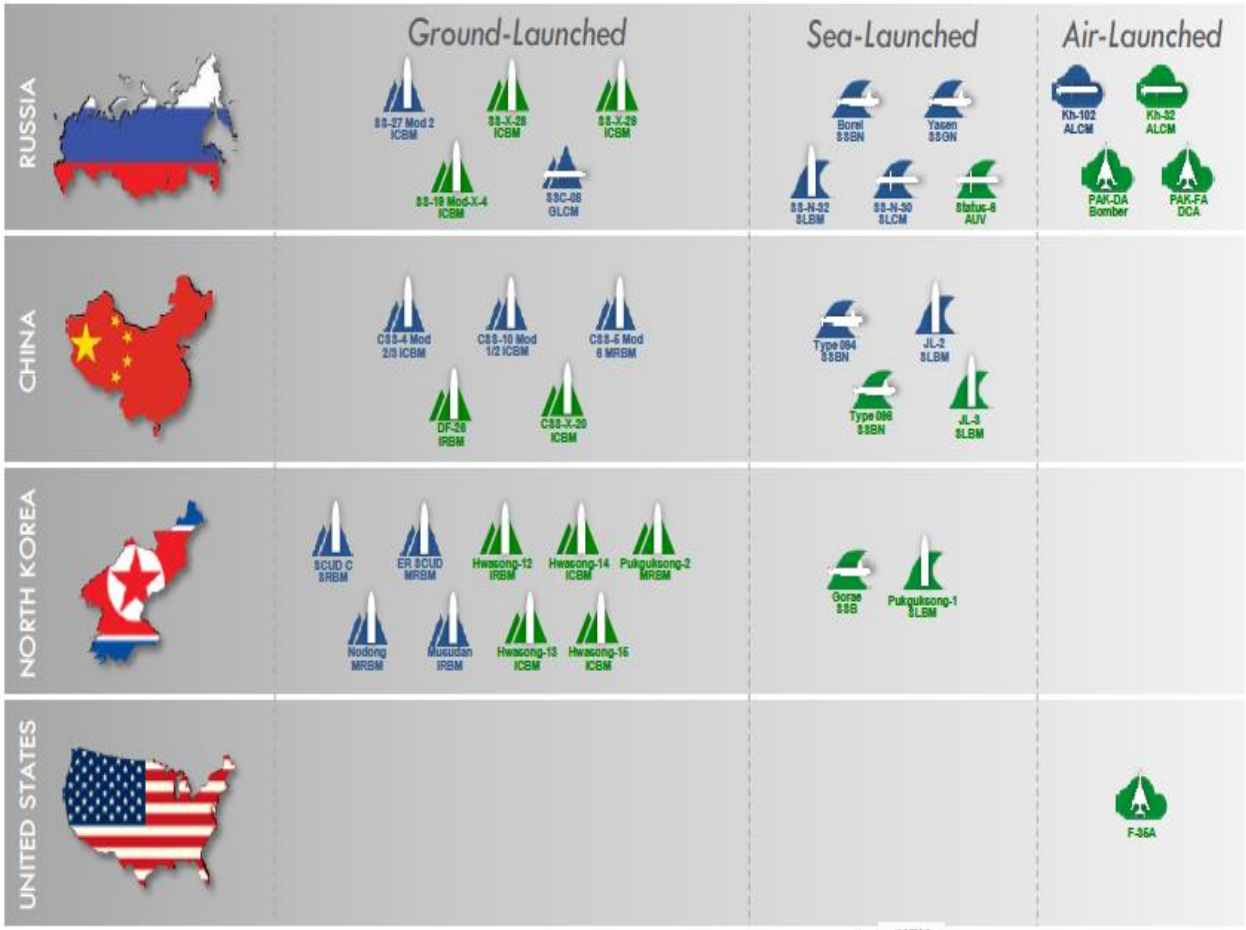


Figure 1. Nuclear Delivery Systems Since 2010
Data provided by the DoD

Office of the Secretary of Defense, *2018 Nuclear Posture Review*, Department of Defense February 2018, p. 8

Current Estimates of U.S., Chinese, Russian, and Other Nuclear Weapons

Any estimate of China's evolving status as a nuclear power must be based more on its capabilities than its public statements about its forces, strategy, and intentions. China has issued broad defense white papers in recent years but has provided fewer and fewer specifics. China's public statements about its nuclear strategy are largely formal declarations with little focus on China's real-world strategic needs and posture. Its statements about its holdings of nuclear weapons and plans for developing its nuclear weapons and delivery systems are particularly lacking in detail. As a result, there are many major uncertainties regarding China's current nuclear posture.

The historical analysis of China's nuclear posture has already identified some of these uncertainties. Some are addressed in the open-source literature issued by other countries and research centers, although usually with at least some conflicts in such estimates and major qualifications as to their reliability. One critical problem is that China's actual nuclear weapons production schedule and stockpiles at any given time have rarely been reported in any open-source form. When they have, it has been in the form of total weapons with the details missing and largely unknown.

China's Slowly Rising Nuclear Weapons Holdings?

U.S. official estimates indicate that China carried out a relatively slow build-up of its nuclear weapons stockpile and delivery systems once it finished developing thermonuclear weapons, ICBM, and SLBM capabilities.

Open-source DIA estimates put China's total stockpile at 150-160 weapons in 1984 but did not indicate how many weapons were actually deployed. A U.S. National Security Council study put China's nuclear-armed missile stockpile at 60-70 weapons in 1993, but this estimate included all missiles and not ICBMs. A DIA study dated 1999-2000 put China's total nuclear weapons inventory at 140-157 weapons, and another DIA estimate provided to the U.S. Congress in 2006 put the total at more than 100 weapons –and in both cases there was little supporting detail.[14]

A Department of Defense estimate in 2011 gave China 55-60 nuclear-armed ICBMS and SLBM in silos and on submarines. The head of STRATCOM put China's total stockpile at the "range of several hundred weapons" in 2012, and the Federation of American Scientists indicated that the nominal total was 240. The Department of Defense document *China Military Power* credited China with 50-75 ICBMs and SLBMs in 2013, and approximately 1,100 shorter-range missiles, but did not estimate China's nuclear stockpile. Some open-source estimates rose to 250 weapons by 2015, and 260 weapons by 2017.

Figure Two provides a summary estimate of the Chinese stockpile by delivery system and yield in 2018, which has been developed by Hans M. Kristensen and Robert Norris of the Federation of American Scientists (FAS) – two leading experts on Chinese holdings of nuclear weapons as well as of the total holdings of other states. This estimate clearly acknowledges the key the uncertainties involved, and they are described in detail in the source shown at the bottom of Figure Two, as well as in the 2018 update to the Chinese version of the nuclear notebook available on the FAS web site.

An interactive estimate on the Bulletin of Atomic Scientists web page – which also draws on work by Kristensen and Norris – estimates that China's total nuclear weapons stockpile grew relatively

rapidly from 1 in 1964 to 5 in 1965, 75 in 1970, and 180 in 1975. Its growth then slowed down sharply to 205 weapons in 1980, 222 in 1985, and 232 in 1990. It rose slowly to 234 weapons in 1995, dropped back to 232 in 2000, reached 235 in 2005, and then grew from 240 in 2010, to 260 in 2015 and 270 in 2017.[15]

It is important to note that the total size of the Kristensen and Norris estimate of China's current holdings in 2018 was still only 254-280 weapons. This total is so small that it indicates that most of the of the Chinese stockpile has to be reserved for China's strategic nuclear forces, and for the mission of deterring the United State and Russia. These numbers also limit the kind of strategic strikes that China could execute. Moreover, most of China's current strategic delivery systems lack the precision and reliability needed for strike in *counterforce* attacks against U.S. and Russia missile silos.

There is, of course, no certainty to any such figures. Even the best open-source estimate has many elements of a guess, and all such estimates of Chinese numbers need to be kept in careful perspective. Some unofficial estimates do go much higher – with totals up to 1,600-3,000 weapons. Such Chinese totals are at least *possible* and help illustrate why U.S. open-source intelligence estimates and the 2018 U.S. NPR stress the uncertainties in assessing Chinese programs.

Such higher estimates, however, seem to be based largely on speculation that China has quietly been far more active in modernizing and expanding its nuclear weapons inventory in past years than U.S. official sources have detected, and that China has covertly drawn on stockpiles of plutonium it processed into fissile material, and has covertly enriched part of its large stockpiles of Uranium to weapons grade levels.

U.S. experts indicate that they do not feel that there is a serious risk that China developed larger stockpiles than U.S. officials have mentioned in the past, or that China has thousands of weapons. While some experts feel that such a covert effort is this is technically *possible* – they do not agree it reflects anything like the *probable result of* Chinese actions and capabilities.

They indicate that it is unclear that such increases could be concealed, both for technical reasons and because China could only use such large stockpiles effectively by conducting detectable command and control, targeting, and exercise activities. They also feel that it is unlikely that China could have created the necessary large-scale covert facilities and procurements. This may explain why the U.S. Department of Defense and the U.S. intelligence community have not expressed the concerns that China may be a much larger nuclear power that have been raised by some outside analysts – although there has been surprisingly little open-source reporting of Chinese stockpile data by U.S. officials regarding any aspect of Chinese holdings of nuclear weapons in recent years.

Relatively slow increases in its stockpiles and halts to nuclear testing also do not mean that China has been unable to make major advances in the capability of its weapons. Such advances could include greater or variable yields, changes in size and weight that affect operational ranges and accuracy, improvements in resistance to shock and reliability, greater ability to alter height of burst to shape fallout and weapons effects, and ability to hit hard targets and penetrate the earth.

Making such changes would probably not require active nuclear testing. Reports that China has obtained significant amounts of U.S. nuclear weapons design data are at least moderately credible. It is also important to note that Israel has never openly tested nuclear weapons, but is treated as a fully effective nuclear power, and reported to have made major improvement in its weapons

designs over time – some possibly based on French and U.S. weapons designs derived from actual testing.

Other reporting indicates that Pakistan and India began to improve their stockpiles and designs several decades ago by using passive testing of nuclear weapons that did not have fissile cores and critical components like the triggering and behavior of high explosive lenses and hemispheres using technology like "flash X-rays."

There are now a range of ways in which China and other states can model and actually test far more advanced nuclear weapons designs without using fissile material compared to tests and modelling used by countries like Pakistan. They include the static test and actual launch of instrumented weapons designs and components with telemetry, simulated shock tests, airburst and penetration tests. They also include instrumented explosive tests of components for – or full actual weapons designs – using non-fissile uranium and plutonium. For example, an article in the *South China Post* in late May 2018 reported that, [16]

> "China is aggressively developing its next generation of nuclear weapons, conducting an average of five tests a month to simulate nuclear blasts, according to a major Chinese weapons research institute… Its number of simulated tests has in recent years outpaced that of the United States, which conducts them less than once a month on average. Between September 2014 and last December, China carried out around 200 laboratory experiments to simulate the extreme physics of a nuclear blast, the China Academy of Engineering Physics reported in a document released by the government earlier this year and reviewed by the *South China Morning Post* this month.
>
> In comparison, the US carried out only 50 such tests between 2012 and 2017 – or about 10 a year – according to the Lawrence Livermore National Laboratory… Although an international ban prevents nuclear weapons from being tested – with high-profile exceptions like North Korea – the major nuclear powers have been able to continue conducting simulated tests. Such tests are typically carried out using high-powered gas guns that fire projectiles at weapons-grade materials in laboratories. Over the past three years, Chinese nuclear Chinese nuclear scientists have performed more such tests than their American counterparts have in 15 years.
>
> In tunnels deep under mountains in Mianyang, southwestern Sichuan province, where China's main nuclear design facilities are based, loud blasts from these experiments can be heard more than once a week. In comparison, between 2003 and 2017, the US fired a total of 150 simulated shots at its Joint Actinide Shock Physics Experimental Research (Jasper) facility at the Nevada National Security Site…. But China's large number of simulated tests did not mean it was ahead of the US in nuclear weapons development, according to Professor Wang Chuanbin, from the State Key Laboratory of Advanced Technology for Materials Synthesis and Processing at the Wuhan University of Technology.
>
> In fact, its number of live tests paled in comparison with the US, said Wang, whose team supplied the Mianyang research center, which combines the functions of several leading American nuclear facilities, with critical materials for its experiments. The US has detonated more than 1,000 nuclear warheads since 1945, when a nuclear bomb was set off for the first time as part of the Manhattan Project. In contrast, China has carried out only 45 live tests starting from 1964. "It is possible we are in a hurry to catch up," Wang said.
>
> … The tests are conducted using a large, sophisticated facility known as a multi-stage gas gun, which simulates the extreme heat, pressure and shock waves produced in a real nuclear blast. The experiments with the gas gun provide scientists with the data they need to develop more advanced nuclear weapons. In the past, researchers used supercomputers to draw on historic data derived from live nuclear tests performed before the international ban was imposed in the 1990s…But new technology that emerged in recent years, such as hypersonic vehicles and artificial intelligence, opened the door for the development of new nuclear weapons that could be smaller in size and more precise.
>
> … Researchers Luo and Wang's laboratory produces a key component used in the gas gun, known as the graded impactor. The gun works by using special explosives to force a piston down a hydrogen-filled metal tube. When the hydrogen gas reaches a certain temperature and pressure, a valve opens to project the impactor at extremely high speeds – of at least 30,000 km per hour (18,640mph) – towards a target. When the impactor

> hits the target, which is made of the same materials used in nuclear warheads, such as plutonium, the collision produces a chemical reaction similar to that of a nuclear detonation.

China also has not needed large numbers of weapons in the past to inflict a high level of assured destruction on the U.S. and Russia. As is explained in the final part of this report, and is illustrated in **Figure Nine**, China has long been able to arm enough ICBMs and SLBMs with nuclear weapons carry out a major *countervalue attack* on U.S. and Russian cities and key economic targets.

At the same time, ongoing improvements in U.S. and Russian counterforce capabilities and ability to carry out theater level nuclear strikes, China's desire to assert itself with all the capabilities of a major superpower, and improving US and Russian missile defenses now give China growing incentives to expand its nuclear weapons stockpiles to much higher levels.

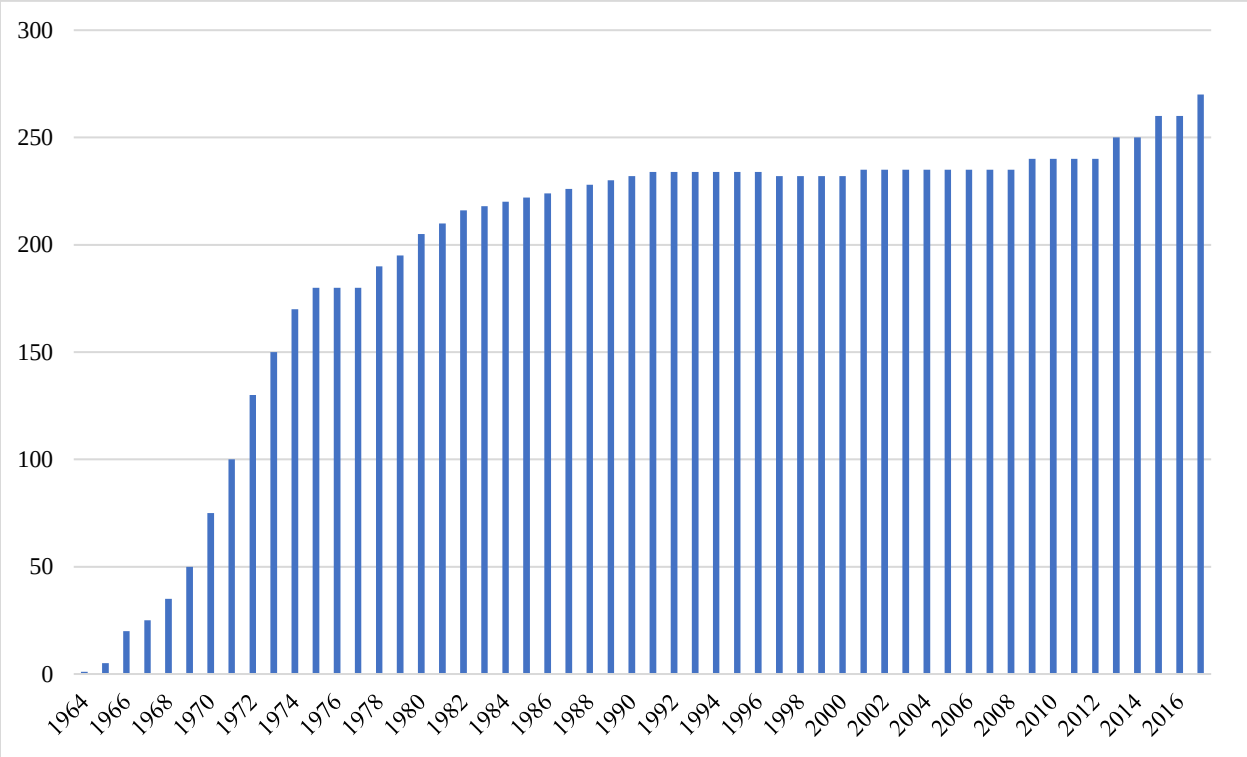
Figure Two Part One: Chinese Nuclear Forces: The Kristensen and Norris Estimate

Type	NATO Designation	Number of Launchers	Year Deployed	Range (Km)	Warhead X Yield[2] (kilotons)	Number of Warheads
Land-Based Ballistic Missiles						
sDF-4	CSS-3	~5	1980	5,500+	1 X 3,300	~10
DF-5A	CSS-4 Mod 2	~10	1981	13,000+	1 X 4,000-5,000	~10
DF-5B	CSS-4 Mod 3	~10	2015	~13,000	3 X 200-300	~30
DF-15	CSS-6	?	1990	6000	1 X ?	?
DF-21	CSS-5 Mods 2, 6	~40	1991, 2000, 2016	2,150	1 X 200-300	~80
DF-26	?	16	(2017)	4,000+	1 X 200-300	16
DF-31	CSS-10 Mod 1	~8	2006	7,000+	1 X 200-300	~8
DF-31A	CSS-10 Mod 2	~32	2007	11,000+	1 X 200-300	~32
DF-31AG	(CSS-10 Mod 3?)	(16)	(2017)	?	(1 X ?)	?
DF-41	CSS-X-20	N/A	?	?	N/A	N/A
Subtotal		*~121*				*~186*
Submarine-Launched Ballistic Missiles						
JL-2	CSS-N-14	48	(2016)	7,000+	1 X 200-300	48
Aircraft						
H-6	B-6	(~20)	1965	3,100+	1 X bomb (1 X ALBM)	(~20)
Fighters	?	?	?	N/A	1 X bomb	?
Cruise Missiles Total						~254 (280)

a. The Chinese nuclear testing program demonstrated a wide range of warhead yields. While older and less accurate missiles were equipped with megaton yield warheads, new and more accurate missiles carry warheads with much lower yields, possibly in the low hundreds of kilotons. It is possible that some warheads have even lower yield options.
b. The CIA concluded in 1993 that China “almost certainly” had developed a warhead for the DF-15, but it is unclear whether the capability was fielded.
c. This table only counts nuclear versions DF-21 (CSS-5 Mod 1) and DF-21A (CSS-5 Mod 2), each of which has fewer than 50 launchers deployed. The conventional DF-21C and DF-21D are not counted.
d. The US designation for the DF-31AG (sometime called DF-31B) is not known. Nor is it clear if the DF-31AG TEL is simply an improved launcher for the existing DF-31A ICBM or carries a new missile. Rumors about MIRV capability have not been confirmed.
e. The missile and warhead inventory may be larger than the number of launchers, some of which can be reused to fire additional missiles.
f. The former JL-1 SLBM and its warheads are thought to have been retired and dismantled.
g. Bombers were used to conduct at least 12 of China’s nuclear test explosions between 1965 and 1979. Gravity bomb models are displayed in museums, and China is apparently developing a possible nuclear-capable air-launched ballistic missile for the H-6. Although they do not have an active nuclear mission, we estimate that a small number of the bombers may have a secondary nuclear capability. Aircraft range is equivalent to combat radius, which for some H-6 bombers can be extended with air refueling.
h. A fighter-bomber was used in a nuclear test in 1972 and models of tactical gravity bombs are exhibited at Chinese museums, but it is not clear whether a tactical bomb capability has been fielded.
i. US military publications have from time to time attributed nuclear capability to various Chinese cruise missiles, an air-launched cruise missile being the most consistent candidate.
j. The number in parentheses includes nearly 30 warheads produced for additional DF-26s and the DF-41, for a total stockpile of approximately 280 warheads.

