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**NEAR-PEER ADVANCEMENTS IN SPACE
AND NUCLEAR WEAPONS**

HEARING

BEFORE THE

SUBCOMMITTEE ON STRATEGIC FORCES

OF THE

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NEAR-PEER ADVANCEMENTS IN SPACE AND NUCLEAR WEAPONS

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON STRATEGIC FORCES,
Washington, DC, Tuesday, February 23, 2021.

The subcommittee met, pursuant to call, at 3:01 p.m., in room 2118, Rayburn House Office Building, Hon. Jim Cooper (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. JIM COOPER, A REPRESENTATIVE FROM TENNESSEE, CHAIRMAN, SUBCOMMITTEE ON STRATEGIC FORCES

Mr. COOPER. This hearing is called to order. Members who are joining remotely must be visible on screen for the purposes of identity verification, establishing and maintaining a quorum, participating in the proceeding, and voting. Those members must continue to use the software platform's video function while in attendance, unless they experience connectivity issues or other technical problems that render them unable to participate on camera.

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Finally, I have designated a committee staff member to, if necessary, mute unrecognized members' microphones to cancel any inadvertent background noise that may disrupt the proceedings.

Now that we have handled that boilerplate, let me start by thanking our excellent witnesses today at today's hearing.

Ms. Madelyn Creedon is here in person. She is a nonresident fellow at The Brookings Institution here in Washington. General (retired) Robert Kehler is affiliated with the Center for International

Security and Cooperation at Stanford University. Mr. Todd Harrison, director of the Aerospace Security Project at the Center for Strategic and International Studies and, I may add, the author of an exciting new study that I will refer to later. And Mr. Tim Morrison, senior fellow at the Hudson Institute.

Today's hearing concerns advances that Russia and China are making in their space and nuclear weapons programs and how the U.S. should respond to these advances.

Someone is not muted on the screen.

Discussions like this are usually held in secret, but both my ranking member and I think that we should highlight these issues for the public so that the public can be included in the debate.

To give you a small example of what we are talking about, decades ago the U.S. Air Force created the GPS [Global Positioning System] navigation and timing system, not just for itself but for the entire world. Yes, GPS is one of the benefits of the U.S. military. Because the U.S. offered it completely free, not even thinking of charging for the service, GPS is one of the largest gifts in the history of diplomacy, worth an estimated \$1 trillion annually to all the nations of the world.

This gift approaches the magnitude of freedom of the seas, and even world peace, as benefits to the globe.

Enjoying such a gift, why would our potential adversaries, and even some of our allies, choose to spend billions of dollars to copy GPS with their own proprietary versions, and then to develop technologies that could destroy our GPS satellites? Is there an innocent explanation for this behavior? Wouldn't they be worried if the roles were reversed?

Their actions seem to be much worse than ingratitude. They are, in effect, looking at our gift horses in the mouth and then going to the extraordinary trouble of breeding their own stable horses while conspiring to possibly kill all of ours. Friendly neighbors don't do that.

Similar examples can be found in countless other areas of strategic competition. Why are our potential adversaries spending so much time and trouble developing so many low-yield nuclear weapons?

Why would Vladimir Putin, the dictator that President Trump never criticized once during his term of office, have a showy press conference where he delighted in describing virtually every possible variety of nuclear weapons that Russia is developing?

And why are the Chinese on a path to multiply their nuclear arsenal after many years of stability?

These and other questions are the subject of this hearing.

I now turn to my ranking member, Mr. Turner, for any opening remarks that he may have.

[The prepared statement of Mr. Cooper can be found in the Appendix on page 35.]

STATEMENT OF HON. MICHAEL R. TURNER, A REPRESENTATIVE FROM OHIO, RANKING MEMBER, SUBCOMMITTEE ON STRATEGIC FORCES

Mr. TURNER. Thank you, Mr. Chairman. Thank you for holding this hearing. This is incredibly important that we have a public

discussion about what our adversaries are doing. The more that we learn from experts about Russia and China's nuclear and space capabilities and how they threaten U.S. and allied national security, I think it helps give us an understanding of what we need to be doing.