Source: Hans M. Kristensen and Robert S. Norris, "Chinese nuclear forces, 2018; Nuclear Notebook," *Bulletin of the Atomic Scientists*, 2018, VOL. 74, NO. 4, 289–295, https://doi.org/10.1080/00963402.2018.1486620

Figure Two Part One: Buildup of Chinese Nuclear Weapons Stocks: The Kristensen and Norris Estimate



1964	**1965**	**1966**	**1967**	**1968**	**1968**	**1970**	**1971**	**1972**	**1973**
1	5	20	25	35	50	75	100	130	150
1974	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**
170	180	180	180	190	195	205	210	216	218
1984	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**
220	222	224	226	228	230	232	234	234	234
1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
234	234	234	232	232	232	232	235	235	235
2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
235	235	235	235	235	240	240	240	240	250
2014	**2015**	**2016**	**2017**						
250	260	260	270						

Source: Hans M. Kristensen and Robert S. Norris, "Chinese nuclear forces, 2018; Nuclear Notebook," *Bulletin of the Atomic Scientists*, 2018, VOL. 74, NO. 4, 289–295, https://doi.org/10.1080/00963402.2018.1486620

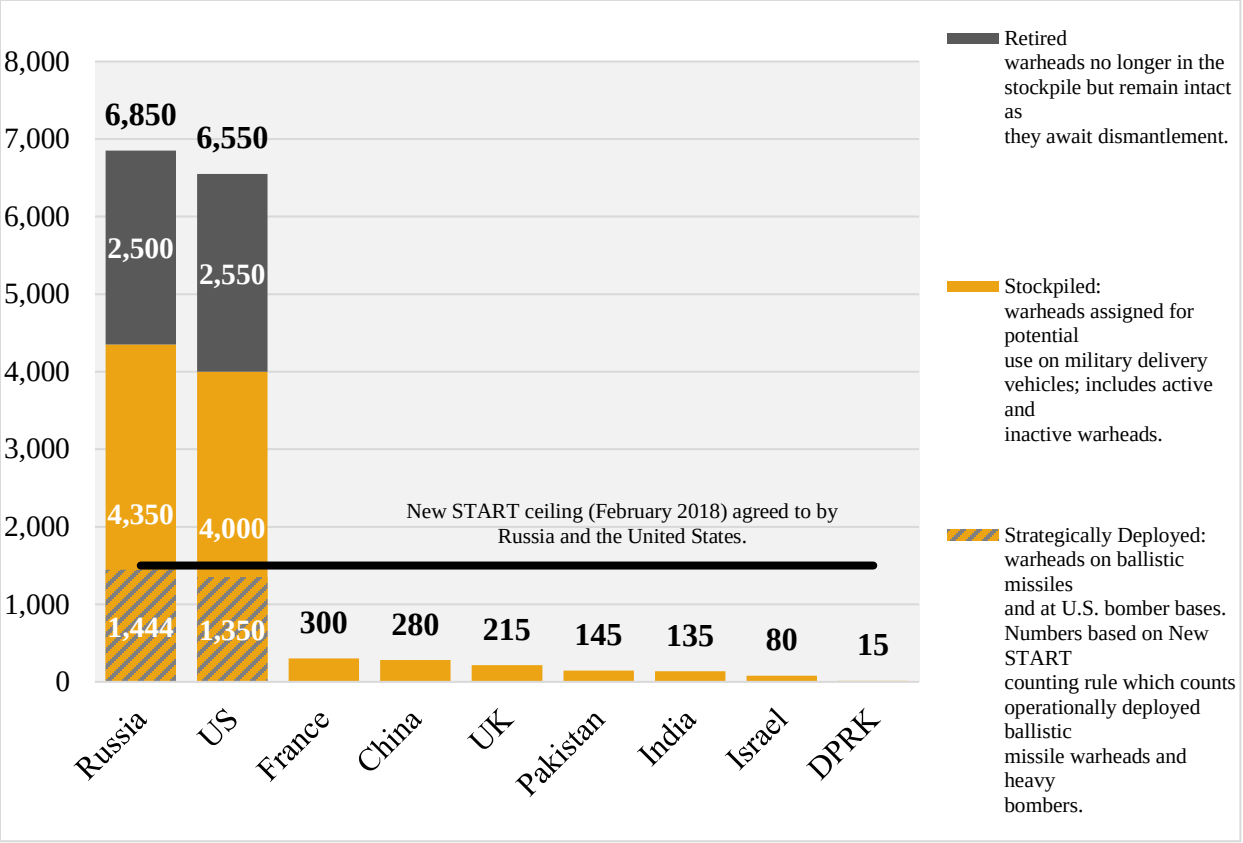
Comparing Current US, Russian, and Chinese Nuclear Weapons Stockpiles

At present, China has a far smaller weapons stockpiles than the other superpowers. The Arms Control Association estimates the total global nuclear weapons holdings shown in **Figure Three**. This estimate again draws upon the work of Hans M. Kristensen and Robert Norris, as well as the work of the Department of State and the Stockholm International Peace Research Institute (SIPRI). Once again, it should be stressed that such estimates are nominal and uncertain, particularly for the smaller nuclear powers shown. They are, however, likely to be broadly correct in showing how a Chinese stock pile of 280 weapons compares to the massive holdings of the United States or Russia.[17]

According to these Arms Control Association estimates, the Chinese total of 280 nuclear weapons – of which as few as 180 weapons may be operationally deployed – would be only 4.3% of the U.S. Inventory of 6,550, and only 4.1% of the Russian inventory of 6,850. Even if one only counts a total of 5,250 U.S. deployed and stockpiled weapons, the Chinese total is still only 5.3% of the U.S. total. It is only 4.8% of the Russian total of 5,794 deployed and stockpiled weapons.

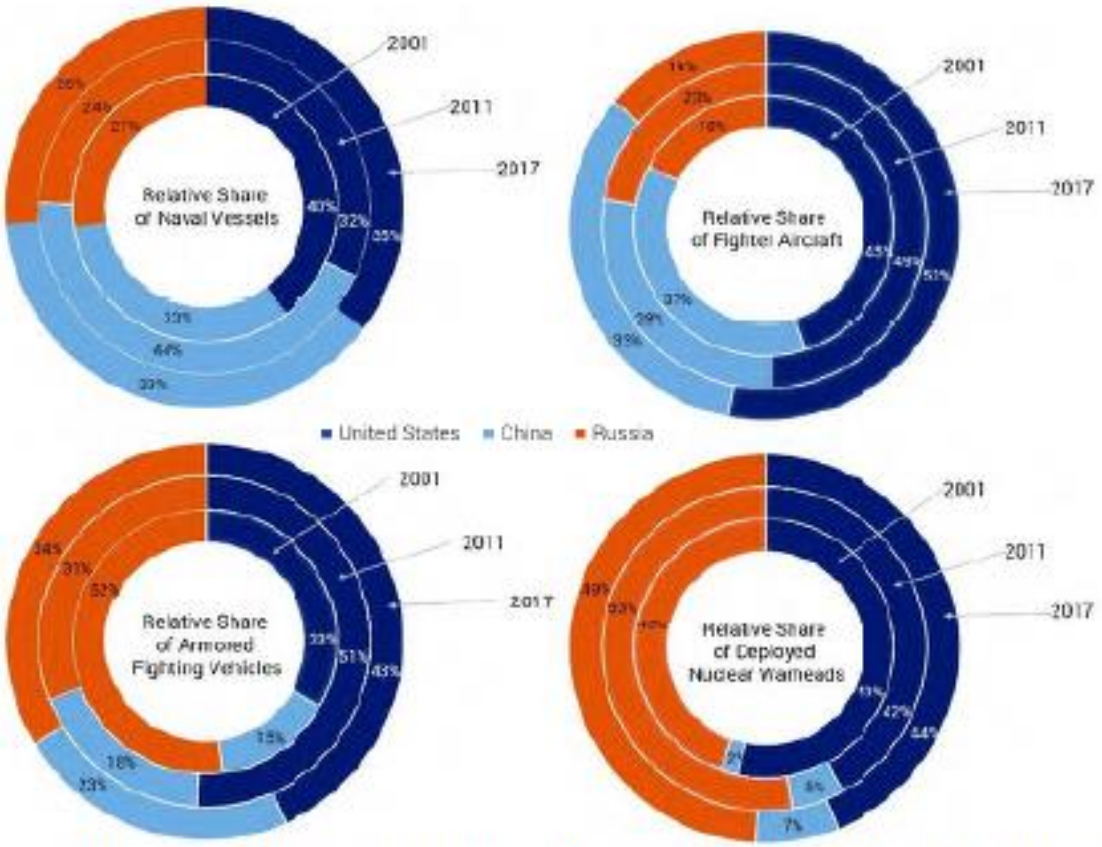
There are no current official open source estimates of Chinese holdings of nuclear weapons. The National Defense Strategy Commission did, however, issue a broad comparison of the relative size and growth of Chinese, U.S. and Russian nuclear weapons – as well as of ships, fighter aircraft, and armored fighting vehicles between 2001 and 2017 in its final report on *Providing for the Common Defense* on November 14, 2018. These comparisons are stated to draw on non-official sources, but it seems likely that they had enough official U.S. review to broadly reflect U.S. government estimates. The result is shown in **Figure Four**, and it is clear that Chinese nuclear weapons holdings did grow between 2001 and 2017, but remain far smaller relative to U.S. and Russian forces than the key elements of China's conventional forces.

Figure Three: Estimated Nuclear Weapons Holdings in 2018



Source: Hans M. Kristesen and Robert S. Norris; U.S. Department of State; Stockholm International Peace Research Institute. Updated June 20, 2018.

Figure Four: Chinese versus U.S. and Russian Nuclear Warheads, Ships, Fighters, and Land Weapons



Sources: International Institute for Strategic Studies (IISS) Military Balance, 2002, 2012, 2018. Bulletin of Atomic Scientists, Nuclear Notebook.
Notes: Naval vessels include submarines and combat logistics force ships, but exclude small patrol and landing craft. Fighter aircraft exclude "attack aircraft," but include "fighter, ground attack" aircraft, as classified by IISS.

Source: *The* final *report of the National Defense Strategy Commission*, USIP download, p. 13, https://www.usip.org/publications?publication_type%5B0%5D=7

Comparing U.S., Chinese, and Russian Delivery Systems

As for delivery systems, China is just beginning to create a true nuclear triad and now has far smaller forces. As is described in detail later in this analysis, Estimates of total active delivery systems again differ from source to source and tend to focus on strategic systems, rather than on intermediate range/theater and tactical nuclear systems, but the broad trends are clear.

Figure Five shows an IISS estimate of U.S, Russian, and Chinese forces based on the IISS *Military Balance* for 2018, along with a comparison of the START data on the accountable holdings of U.S. and Russia reported by the U.S. State Department in September 2018.

In contrast, a January 2018 study by Gregory Kulacki of the Union of Concerned Scientists states the Department of Defense indicated that China had 75-100 ICBMs compared to 400 for the U.S.[18] While the Department reported that Chinese was beginning to deploy missiles that were capable of carrying MIRV/d warheads, all existing U.S. ICBMS could carry three nuclear weapons while deployed China's ICBMs could still only carry one.

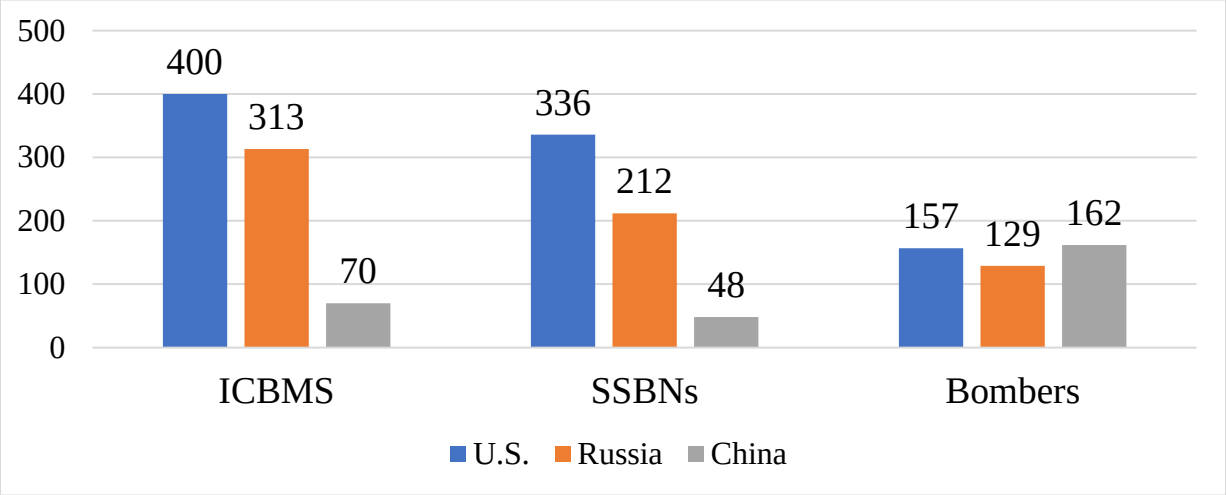
Kulacki also reports that China had four nuclear submarines with a total launch capability of 48 missiles, and a fifth under construction that could launch 12 more. The U.S had 248 submarine-launched ballistic missiles (SLBMs) on 12 SSBNs. Once again, Chinese missiles could only carry one. The U.S. missiles could carry up to 12 warheads – for a total of 2,976 – although the START Treaty limited the total to 1,152, and the U.S. actually deployed only 890.

Although only START has limited the number of strategic nuclear weapons the U.S. can load on its bombers, Kulacki estimates the U.S. has a total of 1,100 nuclear bombs that its bombers and fighter could carry, and 526 nuclear warheads on air-launched cruise missiles. He notes the U.S. evidently has several hundred "dual capable" CJ-10 land-launched and CJ-20 air launched cruise missiles, but their actual nuclear capability is unclear.

Figure Five: IISS and U.S. State Department Comparisons of U.S., Russian, and Chinese Strategic Nuclear Delivery Systems

IISS Estimate of Strategic Delivery Systems

	U.S.	Russia	China
ICBMs	400	313	70
SSBNs (Ships/Maximum Missiles)	14/336	13/192-212	4/48
Bombers	157	129	162



U.S. State Department Estimate of START forces (September 1, 2018) versus Chinese Forces

Deployed ICBMs, Deployed SLBMs, and Deployed Heavy Bombers	659	577	N/A
Warheads on Deployed ICBMs, on Deployed SLBMs, and Nuclear Warheads Counted for Deployed Heavy Bombers	1,358	1,420	N/A
Deployed and Non-deployed Launchers of ICBMs, Deployed and Non-deployed Launchers of SLBMs, and Deployed and Non-deployed Heavy Bombers	800	775	N/A

U.S. State Department, Bureau of Arms Control, Verification, and Compliance, *New START Treaty Aggregate Numbers of Strategic Offensive Arms*, Fact Sheet, September 1, 2018; IISS, *Military Balance 2018*, p. 22

U.S. Nuclear Forces and Modernization Plans

These estimates of current Chinese, U.S., and Russian capabilities are only temporary benchmarks in the nuclear arms race. Regardless of the vague statements China makes about nuclear weapons in its public statements and white papers, China must shape its nuclear plans and forces to deal with the evolving character of U.S. and Russian forces, and the theater threats imposed by India and that can grow out of a conflict involving a nuclear-armed North Korean. China has no reason to publicly provoke or warn the other two super powers or its neighbors, but it must deal with existential threats in grimly realistic terms and serve its strategic needs and ambitions accordingly.

This means China must size and shape its forces to deal with the changes taking place in the nuclear forces of its most urgent threat – the United States, a possible future confrontation or conflict with Russia, and the need to do its best to deter any involvement in a U.S.-Russian nuclear exchange. At least for the next decade, any Chinese nuclear forces that can meet these criteria will be more than adequate to deal with threats like India or a nuclear clash in the Koreas.

The NPR Summary of U.S. Nuclear Forces

Some of the key trends in U.S. nuclear forces that China must react to have already been touched upon, but any speculation about the motives behind China's nuclear modernization efforts mean they need to be explored in depth. The Nuclear Posture Review that the U.S. issued in February 2018 provides an unclassified summary of U.S. forces that is almost certainly accurate, and addresses some of the linkages between U.S. delivery systems and the nuclear weapons they carry – linkages that China does not publicly report,[19]

> ...The triad's synergy and overlapping attributes help ensure the enduring survivability of our deterrence capabilities against attack and our capacity to hold at risk a range of adversary targets throughout a crisis or conflict. Eliminating any leg of the triad would greatly ease adversary attack planning and allow an adversary to concentrate resources and attention on defeating the remaining two legs. Therefore, we will sustain our legacy triad systems until the planned replacement programs are deployed.
>
> The United States currently operates 14 OHIO-class SSBNs, [originally with 24 missile launchers each for a total of 336, being reduced to 20 each for a total of 280 under START, and 8-12 MIRV'd warheads each] and will continue to take the steps needed to ensure that OHIO SSBNs remain operationally effective and survivable until replaced by the COLUMBIA-class SSBN. The COLUMBIA program will deliver a minimum of 12 SSBNs to replace the current OHIO fleet and is designed to provide required deterrence capabilities for decades.
>
> The United States currently operates 14 OHIO-class SSBNs and will continue to take the steps needed to ensure that OHIO SSBNs remain operationally effective and survivable until replaced by the COLUMBIA-class SSBN. The COLUMBIA program will deliver a minimum of 12 SSBNs to replace the current OHIO fleet and is designed to provide required deterrence capabilities for decades.
>
> The ICBM force consists of 400 single-warhead Minuteman III missiles deployed in underground silos and dispersed across several states. The United States has initiated the Ground-Based Strategic Deterrent (GBSD) program to begin the replacement of Minuteman III in 2029. The GBSD program will also modernize the 450 ICBM launch facilities that will support the fielding of 400 ICBMs.
>
> The bomber leg of the triad consists of 46 nuclear-capable B-52H and 20 nuclear-capable B-2A "stealth" strategic bombers. The United States has initiated a program to develop and deploy the next-generation bomber, the B-21 Raider. It will first supplement, and eventually replace elements of the conventional and nuclear-capable bomber force beginning in the mid-2020s.
>
> The B83-1 and B61-11 gravity bombs can hold at risk a variety of protected targets. As a result, both will be retained in the stockpile, at least until there is sufficient confidence in the B61-12 gravity bomb that will be available in 2020.

> Beginning in 1982, B-52H bombers were equipped with ALCMs. Armed with ALCMs, the B-52H can stay outside adversary air defenses and remain effective. The ALCM, however, is now more than 25 years past its design life and faces continuously improving adversary air defense systems. The Long-Range Stand-Off (LRSO) cruise missile replacement program will maintain into the future the bomber force capability to deliver standoff weapons that can penetrate and survive advanced integrated air defense systems, thus supporting the long-term effectiveness of the bomber leg.
>
> ...Arming our force of strategic bombers with LRSO is critical to ensuring their continuing effectiveness in the face of improving air defenses and to provide a diverse range of response options. The LRSO will enable the B-52H to remain an effective part of the nuclear-capable bomber force and preserve upload potential as a key hedge against unforeseen technical and geopolitical challenges. The B-21 will be able to deliver both gravity bombs and the LRSO, the latter supporting the long-term effectiveness of the bomber leg. Crucial to the success of the heavy bomber force is a viable aerial refueling capability, which also needs recapitalization.
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> The current non-strategic nuclear force consists exclusively of a relatively small number of B61 gravity bombs carried by F-15E and allied dual capable aircraft (DCA). The United States is incorporating nuclear capability onto the forward-deployable, nuclear-capable F-35 as a replacement for the current aging DCA. In conjunction with the ongoing life extension program for the B61 bomb, it will be a key contributor to continued regional deterrence stability and the assurance of allies.
>
> ... The United States is also incorporating nuclear capability onto the F-35, to be used by the United States and NATO allies, as a replacement for the current aging DCA. Improved DCA readiness and the arrival of the F-35, a "fifth generation aircraft," in conjunction with the ongoing B61-12 gravity bomb LEP, will preserve the DCA contribution to regional deterrence stability and assurance. In parallel with its warhead LEP, the B61-12 will be equipped with a guidance tail kit to sustain the military capability of existing B61 variants. As is the case with the sustainment and replacement programs necessary to maintain the triad, the programs supporting the DCA mission must be completed on time.

The NPR Summary of U.S. Nuclear Modernization

The U.S. Nuclear Posture Review also provides more details on the key U.S. nuclear modernization efforts that China must take into account in shaping its own nuclear forces. China almost certainly will not mirror image either U.S. or Russian nuclear forces, but its own developments must take account of every aspect of U.S. and Russian activity, and they provide a model of the [potential steps China can and must take in the many areas where China does not provide any public detail on its efforts.[20]

> Existing elements of the nuclear force replacement program predate the dramatic deterioration of the strategic environment. To meet the emerging requirements of U.S. strategy, the United States will now pursue select supplements to the replacement program to enhance the flexibility and responsiveness of U.S. nuclear forces. It is a reflection of the versatility and flexibility of the U.S. triad that only modest supplements are now required in this much more challenging threat environment.
>
> These supplements will enhance deterrence by denying potential adversaries any mistaken confidence that limited nuclear employment can provide a useful advantage over the United States and its allies. Russia's belief that limited nuclear first use, potentially including low-yield weapons, can provide such an advantage is based, in part, on Moscow's perception that its greater number and variety of non-strategic nuclear systems provide a coercive advantage in crises and at lower levels of conflict. Recent Russian statements on this evolving nuclear weapons doctrine appear to lower the threshold for Moscow's first-use of nuclear weapons. Russia demonstrates its perception of the advantage these systems provide through numerous exercises and statements. Correcting this mistaken Russian perception is a strategic imperative.
>
> To address these types of challenges and preserve deterrence stability, the United States will enhance the flexibility and range of its tailored deterrence options. To be clear, this is not intended to, nor does it enable, "nuclear war-fighting." Expanding flexible U.S. nuclear options now, to include low-yield options, is important for the preservation of credible deterrence against regional aggression. It will raise the nuclear

threshold and help ensure that potential adversaries perceive no possible advantage in limited nuclear escalation, making nuclear employment less likely.

Consequently, the United States will maintain, and enhance as necessary, the capability to forward deploy nuclear bombers and DCA around the world. We are committed to upgrading DCA with the nuclear-capable F-35 aircraft. We will work with NATO to best ensure—and improve where needed—the readiness, survivability, and operational effectiveness of DCA based in Europe.

Additionally, in the near-term, the United States will modify a small number of existing SLBM warheads to provide a low-yield option, and in the longer term, pursue a modern nuclear-armed sea-launched cruise missile (SLCM). Unlike DCA, a low-yield SLBM warhead and SLCM will not require or rely on host nation support to provide deterrent effect. They will provide additional diversity in platforms, range, and survivability, and a valuable hedge against future nuclear "break out" scenarios.

DoD and National Nuclear Security Administration (NNSA) will develop for deployment a low-yield SLBM warhead to ensure a prompt response option that is able to penetrate adversary defenses. This is a comparatively low-cost and near-term modification to an existing capability that will help counter any mistaken perception of an exploitable "gap" in U.S. regional deterrence capabilities.

In addition to this near-term step, for the longer term the United States will pursue a nuclear-armed SLCM, leveraging existing technologies to help ensure its cost effectiveness. SLCM will provide a needed non-strategic regional presence, an assured response capability. It also will provide an arms control compliant response to Russia's non-compliance with the Intermediate-range Nuclear Forces Treaty, its non-strategic nuclear arsenal, and its other destabilizing behaviors.

In the 2010 NPR, the United States announced the retirement of its previous nuclear-armed SLCM, which for decades had contributed to deterrence and the assurance of allies, particularly in Asia. We will immediately begin efforts to restore this capability by initiating a capability study leading to an Analysis of Alternatives (AoA) for the rapid development of a modern SLCM.

These supplements to the planned nuclear force replacement program are prudent options for enhancing the flexibility and diversity of U.S. nuclear capabilities. They are compliant with all treaties and agreements, and together, they will: provide a diverse set of characteristics enhancing our ability to tailor deterrence and assurance; expand the range of credible U.S. options for responding to nuclear or non-nuclear strategic attack; and, enhance deterrence by signaling to potential adversaries that their limited nuclear escalation offers no exploitable advantage.