I would like to give my thanks to all the witnesses who will be participating today. I certainly want to recognize Tim Morrison, who is a Strategic Forces alum. We appreciate him being here.

To give some context of what our adversaries are doing in Russia and China I am going to offer several quotes from others about what they are doing. And I want to just open with one, you know, aspect of I think where sometimes we fall short.

So many times when assessments are being done we look at what our adversaries are doing and try to rationalize them, assuming that they are taking actions based upon our actions, that our actions have justified theirs. Clearly what they are, what Russia and China is doing is not a response or result of United States actions. However, when you look at the to-do list of this subcommittee, our response has to be with an understanding of what their actions are.

Here are some of the comments by our defense intelligence and military leaders.

General Robert Ashley, then director for the Defense Intelligence Agency, publicly stated in 2019, "Russia's stockpile of non-strategic nuclear weapons, already large and diverse, is being modernized with an eye towards greater accuracy, longer ranges, and lower yields, to suit their potential warfighting role."

Now, remember, warfighting is not deterrence, it is warfighting.

"The U.S. has determined that Russia's actions have strained key pillars of arms control architecture. The United States believes that Russia probably is not adhering"—this is his words again—"that Russia is probably not adhering to the nuclear testing moratorium in a manner consistent with the zero yield standard. And Russia is also pursuing novel nuclear delivery systems," some which we will hear about today, "that create a strategic challenge for the U.S., and which are difficult to manage under current arms control agreements."

On China, according to General Ashley, "China soon will yield"—excuse me, "China will soon field its own version of a nuclear triad, demonstrating China's commitment to expanding the role and centrality of nuclear forces in Beijing's military aspirations. And like Russia, China is also working to field nuclear theater range precision strike systems. While China's overall arsenal is assessed to be much smaller than Russia's, this does not make this trend any less concerning."

Admiral Charles Richard, the commander of the U.S. Strategic Command, this January publicly reinforced those troubling trends by stating, "More than a decade ago, Russia began aggressively modernizing its nuclear forces, including its non-treaty-accountable medium- and short-range systems."

Russian nuclear "modernization is about 70 percent complete and on track to be fully realized in a few years."

And on China he stated, "China is also on a trajectory to be a strategic peer, and should not be mistaken as a lesser included

case. China's nuclear weapons stockpile is expected to double, if not triple, or quadruple over the next decade." Again, his words.

Russia and China have begun to aggressively challenge international norms and global peace using instruments of power and threats of force in ways not seen since the height of the Cold War, and in many cases in ways not seen during the Cold War such as cyberattacks and threats in space, according to Admiral Richard.

General John Hyten, Vice Chairman of the Joint Chiefs of Staff, at a National Security Space Association event in January said, "Russia and China are building capabilities to challenge us in space, because if they can challenge us in space they understand, as dependent as we are in space they can challenge us as a nation."

The Defense Intelligence Agency has also reported that China and Russia in particular have taken steps to challenge the United States in space, and have developed military doctrines that indicate that they view space as important to modern warfare and view counterspace capabilities as a means to reduce U.S. and allied military effectiveness.

I believe that Secretary of Defense Lloyd Austin and Deputy Secretary of Defense Kathleen Hicks, based on their confirmation hearings, recognize the strategic and existential threats that Russia and China pose to the United States. Secretary Austin endorsed the triad here in his testimony.

This year, failing to ensure that we have a credible nuclear deterrent as well as a space and counterspace capabilities will have a profound and incalculable impact on our national security. This makes it even more critical that we execute the modernization of all legs of the nuclear triad. This is necessary for us to keep, as the chairman said, world peace, to deter Russia and China from even considering escalation of a conflict with the United States.

I yield back.

Mr. COOPER. Thank you so much, Mr. Turner. We will now turn to our witnesses for their remarks. We will begin with Ms. Creedon.

**STATEMENT OF MADELYN R. CREEDON, NONRESIDENT
FELLOW, THE BROOKINGS INSTITUTION**

Ms. CREEDON. Good afternoon, Chairman Cooper, Ranking Member Turner, and members of the subcommittee. It is always an honor to appear before the House Armed Services Committee and to be back in this room. Even if wearing a mask and socially distanced, it is a pleasure to have the opportunity to actually be here in person.

First, I would like to make the normal disclosure statements. I appear today in my personal capacity. I do not represent or speak on behalf of any organization, entity, or individual, and my thoughts are my own.

The topics today—U.S. national security space, and nuclear deterrence—and the threats and challenges confronting each are both important and difficult, and should be discussed more often, particularly in an unclassified setting.

The current administration, similar to most previous administrations, probably wants to avoid a costly arms race; prevent the use of nuclear weapons; prevent a war, or, if one starts, ensure that it

is limited; enter into arms control or other agreements if consistent with national security goals; ensure transparency and stability with potential adversaries; support and strengthen alliances; ensure the U.S. national security structure is robust and military personnel are well-trained, well-equipped, and ready to respond; all while retaining a credible deterrent, including adequate nuclear forces.

The challenge, of course, is to develop policies, procedures, and forces relevant to our more chaotic and more complex world, while not starting or expanding a nuclear arms race, and not getting embroiled in a push for numerical parity with Russia, or China, or both.

The United States will no doubt seek to maintain a qualitative, if not quantitative, advantage to ensure deterrence in all domains. How to do this and not break the bank is the challenge.

Today's hearing is not an intelligence hearing. Certainly, you all received the detailed classified briefings and are well aware of what Russia and China are doing to each further their own self-interests and respond to their own perceived threats. Although there are areas of uncertainty, much has been written openly about each country's modernization activities and policies, and to varying degrees each country has provided insight into their own long-term thinking.

China has rapidly expanded its conventional missile and air defense capabilities, and is modernizing its naval and war—naval and air systems. China's satellite fleet is second only to the U.S. fleet, and it has plans to expand its manned space program. It is developing a wide array of kinetic and non-kinetic anti-satellite systems, ASATs, and has tested its kinetic ASAT system in a very public way. In addition, it is expanding its own on-orbit military capabilities.

China's nuclear modernization appears to be largely consistent with its longstanding doctrine. Historically, China has taken the view that it will sustain a minimal deterrence capability and maintain a no-first-use posture. Consistent with no-first-use, China maintains an assured second-strike, retaliatory capability which, according to Chinese doctrine should prevent nuclear attack or coercion.

In many respects, China's modernization program is responding to threats to its assured second-strike capability, such as for missile defense, and is simply reinforcing its assuredness. On the other hand, because China is increasing the size of its nuclear arsenal, possibly doubling it to around 600 warheads, and developing a true triad, some have questioned whether the modernization program may signal a future change in China's policy of minimum nuclear deterrence.

But the real contrast, however, particularly in regards to U.S. modernization, is Russia's approach to nuclear modernization. Russia has used its once decrepit and now robust infrastructure to manufacture new warheads with new military capabilities, while the U.S. has gone to great lengths to avoid any new capabilities, rebuilding existing warheads and preserving existing military characteristics.

Russia has prioritized its nuclear modernization programs while the U.S. agonizes annually over the programs and funding.

Russia has significantly modified its nuclear posture to integrate nuclear and conventional planning, thus, at least theoretically, increasing the possibility that a nuclear weapon would be used in a warfighting scenario, while the U.S. has gone to great lengths to reduce the role of U.S. nuclear weapons and improve conventional capabilities and deterrence.

I should note that Russia as well has also developed an anti-satellite capability and is expanding its ability to take away U.S. advantage in space while improving its own on-orbit capabilities.