... In light of the critical need to ensure our NC3 (nuclear command, control, and communications) system remains survivable and effective, the United States will pursue a series of initiatives. This includes: strengthening protection against cyber threats, strengthening protection against space-based threats, enhancing integrated tactical warning and attack assessment, improving command post and communication links, advancing decision support technology, integrating planning and operations, and reforming governance of the overall NC3 system.

...Over the past several decades, the U.S. nuclear weapons infrastructure has suffered the effects of age and underfunding. Over half of NNSA's infrastructure is over 40 years old, and a quarter dates back to the Manhattan Project era. All previous NPRs highlighted the need to maintain a modern nuclear weapons infrastructure, but the United States has fallen short in sustaining a modern infrastructure that is resilient and has the capacity to respond to unforeseen developments. There now is no margin for further delay in recapitalizing the physical infrastructure needed to produce strategic materials and components for U.S. nuclear weapons. Just as our nuclear forces are an affordable priority, so is a resilient and effective nuclear weapons infrastructure, without which our nuclear deterrent cannot exist.
The U.S. must have the ability to maintain and certify a safe, secure, and effective nuclear arsenal. Synchronized with DoD replacement programs, the United States will sustain and deliver on-time the warheads needed to support both strategic and non-strategic nuclear capabilities by:

- Completing the W76-1 Life Extension Program (LEP) by Fiscal Year (FY) 2019;
- Completing the B61-12 LEP by FY2024;
- Completing the W88 alterations by FY2024;

- Synchronizing NNSA's W80-4 life extension, with DoD's LRSO program and completing the W80-4 LEP by FY2031;
- Advancing the W78 warhead replacement one year to FY19 to support fielding on GBSD by 2030 and investigate the feasibility of fielding the nuclear explosive package in a Navy flight vehicle;
- Sustaining the B83-1 past its currently planned retirement date until a suitable replacement is identified; and,
- Exploring future ballistic missile warhead requirements based on the threats and vulnerabilities of potential adversaries, including the possibility of common reentry systems between Air Force and Navy systems.

The United States will pursue initiatives to ensure the necessary capability, capacity, and responsiveness of the nuclear weapons infrastructure and the needed skills of the workforce, including the following:

- Pursue a joint DoD and Department of Energy advanced technology development capability to ensure that efforts are appropriately integrated to meet DoD needs.
- Provide the enduring capability and capacity to produce plutonium pits at a rate of no fewer than 80 pits per year by 2030. A delay in this would result in the need for a higher rate of pit production at higher cost.
- Ensure that current plans to reconstitute the U.S. capability to produce lithium compounds are sufficient to meet military requirements.
- Fully fund the Uranium Processing Facility and ensure availability of sufficient low enriched uranium to meet military requirements.
- Ensure the necessary reactor capacity to produce an adequate supply of tritium to meet military requirements.
- Ensure continuity in the U.S. capability to develop and manufacture secure, trusted strategic radiation-hardened microelectronic systems beyond 2025 to support stockpile modernization.
- Rapidly pursue the Stockpile Responsiveness Program established by Congress to expand opportunities for young scientists and engineers to advance warhead design, development, and production skills.
- Develop an NNSA roadmap that sizes production capacity to modernization and hedging requirements.
- Retain confidence in nuclear gravity bombs needed to meet deterrence needs.
- Maintain and enhance the computational, experimental, and testing capabilities needed to annually assess nuclear weapons.

U.S. Missile Defenses

China not only needs to react to U.S. offensive nuclear systems, it needs to react to U.S. missile defenses. Current and planned U.S. missile defenses now only include a small number of Ground-Based Midcourse defense systems. The U.S. deploys only 44 interceptor silos in Alaska and Hawaii—a number that was designed to deal with the limited or developing threat from Iran and North Korea, and forces that are not located for anything approaching an effective defense against Russia.

The FY2019 budget overview issued by the Department of Defense in February 2018 notes that U.S. goals for strategic missile defense are planned to remain limited and have a negligible capability against a major Russian or Chinese attack—both in a probable first major strike and in any follow-on strikes:[21]

> The Department will develop an additional missile field in Alaska and increase the number of operational, deployed Ground-Based Interceptors (GBI) to 64 missiles as early as FY 2023. The Department is also investing in the infrastructure required to maintain an operational fleet of 64 GBIs into the future. The FY 2019 request would continue development of the Redesigned Kill Vehicle (RKV) to address the evolving threat and improve kill vehicle reliability, continue development of a 2-/3-stage booster selectable capability to expand battlespace for GBI engagements for homeland defense. The budget also uses available technology to improve existing sensors, battle management, fire control, and kill vehicle capabilities.
>
> The budget also supports development and deployment of new sensors to improve Missile Defense System (MDS) discrimination capability and allow for more efficient use of the GBI inventory, to include a Long-Range Discrimination Radar in Alaska, a Homeland Defense Radar in Hawaii, and an additional Medium Range Discrimination Radar in the Pacific. The MDA will also deliver an experimental space-based kill assessment capability for defense of the homeland as part of an integrated post intercept assessment solution.
>
> Today's operational Ground-Based Midcourse (GMD) system interceptors or (GBIs) are deployed in Alaska and California to defend the U.S. homeland against an ICBM limited attack from countries like North Korea and Iran, and which can only defend against intermediate and long-range ballistic missiles. The rest are a limited number of theater and area defense systems that are not designed to intercept ICBM and include the Terminal High Altitude Area Defense (THAAD) being delivered to the U.S. Army, the Aegis BMD near-term Sea-Based Terminal Defense capability using the SM-2 Block IV and follow-on SM-3missiles, and the U.S. Army's PATRIOT Advanced Capability-3 (PAC-3) now deployed worldwide.

The U.S. FY2019 budget submission makes it equally clear that programmed U.S. improvements will not threaten or alter Russia or China's strategic capabilities to launch a major attack: [22]

- Supports the U.S. Forces Korea (USFK) to improve missile defense capability on the Korean peninsula
- Provides the funding for the development of advanced missile defense technologies to counter future threats, including discrimination improvements, multi-object kill vehicle technology, hypersonic threat missile defeat, and high-powered lasers
- Continues, in alignment with the United States Navy, to support and operate the Aegis Ashore site in Romania and deployment of a second site in Poland, as an integral part of NATO’s Ballistic Missile Defense (BMD) architecture
- Continues increasing BMD capability and capacity of the Aegis Fleet and procures 37 Standard Missile (SM-3) Block IB missiles to be deployed on Aegis BMD ships and at Aegis Ashore Sites as part of a Multiyear Procurement; continues the integration of the SM-3 Block IIA into the Aegis BMD Weapon Systems; procures 6 SM-3 Block IIA missiles to contribute to defense against longer-range and more complex threats; ensures the maturation of the manufacturing process; and continues development of the Sea Based Terminal capability to protect the Fleet and forces ashore
- Provides funding for Terminal High Altitude Area Defense (THAAD) development efforts and software upgrades such as implementation of flexible threat packages and defense planning, improved capability to engage SRBM, MRBM and limited IRBM threats and integration of the THAAD Battery capability into the Army’s Integrated Air and Missile Defense Battle Command System (IBCS) planning process. The THAAD budget request also includes funding for the procurement of 82 THAAD Interceptors in FY 2019 as well as for operating support to maintain and upkeep BMD System-unique items of fielded THAAD Batteries and for training devices.
- Provides funding to perform the systems engineering required to design, build, test, assess and field the integrated MDS
- Provides funding to execute a comprehensive, highly integrated, complex, cost-effective series of flight tests, ground tests, wargames and exercises to ensure that MDS capabilities are credibly demonstrated and validated prior to delivery to the Warfighter.

Russian Nuclear Forces and Modernization Plans

China must also shape its nuclear forces to react to the changes and improvements in Russian nuclear forces. China may now have better strategic relations with Russia than the U.S. but it cannot ignore the fact that Russia is also a major nuclear superpower, has been a major threat to China in the past, and could become major competitor or threat in the future. Moreover, Russia's need to compete with the U.S. with far fewer resources may make it more of a model for a China seeking to catch up with the United States in key aspect of nuclear weapons capabilities at some point well before 2030.

Russia's Nuclear Posture

Putin made Russia's nuclear ambitions all too clear in his annual Presidential Address to the Russian National Assembly, which he gave on March 1, 2018.[23] Putin said nothing about China and focused on what he said was the increasing aggressiveness of the U.S. and NATO, [24]

> I want to specifically emphasize that the newly developed strategic arms – in fact, new types of strategic weapons – are not the result of something left over from the Soviet Union. Of course, we relied on some ideas from our ingenious predecessors. But everything I have described today is the result of the last several years, the product of dozens of research organizations, design bureaus and institutes.
>
> Thousands, literally thousands of our experts, outstanding scientists, designers, engineers, passionate and talented workers have been working for years, quietly, humbly, selflessly, with total dedication. There are many young professionals among them. They are our true heroes, along with our military personnel who demonstrated the best qualities of the Russian army in combat. I want to address each of them right now and say that there will absolutely be awards, prizes and honorary titles but, because I have met many of you in person many times, I know you are not after awards. The most important thing is to reliably ensure the security of our country and our people. As President and on behalf of the Russian people, I want to say thank you very much for your hard work and its results. Our country needs them so much.
>
> As I have already said, all future military products are based on remarkable advances that can, should and will be used in high-technology civilian sectors. I would like to stress that only a country with the highest level of fundamental research and education, developed research, technology, industrial infrastructure and human resources can successfully develop unique and complex weapons of this kind. You can see that Russia has all these resources.
>
> ...We are not threatening anyone, not going to attack anyone or take away anything from anyone with the threat of weapons. We do not need anything. Just the opposite. I deem it necessary to emphasize (and it is very important) that Russia's growing military power is a solid guarantee of global peace as this power preserves and will preserve strategic parity and the balance of forces in the world, which, as is known, have been and remain a key factor of international security after WWII and up to the present day.
>
> And to those who in the past 15 years have tried to accelerate an arms race and seek unilateral advantage against Russia, have introduced restrictions and sanctions that are illegal from the standpoint of international law aiming to restrain our nation's development, including in the military area, I will say this: everything you have tried to prevent through such a policy has already happened. No one has managed to restrain Russia.
>
> Now we have to be aware of this reality and be sure that everything I have said today is not a bluff – and it is not a bluff, believe me – and to give it a thought and dismiss those who live in the past and are unable to look into the future, to stop rocking the boat we are all in and which is called the Earth.
>
> In this connection, I would like to note the following. We are greatly concerned by certain provisions of the revised nuclear posture review, which expand the opportunities for reducing and reduce the threshold for the use of nuclear arms. Behind closed doors, one may say anything to calm down anyone, but we read what is written. And what is written is that this strategy can be put into action in response to conventional arms attacks and even to a cyber-threat.

I should note that our military doctrine says Russia reserves the right to use nuclear weapons solely in response to a nuclear attack, or an attack with other weapons of mass destruction against the country or its allies, or an act of aggression against us with the use of conventional weapons that threaten the very existence of the state. This all is very clear and specific.

As such, I see it is my duty to announce the following. Any use of nuclear weapons against Russia or its allies, weapons of short, medium or any range at all, will be considered as a nuclear attack on this country. Retaliation will be immediate, with all the attendant consequences.

There should be no doubt about this whatsoever. There is no need to create more threats to the world. Instead, let us sit down at the negotiating table and devise together a new and relevant system of international security and sustainable development for human civilization. We have been saying this all along. All these proposals are still valid. Russia is ready for this.

I will speak about the newest systems of Russian strategic weapons that we are creating in response to the unilateral withdrawal of the United States of America from the Anti-Ballistic Missile Treaty and the practical deployment of their missile defense systems both in the US and beyond their national borders.

Back in 2000, the US announced its withdrawal from the Anti-Ballistic Missile Treaty. Russia was categorically against this. We saw the Soviet-US ABM Treaty signed in 1972 as the cornerstone of the international security system. Under this treaty, the parties had the right to deploy ballistic missile defense systems only in one of its regions. Russia deployed these systems around Moscow, and the US around its Grand Forks land-based ICBM base.

Together with the Strategic Arms Reduction Treaty, the ABM Treaty not only created an atmosphere of trust but also prevented either party from recklessly using nuclear weapons, which would have endangered humankind, because the limited number of ballistic missile defense systems made the potential aggressor vulnerable to a response strike.

We did our best to dissuade the Americans from withdrawing from the treaty. All in vain. The US pulled out of the treaty in 2002. Even after that we tried to develop constructive dialogue with the Americans. We proposed working together in this area to ease concerns and maintain the atmosphere of trust. At one point, I thought that a compromise was possible, but this was not to be. All our proposals, absolutely all of them, were rejected. And then we said that we would have to improve our modern strike systems to protect our security. In reply, the US said that it is not creating a global BMD system against Russia, which is free to do as it pleases, and that the US will presume that our actions are not spearheaded against the US.

The reasons behind this position are obvious. After the collapse of the USSR, Russia, which was known as the Soviet Union or Soviet Russia abroad, lost 23.8 percent of its national territory, 48.5 percent of its population, 41 of the GDP, 39.4 percent of its industrial potential (nearly half of our potential, I would underscore), as well as 44.6 percent of its military capability due to the division of the Soviet Armed Forces among the former Soviet republics. The military equipment of the Russian army was becoming obsolete, and the Armed Forces were in a sorry state. A civil war was raging in the Caucasus, and US inspectors oversaw the operation of our leading uranium enrichment plants.

For a certain time, the question was not whether we would be able to develop a strategic weapon system – some wondered if our country would even be able to safely store and maintain the nuclear weapons that we inherited after the collapse of the USSR. Russia had outstanding debts, its economy could not function without loans from the IMF and the World Bank; the social sphere was impossible to sustain.

Apparently, our partners got the impression that it was impossible in the foreseeable historical perspective for our country to revive its economy, industry, defense industry and Armed Forces to levels supporting the necessary strategic potential. And if that is the case, there is no point in reckoning with Russia's opinion; it is necessary to further pursue ultimate unilateral military advantage in order to dictate the terms in every sphere in the future.

Basically, this position, this logic, judging from the realities of that period, is understandable, and we ourselves are to blame. All these years, the entire 15 years since the withdrawal of the United States from the Anti-Ballistic Missile Treaty, we have consistently tried to reengage the American side in serious discussions, in reaching agreements in the sphere of strategic stability.

We managed to accomplish some of these goals. In 2010, Russia and the US signed the New START treaty, containing measures for the further reduction and limitation of strategic offensive arms. However, in light of the plans to build a global anti-ballistic missile system, which are still being carried out today, all agreements signed within the framework of New START are now gradually being devaluated, because while the number of carriers and weapons is being reduced, one of the parties, namely, the US, is permitting constant, uncontrolled growth of the number of anti-ballistic missiles, improving their quality, and creating new missile launching areas. If we do not do something, eventually this will result in the complete devaluation of Russia's nuclear potential. Meaning that all of our missiles could simply be intercepted.

Despite our numerous protests and pleas, the American machine has been set into motion, the conveyer belt is moving forward. There are new missile defense systems installed in Alaska and California; as a result of NATO's expansion to the east, two new missile defense areas were created in Western Europe: one has already been created in Romania, while the deployment of the system in Poland is now almost complete. Their range will keep increasing; new launching areas are to be created in Japan and South Korea. The US global missile defense system also includes five cruisers and 30 destroyers, which, as far as we know, have been deployed to regions in close proximity to Russia's borders. I am not exaggerating in the least; and this work proceeds apace.

So, what have we done, apart from protesting and warning? How will Russia respond to this challenge? This is how.

During all these years since the unilateral US withdrawal from the ABM Treaty, we have been working intensively on advanced equipment and arms, which allowed us to make a breakthrough in developing new models of strategic weapons.

Let me recall that the United States is creating a global missile defense system primarily for countering strategic arms that follow ballistic trajectories. These weapons form the backbone of our nuclear deterrence forces, just as of other members of the nuclear club.

As such, Russia has developed, and works continuously to perfect, highly effective but modestly priced systems to overcome missile defense. They are installed on all of our intercontinental ballistic missile complexes.

… Let me reiterate that each of the armament systems I referred to is uniquely important. Even more importantly, taken together all these advances enable the Defence Ministry and General Staff to develop a comprehensive defense system, in which every piece of new military equipment will be assigned a proper role. On top of strategic weapons that are currently on combat alert and benefit from regular updates, Russia will have a defense capability that would guarantee its security in the long term.

…I hope that everything that was said today would make any potential aggressor think twice, since unfriendly steps against Russia such as deploying missile defenses and bringing NATO infrastructure closer to the Russian border become ineffective in military terms and entail unjustified costs, making them useless for those promoting these initiatives.

It was our duty to inform our partners of what I said here today under the international commitments Russia had subscribed to. When the time comes, foreign and defense ministry experts will have many opportunities to discuss all these matters with them, if of course our partners so desire.

For my part, I should note that we have conducted the work to reinforce Russia's defense capability within the current arms control agreements; we are not violating anything. I should specifically say that Russia's growing military strength is not a threat to anyone; we have never had any plans to use this potential for offensive, let alone aggressive goals.

We are not threatening anyone, not going to attack anyone or take away anything from anyone with the threat of weapons. We do not need anything. Just the opposite. I deem it necessary to emphasize (and it is very important) that Russia's growing military power is a solid guarantee of global peace as this power preserves and will preserve strategic parity and the balance of forces in the world, which, as is known, have been and remain a key factor of international security after WWII and up to the present day.

Ongoing Russian Nuclear Modernization

Putin went on to suddenly introducing a range of dramatic new strategic nuclear strike systems into his speech, along with a series of remarkably shallow short videos. He almost exclusively on "gee whiz" technologies—the "toy factor" —in these systems and their impact on missile and air defenses without regard to their impact on the strategic balance and global stability. In doing so, he largely ignored many ongoing Russian modernization programs that were already reshaping Russia's strategic forces.

Many of the details of such programs remain classified, but the IISS *Military Balance* for 2018 provides an good summary of what is known from open-sources in a section entitled "Russia: strategic-force modernization."[25] Limited excerpts from this IISS analysis cannot do it justice, but even providing such excerpts as "bullets" that cover major ongoing Russian efforts provides a picture of the effort China must already being studying, and considering in its own nuclear planning and compare to the more limited changes called for in the U.S. Nuclear Posture Review:

- Russia's military doctrine, last updated in 2014, states that the country reserves the right to use its nuclear capability in response to the use of nuclear weapons – or other weapons of mass destruction – against Russia or its allies, and in circumstances where aggression with conventional weapons would put at risk the very existence of the state. While this language indicates that the range of conditions for the use of Russia's nuclear weapons is relatively constrained, it is nuanced enough to allow Moscow to suggest that it can resort to nuclear weapons in a number of scenarios.
- While the Russian political and military leadership clearly understands the catastrophic consequences of a large-scale nuclear exchange, Moscow appears to be maintaining a degree of ambiguity about its intentions and capabilities that make it very difficult to completely rule out the possibility of a limited use of nuclear weapons in some eventualities. Indeed, in its military exercises, Russia has practiced scenarios that involve the use of such weapons.
- During the financially lean years of the 1990s, Russia focused on maintaining the core components of its strategic arsenal, preserving key defense-industrial enterprises, and consolidating development and production in Russia…As more funds became available in the 2000s, the modernization effort was intensified and subsequently expanded to include a number of new programs. To a large extent, this expansion was driven by the defense industry, although the factors that helped justify the modernization effort included the need to maintain numerical parity with the United States and to counter US missile defense developments.
- …key enterprises involved in the development and production of Russia's strategic systems include the Moscow Institute of Thermal Technology, which leads the development of land and sea-based solid-propellant ballistic missiles (RS-12M2 Topol-M (SS-27 mod 1), RS-24 Yars (SS-27 mod 2) and Bulava), and the Votkinsk Machine Building Plant, which produces the missiles.
- The Makeyev State Rocket Center is the lead developer of liquid-fuel missiles, including modifications of the R-29RM Sineva (SS-N-23 Skiff) submarine launched ballistic missile (SLBM) and the new silo based Sarmat.
- The Tupolev Design Bureau is the main contractor for work on the current range of strategic bombers. Upgrades to old bombers are carried out at several plants, but it is planned that new aircraft production will be concentrated at the Gorbunov Aviation Plant in Kazan.
- …the Bulava missile program encountered some difficulties at the development and serial-production stages; development of the Sarmat missile is now several years behind schedule; and the industry still has to demonstrate that it can resume the production of strategic bombers.
- Russia is carrying out an active ICBM modernization program, which has accelerated in recent years. The missile system at the center of this modernization is the single-warhead Topol-M (SS-27 mod 1), which was deployed in 1997–2009…When START expired in 2009, Russia switched to deployment of the RS-24 Yars (SS-27 mod 2), which is a version of the Topol-M (probably somewhat upgraded) that uses multiple

independently-targetable re-entry vehicles (MIRVs). Both of these missiles are deployed in silos as well as on road-mobile launchers. As of early 2017, Russia was estimated to have 78 single-warhead Topol-M missiles and 96 multiple-warhead Yars ICBMs.