So, the question is, what does the U.S. do?

So, I would like to offer five suggestions to the new administration as it conducts its various security, strategy, and posture reviews.

First, understand the threats and the drivers for Chinese and Russian policies and programs. Pay attention to the intelligence, including the uncertainties.

Second, have extensive and serious consultations with allies and partners, and work with them whenever possible. Don't just inform them of decisions already made and mistake foreign military sales for cooperation.

Third, to the maximum extent practical—practicable, share some of this thinking publicly, including having discussions with academics and think tanks.

Fourth, don't take anything off the table at the outset of the review. Be guided by the analysis and understanding gained during the review to shape policy, postures, and programs.

And, fifth, reestablish substantive discussions on strategic stability with Russia, China, and our allies. Explore options and topics for transparency, explore mutual misunderstandings, don't dismiss arguments out of hand, and seek agreements, if possible, that ensure stability.

So, thank you very much, and I look forward to your questions.

[The prepared statement of Ms. Creedon can be found in the Appendix on page 36.]

Mr. COOPER. Thank you, Ms. Creedon.

Now General Kehler.

STATEMENT OF GEN C. ROBERT KEHLER, USAF (RET.), AFFILIATE, CENTER FOR INTERNATIONAL SECURITY AND CO-OPERATION, STANFORD UNIVERSITY

General KEHLER. Thank you, Mr. Chairman, and Ranking Member Turner, distinguished members of the subcommittee. I am honored to join with you today. Pleased to offer my personal perspective on near-peer advancements in space and nuclear weapons.

Let me say at the outset that I am going to present the viewpoint of a former senior commander, but not an intelligence analyst; but I am representing my own views here today, not the official policy or position of the Strategic Command, or the Department of Defense, or the United States Government. So, I am mindful of your time. Let me make four quick points to you for your consideration.

First, China and Russia continue to invest in decades-long military modernization programs. And those programs are delivering

highly capable weapons systems. While both countries are pursuing different grand strategies, both are on pathways to field modern forces that can employ integrated nuclear and non-nuclear capabilities across domains to hold valuable targets in the U.S., in our allied homelands, and in our territories at risk, while they are also deploying other capabilities to disrupt or deny our ability to project power and conduct military campaigns.

In a significant departure from the Cold War, these modern strategic capabilities allow them to threaten our homeland below the nuclear threshold with long-range conventional and cyber weapons, while holding nuclear weapons as the ultimate threat. In essence, they can now credibly hold us at risk without having to be concerned about crossing the nuclear threshold, and use that to leverage our decision-making.

In both of the minds of the Chinese and the Russians, this credible strategic threat is going to raise the risks and costs of our intervention in regional affairs, and enable more assertive foreign policies and aggressive behaviors on their part.

Second point, nuclear and space modernization efforts have received particular attention in both countries, as has the development of cyberspace capabilities, not a subject for this hearing directly today, but I think something that should always be at the front of our conversation. The nuclear threat clearly remains the worst-case threat. And as far into the future as I can see, we are going to have to deter the actual or coercive use of nuclear weapons against us by any nuclear-armed adversaries, particularly Russia and China.

The Russian and Chinese nuclear programs are different, but both are ambitious, and production is well underway in both countries to deliver new ballistic missiles, cruise missiles, and launch platforms to include new ballistic missile submarines, which is a first for the Chinese.

Despite delivery and other problems, according to President Putin modern equipment now makes up 82 percent of Russia's nuclear triad. President Putin has also announced his country's intent to pursue what some are calling novel nuclear capabilities, some of which are not accountable within the New START [Strategic Arms Reduction] Treaty and its extension.

Chinese nuclear modernization is also impressive, and includes new road-mobile ICBMs [intercontinental ballistic missiles] and new submarine-launched ballistic missile systems.

My third point, China and Russia have backed their impressive programmatic progress with updated strategies and doctrine, new organizations, and aggressive and realistic training. Some of the results of their modernization and this new doctrine and organizational structure and training have been demonstrated very capably in contingencies, for example the Russian invasion of the Ukraine, and certainly what we see out of Russia and China on the cyber front.

So, I agree with those who point out that over the last decade Russia has come to rely more on nuclear weapons in its military and national security strategy. And it looks like Russian doctrine goes beyond basic deterrence and into regional warfighting, a point

that I believe is validated by their introduction of low-yield weapons.

While China still professes a no-first-use policy, some interpret Chinese nuclear ambitions and their emerging capabilities to represent a pathway to a more responsive or perhaps a first strike capability. We will have to wait and see. But any declaratory policy can be quickly abandoned if it is in China's best interests to do so.

I believe it is important for you to remember that either Russia, or to a lesser extent China, can unleash large-scale nuclear attacks against the United States and our allies. And as unlikely as it might be, Russia still retains the ability to destroy the United States with a massive nuclear strike with little or no warning.

My final point deals with space, where China and Russia are both making determined investments to exploit our vulnerabilities and threaten our most important national security space capabilities. While some of their advances have been impressive, I am most concerned about what both countries are doing in space.

Both have practiced orbital rendezvous and inspection.

Both have launched satellites and have gotten close to our important national security satellites and performed what looked like intelligence gathering or rehearsals to attack them in some way.

And as an aside, while again it is not a specific subject of this hearing, I am even more concerned about the cyber threat to our satellites, our industry, our infrastructure, and our networks and the data that flows through them.

Mr. Chairman and subcommittee members, I can't recall a time during my professional career when potential threats to our security were more varied or pronounced than they are today. These threats go well beyond Russia and China and nuclear and space. I recognize you are facing critical decisions about an unprecedented set of competing national priorities, but the United States cannot defer or delay the bipartisan strategic modernization program that was laid out well over a decade ago.

To preserve deterrence and underwrite the security of the United States and our allies and partners, we must modernize all three legs of our nuclear triad and improve the resilience and performance of the critical nuclear command, control, and communications system. We must follow your bold steps to create a separate United States Space Force by adding investment in sensible growth, in resilient space capabilities, and in the means to deny an adversary's use of space should that become necessary.

And we must invest in non-kinetic capabilities to address the growing threats through cyberspace.

As always, supporting the men and women who serve in and lead our military is the highest priority or all.

Thanks again for your continued focus on these critical issues and for inviting me to participate today. I look forward to your questions.

[The prepared statement of General Kehler can be found in the Appendix on page 49.]

Mr. COOPER. Thank you so much, General. I appreciate that.

Before we get to Mr. Harrison, let me promote his new report from CSIS [Center for Strategic and International Studies]. If the definition of politics is putting the cookies on a low shelf, it is real-

ly hard to imagine a nuclear weapons space report that quotes Harry Potter figures such as Albus Dumbledore so extensively. I was reassured that although Mr. Harrison claims to have been a resident of Gryffindor House, I am glad that he is aided by Kaitlyn Johnson, who apparently is a Slytherin, much more familiar with the dark arts.

So, this is a remarkable new report and should do a lot to help the general public understand the issues that we are dealing with.

So, without further ado, Mr. Harrison.

STATEMENT OF TODD HARRISON, DIRECTOR, AEROSPACE SECURITY PROJECT, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES

Mr. HARRISON. Thank you, Chairman Cooper, Ranking Member Turner, and distinguished members of the subcommittee, I just want to thank you for the opportunity to testify today.

Space has traditionally been viewed by many as the domain of science, commerce, and exploration. While that continues to be true, it is also a warfighting domain. Since the beginning of the Space Age, satellites have provided important military capabilities for warfighters on Earth. And as soon as the military potential of space became apparent, nations started developing ways to attack space systems.

History provides some hard truths that many in the space community and national security enterprise may find difficult to accept. Space was never really a sanctuary; space was militarized from the beginning. And if one considers a satellite that can attack other satellites a space weapon, then space has already been weaponized as well.