- The relatively new Topol-M and Yars missiles carry about half of all the ICBM warheads in Russia's inventory. The other half are deployed with the older ICBMs that were introduced in the early 1980s. One of these missiles, the UR-100NUTTH (SS-19 mod 3), is in the process of being withdrawn from active service.
- The other, the heavy R-36M2 (SS-18 Satan mod 5), is currently deployed with two missile divisions. With each missile carrying ten warheads, 46 ICBMs of this type account for 460 deployed warheads. These missiles are expected to stay in service until about 2020. After that they will be replaced by Sarmat, a new silo-based liquid-fuel ICBM that is currently under development.
- Russia has considered reviving the idea of building a rail-mobile ICBM. (The IISS reports that, "Even though the project, known as Barguzin, was not included in the earlier State Armament Program, development is under way and the first missile ejection test took place in November 2016." Other experts believe Russia has since ended this effort.)
- Another missile under development, known as the RS-26 Rubezh, is nominally considered an ICBM, since it demonstrated a range of more than 5,500km in one of its flight tests. Rubezh, however, is believed to be an intermediate-range missile that is based on the first two stages of Yars. Russia completed flight tests of the missile in 2014 and initially planned to begin deployment in 2015 to missile units near Irkutsk and at Edrovo/Vypolzovo. However, the deployment was postponed and is not expected to begin until at least mid-2018.
- In 2014 the Russian Navy received the third Project 955 Borey-class ballistic-missile submarine. This delivery was part of Moscow's strategic fleet modernization program, which calls for the construction of eight submarines of this class. The fourth submarine, which is expected to join the fleet in 2019 – and subsequent boats that are currently at various stages of construction – appears to be an upgraded design, called Project 955A Borey-A. Each submarine carries 16 Bulava solid-propellant SLBMs, with up to six warheads on each missile. This construction program is now expected to be completed in 2021.
- It seems likely that Delta-III submarines will be withdrawn from service when they are replaced by the new Project 955 Borey, although Delta-IV-class boats will probably remain in service for some time after 2025…Most likely, Russia will continue the Project 955 line along with the development of a new submarine with a solid-propellant missile. Given Bulava's patchy test record, it is possible that the missile will be new as well.
- To equip submarines of the Delta-IV class, Russia has relaunched a production line for R-29RMU2 Sineva (SS-N-23) SLBMs and developed an upgraded version of that missile, known as the R-29RMU2.1Layner. This latter missile, accepted for service in 2014, is said to be capable of carrying up to ten warheads, although it is perhaps deployed with only four, like Sineva… no decision about the direction of the SLBM program is understood to have been taken at the time of writing.
- The recent overhaul and modernization of the Tu-160 (heavy bomber) fleet has given these aircraft the capability to use conventional weapons as well. Both aircraft can carry the Kh-555 ALCM, which is a conventional version of the Kh-55. They can also carry the new conventional Kh-101 ALCM, and its nuclear version, which is known as Kh-102. The capability of the Tu-160 and Tu-95MS to use conventional ALCMs (Kh-555 as well as Kh-101) was first demonstrated in 2015, when these aircraft were used to attack targets in Syria.
- Modernization plans for Russia's strategic aviation currently include two main projects: the development of a new long-range bomber, known as PAK-DA, and revived production of the Tu-160; these newly produced versions are designated Tu-160M2. PAK-DA, meanwhile, is reported to be a subsonic flying-wing aircraft, although there is only scant information on the project.
- In order to allow its bombers to conduct stand-off operations, Russia is reportedly working on a new ALCM, known as Kh-BD, with a range that will be considerably greater than that reported for the Kh-101/-102. PAK-DA may conduct its first flight in the 2020s. Once in service, it will replace the old Tu-95MS bombers, although the air force has not yet indicated how many new bombers it would like to procure.

- The first Tu-160M2 is also expected to be ready in 2019, with serial production starting in 2021, and the air force is considering an order of up to 50 of the aircraft.
- It is estimated that Russia's current active arsenal includes about 2,000 nuclear warheads assigned to non-strategic delivery systems.
- The development and deployment of new nuclear-capable delivery systems is clearly under way, although most of the new systems are designed to be dual-capable. One major project in this area is the development of the Iskander-M system, which includes a short-range ballistic missile and a short-range cruise missile. The system is widely believed to be nuclear-capable and has apparently been used in some exercises to simulate nuclear strikes. Russia will soon complete the deployment of Iskander-M in all 12 army and navy missile brigades, where they are replacing older Tochka-U missiles.
- Another important program is the development of a family of long-range cruise missiles that can be deployed on submarines, surface ships and potentially on land-based launchers. This family includes the long-range missile known as the 3M14, a land-attack cruise missile (LACM) that is part of the Kalibr weapon system. Starting in 2015, Russia repeatedly demonstrated the capability of this missile in attacks against targets in Syria…Russia has announced a plan to deploy Kalibr missiles on a range of surface ships and submarines. The first multipurpose submarine of the Project 885 Yasen class, Severodvinsk, has demonstrated the capability to launch…Older types of submarine are being modified to carry these missiles in their torpedo compartments; Yasen, in contrast, is believed to have a mix of vertical launch tubes and missile-capable torpedo tubes.

The Cutting Edge of Russia's Nuclear Modernization: The RS-28 Sarmat ICBM

At the same time, China must also consider major new systems that Putin did highlight – both as potential threats and as ways China might be able to leapfrog some aspects of U.S. force improvements. The exact status of the new systems Putin mentioned and provided videotapes of is problematic. Several, however, are very real, and the Sarmat ICBM is such a case. Putin introduced it in his speech as follows: [26]

> In addition, we have embarked on the development of the next generation of missiles. For example, the Defence Ministry and enterprises of the missile and aerospace industry are in the active phase of testing a new missile system with a heavy intercontinental missile. We called it Sarmat. Sarmat will replace the Voevoda system made in the USSR. Its immense power was universally recognized. Our foreign colleagues even gave it a fairly threatening name.
>
> That said, the capabilities of the Sarmat missile are much higher. Weighing over 200 tons, it has a short boost phase, which makes it more difficult to intercept for missile defense systems. The range of the new heavy missile, the number and power of its combat blocs is bigger than Voevoda's. Sarmat will be equipped with a broad range of powerful nuclear warheads, including hypersonic, and the most modern means of evading missile defense. The high degree of protection of missile launchers and significant energy capabilities the system offers will make it possible to use it in any conditions.
>
> Voevoda's range is 11,000 km while Sarmat has practically no range restrictions. As the video clips show, it can attack targets both via the North and South poles. Sarmat is a formidable missile and, owing to its characteristics, is untroubled by even the most advanced missile defense systems.

The deployment of such a new ICBM was almost inevitable. The Sarmat has not yet deployed but it is reported to be a replacement for the aging Voevoda, or SS-18 ICBM, currently the biggest Russian ICBM. It is reported to be a system larger than 200 tons, and has the range payload to deliver a comparatively large number of MIRV'd warheads and decoys.

Some sources credit it with counterforce accuracy, and with the ability to deliver 10 independently targeted (MIRV'd) heavy warheads, 15 lighter ones, or up to 24 hypersonic glide vehicles similar

to the Avangard described later, and/or a mix of warheads, decoys, and penetration aids. These estimates seem high but there are no reliable data.

An International Institute of Strategic Studies (IISS) analysis provides the following assessment, as well as indicates that Sarmat may be the launch platform for the Glide wing system Putin also mentioned:[27]

> Sarmat…is not necessarily an adequate replacement for its heavy predecessor, as its characteristics are closer to those of the UR-100NUTTH (SS-19); this stems, analysts maintain, from the fact that the R 36M2 was built in Ukraine and that as a consequence Sarmat is, in effect, the heaviest missile that Russia can currently produce. With a launch weight of about half that of the R-36M2, Sarmat is likely to have smaller throw-weight and might carry fewer than ten warheads.
>
> … Russia appears to believe that Sarmat is essential for countering US missile defenses. Its calculation is that even if only a small number of these missiles can survive an attack, they could provide an adequate retaliatory response. The hypersonic vehicle also appears to have the penetration of missile defenses as its primary mission

Such a new Russian ICBM will almost certainly have improved penetration aids. The incremental cost is negligible, and reduces boost-phase vulnerability. This would help counter any deployment of any high-energy laser missile defense or other boost phase defenses, although the U.S. has not moved forward with such systems because of geography and Russian air defenses. At the same time, implying that existing missile defense technology provides *no* potential defense capability is an obvious exaggeration.

The (Nuclear Powered?) Hypersonic Cruise Missile

The real world status of some of the other Russian systems Putin highlighted is more problematic. Senior U.S. officers have publicly announced, however, that Russia does have cruise missiles with significantly longer ranges than those of U.S. cruise missiles, and have tested hypersonic cruise missiles that may have had ramjet or scramjet engines. Putin, however, now claimed the possible development of a long-range cruise missile with a nuclear-powered engine and indefinite cruise range and endurance—although some experts believe Russia has only tested such missiles with electric engines to date.[28]

> Russia's advanced arms are based on the cutting-edge, unique achievements of our scientists, designers and engineers. One of them is a small-scale heavy-duty nuclear energy unit that can be installed in a missile like our latest X-101 air-launched missile or the American Tomahawk missile – a similar type but with a range dozens of times longer, dozens, basically an unlimited range. It is a low-flying stealth missile carrying a nuclear warhead, with almost an unlimited range, unpredictable trajectory and ability to bypass interception boundaries. It is invincible against all existing and prospective missile defense and counter-air defense systems. I will repeat this several times today.
>
> In late 2017, Russia successfully launched its latest nuclear-powered missile at the Central training ground. During its flight, the nuclear-powered engine reached its design capacity and provided the necessary propulsion. Now that the missile launch and ground tests were successful, we can begin developing a completely new type of weapon, a strategic nuclear weapons system with a nuclear-powered missile.
>
> You can see how the missile bypasses interceptors. As the range is unlimited, the missile can maneuver for as long as necessary. As you no doubt understand, no other country has developed anything like this. There will be something similar one day but by that time our guys will have come up with something even better.

Such systems are certainly possible with existing technology. The U.S. examined such options as part of Project Pluto during the Cold War, and the option of adding nuclear-power system to a

cruise missile, creating a device called SLAM, or Supersonic Low-Altitude Missile. It experimented with ramjet engines and at least considered a nuclear powered scramjet option.

It is far from clear how far Russia has really gotten in producing the components for a fully operational system for a nuclear powered cruise missile. A nuclear armed cruise missile with almost indefinite endurance and low-altitude flight capability would give Russia the capability to bypass U.S. and NATO's limited and developmental ballistic missile defenses, and U.S. and NATO's limited deployments of low-altitude air defenses now have virtually negligible capability to intercept such systems. It would be a countermeasure to a non-existent missile defense threat.

At the same time, any long-endurance low flier with a highly radioactive nuclear engine is an inherently high risk and extremely demanding design, and there are reports that one test has already crashed. Such a system is far costlier to introduce in a truly reliable form than a more modern ICBM. Calling any nuclear weapon an intimidating toy is a step too far, but saying it is relevant to the nuclear balance and more than a showpiece effort to highlight Russia's nuclear capabilities is equally unrealistic.

Unmanned, High Speed Submersible Vehicle (Status 6 or Kanyon Nuclear Torpedo)

Putin also mentioned a nuclear-powered, nuclear-armed submersible. Some aspects of its design still seem to be problematic in terms of its real-world capabilities and prospects for deployment as the nuclear-engine cruise missile—although, like the nuclear engine—it is known to be a serious development effort and one mentioned in the U.S. Nuclear Posture Review issued in February 2018. Putin described this system as follows: [29]

> Now, we all know that the design and development of unmanned weapon systems is another common trend in the world. As concerns Russia, we have developed unmanned submersible vehicles that can move at great depths (I would say extreme depths) intercontinentally, at a speed multiple times higher than the speed of submarines, cutting-edge torpedoes and all kinds of surface vessels, including some of the fastest. It is really fantastic. They are quiet, highly maneuverable and have hardly any vulnerabilities for the enemy to exploit. There is simply nothing in the world capable of withstanding them.
>
> Unmanned underwater vehicles can carry either conventional or nuclear warheads, which enables them to engage various targets, including aircraft groups, coastal fortifications and infrastructure.
>
> In December 2017, an innovative nuclear power unit for this unmanned underwater vehicle completed a test cycle that lasted many years. The nuclear power unit is unique for its small size while offering an amazing power-weight ratio. It is a hundred times smaller than the units that power modern submarines, but is still more powerful and can switch into combat mode, that is to say, reach maximum capacity, 200 times faster.
>
> The tests that were conducted enabled us to begin developing a new type of strategic weapon that would carry massive nuclear ordnance...By the way, we have yet to choose names for these two new strategic weapons, the global-range cruise missile and the unmanned underwater vehicle. We are waiting for suggestions from the Defence Ministry

The U.S. Nuclear Posture Review January confirmed the existence of such a system as “a new intercontinental, nuclear-armed, nuclear-powered, undersea autonomous torpedo.” Some press descriptions of this system also claimed it could have a 100-megaton warhead, and be used to attack coastal facilities and U.S. carriers and carrier task forces. The deployment of a such a long-range underwater nuclear "torpedo"—which is variously being called a high-speed underwater drone or autonomous underwater vehicle (AUV)—could marginally increase the threat to coastal cities, sea/airbases, and carrier task forces.

The problem with such a system, however, is that the use of a 100-megaton weapons or any much lower yield thermonuclear weapon or boosted weapon in a nuclear attack on any given U.S. base or city would probably trigger an all-out nuclear exchange—effectively killing Russia. A 100-megaton (or other multi-megaton/high yield) nuclear attack on a carrier task force would escalate theater nuclear war to levels that would both inflict major damage on Russia and create a massive risk of escalating to an all-out nuclear exchange.

Such a system lacks a clear practical purpose if the goal is to defeat a non-existent missile defense threat to a major Russian strategic nuclear attack. It would potentially be more meaningful in bypassing the AEGIS missile defenses on U.S. ships, but again such a Russian nuclear attack would trigger massive escalation and phase use of a nuclear high altitude burst to counter fleet electronic sensors and missile defenses, followed by a nuclear-armed ballistic missile attack on the fleet, would probably be equally successful.

One possible exception would be attacks on coastal targets with very sharp drop-offs into deep ocean waters. Back at the peak of the Cold War, some experts talked about using gigaton strikes to create massive waves to attack coastal cities. This did not seem to be a particularly advantageous option then and it does not seem particularly advantageous or practical in a cruise missile now.

Hypersonic Air Attack System

Putin broadly described a fourth system in ways that made it seem operational: [30]

> Countries with high research potential and advanced technology are known to be actively developing so-called hypersonic weapons. The speed of sound is usually measured in Mach numbers in honor of Austrian scientist Ernst Mach who is known for his research in this field. One Mach is equal to 1,062 kilometers per hour at an altitude of 11 kilometers. The speed of sound is Mach 1, speeds between Mach 1 and Mach 5 is called supersonic, and hypersonic is above Mach 5. Of course, this kind of weapon provides substantial advantages in an armed conflict. Military experts believe that it would be extremely powerful, and that its speed makes it invulnerable to current missile and air defense systems, since interceptor missiles are, simply put, not fast enough. In this regard, it is quite understandable why the leading armies of the world seek to possess such an ideal weapon.
>
> Friends, Russia already has such a weapon…The most important stage in the development of modern weapons systems was the creation of a high-precision hypersonic aircraft missile system; as you already know for sure, it is the only one of its kind in the world. Its tests have been successfully completed, and, moreover, on December 1 of last year, these systems began their trial service at the airfields of the Southern Military District.
>
> The unique flight characteristics of the high-speed carrier aircraft allow the missile to be delivered to the point of discharge within minutes. The missile flying at a hypersonic speed, 10 times faster than the speed of sound, can also maneuver at all phases of its flight trajectory, which also allows it to overcome all existing and, I think, prospective anti-aircraft and anti-missile defense systems, delivering nuclear and conventional warheads in a range of over 2,000 kilometers. We called this system *Kinzhal* (Dagger).

Gliding Wing Delivery System: Project 4202 or Yu-71

Putin described a fifth system as being operational, but in terms so vague that made it almost impossible to appraise its real world status: [31]

> A real technological breakthrough is the development of a strategic missile system with fundamentally new combat equipment – a gliding wing unit, which has also been successfully tested.
>
> I will say once again what we have repeatedly told our American and European partners who are NATO members: we will make the necessary efforts to neutralize the threats posed by the deployment of the US global missile defense system. We mentioned this during talks, and even said it publicly. Back in 2004, after

> the exercises of the strategic nuclear forces when the system was tested for the first time, I said the following at a meeting with the press (It is embarrassing to quote myself, but it is the right thing to say here):
>
> So, I said: "As other countries increase the number and quality of their arms and military potential, Russia will also need to ensure it has new generation weapons and technology.
>
> In this respect, I am pleased to inform you that successfully completed experiments during these exercises enable us to confirm that in the near future, the Russian Armed Forces, the Strategic Missile Forces, will receive new hypersonic-speed, high-precision new weapons systems that can hit targets at inter-continental distance and can adjust their altitude and course as they travel. This is a very significant statement because no country in the world as of now has such arms in their military arsenal."
>
> Of course, every word has a meaning because we are talking about the possibility of bypassing interception boundaries. Why did we do all this? Why did we talk about it? As you can see, we made no secret of our plans and spoke openly about them, primarily to encourage our partners to hold talks. Let me repeat, this was in 2004. It is actually surprising that despite all the problems with the economy, finances and the defense industry, Russia has remained a major nuclear power. No, nobody really wanted to talk to us about the core of the problem, and nobody wanted to listen to us. So listen now.
>
> Unlike existing types of combat equipment, this system is capable of intercontinental flight at supersonic speeds in excess of Mach 20. As I said in 2004, in moving to its target, the missile's gliding cruise bloc engages in intensive maneuvering – both lateral (by several thousand km) and vertical. This is what makes it absolutely invulnerable to any air or missile defense system. The use of new composite materials has made it possible to enable the gliding cruise bloc to make a long-distance guided flight practically in conditions of plasma formation. It flies to its target like a meteorite, like a ball of fire. The temperature on its surface reaches 1,600–2,000 degrees Celsius but the cruise bloc is reliably guided.
>
> For obvious reasons we cannot show the outer appearance of this system here. This is still very important. I hope everyone understands this. But let me assure you that we have all this and it is working well. Moreover, Russian industrial enterprises have embarked on the development of another new type of strategic weapon. We called it the Avangard.

Once again, there is no way to determine exactly how much progress that Russia has made towards a fully deployable system. As an article by William J. Broad and Ainara Tiefenthaler in the March 2, 2018 edition of the *New York Times* noted, however, such a warhead could glide to earth at something like 230 times the speed of sound: "All the big powers—Russia, China, and the United States—are racing to develop this kind of superfast maneuverable warhead. It can fly into space on a regular rocket and then navigate autonomously in the atmosphere. That way, it can evade antimissile defenses, as well as shorten or eliminate enemy warning time."[32]

The IISS estimates that the Sarmat missile booster, "appears to be the launcher of choice for Russia's developmental hypersonic glide vehicle (HGV), which is often referred to as Project 4202 or Yu-71. The Yu-71 vehicle is currently undergoing flight tests, which may lead to an initial deployment in the 2020s. The boost-glide HGV will not necessarily be nuclear-armed."[33]

A Rand study issued in 2017 notes the potential importance of such systems in being able to close so quickly on a target that detection would be highly difficult and missile defenses could not react in time:[34]

> Hypersonic missiles — specifically hypersonic glide vehicles and hypersonic cruise missiles — are a new class of threat because they are capable both of maneuvering and of flying faster than 5,000 kilometers per hour. These features enable such missiles to penetrate most missile defenses and to further compress the timelines for a response by a nation under attack.
>
> Hypersonic missiles are being developed by the United States, Russia, and China. Their proliferation beyond these three could result in other powers setting their strategic forces on hair-trigger states of readiness. And such proliferation could enable other powers to more credibly threaten attacks on major powers.

> The diffusion of hypersonic technology is under way in Europe, Japan, Australia, and India — with other nations beginning to explore such technology. Proliferation could cross multiple borders if hypersonic technology is offered on world markets.

The Avangard

Finally, Putin mentioned a sixth strategic system he did not describe in any detail, reported undefined advances in laser weapons—possibly affecting missile defense—and claimed that all of the advances he had described were post-Soviet in origin: [35]

> For obvious reasons we cannot show the outer appearance of this system here. This is still very important. I hope everyone understands this. But let me assure you that we have all this and it is working well. *Moreover, Russian industrial enterprises have embarked on the development of another new type of strategic weapon. We called it the Avangard*.
>
> We are well aware that a number of other countries are developing advanced weapons with new physical properties. We have every reason to believe that we are one step ahead there as well – at any rate, in the most essential areas.
>
> We have achieved *significant progress in laser weapons*. It is not just a concept or a plan any more. It is not even in the early production stages. Since last year, our troops have been armed with laser weapons.
>
> I do not want to reveal more details. It is not the time yet. But experts will understand that with such weaponry, Russia's defense capacity has multiplied.
>
> Here is another short video. *(Video plays.)*
>
> Those interested in military equipment are welcome to suggest a name for this new weaponry, this cutting-edge system.
>
> Of course, we will be refining this state-of-the-art technology. Obviously, there is far more in development than I have mentioned today. But this is enough for now. I want to specifically emphasize that the newly developed strategic arms – in fact, new types of strategic weapons – are not the result of something left over from the Soviet Union. Of course, we relied on some ideas from our ingenious predecessors. But everything I have described today is the result of the last several years, the product of dozens of research organizations, design bureaus and institutes.

It is not clear whether Avangard is the launch vehicle for the hypersonic glider described earlier, but Tass reported on March 3, 2018 that, "Avangard [systems] have entered series production and implied that it would deliver a hypersonic glider. The March 3 edition of *Miltary and Defense* also reported that, "Russia's Strategic Missile Force Commander Sergei Karakayev said that the testing of advanced Avangard strategic missile complexes with glide vehicles had been completed. 'Creating the strategic missile system Avangard, equipped with a glide vehicle, has become a no less efficient response to the deployment of the American anti-missile defenses. Its testing has been successfully completed'"[36]

Russian Missile Defenses

Putin made no mention of the fact that the USSR had deployed ballistic missile defenses long before the U.S., had five regiments of its own S-400 forces with missile defense capability and its own Space Command and Anti-Ballistic Missile defense engagement system around Moscow, and was selling systems with missile defense capabilities like its S-400 system to China and Iran. He did not mention Russia's deployment of dual capable ballistic missiles in areas like Kaliningrad, or touch upon the fact the U.S. Nuclear Posture Review indicates that Russia is developing its own systems to modernize its missile defenses.