The choice facing the United States today in space is not whether we should militarize or weaponize space. That has already happened. Our decision is how to respond to the threats we face in the domain.

In our annual CSIS Space Threat Assessment, we document publicly available information on the counterspace capabilities of other nations. While China has conducted a widely condemned anti-satellite test back in 2007, what is less known is that China continued testing its direct-ascent ASAT weapons at a pace of about once each year.

Russia has been testing similar direct-ascent ASAT weapons with its most recent test in December of 2020, and it has revived its co-orbital ASAT capabilities that date back to the 1960s.

Last summer, the Russian Cosmos 2543 satellite maneuvered near another Russian satellite and fired what was believed to be a projectile. While kinetic forms of attacks such as these often receive the most attention, there are many other types of counterspace weapons being developed and proliferated by Russia, China, and others, to include lasers that can dazzle or blind the sensors on satellites; electronic warfare systems that can jam or spoof the signals going to or from satellites; and cyberattacks against the ground systems that control satellites.

The data is clear: both China and Russia pose serious threats to commercial, civil, and military space systems. But the lack of public discourse about how to defend against space threats may have

led some to mistakenly conclude that space is not defensible and should not be relied upon by the military. The fact that space is contested just means that the United States will have to fight to protect its ability to operate in this domain, just as it does in the air, land, and maritime domains.

A wide array of defenses are available to improve the protection of space systems from counterspace weapons. These include passive defenses that make space systems more difficult to attack, and active defenses that target the threats themselves.

In the CSIS report that Chairman Cooper referenced, we detail a broad range of these space defenses, and make seven recommendations for investment priorities, actions, and additional analysis to improve U.S. space defense capabilities. I want to highlight four of these recommendations for the subcommittee today.

First, a priority should be placed on improving space domain awareness capabilities to include more space-based sensors, better integration with commercial and friendly foreign government space surveillance networks, and the use of artificial intelligence to analyze data and form a better understanding of adversary capabilities and intentions.

Second, new space architectures are needed. They use a combination of distribution, proliferation, and diversification of orbits. These new architectures do not necessarily need to replace legacy architectures, but rather should be used to supplement and diversify existing space capabilities.

Third, non-kinetic active defenses such as onboard jamming and lasing systems are needed to protect high-value satellites from kinetic attacks. DOD [Department of Defense] should also explore a physical seizure capability that can grab uncooperative satellites that pose a threat to critical military capabilities or the space environment itself.

And, fourth, new options should be considered to improve DOD's integration with commercial space operators, such as creating a program like the Civil Reserve Air Fleet with commercial space companies.

Progress is being made in some but not all of these areas. Investments in space defenses are especially important now because the U.S. military is in the process of modernizing many of its key satellite constellations. The decisions made over the coming months and years about what types of space architectures to build, and which defenses to incorporate, will have repercussions for the life of these systems.

Thank you, and I look forward to your questions.

[The prepared statement of Mr. Harrison can be found in the Appendix on page 62.]

Mr. COOPER. Thank you so much, Mr. Harrison.

And now we will hear from Mr. Morrison.

**STATEMENT OF TIM MORRISON, SENIOR FELLOW,
HUDSON INSTITUTE**

Mr. MORRISON. Sorry about that.

Chairman Cooper, Ranking Member Turner, members of the subcommittee, thank you for the invitation to testify today and for holding a public hearing on this most important topic. I would like

to recap a few important points from my prepared statement, which I submitted yesterday.

There is an arms race underway. Today the U.S. is sitting on the sidelines.

I would never try to sit in your shoes, Madelyn.

We have long known about Russia's reliance on its nuclear forces. Russia is a failing state, a declining power. To paraphrase former Senator John McCain, Russia is a Mafia-run gas station with nuclear weapons. Its nuclear forces are just another example of Putin's need to cheaply create relevance for a formerly great power he is steering into the ground at an increasing rate of speed.