The U.S. Nuclear Posture Review addressed Russian nuclear forces, and the shifting U.S. and Russian nuclear balance, as follows:[37]

> The United States does not wish to regard either Russia or China as an adversary and seeks stable relations with both. We continue to seek a dialogue with China to enhance our understanding of our respective nuclear policies, doctrine, and capabilities; to improve transparency; and to help manage the risks of miscalculation and misperception. The United States and Russia have in the past maintained strategic dialogues to manage nuclear competition and nuclear risks. Given Russian actions, including its occupation of Crimea, this constructive engagement has declined substantially. The United States looks forward to a new day when Russia engages with the United States, its allies, and partners transparently and constructively, without aggressive actions and coercive nuclear threats.
>
> Russia considers the United States and the North Atlantic Treaty Organization (NATO) to be the principal threats to its contemporary geopolitical ambitions. Russian strategy and doctrine emphasize the potential coercive and military uses of nuclear weapons. It mistakenly assesses that the threat of nuclear escalation or actual first use of nuclear weapons would serve to "de -escalate" a conflict on terms favorable to Russia. These mistaken perceptions increase the prospect for dangerous miscalculation and escalation. [38]
>
> Russia has sought to enable the implementation of its strategy and doctrine through a comprehensive modernization of its nuclear arsenal. Russia's strategic nuclear modernization has increased, and will continue to increase its warhead delivery capacity, and provides Russia with the ability to rapidly expand its deployed warhead numbers.
>
> In addition to modernizing "legacy" Soviet nuclear systems, Russia is developing and deploying new nuclear warheads and launchers. These efforts include multiple upgrades for every leg of the Russian nuclear triad of strategic bombers, sea-based missiles, and land-based missiles. Russia is also developing at least two new intercontinental range systems, a hypersonic glide vehicle, and a new intercontinental, nuclear-armed, nuclear-powered, undersea autonomous torpedo.
>
> Russia's increased reliance on nuclear capabilities to include coercive threats, nuclear modernization programs, refusal to negotiate any limits on its non-strategic nuclear forces, and its decision to violate the INF Treaty and other commitments all clearly indicate that Russia has rebuffed repeated U.S. efforts to reduce the salience, role, and number of nuclear weapons.
>
> Russia possesses significant advantages in its nuclear weapons production capacity and in non-strategic nuclear forces over the U.S. and allies. It is also building a large, diverse, and
>
> modern set of non-strategic systems that are dual-capable (may be armed with nuclear or conventional weapons). These theater-and tactical-range systems are not accountable under the New START Treaty and Russia's non-strategic nuclear weapons modernization is increasing the total number of such weapons in its arsenal, while significantly improving its delivery capabilities.
>
> This includes the production, possession, and flight testing of a ground-launched cruise missile in violation of the INF Treaty. Moscow believes these systems may provide useful options for escalation advantage. Finally, despite Moscow's frequent criticism of U.S. missile defense, Russia is also modernizing its long-standing nuclear-armed ballistic missile defense system and designing a new ballistic missile defense interceptor.
>
> … Russia is not the Soviet Union and the Cold War is long over. However, despite our best efforts to sustain a positive relationship, Russia now perceives the United States and NATO as its principal opponent and impediment to realizing its destabilizing geopolitical goals in Eurasia. [39]
>
> Russia has significantly increased the capabilities of its non-nuclear forces to project power into regions adjacent to Russia and, as previously discussed, has violated multiple treaty obligations and other important commitments. Most concerning are Russia's national security policies, strategy, and doctrine that include an emphasis on the threat of limited nuclear escalation, and its continuing development and fielding of increasingly diverse and expanding nuclear capabilities. Moscow threatens and exercises limited nuclear first use, suggesting a mistaken expectation that coercive nuclear threats or limited first use could paralyze the United States and NATO and thereby end a conflict on terms favorable to Russia. Some in the United States

> refer to this as Russia's "escalate to de-escalate" doctrine. "De-escalation" in this sense follows from Moscow's mistaken assumption of Western capitulation on terms favorable to Moscow.
>
> Effective U.S. deterrence of Russian nuclear attack and non-nuclear strategic attack now requires ensuring that the Russian leadership does not miscalculate regarding the consequences of limited nuclear first use, either regionally or against the United States itself. Russia must instead understand that nuclear first-use, however limited, will fail to achieve its objectives, fundamentally alter the nature of a conflict, and trigger incalculable and intolerable costs for Moscow. Our strategy will ensure Russia understands that any use of nuclear weapons, however limited, is unacceptable.
>
> The U.S. deterrent tailored to Russia, therefore, will be capable of holding at risk, under all conditions, what Russia's leadership most values. It will pose insurmountable difficulties to any Russian strategy of aggression against the United States, its allies, or partners and ensure the credible prospect of unacceptably dire costs to the Russian leadership if it were to choose aggression.
>
> This strategy will ensure Russia understands it has no advantages in will, non-nuclear capabilities, or nuclear escalation options that enable it to anticipate a possible benefit from non-nuclear aggression or limited nuclear escalation. Correcting any Russian misperceptions along these lines is important to maintaining deterrence in Europe and strategic stability.
>
> Correspondingly, at the 2016 NATO Summit, the Alliance emphasized that, "no one should doubt NATO's resolve if the security of any of its members were to be threatened. NATO will maintain the full range of capabilities necessary to deter and defend against any threat to the safety and security of our populations, wherever it should arise."
>
> To correct any Russian misperceptions of advantage and credibly deter Russian nuclear or non-nuclear strategic attacks—which could now include attacks against U.S. NC3—the President must have a range of limited and graduated options, including a variety of delivery systems and explosive yields. These requirements put a premium on the survivability, flexibility and readiness of Western nuclear and non-nuclear capabilities to hold diverse types of Russian targets at risk throughout a crisis or conflict, and point to the continuing great value of the flexibility inherent in the combination of the U.S. nuclear triad, U.S. and other NATO non-strategic nuclear forces deployed in Europe, and the nuclear forces of our British and French allies.

Dealing with Russia's (and America's) Uncertain Plans

The U.S. plans described in the previous chapter of this analysis have several major uncertainties of their own. There are strong indications that they are under-costed, and have optimistic delivery schedules. They were formed at a time when the INF Treaty was still in force, before Putin announced the range of more advance delivery programs that have just been listed, and seeming in an environment where China's new nuclear delivery systems and probable increase in nuclear weapons where not seen as a major consideration. The U.S. must now react to Russia and China, just as China must react to the U.S. and Russia.

China probably faces far more uncertainties about Russia's current intentions, however, than it does in reacting the plans the U.S. has made public as a result of the NPR. Many of the ongoing improvements in Russian nuclear delivery systems have never been announced in the same level of detail as U.S. plan, and the "cutting edge" improvements just listed are particularly uncertain. Russia does not publicly discuss any concerns over China's emergence as a rival superpower, but it can scarcely ignore the emergence of one on its borders. In short, all three powers must increasing react to the actions of the other two, and do so over time in ways where no power can now accurately predict all the future actions of the others.

China must deal with four key sets of wild cards: U.S. and Russian missile defenses, regional missile defenses, India's nuclear forces and those of North Korea.

The Challenge of START

Finally, China must deal with the fact that it has never been part of START or any strategic nuclear arms talks. It cannot count on the START limits of U.S. and Russian nuclear delivery forces and warheads described earlier remaining in force over the next decade – just as the U.S. and Russia now have to consider all the uncertainties in China's emerging forces.

Moreover, even if the START numerical limits do remain in force, they now have the same problems as the Washington Naval Arms Treat did between World War I and World War II, and SALT did when it only capped delivery systems. The qualitative changes in U.S. and Russian forces taking place with the START limits are now openly competitive and there seems to be little interest in further reductions in numbers.

U.S. Intelligence Assessments of China's Evolving Nuclear Role

All of these U.S. and Russian developments illustrate the military and political incentives China has to create larger and less vulnerable nuclear forces, or cannot use nuclear weapons successfully in other scenarios. As noted earlier, China already is modernizing its nuclear forces, and sheer numbers do reduce its vulnerability to preemption and counterforce strikes. Nuclear weapons can be used at the tactical and theater levels. And, achieving parity or taking a lead in some aspect of nuclear weapons would enhance Chinese prestige and influence even if it did not make a major difference in warfighting capability.

It should also be clear that Chinese, U.S., and Russian nuclear forces and modernization efforts need to be kept in a net assessment context, and assessed in interactive terms. Nuclear modernization is not only a vital strategic interest for each power, it is an existential necessity. Even in a far more friendly environment, and one still focused on arms control, each power still had to ensure that advances in technology did not give the others a critical advantage or a first strike and counter force advantage.

That environment clearly no longer exists, if it ever really did, and unless it can be rebuilt, global stability and security – not just the security of any given superpower – depends on each superpower being fully convinced that that no other superpower has a decisive advantage it might try to exploit in a crisis.

Chinese nuclear force developments – like those of the U.S. and Russia – must be analyzed in these terms.

The Director of National Intelligence Assessment

The U.S. intelligence community may not have produced a great deal of open-source data on China's nuclear weapons, but it has produced some useful official assessments of China's ongoing progress in modernizing its nuclear force structure and delivery systems, and of possible changes in its strategy. It is also clear that China is extremely unlikely to execute the improvements it now has underway in its delivery systems without increasing the number, quality, and variety of the nuclear weapons they carry.

Daniel R. Coats, the U.S. Director of National Intelligence (ODNI). made the following summary of the Chinese nuclear effort in his *Worldwide Threat Assessment* testimony to Congress on March 6, 2018. He focused on the fact that China – the U.S. and Russia –was modernizing all three elements of its triad:[40]

> The Chinese People's Liberation Army (PLA) continues to modernize its nuclear missile force by adding more survivable road-mobile systems and enhancing its silo-based systems. This new generation of missiles is intended to ensure the viability of China's strategic deterrent by providing a second-strike capability. China also has tested a hypersonic glide vehicle. In addition, the PLA Navy continues to develop the JL-2 submarine-launched ballistic missile (SLBM) and might produce additional JIN-class nuclear-powered ballistic missile submarines. The JIN-class submarines—armed with JL-2 SLBMs—give the PLA Navy its first long-range, sea-based nuclear capability. The Chinese have also publicized their intent to form a triad by developing a nuclear-capable next-generation bomber.

The Director of the Defense Intelligence Agency Assessment

Lieutenant General Robert Ashley, the Director of the Defense Intelligence Agency (DIA) provided a broader picture of China's modernization efforts in his testimony the same day. He noted that China's efforts were part of a much broader modernization effort that involved

increasing China's stockpile of nuclear weapons, modernizing every element of its Triad, and modernizing and increase tactical and theater nuclear forces as well as strategic forces [41]

> In 2017, China's armed forces continued implementing sweeping organizational reforms that President Xi Jinping and other Chinese leaders unveiled in 2015. This reorganization is the latest phase in China's long-term military modernization program, which the country's leaders have characterized as essential to achieving great-power status and what Xi calls the "China Dream of national rejuvenation." The leadership portrays a strong military as critical to advancing China's interests and ensuring that China can defend itself and its sovereignty claims.
>
> These military reforms seek to enhance the ability of the People's Liberation Army (PLA) to conduct joint operations; improve its ability to fight short-duration, high-intensity regional conflicts at greater distances from the Chinese mainland; and strengthen the Chinese Communist Party's control over the military. The changes instituted during the past year and codified in the 19th Party Congress reduced the size of the Central Military Commission, streamlined its control over the PLA, and propagated reform to corps-level units and below, transforming ground and air combat units with foundational improvements, including modern C2 and the abilities to conduct more effective joint operations. The PLA also is strengthening its joint operational command system and developing its new Strategic Support Force, which consolidates cyber, electronic warfare, and space capabilities.
>
> In early 2017, China announced a 6.5-percent inflation-adjusted increase in its annual military budget, to $154.3 billion, second only to the United States and about 1.3 percent of China's GDP. Since China omits several major categories of expenditure from its published military budget, we estimate its actual military-related spending to be over $190 billion. This budget extends more than two decades of annual defense spending increases, which we expect China to sustain for the foreseeable future.
>
> Chinese military forces continue to develop capabilities to dissuade, deter, or defeat potential third-party intervention during a large-scale theater campaign, such as a Taiwan contingency. China's military modernization plan includes the development of capabilities to conduct long-range attacks against adversary forces that might deploy or operate in the western Pacific Ocean. These capabilities, spanning the air, maritime, space, electromagnetic, and information domains, are most robust within the first island chain, but China is rapidly extending capabilities farther into the Pacific Ocean.
>
> The PLA Rocket Force is bolstering its medium-range DF-21 antiship ballistic missile with the DF-26 intermediate-range ballistic missile, capable of conducting precision conventional or nuclear strikes against targets as far away as Guam. The PLA is also developing and fielding numerous advanced, long-range land-attack and antiship cruise missiles, some capable of reaching supersonic speeds, and operated from ground, air, ship, and submarine platforms. These capabilities are being augmented with two new air-launched ballistic missiles, one of which may include a nuclear payload.
>
> The PLA Air Force is fielding modern fighters and extending the range and capabilities of its bomber force. During the PLA's 90th anniversary parade in July, the Air Force conducted high-profile public flybys of its developmental, fifth-generation J-20 stealth fighter and debuted advanced variants of fourth-generation fighters with upgraded weapons.
>
> The PLA Navy is developing into a global force, gradually extending its ability to sustain its operational reach beyond East Asia. Its latest naval platforms enable combat operations beyond the reach of China's land-based defenses. In particular, China's aircraft carrier and planned follow-on carriers, once operational, will extend air defense umbrellas beyond the range of coastal and shipboard missile systems and help enable task group operations at increasingly greater distances.
>
> The ongoing modernization of the PLA's nuclear force is focused on mobility, survivability, and effectiveness intended to ensure the viability of China's strategic deterrent in the face of perceived advances in U.S. and, to a lesser extent, Russian offensive and defensive capabilities. China is developing a range of technologies, such as multiple independently targetable reentry vehicles (MIRVs), maneuvering warheads, decoys, chaff, jamming, thermal shielding, and hypersonic glide vehicles, in an attempt to counter ballistic missile defense systems.
>
> These technologies will be incorporated into China's silo and road-mobile ICBMs while Beijing expands the force in the size and types of missiles and the number of warheads capable of striking the United States over

the next 15 years. The PLA Navy's four Jin class nuclear-powered ballistic missile submarines, armed with the JL-2 submarine-launched ballistic missile, provide China its first viable sea-based nuclear deterrent. The PLA Air Force is developing a strategic bomber that we expect to have a nuclear mission; when combined with Rocket Force and Navy capabilities, this bomber would complete China's first credible nuclear "triad."

Strategists in the PLA regard the ability to use space-based systems—and to deny them to adversaries—as central to enabling modern warfare. As a result, the PLA continues to strengthen its military space capabilities despite its public stance against the weaponization of space. Beijing has invested in space system improvements, with an emphasis on intelligence, surveillance, and reconnaissance systems, satellite communications, satellite navigation, meteorology, and human spaceflight and interplanetary exploration. China also continues to develop a variety of counterspace capabilities designed to limit or prevent an adversary's use of space-based assets during crisis or conflict. Space and counterspace capabilities, like missile forces, advanced air and sea power, and cyber capabilities, are critical for China to fight and win modern military engagements.

The Department of Defense Annual Report on Military and Security Developments Involving the People's Republic of China

The broad intelligence assessments provide important warnings, but they do not provide a basis for either assessing China's current capabilities or how it is already reacting to U.S. and Russian force developments. In this case, the devil quite literally lies in the details. While many of these details are unknown, or classified, the 2018 edition of the Office of the Secretary of Defense's (OSD) annual report to Congress on *Military and Security Developments Involving the People's Republic of China* provides a great deal of detail on what is known about China's actions and intentions.

The report draws heavily on the work of the U.S. Intelligence Community, as well as military experts, and provides the most reliable open-source assessment of China's forces and plans.

This document does provide an overview of China's declared nuclear strategy, but much of its analysis of Chinese developments affecting nuclear forces and their possible use is provided in passing in other parts of the report. Accordingly, the portions that provide insight into China's future nuclear efforts need to be examined as a whole, and in depth.[42]

Nuclear Deterrence and Strategy

Like almost all open-source material, the Chinese military power report to Congress does not examine China's possible nuclear war plans and strategies in terms of relative warfighting capability. It instead reports on what China's open-source statements and white papers say about China's nuclear posture:

> China has nuclear-capable delivery systems in the PLARF and PLAN, and the PLAAF has been newly re-assigned a nuclear mission, which would create a nuclear triad. China's nuclear weapons policy prioritizes the maintenance of a nuclear force able to survive a first strike and to respond with sufficient strength to inflict unacceptable damage on an enemy. China insists that the new generation of mobile missiles, with warheads consisting of MIRVs and penetration aids, are intended to ensure the viability of its strategic deterrent in the face of continued advances in U.S. and, to a lesser extent, Russian strategic ISR, precision strike, and missile defense capabilities. (pp. 75-76)
>
> China has long maintained a "no first use" (NFU) policy, stating it would use nuclear forces only in response to a nuclear strike against China. China's NFU pledge consists of two stated commitments: China will never use nuclear weapons first at any time and under any circumstances, and it unconditionally undertakes not to use or threaten to use nuclear weapons against any non-nuclear-weapon state or in nuclear-weapon-free zones.
>
> There is some ambiguity, however, over the conditions under which China's NFU policy would no longer apply. Some PLA officers have written publicly of the need to spell out conditions under which China might need to use nuclear weapons first; for example, if an enemy's conventional attack threatened the survival of China's nuclear force or of the regime itself. There has been no indication that national leaders are willing to attach such nuances and caveats to China's NFU policy. (pp. 75-76)
>
> China's lack of transparency regarding the scope and scale of its nuclear modernization program raises questions regarding its future intent. (pp. 75-76)
>
> China invests considerable resources to maintain a limited, but survivable, nuclear force to ensure that the PLA can deliver a damaging responsive nuclear strike. China is enhancing peacetime readiness levels for these nuclear forces to ensure responsiveness. (pp. 75-76)

Here, is it worth pointing out that these Chinese public commitments to a "no first use" strategy may well be China's actual preferred posture. In practice, however, crises do not develop and escalate in predictable ways. Like all major nuclear powers – regardless of their political strategy

statements – China must act on an existential basis in the ways it assumes will be allow it to survive, limit damage, and achieve its goals. It must develop a comprehensive set of operational plans to deal with as many contingencies as possible, and then adapt them under pressure as a specific scenario for nuclear fighting develops. No nation's plans –or good intentions – will survive engagement with this urgent a form of reality.

Launch on Warning

At the same time, China is firmly committed to emerging as at least a peer competitor to the U.S. and Russia as superpower. It cannot ignore the fact that the other two nuclear superpowers now have much larger forces, that these forces are now experiencing major long-term upgrades, and that their capabilities to carry out first strikes against China's nuclear forces may improve sharply with time.

China must recognize that any major nuclear exchange between them that did include China would effectively leave China as the world's only surviving superpower. This gives China a strong incentive to stand aside from any U.S.-Russian exchange, and to avoid expanding on the U.S.-Russia competition by expanding its own nuclear forces to the point where it turns the U.S.-Russian arms race into a three-way competition for the largest and most effective force.

China must recognize that it needs to size and shape a force that is survivable enough and capable enough to pose an unacceptable threat to both other superpowers, and increase and improve its strategic nuclear forces accordingly. At the same time, this does not compel China to match the size of U.S. or Russian strategic and other nuclear forces. China may conclude it is far cheaper to create a "launch-on-warning" capability than fully survivable forces even if this is a questionable posture in no first use terms.

It also has different priorities in sizing its theater and intermediate range nuclear forces. China must consider possible regional nuclear exchanges in writing real-world war plans. A China-India nuclear exchange seems unlikely but still has to be considered. So is a U.S.-North Korean nuclear exchange, and whether China would seek to try to deter one and protect North Korea in an extreme case. Finally, China must also consider the possibility of U.S.-China theater level nuclear exchanges, and how it would posture its strategic forces during and after any such exchanges.

The OSD report for 2018 makes some aspects of this reality clear in contrasting China's emphasis on "launch on warning" with tis no first use doctrine:

> PLA writings express the value of a "launch on warning" nuclear posture, an approach to deterrence that uses heightened readiness, improved surveillance, and streamlined decision-making processes to enable a more rapid response to enemy attack. These writings highlight the posture's consistency with China's nuclear "No First Use" policy, suggesting it may be an aspiration for China's nuclear forces. China is working to develop a space-based early warning capability that could support this posture in the future. (p. 77)

Nuclear Triad

The report stresses the fact that China is moving towards a much better balanced and more advanced Triad, and – as is shown shortly – describes these advance in considerable detail in the portions of the report dealing with each service and element of this Triad,

> China maintains nuclear-capable delivery systems in the PLARF and PLAN, and the PLAAF has been re-assigned a nuclear mission. The deployment and integration of nuclear capable bombers would, for the first time, provide China with a nuclear "triad" of delivery systems dispersed across land, sea, and air – a posture considered since the Cold War to improve survivability and strategic deterrence. A defense industry

> publication has also discussed the development of a new low-yield nuclear weapon. (p. 77)
>
> In 2016, the PLAAF commander referred publicly to the military's efforts to produce an advanced long-range strategic bomber, a platform observers tied to nuclear arms. China is developing a stealthy, long-range strategic bomber with a nuclear delivery capability that could be operational within the next ten years. (p. 77)

Joint Warfare and Command

The evolution towards more balanced Triad is also, however, part of a much broader modernization effort that stresses joint warfare, improved intelligence and target, and improved command and control. This affects the potential use of nuclear weapons both is warfighting tools and as ways of limiting and shaping escalation at every level from tactical to theater to strategic.

> The PLA is a historically army-centric organization, and bureaucratic intransigence has for years limited the PLA's ability to transform itself into a modern joint force. Beginning in 2015, the execution of PLA reforms are addressing this need, as well as critical related issues such as institutional intransigence borne of corruption and the parochial interests of senior PLA leaders. In addition to strengthening Party control over the PLA, China's leaders directed a complete restructuring of the PLA headquarters to strengthen CMC administrative control of the PLA and to establish a joint command system capable of organizing and directing operations on a routine basis. (pp. l14-115)
>
> China's military is continuing major reforms to PLA organization and operations that include the most comprehensive restructuring of forces in its history. One of the goals of these reforms, conceptualized over the past several decades and launched by President Xi Jinping in late 2015, is to advance the PLA's ability to conduct joint operations and increase its combat effectiveness. Drawing from PLA experience in previous border conflicts and observations of U.S. military operations in the Persian Gulf in the 1990s, the PLA recognized joint operations are imperative to the successful conduct of future warfare. In December 1998, the CMC initiated a series of military reforms to transform the PLA into a modern and professional joint operations force which were subsequently outlined in the January 1999 "PLA Joint Combat Program." (pp. l14-115)
>
> The previous seven Military Regions were replaced by five joint theater commands each assigned specific operational missions to defend China's territorial and strategic interests. With the possible exception of strategic units associated with the PLARF, SSF, JLSF, and CMC support and training missions, control of all PLA units has reportedly shifted to theater commands, centralizing control of forces for emergency response, territorial defense, and regional offensive operations under single operational authorities. (pp. l14-115)
>
> Service headquarters were delegated resource management and force readiness responsibilities, while joint force headquarters manage operations. To enable joint force management, an Army headquarters was established and the *newly redesignated PLARF* was elevated to serve as a service alongside the PLAA, PLAN, and PLAAF. (pp. l14-115)
>
> Additionally, the PLA will likely continue deploying more sophisticated C2 systems and refining C2 processes as growing numbers of mobile ICBMs and future SSBN deterrence patrols require the PLA to safeguard the integrity of nuclear release authority for a larger, more dispersed force. (pp. 75-76)

China also seeks to adapt and modernize Sun Tzu to emphasize innovative and unconventional tactics and strategies that exploit the limits of an enemy's strategy and reaction capability – rather than focusing on directly defeating or destroying an enemy's forces. This is a major departure from the past U.S. and Soviet focus on major strategic exchanges and mutual assured destruction, and makes China's future posture and strategy increasingly unpredictable.

It also helps explain why China assigned its strategic and tactical missile forces to a separate Army command called the Second Artillery Corps (SAC) in 1966, and then upgraded these forces to a separate service called the *People's Liberation Army Rocket Force* (PLARF) in 2016.

Precision Strike Capabilities and the Evolving Role of Nuclear Weapons

The OSD report indicates that China may be seeking to "leapfrog" across its qualitative gap in air and seapower by developing and deploying far more advanced mixes of missile design that include hypersonic systems, and land-based conventional systems "smart" and accurate enough to use conventional warheads to destroy high value land and sea-based targets – including America's $5 billion-plus carriers.

This could *potentially* allow China to compensate for its inferior air capabilities until it could fully deploy the more advanced tactical, theater, and strategic crewed and un crewed combat aircraft and UAVs described later, and then mix near or actual air parity with a significant lead in missile power, while helping guard against the large-scale deployment of effective U.S. or other missile defense systems.

At the same time, China's development of low-yield nuclear-armed missiles with equal precision and reliability would act as a powerful deterrent to a U.S. or other opponent's ability to escalate by broadening the range of targets or threatening nuclear escalation. This could be accomplished in many scenarios with relatively limited deployments of such nuclear-armed systems. For example, even threatening to target Guam, Okinawa, or Taiwan with such systems could limit U.S. willingness to escalate.

It is far too early to describe this as a Chinese plan, or to assess its timing, technical details, and feasibility. However, the OSD report does give a high priority to describing China's steadily improving emphasis on precision strikes:

> **Long-Range Precision Strike.** Military modernization has resulted in the rapid transformation of the PLA's missile force. Today, China fields an array of conventionally armed short and medium-range ballistic missiles as well as ground- and air-launched land-attack cruise missiles. U.S. bases in Japan are in range of a growing number of Chinese MRBMs and LACMs. H-6K bomber flights into the Western Pacific Ocean demonstrate China's ability to range Guam with air launched LACMs. The DF-26, which debuted publicly in 2015 and was paraded again in 2017, is capable of conducting precision conventional or nuclear strikes against ground targets that could include U.S. bases on Guam. (pp. 114-115). PLA writings see logistics and power projection assets as potential vulnerabilities in modern warfare – a judgment that accords with an expanding ability to target regional air bases, logistics and port facilities, communications, and other ground-based infrastructure. (p. 60, 63-64)
>
> **Short-Range Ballistic Missiles (300-1,000 km).** The PLARF has approximately 1,200 SRBMs. The force fields advanced variants with improved ranges and accuracy in addition to more sophisticated payloads, and is phasing out earlier generations lacking true precision strike capability.
>
> **Medium-Range Ballistic Missiles (1,000-3,000 km).** The PLA is fielding approximately 200-300 conventional MRBMs to increase the range at which it can conduct precision strikes against land targets and naval ships operating out to the first island chain.
>
> **Intermediate-Range Ballistic Missiles (3,000-5,500 km).** The PLA has begun fielding a road-mobile, nuclear and conventional capable IRBM, expanding its near-precision strike capability as far as the second island chain. The PLAN also is expanding its network of sky wave and surface wave over-the-horizon (OTH) radars. In conjunction with reconnaissance satellites, these OTH systems provide targeting capabilities at extended distances from China to support long-range precision strikes, including employment of ASBMs.
>
> **Land-Attack Cruise Missiles.** The PLA continues to field approximately 200 to 300 air- and ground-launched LACMs for standoff precision strikes. Air-launched LACMs include the YJ-63, KD-88, and CJ-20 (the air-launched version of the CJ-10 GLCM). China may be adding an electro-optic or imaging infrared terminal guidance capability to the 1,500 km-range CJ-20. China recently adapted the KD-88 LACM, which has an advertised range of more than 100 km, and may be testing a longer range version.

Anti-Ship Cruise Missiles. China deploys a wide range of advanced ASCMs with the YJ-83 series as the most numerous, equipping the majority of China's ships as well as multiple aircraft. China has also outfitted several ships with YJ-62 ASCMs. The YJ-18 is a long-range, torpedo tube launched ASCM with a supersonic terminal sprint. It has likely replaced the older YJ-82 on SONG, YUAN, and SHANG class submarines, and China claims that the new LUYANG III-class DDG and RENHAI CG are outfitted with a vertically launched variant of the YJ-18. China has also developed the long range supersonic YJ-12 ASCM for the H-6 bomber. At China's 90th anniversary parade in July, China displayed a ship-to-ship variant of the YJ-12 called the YJ-12A. China also carries the Russian SS-N- 22 SUNBURN on four Russian built SOVREMENNYY-class DDGs and the Russian SS-N-27b SIZZLER on eight Russian built KILO-class submarines.

Ground Attack Munitions. The PLAAF has a small number of tactical air-to-surface missiles as well as precision munitions; guidance options include satellite positioning, laser, electro-optic, and imaging infrared. China is developing or adapting a range of smaller-sized ASMs and guided bombs for use on its increasing range of armed UAVs.

Anti-Radiation Weapons. The PLA imported Israeli-made HARPY UAVs and Russian-made anti-radiation missiles during the 1990s. As of 2017, China is integrating the YJ-91, an indigenous version of the Russian Kh-31P (AS-17), into its fighter-bomber force, and advertising the ASN-301 anti-radiation drone, an improved domestic variant of the HARPY.

Artillery-Delivered High Precision Munitions. The PLA is fielding long-range rocket artillery systems with the range to strike targets within or even across the Taiwan Strait. The most common of these is the PHL-03 12x300 mm multiple-rocket launcher – similar to the Russian 9A52-2 SMERCH, with a 150 km range. Improved warheads for these rockets may include vertical penetrators and sensor-fused munitions.

ICBMs, Other Ballistic Missiles, and Cruise Missiles

The OSD report describes two sets of improvements in the *People's Liberation Army Rocket Force* (PLARF) – one set affects nuclear forces and the other dual capable forces. The report makes it clear that China is making major advances in both sets of systems in terms of accuracy, reaction times, mobility/vulnerability, and lethality.

It is not clear, however, that China intends to create the kind of clear separation that U.S. now has between nuclear-armed strategic systems and conventionally-armed, but dual capable, tactical to theater systems. Simply having the ability to escalate at the tactical or theater nuclear level could act as a powerful deterrent to an enemy in many contingencies, and help shape the process of escalation and its limits.

The OSD report describes China's strategic nuclear missiles a follows:

> The PLARF trains, equips, and operates China's land-based nuclear and conventional missiles. In 2017, it advanced long-term modernization plans to enhance its "strategic deterrence capability," a theme President Xi echoed during a visit to PLARF headquarters in September 2016 where he called for accelerating the PLARF's pace of development and "breakthroughs . . . in strategic deterrence capability." (pp. 34-35)
>
> ...China's nuclear arsenal currently consists of approximately 75-100 ICBMs, including the silo-based CSS-4 Mod 2 (DF-5A) and Mod 3 (DF-5B); the solid fueled, road-mobile CSS-10 Mod 1 and Mod 2 (DF-31 and DF-31A); and the more limited range CSS-3 (DF-4). During the PLA's 90th Anniversary parade, China displayed for the first time the DF-31AG, described as an enhanced version of the DF-31A ICBM that also uses a transporter-erector-launcher to increase its mobility and survivability. This force is complemented by road-mobile, solid fueled CSS-5 Mod 2 and Mod 6 (DF-21) MRBMs and DF-26 IRBMs for regional deterrence missions. (pp. 75-76)
>
> The PLARF also continues to enhance its silo based intercontinental ballistic missiles (ICBMs) and is adding more survivable, mobile delivery systems. China's ICBM arsenal to date consists of 75-100 ICBMs, including the silo based CSS-4 Mod 2 (DF-5A) and multiple independently targeted reentry vehicles-(MIRV)-equipped Mod 3 (DF-5B); the solid fueled, road-mobile CSS-10 Mod 1 and 2 (DF- 31 and DF-31A);

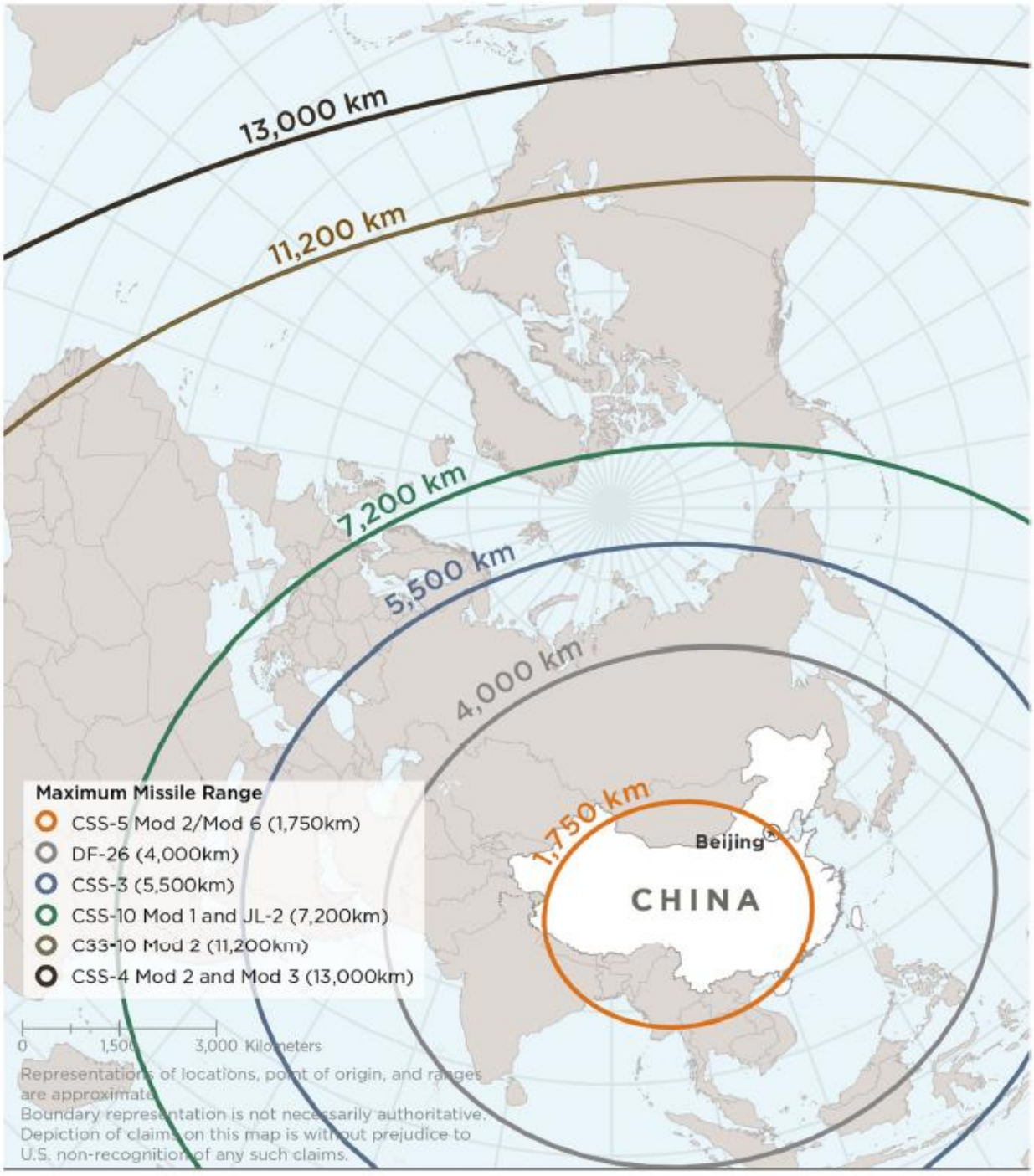
> and the shorter range CSS-3 (DF-4). The CSS-10 Mod 2, with a range in excess of 11,200 km, can reach most locations within the continental United States. (pp. 34-35)
>
> During the 90th anniversary parade, China displayed the DF-31AG, described as an enhanced version of the DF-31A ICBM that also uses a transporter-erector-launcher to increase its mobility and survivability. Development of the CSS-X-20 (DF-41), a new MIRV-capable and road-mobile ICBM, continued in 2017. China appears to be considering additional DF-41 launch options, including rail-mobile and silo basing. (pp. 34-35)

It also describes a wide range of other Chinese missile and rocket forces:

> ...The PLARF fields multiple missiles capable of projecting power beyond the region. Among these are the CSS5 Mod-5 ASBM, which has a range of 1,500 km and a maneuverable reentry vehicle (MaRV) to challenge ballistic missile defenses. China also deploys the land-attack CSS-5 Mod 4, placing targets on Okinawa and the main Japanese islands at risk. The DF-26 IRBM has a maximum range of 4,000 km and is capable of conducting precision strikes against ground and ship targets, potentially threatening U.S. land and sea-based forces as far away as Guam. The PLARF has deployed shorter-ranged missile systems opposite Taiwan, including several types of SRBMs and the ground launched CJ-10 LACM. (p. 70-71)
>
> In 2017, China also displayed the DF-16G MRBM for the first time. According to the PLARF, the system carries a conventional warhead and has high accuracy, strong destructive power, and a short preparation time. (p. 70-71)
>
> China's conventional missile force includes the CSS-6 short-range ballistic missile (SRBM) with a range of 725-850 km; CSS-7 SRBM with a range of 300-600 km; CSS-11 SRBM with a range of over 700 km; land-attack and anti-ship variants of the CSS-5 medium-range ballistic missile (MRBM); the DF-26 intermediate range ballistic missile (IRBM); and the CJ-10 ground-launched cruise missile (GLCM). China's conventionally-armed CSS-5 Mod 5 anti-ship ballistic missile (ASBM) gives the PLA the capability to attack ships, including aircraft carriers, in the western Pacific Ocean. (pp. 34-35)
>
> During the PLA's 90th anniversary parade in July 2017, China displayed a new MRBM designated the DF-16G, which China claims features high accuracy, short preparation time, and an improved maneuverable terminal stage that can better infiltrate missile defense systems. China also displayed the DF-26 IRBM during the PLA's 90th anniversary parade. First fielded in 2016, this system is capable of conducting conventional and nuclear precision strikes against ground targets and conventional strikes against naval targets in the western Pacific and Indian Oceans and the South China Sea. (pp. 34-35)

The expanding ranges of the Chinese missile forces are show in in **Figure Six**. The expanding range of Chinese theater and conventional systems are shown in **Figure Seven**.

Figure Six: Maximum Ranges of Chinese Nuclear-Armed Ballistic Missiles



Source: Office of the Secretary of Defense, *ANNUAL REPORT TO CONGRESS, Military and Security Developments Involving the People's Republic of China 2017*, Department of Defense, May 15, 2018, p. 38.

Figure Seven: Maximum Ranges of Chinese Conventional Strike Capabilities

Source: Office of the Secretary of Defense, *ANNUAL REPORT TO CONGRESS, Military and Security Developments Involving the People's Republic of China 2017*, Department of Defense, May 15, 2018, p. 37.

SSBNs and SLBMs

In contrast to the *People's Liberation Army Rocket Force*, China's nuclear missile submarines and submarine-launched ballistic missile forces seem to be dedicated to the strategic nuclear deterrence and delivery mission, and their primary mission seems to be to provide a secure and survivable strike capability.

It is not clear from open-source literature how the targeting, command and control, and warfighting operations of the SSBN forces would be integrated with the operations of the PLARF and the bomber forces of the People's Liberation Army Air Force, but it seems likely that each element of China's nuclear forces do have some central planning and command group – just as the U.S. does – and that authorization of any activity comes from China's top leadership and some specialized cell in the Communist Party serving that leadership.

The targeting of the SLBM force on China's SSBNs force is unclear, but it seems likely that China's emerging SSBN force is now targeted to act as a survivable force that can guarantee China's ability to execute a major countervalue strike against U.S. or other potential enemy cities and key economic targets. This would greatly simplify command and control, and eliminate the need for the kind of accuracy needed for counterforce missions and theater strikes. At the same time, SSBN forces may have targeting options to try to deter U.S. or other attacks on the deployed and standby SSBN force, an also to execute demonstrative or limited attacks rather than a major countervalue attack.

The OSD report describes China's SSBN/SLBM force as follows:

> **Sea-based Platforms.** China continues to produce the JIN-class SSBN, with four commissioned and at least one other under construction. China's JIN SSBNs, which are equipped to carry up to 12 CSS-N-14 (JL-2) SLBMs, are the country's first viable sea-based nuclear deterrent. China's next-generation Type 096 SSBN, reportedly to be armed with the follow-on JL-3 SLBM, will likely begin construction in the early-2020s. Based on the 40-plus-year service life of China's first generation SSNs, China will operate its JIN and Type 096 SSBN fleets concurrently. (pp. 75-76)
>
> Modernization of China's submarine force remains a high priority for the PLAN. It currently operates 4 nuclear-powered ballistic missile submarines (SSBN), 5, nuclear-powered attack submarines (SSN), and 47 diesel-powered attack submarines. By 2020, this force will likely grow to between 69 and 78 submarines. (pp. 28-29)
>
> Over the past 15 years, the PLAN has constructed 10 nuclear submarines – 2 SHANG I-class SSNs (Type 093), 4 SHANG II-class SSNs (Type 093A), and 4 JIN-class SSBNs (Type 094). Equipped with the CSS-N-14 (JL-2) submarine-launched ballistic missile (SLBM). China's four operational JIN-class SSBNs represent China's first credible, sea based nuclear deterrent. China's next generation Type 096 SSBN, reportedly to be armed with the follow-on JL-3 SLBM, will likely begin construction in the early-2020s. (pp. 28-29)
>
> The PLAN recognizes that long-range ASCMs require a robust, over-the-horizon targeting capability to realize their full potential. China is investing in reconnaissance, surveillance, command, control, and communications systems at the strategic, operational, and tactical levels to provide high-fidelity targeting information to surface and subsurface launch platforms. (p. 30)

Bomber Force

Like its SSBN/SLBM force, the Chinese strategic bomber force is in considerable transition, and is becoming a more capable part of the Triad. The OSD report describes the bomber force and several short-term advances in the bomber force as follows:

> China's bomber force is composed of variants of the H-6 BADGER bomber, and China has worked to maintain and enhance the operational effectiveness of these aircraft. The latest variant, the H-6K which China is fielding in greater numbers, integrates standoff weapons and features more efficient turbofan engines in redesigned wing roots. This extended-range aircraft has the capability to carry six land-attack cruise missiles (LACMs), giving the PLA a long-range standoff precision strike capability that can range Guam. PLAN Aviation fields the H-6G, with four weapons pylons for ASCMs to support maritime missions. (pp. 61-62)

It also, however, notes that much broader, longer-term changes are taking place that are expanding the bombers' role in theater warfare in both conventional and nuclear missions:

> In 2017, Lieutenant General Ding Laihang assumed the post of PLAAF commander, and exhorted the service to build a truly "strategic" air force capable of projecting airpower at a long range. The PLAAF continues to modernize and is closing the gap with the U.S. Air Force across a broad spectrum of capabilities, gradually eroding the United States' longstanding significant technical advantage.
>
> Former PLAAF commander General Ma Xiaotian publicly announced the stealth bomber program in 2016, and the new platform could debut sometime around 2025. The H-6 and future stealth bomber could both be nuclear capable. The PLA is also upgrading its aircraft with two new air-launched ballistic missiles, one of which may include a nuclear payload. (pp. 61-62)
>
> China's development, production and deployment of domestically-developed reconnaissance and combat UAVs continues to expand. In 2017, Chinese defense industry representatives claimed to be developing long-range stealthy and near-space UAVs, and the PLA may soon begin receiving the long-range, high-altitude Xianglong UAV. (p 62)
>
> Following PLAAF Commander General Ma Xiaotian's 2016 public statement that China was developing a new generation of long-range bomber, a number of reports suggest the new bomber, likely named the H-20, could debut sometime in the next decade with the following features: a stealthy design employing many fifth generation technologies; a likely range of at least 8,500 km; a payload of at least 10 metric tons; and a capability to employ both conventional and nuclear weaponry.
>
> A photograph of a possible H-20 prototype depicted a flying wing airframe akin to the B-2 bomber and X-47B stealth unmanned combat aerial vehicle (UCAV). China may also be developing a refuelable bomber that could reach IOC before the long-range bomber, expanding long-range offensive bomber capability beyond the second island chain. (p. 70)

At present, it seems likely that the primary mission of the bomber force is theater warfare and conventional strikes. There may be a dedicated force of bombers on alert, but this is unclear. So is the role of a stealth bomber when deployed, and much might then depend on how U.S. and Russian forces have evolved, rather than the current plans of the PLAAF.

China's bomber force is already flying the much longer theater-wide missions shown in the map in **Figure Eight**.

> ... The PLAAF employs the medium-range H- 6K bomber, which can carry up to six precision-guided CJ-20 air launched cruise missiles each, giving it the ability to engage U.S. forces as far away as Guam. Since 2016, the PLAAF has steadily increased H- 6K operating areas into the Western Pacific Ocean and the South China Sea. The acquisition of three IL-78 MIDAS aerial refueling tankers from Ukraine probably allowed the PLAAF to extend the range of Su-30 fighter aircraft beyond the first island chain to support H-6K bombers (p. 62)
>
> The PLA has long been developing air strike capabilities to engage targets as far away from China as possible. Over the last three years, the PLA has rapidly expanded its overwater bomber operating areas, gaining experience in critical maritime regions and likely training for strikes against U.S. and allied targets. The PLA may continue to extend its operations beyond the first island chain, demonstrating the capability to strike U.S. and allied forces and military bases in the western Pacific Ocean, including Guam. Such flights could potentially be used as a strategic signal to regional states, although the PLA has thus far has not been clear what messages such flights communicate beyond a demonstration of improved capabilities. (pp 116-118)
>
> *Western Pacific.* PLA aircraft first operated beyond the first island chain in 2013, when a PLAN ASCM

> capable H-6G bomber transited through the Bashi Channel; however, the H-6G bomber lacks the range and endurance to patrol the western Pacific Ocean effectively and strike key U.S. and allied facilities. China began to field the longer-range H-6K bomber in 2013, incorporating cruise missile pylons to turn the bomber into a stand-off strike platform. The H-6K's capabilities provided the PLAAF an offensive strike capability against Guam with LACMs. (pp. 118-119)
>
> The PLAAF began flying the H-6K past the First Island Chain into the western Pacific Ocean in 2015, alternating transits through the Miyako Strait and the Bashi Channel and flying within LACM range of Guam. In 2016, the PLAAF improved its capabilities by adding AWACS and fighter aircraft to its bomber flight packages to provide defensive counter-air protection of the bombers beyond the first island chain. (pp. 118-119)
>
> In 2016, the PLAAF also circumnavigated Taiwan for the first time by passing through both the Miyako Strait and Bashi Channel in the same mission, and significantly increased the number of circumnavigation missions in 2017. In addition to long-range flight plans, future H-6 missions may also target Taiwan. Depending on the weapons load, potential future H-6 missions could include antiship or shorter-range strikes targeting eastern Taiwan from all directions or supporting a blockade. (pp. 118-119) Currently, such missions are vulnerable without defense counter-air support provided by fighters traveling along the route with the bombers.
>
> *South China Sea.* In 2016, China began flying H-6K missions in the South China Sea, probably as far as Scarborough Reef, conducting maritime patrols and ISR. H-6s could, if deployed to airfields in the Spratly Islands, extend their range through the Balabac Strait into the Celebes Sea or through the Sunda or Malacca Strait to fly into the Indian Ocean. (pp. 118-119)
>
> *Sea of Japan*. In August 2016, two PLAN H-6 bombers accompanied by a Y-8 AEW&C aircraft conducted the first PLA flights into the Sea of Japan. In January 2017, they flew the same route, this time with six bombers supported by two reconnaissance aircraft. In August 2017, the PLAAF further expanded the PLA's operating area by sending six PLAAF H-6K bombers through the Miyako Strait, and for the first time, turned north to fly east of Okinawa and as far north as the Kii Peninsula. These flights demonstrated a maturing capability for H-6K bombers to conduct off-axis strikes against U.S. and allied facilities. Previously demonstrated flight endurance of the PLAAF H-6K suggest future missions could fly around Japan, along the Philippines' coast, and use a wider area of operations throughout the Philippine Sea than current operations by Chinese aircraft. (pp. 119-120)

These longer-range missions conform in many ways to China's claims in the South China Seas and Sea of Japan, but they also extend to Guam and other Pacific islands. If one looks a mission distances, it is also clear that China's bombers could cover India and must of Central Asia as well.

Figure Eight: Expanding Range of Chinese Bomber Operations

Source: Office of the Secretary of Defense, *ANNUAL REPORT TO CONGRESS, Military and Security Developments Involving the People's Republic of China 2017*, Department of Defense, May 15, 2018, p. 37.

Missile Defenses

China has strongly opposed the deployment of U.S. missile defenses in Japan and South Korea, and claimed that they provide the U.S. with major improvements in intelligence collection and possible capability to intercept Chinese ICBMs. In practice, however, China is now developing its own missile defenses. The OSD report notes that,

> The PLAAF possesses one of the largest forces of advanced long-range SAM systems in the world, consisting of a combination of Russian sourced SA-20 (S-300PMU1/2) battalions and domestically produced CSA-9 battalions. China has contracted with Russia for the S- 400/Triumf SAM system, as a follow-on to theSA-20 and CSA-9, to improve strategic long-range air defenses; delivery could take place by the end of the decade. China is also developing its indigenous HQ-19 to provide the basis fora ballistic missile defense capability. (34-35)
>
> The service is developing and testing several new variants of missiles and developing methods to counter ballistic missile defenses. In September 2017, LTG Zhou Yaning took command of the PLARF, replacing Wei Fenghe, who became Minister of Defense in March 2018. (pp. 34-35)
>
> China is working to develop ballistic missile defenses consisting of kinetic-energy exo-atmospheric and endo-atmospheric interceptors. In 2016, official media confirmed China's intent to move ahead with land- and sea-based midcourse missile defense capabilities. The HQ-19 mid-course interceptor was undergoing tests in 2016 to verify its capability against 3,000 km-class ballistic missiles, and an HQ-19 unit may have begun preliminary operations in western China. Indigenous radars including the JY-27A and JL-1A – the latter advertised as capable of the precision tracking of multiple ballistic missiles – reportedly provide target detection for the system. (p.60)
>
> The PLA's long-range SAM inventory also offers a limited capability against ballistic missiles. China's domestic CSA-9 (HQ-9) long range SAM system is expected to have a limited capability to provide point defense against tactical ballistic missiles. China has fielded SA- 20 PMU2 SAMs and future S-400 SAMs may have some capability to engage ballistic missiles depending on the interceptors and supporting infrastructure. (p. 60)
>
> Integrated Air Defense System (IADS). China has a robust and redundant IADS architecture over land areas and within 300 nm (556 km) of its coast that relies on an extensive early warning radar network, fighter aircraft, and a variety of SAM systems. China is also placing radars and air defense weapons on outposts in the South China Sea, further extending its IADS. It also employs point defense primarily to defend strategic targets against adversary long-range cruise missiles and airborne strike platforms.
>
> China has increasing numbers of advanced long-range SAMs, including its indigenous CSA-9, Russian SA-10 (S-300PMU), and SA-20 (S-300PMU1/PMU2), all of which have the advertised capability to protect against both aircraft and low-flying cruise missiles. To improve its strategic air defenses, within the next few years China will take delivery of the Russian-built S-400 Triumf SAM system as a follow-on to the SA-20 and CSA-9. Compared to these other systems, the S-400s will feature a longer maximum range, improved missile seekers, and more sophisticated radars. China manufactures a variety of long-range air surveillance radars, including models claiming to support ballistic missile defense and others asserting the ability to detect stealth aircraft.
>
> Marketing materials also emphasize the systems' ability to counter long-range airborne strike and combat support aircraft. PLAAF AEW&C aircraft such as the KJ-2000 and KJ- 500 can further extend China's radar coverage to well past the range of its ground-based radars. (p. 62)

China is also improving its missile capabilities to counter hostile missile defenses,

> The PLA is developing a range of technologies China perceives are necessary to counter U.S. and other countries' ballistic missile defense systems, including MaRV, MIRVs, decoys, chaff, jamming, thermal shielding, and hypersonic glide vehicles. (pp. 75-76)

In short, China – like the U.S. and Russia – may well make missile defense the future fourth element of its strategic forces – effectively going from a Triad to a "Quadrad.".

PLA Underground Facilities

One final part of the OSD report addresses the fact China has spent decades developing underground facilities. It began such efforts under Mao – before China acquired its own nuclear weapons – in an attempt to create protection against a U.S. nuclear attack. This complex has been developed ever since, and is sometimes referred to as the "Great Redoubt" or "underground Great Wall of China.

Since that time, some analysts have speculated that China may use them to produce and stockpile much larger inventories of nuclear weapons than the totals in open-source official U.S. and most non-governmental reporting.[43]

The OSD report for 2018 describes its estimate of the role of the tunnels as follows:

> The PLA continues to maintain a robust and technologically advanced underground facility (UGF) program protecting all aspects of its military forces, including C2, logistics, missile systems, and naval forces. China has thousands of UGFs with more being constructed each year. The PLA may utilize these UGFs to protect valuable assets from the effects of missile strikes and conceal military operations from adversaries. China's nuclear "No First Use" policy also contributed to the construction of UGFs for the country's nuclear forces, which plan to survive an initial nuclear strike. (p. 78)
>
> China began to update and to expand its military UGF program in the mid- to late-1980s. This modernization effort took on a renewed urgency following China's observation of U.S. and coalition air operations during the 1991 Gulf War and their use in OPERATION ALLIED FORCE (Kosovo) in 1999. These military campaigns convinced China that it needed to build more survivable, deeply buried facilities to protect from the effects of modern penetrating munitions. We expect that China will continue to develop and expand its UGF program to support its growing forces. (p 78)

China and Strategic Nuclear Exchanges: How Many Dead Do You Need?

It is far too early to predict the details of how China will compete in nuclear delivery systems and nuclear weapons numbers and performance with those of the U.S. and Russia over the coming decade. China may or may not be seeking something closer to parity with the U.S. and Russia in strategic delivery systems and warheads. One key danger in analyzing Chinese efforts is to assume that China should be judged by U.S. and Russian numbers, rather than by the cost-benefits of its past and current approach to sizing its nuclear forces, providing *needed* nuclear warfighting capability, and creating an *effective* level of deterrence. The fact it is modernizing and expanding its nuclear forces does not mean it feels it much try to match the nuclear forces of the other superpowers.

Comparisons of nuclear forces and their capability to deter is not a numbers game based on which side has the most and/or the best toys. Such comparison must be based on the utility to nuclear weapons in dominating a crisis and in warfighting from the tactical to the strategic level.

The problem with the previous comparisons of total numbers of nuclear weapons and delivery systems is that they tend to imply that the side that possesses – or dies – with or having used the most nuclear weapons "wins." In reality, it is probably the side that successfully deters with the least expensive nuclear forces that "wins". Once a major nuclear exchange takes place, every side that actually engages in a major countervalue strike is almost certain to have lost so much of its economy and population that "winning" becomes an oxymoron

The current Chinese numbers in **Figure Two** through **Figure Five** may have seemed to be small relative to those of the U.S. and Russia, and there is little evidence that Chinese is yet ready to seek near to mid-term parity in total nuclear weapons or delivery system numbers. However, achieving the necessary level of capability may well not require massive increases in China's numbers and China's forces may already be more than adequate to meet its immediate strategic needs.

Playing a Two (or Three) Person, No Possible Benefit, Game

Strategic nuclear weapons are generally used for one of two major purposes. The first is to conduct *countervalu*e strikes – ones that attack the population and economy of the target state. These can be tailored to strike at critical value targets in the economy that are distant from heavily populated areas, or to strike at entire cites – both killing the population and destroying everything of economic value. The attacker can also choose to increase fallout by using surface burst or earth penetrators, or avoid it by using airbursts.

The second is a *counterforce* strike against an enemy's strategic nuclear forces. This can take the form of any kind of nuclear strike that reduces or removes an enemy's nuclear forces either before the enemy can launch its own nuclear weapons, or during a series of strikes and counterstrikes. A successful counterforce generally requires a massive force to try to deny the target country the ability to launch its own surviving nuclear weapons in retaliation, and it may well be impossible.

Regardless of the theoretical performance specifications of the delivery systems involved, mobile launchers and SSBNs are extremely hard to target. Destroying fully hardened missile launchers are still a challenge to the real world combination of accuracy and reliability of many ICBM and SLBMs. Unless aside can somehow achieve a surprise attack when the targeted side is totally

unprepared and is not on alert, at least a partial launch on warning is all too likely. In some scenarios, the side that launches on warning will actually be able to fire more missiles at countervalue targets because it does not use large number of its weapons in counterforce strikes.

Moreover, in a world where the U.S. and Russia see each other as key opponents, the question still arises as to where either power would be after a nuclear exchange that did not involve China. In the past, the two existing superpowers never really had to consider Nth Country forces like those of China. Today, the U.S. and particularly Russia, has to consider exactly what a two strategic country strategic exchange between them would do to further empower China.

Conversely, any Russian or U.S. exchange with China alone that led to a major series of successful Chinese attacks on their cities would give the country that did not participate a major advantage, and planning a three country war that involved all three powers becomes a nightmare where the practical ability to limit the resulting exchanges is hard to envisage even in theory. The only thing worse than having the country that stands aside become the effective winner is creating a three country war where all sides end in executing a maximum series of strikes without a practical ability to put an end to the process of mutual escalation.

Countervalue Killing: How Much is Too Much?

Under these conditions, Mutual Assured Destruction or MAD can become a very relative term. The side that that has the largest surviving population and economy, or inflicts the most damage upon its opponent, does not "win" in any meaningful sense. If it suffers any serious retaliatory or first strike damage to its civilian population or economy, the war will have cost it far more than any conflict can be worth and it may or may not be able to recover more quickly and effectively than it opponent.

The emphasis most studies place on weapons numbers and performance can be very misleading. If a nuclear exchange does occur, the real world level of assured destruction may not be determined as much by the total inventory of nuclear weapons and delivery systems on a given side before a nuclear countervalue war begins, as by the targeting choices of each side and the vulnerability of its opponent.

Much will depend on how well each side calculates the other side's overall ability to recover from a given set of strikes. Modern economies have become steadily more dependent on limited critical facilities which may or may not be located near population centers, and many of which have long lead times even in peacetime for the fabrication of critical components. Cities vary sharply in size and in area and the dispersal of housing, food, and critical services. A given side can choose the maximum or limit the yield of its weapons, and sharply vary their effects by going from penetrators and ground bursts that maximize fall out to heights of burst that maximize thermal and other effects.

The number of warheads used per target can sharply alter every aspect of survival and recovery, as can the number and timing of the warheads used in an attack. There are sharp limits to how many warheads can survive the effects causes by the previous warhead if the strike come too closely together – an effect called "fratricide" – but launch on warning and uncertainties over accuracy and reliability can force a given side to launch more warheads at each target near simultaneously.

At the same time, modern weather satellites make it far more practical to use "offset targeting" that combines direct strikes with maximum fallout, and some unclassified studies by OTA in the 1970s

indicated that strikes designed to maximize fall out might have more lasting impact on recovery, and kill more people overtime, than a set of countervalue strikes that emphasized direct attacks on city centers.

Highly urbanized nations like the nations like the U.S. which emphasize their service sector, have steadily diminishing rural populations and rural ability to absorb refugees, and cities with key specialized economic functions because more vulnerable in some ways with each advanced in development – a vulnerability compounded by creating large, highly advanced industrial facilities to achieve economies of scale. No state can easily lose millions of its best educated and most productive people and see having a higher survival rate as a meaningful victory. Most of the living will not envy the dead, but being on the receiving end of any major level of Mutual Assured Destruction will be a lasting national nightmare.

This means that the numbers of systems China requires to deter require for a successful level of MAD, and to execute an effective countervalue mission can be surprising small, although much *now* depends on how much China could confident of executing a *first strike* before an opponent can target China nuclear forces; or being able to options like silos, shelters, mobility, SSBNs, and concealment to ensure that its forces survived a U.S. or Russian counterforce strike. Ironically, nuclear restraint is far easier with large, survivable forces than minimal forces – a problem that makes the survivability or first strike use of nuclear forces steadily more important as opponents increase their counterforce capabilities.

It should be stressed that even the highest yield thermonuclear weapons would not produce a prompt kill of the entire population in any major modern city. Modern construction would produce islands of survivability and many cities are so dispersed in areas that substantial suburbs and manufacturing areas would survive. Most medical facilities, however, would be destroyed. National emergency relief systems would collapse if more key cities were hit at the same time. Distribution of food, power, safe water, useful transportation and distribution systems, basic shelter options would all present massive problems that would add to the killing effect. Fall out, burns, and blast damage would be major problems, and the mid to long-term death rate from radiation would continue for decades.

Figure Nine shows that an *effective* thermonuclear strike on the top cities in any nation in the world would have devastating impact on its national character, economy, and future although might well "recover" many of its lost economic capabilities in several years. A successful Chinese nuclear strike on the 20 most critical American cities could be a crippling countervalue threat even to a nation as developed as the U.S.

Even assuming that China reserved three warheads for the initial strike and follow-on strikes on each American city to guard against a miss or systems failure, China would still only require 120 warheads to attack 40 major U.S. cities, and the comparative prestrike inventories of weapons and delivery systems would scarcely matter to anyone in those U.S. cities. Dead is dead.

There would be no "winner" in this scenario Such a Chinese attack would leave China vulnerable to massive U.S. retaliation. U.S. delivery systems are probably now far more reliable than Chinese forces, and the U.S. would probably only have to allocate a maximum of two warheads per Chinese city. The U.S. total is probably more than large enough to do a similar or larger level of assured destruction to China's much larger population even if the U.S. held back a major reserve of warheads to deter Russia.

Counterforce and Theater Nuclear Trigger Forces

That said, there are two critical ways in which Mutual Assured Destruction can fail in any conflict involving China (and the U.S. and Russia). The first has already been mention: counterforce strikes. Technology gain steadily improves the ability to detect and target enemy strategic nuclear forces, improved accuracy and penetration systems improve the capability to kill strategic delivery systems. "Smart" warheads can further improve detection and kill capability in the future.

This, however, is an ongoing duel. Mobility, dispersal, hardening/shelters, MIRVing, missile and air defenses all improve survivability. Advanced radars, detection systems, and survivable ways of measuring the precise nature of ongoing nuclear strikes all improve launch-on-warning and launch-under-attack capabilities. Simply increasing the number of delivery systems and the warheads or bombs they carry also improved survivable retaliatory capability – although it can also improve counterforce strike capability at the same time.

The defender also has a limited advantage. Both offensive and defensive capabilities involve major cumulative uncertainties as to how given forces will actually perform – and history provides countless examples of the fact that limited testing and evaluation – even under fairly realistic conditions and in numbers with some statistical meaning – run up against a problem called the "law of large numbers." It simply is not possible to firmly predict the outcome of a major exchange using limited test and evaluation data. Accordingly, betting the nation and its future on a counterforce strike requires an extraordinary amount of risk taking.

The other way Mutual Assured Destruction can fail is more credible and more dangerous. If nuclear powers engage in the use of theater nuclear weapons – or weapons with nuclear lethality like biological or some chemical weapons – the resulting pattern of escalation becomes harder and harder to manage and predict with each use. Sufficiently lethal theater strikes against a base or allied targets can trigger a process of escalation that may lead to the use of low yield strategic weapons for demonstrative or deterrent purposes. A limited attack or bring all strategic nuclear systems to readiness can be seen as the equivalent of a reason to launch on warning. This is why Russian and U.S. low yield warhead deployments, and a renewal of long-range theater nuclear missile deployments can be destabilizing and it is difficult to believe that China will not follow suit.

Losing by Winning

There are countless variations on such strategic exchanges, including ones where both China and Russia combine against the United State, were Russia is attacked to keep it from "winning" a U.S and Chinese exchange, and where Russia wins the U.S.-Chinese exchange because it is not involved and emerges unscathed.

The only clear outcome of all these possible cases is that none today seem likely to avoid unacceptable levels of mutual assured destruction for either the U.S. or Russia in attacking China as long as it can survive a counterforce strike and destroy a significant number of U.S, or Russian cities.

Figure Nine: Mutual Assured Destruction: An Illustrative Target Base

(Population in Millions)

	United States		Russia		China	
Rank	**Name**	**Population**	**Name**	**Population**	**Name**	**Population**
1	New York	8,537,673	Moscow	10,381,222	Shanghai	22,315,474
2	Los Angeles	4,030,668	Saint Petersburg	5,028,000	Beijing	11,716,620
3	Chicago	2,687,682	Novosibirsk	1,419,007	Tianjin	11,090,314
4	Houston	2,340,814	Yekaterinburg	1,349,772	Guangzhou	11,071,424
5	Phoenix	1,679,243	Nizhniy Novgorod	1,284,164	Shenzhen	10,358,381
6	Philadelphia	1,573,688	Samara	1,134,730	Wuhan	9,785,388
7	San Antonio	1,541,456	Omsk	1,129,281	Dongguan	8,000,000
8	San Diego	1,438,060	Kazan	1,104,738	Chongqing	7,457,600
9	Dallas	1,359,133	Rostov-na-Donu	1,074,482	Chengdu	7,415,590
10	San Jose	1,030,796	Chelyabinsk	1,062,919	Nanjing	7,165,292
Top 10		**26,219,213**		**24,968,315**		**106,376,083**
11	Austin	983,366	Ufa	1,033,338	Nanchong	7,150,000
12	Jacksonville	907,529	Volgograd	1,011,417	Xi'an	6,501,190
13	Fort Worth	893,997	Perm	982,419	Shenyang	6,255,921
14	San Francisco	888,653	Krasnoyarsk	927,200	Hangzhou	6,241,971
15	Columbus	880,182	Saratov	863,725	Harbin	5,878,939
16	Charlotte	873,363	Voronezh	848,752	Tai'an	5,499,000
17	Indianapolis	860,902	Tol'yatti	702,879	Suzhou	5,345,961
18	Seattle	746,046	Krasnodar	649,851	Shantou	5,329,024
19	Denver	719,116	Ulyanovsk	640,680	Jinan	4,335,989
20	Washington DC	702,756	Izhevsk	631,038	Zhengzhou	4,253,913
Top 20		**34,675,123**		**33,259,614**		**163,167,991**
21	El Paso	692,100	Yaroslavl	606,730	Changchun	4,193,073
22	Boston	687,584	Barnaul	599,579	Dalian	4,087,733
23	Nashville	673,008	Vladivostok	587,022	Kunming	3,855,346
24	Detroit	665,713	Irkutsk	586,695	Qingdao	3,718,835
25	Portland	658,347	Khabarovsk	579,000	Foshan	3,600,000
26	Oklahoma City	653,865	Khabarovsk Vtoroy	578,303	Puyang	3,590,000
27	Las Vegas	653,840	Orenburg	550,204	Wuxi	3,543,719
28	Memphis	649,243	Novokuznetsk	539,616	Xiamen	3,531,347
29	Louisville	619,287	Ryazan'	520,173	Tianshui	3,500,000
30	Baltimore	601,188	Tyumen	519,119	Ningbo	3,491,597
Top 30		**41,229,298**		**38,926,055**		**200,279,641**

Looking Towards the Future Strategic Nuclear Arms Race

it is obvious that China's nuclear forces will change radically over the next 5 to 10 years. It is obvious that these changes will affect every element of China's nuclear weapons and delivery systems: ICBMs, SSBNs/SLBMs, bombers and ALCMs. They will involve China's IRBMs and theater and tactical weapons, and the relative role of nuclear and conventional weapons, and they will lead to at least some significant increases in the number of nuclear weapons that China deploys . Regardless of China's declared nuclear posture and strategy, they will also change every aspect of its war planning and reaction to a crisis that involve the potential use of nuclear weapons.

A Three Way Chinese-U.S.-Russian Strategic Nuclear Balance

The 2018 U.S. Nuclear Posture Review (NPR) explicitly recognizes the interaction between changes in number and capability of U.S., Russian, and Chinese nuclear forces. It shows that the U.S. recognizes that future nuclear planning and arms control efforts must recognize China's emergence as a third major nuclear power, and that the past focus on U.S. and Russian Strategic nuclear forces and arms control, must change.

The NPR also makes it clear that there already is a major arms race in nuclear capability, and may well be a major new arms race in sheer numbers. Moreover, it is clear that almost every major change in capability will affect the nature of warfighting, incentives and barriers to escalation, and the effectiveness of any given approach to arms control.

The days of a two player, zero-sum game are over. strategic nuclear balance is now becoming a balance between three – not two – nuclear super powers. Any assessment that only compares Russia and China – and does not consider the impact of a nuclear exchange limited to the U.S. and Russia on China's status as the "surviving" superpower is now unrealistic and obsolete. China cannot "win" by suffering the least in a broken world, but suffering the least is still a far less bad option than being one of two "broken" states.

Unpredictable and Interactive Cycles of Change

What is far less clear is how China's forces will evolve. There is no way to make the kind of sophisticated estimates of Chinese forces even for as short a time in the future as 2023 that Kristensen and Norris have made of China's current weapon holdings in 2018, and that are summarized **in Figure Two**. Even a range of such estimates would probably be more misleading than useful, given the range of uncertainties and possible interactions involved.

From year-to-year or crisis-to-crisis, China will react to what the U.S. and Russia do, and vice versa. The incentives and disincentives the threaten to use nuclear weapons or actually use them relative to conventional weapons will affect these uncertainties. Long-range and other precision guided conventional weapons can achieve critical new levels of lethality against point targets – potentially replace weapons of mass destruction with "weapons of mass effectiveness."

Missile defense is becoming a potential fourth element of the Triad. Advances in biotechnology are redefining "assured destruction." Cyber and space warfare inevitably interaction with the relative use of conventional and nuclear weapons, as well as potentially alter capabilities for every aspect of actual nuclear warfighting. Changes like hypersonic weapons affect warning and launch on warning capabilities. New forms of imagery and intelligence systems alter the ability to carry out first strikes and counter force attacks.

The potential end to the IRBM Treaty, and deployment of high-precision, low-yield nuclear weapons on longer-range ballistic and cruise missiles will mean new levels of nuclear threat in theater warfare in both Europe and Asia. For China, these changes affect its potential involvement in extended deterrence and actual fighting involving the Koreas and Japan, in China's need for contingency planning to deter or fight an evolving nuclear India, and in any linkage between China and some form of extended deterrence for Pakistan.

Some Factors to Consider

In fairness to Albert Einstein, there is little real evidence that he actually said that, "The definition of insanity is doing the same thing over and over again, but expecting different results." That may be just as well, because the same statement defining insanity could easily be applied to the events that led to World War I and World II, and to much of the history of warfare.

It also seems all too likely to apply to the changes now taking place in the global nuclear arms race, and China's nuclear forces. The period from 1945 to the signing of the Intermediate-Range Nuclear Forces (INF) Treaty in 1987 and START I in July 1991, was the modern mirror image of the Anglo-German naval arms race before World War I, and was one of the most dangerous periods in human history. This is shown in the massive build-up in the total nuclear weapons on each side shown in the estimate in **Figure Ten**.

Fortunately, this time history has not yet repeated itself. **Figure Ten** reflects the fact that the long slow process of detente and arms control from the Cuban missile crisis through SALT, START, and the break-up of the former Soviet Union led to the massive reductions in each side's strategic nuclear forces and nuclear weapons. The INF treaty led to the destruction of 2,962 U.S. and Russian nuclear-armed missiles aimed largely at targets in Europe with ranges of 500 to 5,500 kilometers, and to the withdrawal of most of the tactical and theater nuclear weapons on both sides.

There are, however, no guarantees for the future. The rising tensions between the U.S. and Russia following Russia's seizure of the Crimea and invasion of the Ukraine have effectively revitalized a sleeping arms race between the two existing superpowers at a time when a third is clearly emerging.

This new arms race not only has triggered the major qualitative changes in U.S. and Russian nuclear forces summarized earlier, it has effectively reversed their effort to move towards a zero threshold of nuclear weapons and – combined with Russian deployments of a long-range GLCM called the 9M729 (NATO SSC-8) that led the U.S. to withdraw from the IRBM Treaty on October 22, 2018. Whether this will lead to a major quantitative increase in nuclear weapons is unclear, but it is certainly possible.

From a purely military perspective, China has no reason to match every qualitative aspect of this new U.S. and Russian nuclear arms race, and even less reason to match U.S. and Russian numbers. China may or may not equip its strategic forces with low yield nuclear warheads that could be used to destroy military targets in theater or strategic warfare like the new U.S. W-76-2 warhead for the Trident II SLBM, possible variations of the W80 and W88, and W-78.[44]

The reasons China might want to stand aside from any attempt to match current or future U.S. and Russian weapons numbers, and rely on a survivable counter-value threat, have already been discussed. China gains the most from standing aside from the U.S. and Russian strategic nuclear arms races as long as it can guarantee a high enough level of mutual assured destruction to ensure that it will not be attacked.

China will, however, have to make enough qualitative improvements to ensure it has a survivable countervalue capability to deal with any U.S. or even Russian attack, and present an unacceptable threat to both other superpowers if they become involved in a two-way strategic exchange. It also will have to develop matching theater capabilities, as well as deal with threats like India, and the risks posed by the Korea's and other regional threats. China may also feel that it cannot fully asset "parity" as a superpower unless it competes in numbers – a political judgment that nations have found all too easy to make in previous arms races.

Here, two Figures drawn from the U.S. Nuclear Posture Review provide some further insights about this uncertain future. **Figure Eleven** is a reminder that the emerging three way nuclear arms race may not repeat one key recent aspect of history – the post nuclear era limits to wartime fatalities. Even if mutual assured destruction is fully preserved as a deterrent, the return to active superpower strategic nuclear competition will still increase the risk that strategic nuclear competition could lead to a major nuclear exchange. Such an exchange would almost certainly create short and long term casualties that fundamentally increased the human cost of war beyond any previous level.

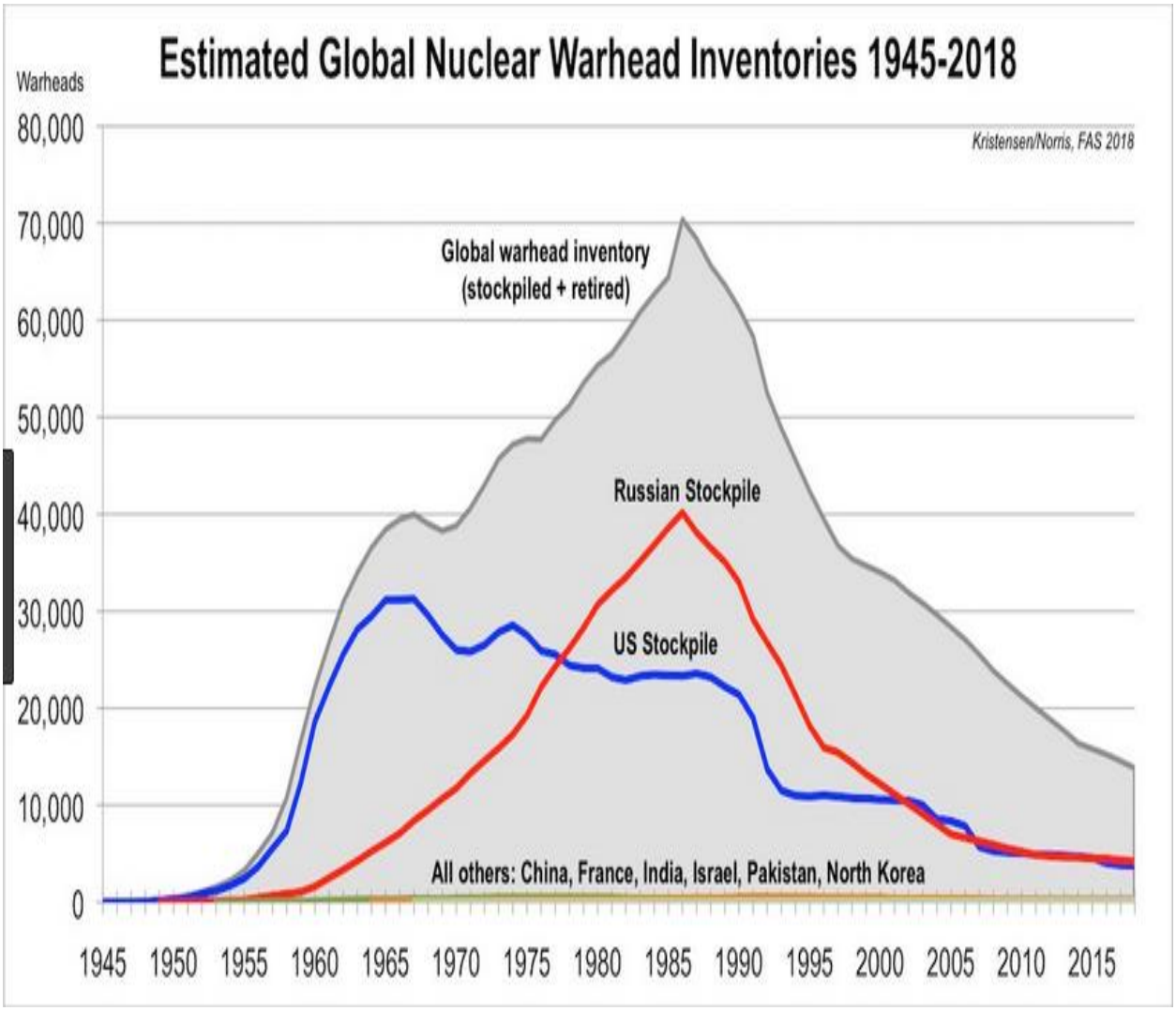
The still uncertain build-up of tactical and theater nuclear forces, the new mixes of nuclear actors and regional contingencies, and the fact that mutual assured destruction would not deter the use of nuclear weapons will also new potential chains of escalation that could trigger strategic exchanges if a given power miscalculates – particularly if additional powers like North Korea, India, and Pakistan become involved. The thinning line between using long-range theater precision-guided conventional missiles and using low-yield nuclear warheads is just one example of a whole new range of complications to preserving a clear break between nuclear and other forms of warfare.

The sheer cost of the coming nuclear arms will also present problems for China. **Figure Twelve** provides a U.S. estimate of the cost *to the U.S.* of simply competing in modernizing an existing nuclear force under the assumption that nothing Russia or China do over more than next 30years will raise the current estimated cost of U.S. plans.

In spite of major problems with cost escalation, this is a cost the U.S. may be able to bear with minimal additional strain – *as long as the U.S. only has to slowly modify its current forces and does not have to react to any new challenge from its competitors*.[45] China, however, will find far more difficult to pay for the cost of creating major new forces in a competitive environment. China may well see these costs reach 3-5% of its GDP in peak years. And, unlike the U.S., China seeks to bring the remaining quarter of its population into a modern economy with far higher living standards and fund a massive conventional arms build-up.

To paraphrase *War Games*, there really are some "games" where the only way to actually win is not to play. There are many more where it does not pay to bet too much – or all you have – in a game that involve existential national survival. This is just as true for China as it is for the U.S. and Russia.

Figure Ten: The U.S-Soviet/Russian- Chinese Nuclear Arms Race: 1945 to 2018



Source: Hans M. Kristensen and Robert S. Norris, *Status of World Nuclear Forces*, Federation of American Scientists, June 2018, https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/

Figure Eleven: Wartime Fatalities as a Percent of the World's Population (Civilian and Military)

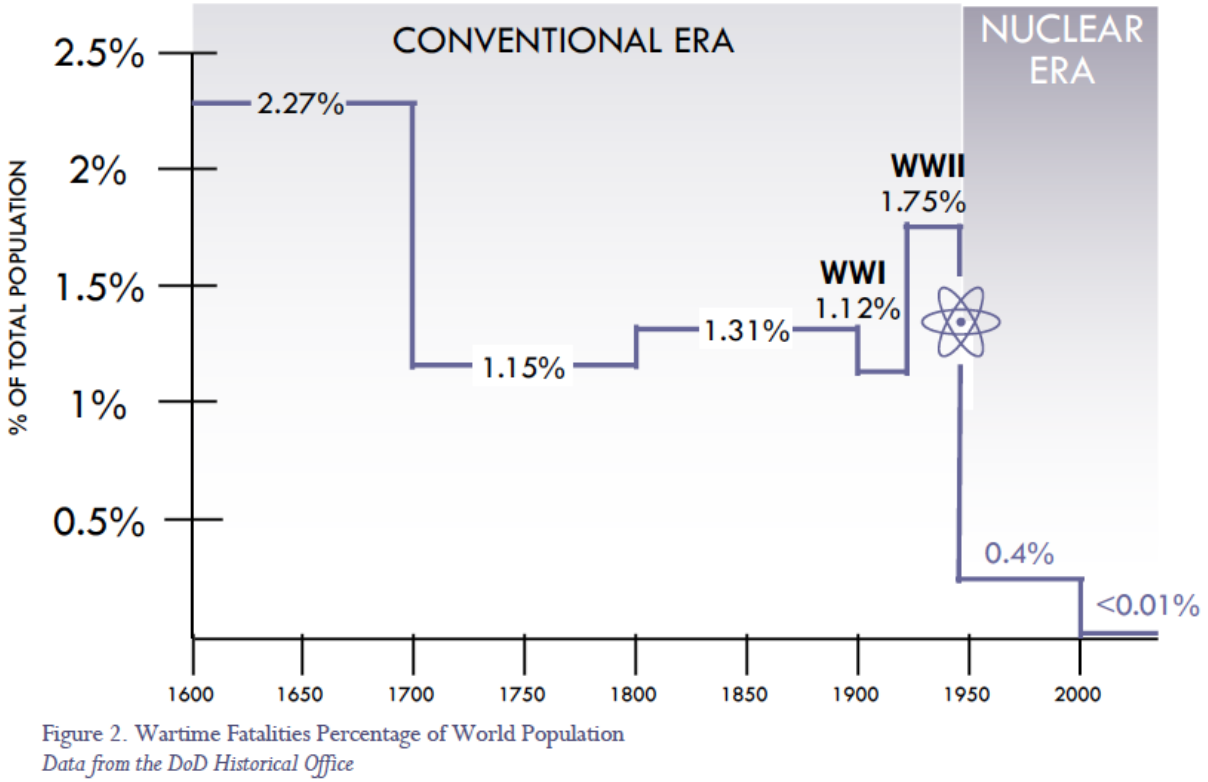
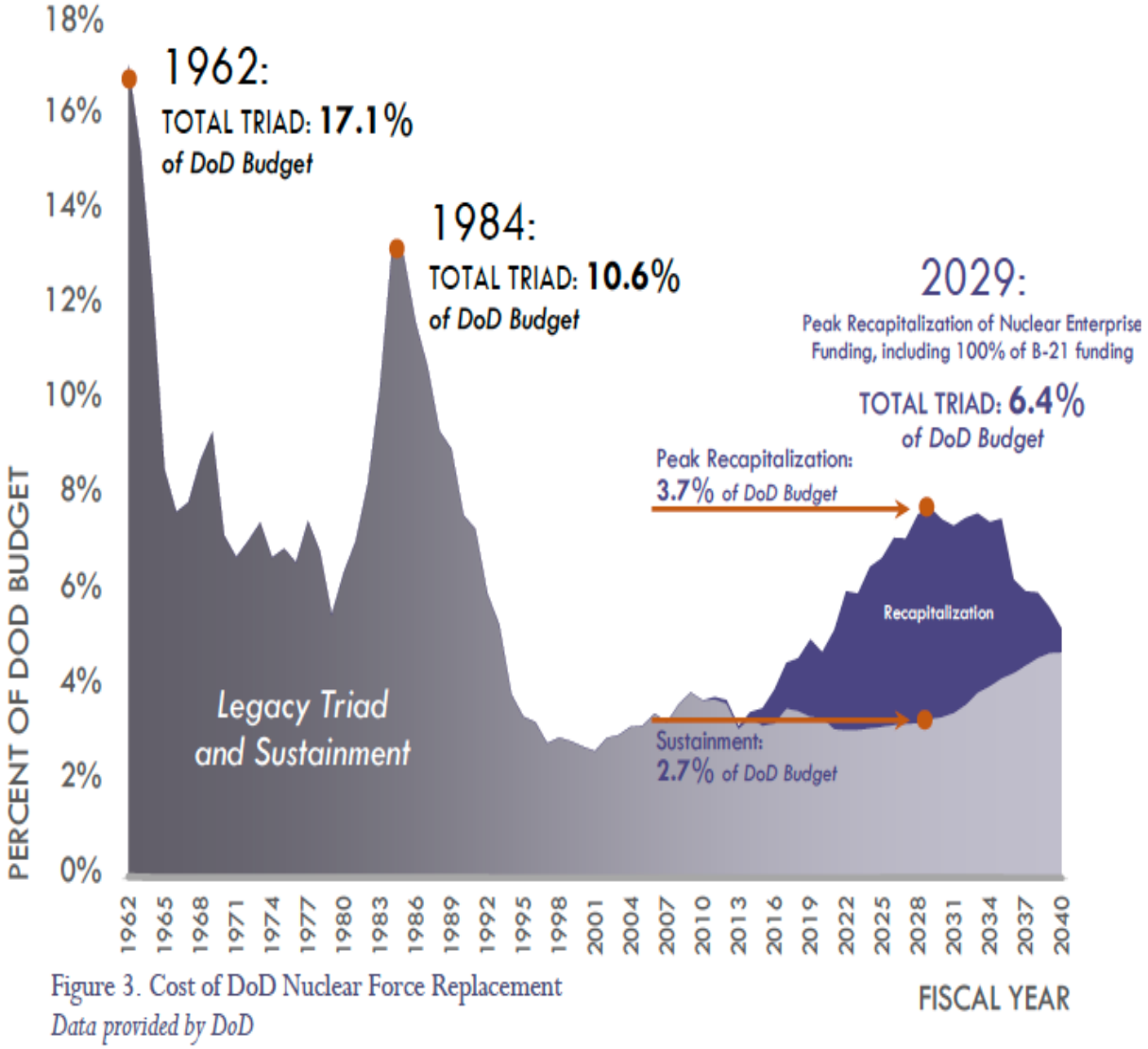


Figure 2. Wartime Fatalities Percentage of World Population
Data from the DoD Historical Office

Source: Office of the Secretary of Defense, *2018 Nuclear Posture Review*, Department of Defense 2018, p. 17.

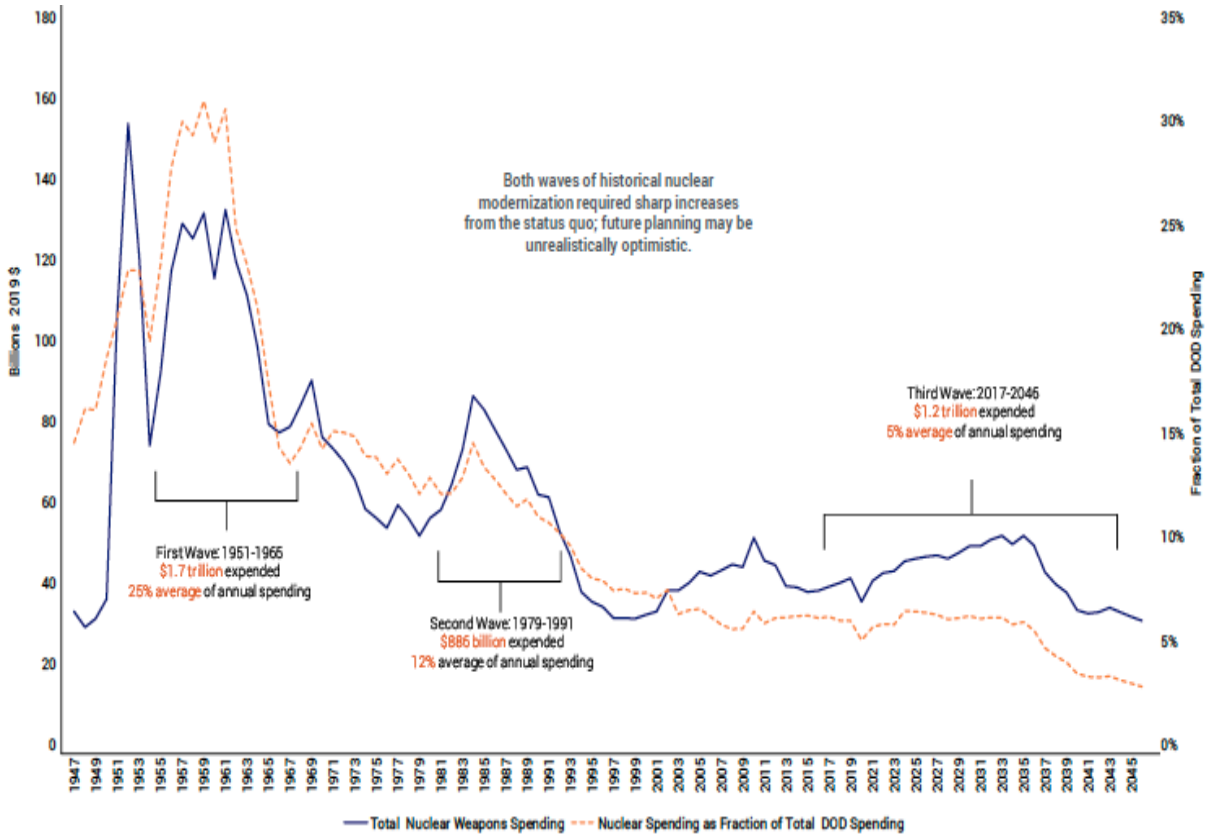
Figure Twelve: Part One
The Strain on the U.S. from the Cost of a New Nuclear Arms Race:
The NPR Estimate



Source: Office of the Secretary of Defense, *2018 Nuclear Posture Review*, Department of Defense 2018, p. 51.

Figure Twelve: Part Two

The Strain on the U.S. from the Cost of a New Nuclear Arms Race: The Department Of Defense Estimate of Nuclear Spending 1947–2046



Source: Department of Defense Green Book Table 6-5; Atomic Audit for methodology on processing data; Congressional Budget Office (CBO), "Approaches for managing the costs of US Nuclear Forces, 2017 to 2046."

Source: National Defense Strategy Commission final report on *Providing for the Common Defense*, November 14, 2018, p.55.

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[13] Office of the Secretary of Defense, *2018 Nuclear Posture Review*, Department of Defense February 2018. See pages 31-32 and 36-37 for quote, and pages 69-74 for discussion of arms control.
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