More recently, the activities of the Chinese Communist Party, including with respect to its nuclear forces, have become increasingly alarming. The People's Republic of China has been growing its nuclear forces behind what the then-Special Presidential Envoy for Arms Control, Ambassador Marshall Billingslea, called The Great Wall of Secrecy.

That General Secretary Xi Jinping would do this should not be surprising. It has been clear since he took power in 2012 that he was a Chinese leader who was done with the practice of previous Chinese Party leadership to "hide and bide." General Secretary Xi promises the "eventual demise of capitalism." He promises that Chinese socialism will "win the initiative and have the dominant position."

This is not a promise of peaceful coexistence between competing world views. We have not heard such rhetoric since Soviet First Secretary Nikita Khrushchev warned the West, "We will bury you."

With respect to Russia's nuclear program, a decade after New START was ratified, Russia's accomplishment was clear: Putin had managed to exempt from arms control the bulk of his nuclear modernization program. Then-Secretary of State Pompeo stated, and I quote, "Only 45 percent of Russia's nuclear arsenal is subject to numerical limits. Meanwhile, that agreement restricts 92 percent of America's arsenal."

It is the simple fact that virtually every nuclear weapons delivery vehicle the U.S. can deploy, and every type of nuclear weapon we deploy is limited by arms control. That simply is not the case with the Russian Federation.

We have recently seen the Biden administration pursue the 5-year extension of the New START Treaty. We have locked in these Russian advantages for 5 more years.

Now, Secretary—excuse me, now-Secretary of Defense Lloyd Austin stated to the Senate Armed Services Committee, "I agree that nuclear deterrence is the department's highest priority mission, and that updating and overhauling our nation's nuclear forces is a critical national security priority." He joins a long line of our nation's senior national security leaders, military and civilian, who have stated that nuclear deterrence is the top priority for the Department of Defense.

What this subcommittee should do to counter the aforementioned threats is recommit to the bipartisan Obama-Trump nuclear modernization program. This bipartisan plan means modernizing the complementary three-legged stool of nuclear weapons delivery systems. I would be surprised if anyone in this room owns a car as

old as any one of these delivery systems, all of which are beyond their design life.

A classic 1964 Ford Mustang would be the exception to the rule, and I would be quite jealous, but I doubt that is the car you depend on. Also, that 1964 Mustang is probably younger than some of the B-52s we operate today.

This bipartisan modernization program also includes Manhattan Project era complex nuclear weapons production facilities. A modernized plutonium pit production and uranium manufacturing capability were integral elements of the bipartisan Obama-Trump nuclear deterrent modernization program. I urge you to continue to support this bipartisan national security policy.

Thank you for the opportunity to testify today. And happy birthday, Maria.

[The prepared statement of Mr. Morrison can be found in the Appendix on page 74.]

Mr. TURNER. Mr. Chairman, could we take a moment so they could figure out the microphones for a moment and address it?

Mr. COOPER. Sure.

Mr. TURNER. Thank you.

Mr. COOPER. You upstaged me. I didn't know it was Maria's birthday today. That's a significant national security event. [Laughter.]

[Pause.]

Mr. COOPER. We will now move to member questions. I am going to restrain myself and just ask one. But before I do that, I would like to ask unanimous consent that the ranking member of the full committee, when he joins us, Mr. Rogers, will be able to be inserted into the lineup here because we have a long list of folks who want to ask questions already.

So, without objection, so ordered.

I would like to ask Ms. Creedon, you make a couple of very salient points in your testimony. One, that for the last 25 years virtually every expectation that U.S. policymakers have had regarding China has led to disappointment in terms of their refusal to join the world order. And then you point out that somehow we must figure out a way to compete with China without isolating it.

And I am wondering, in your testimony I think you refer to the need to have a whole-of-government approach, things like that. And it reminds me that we have enough difficulty here even having interagency approach, must less a whole-of-government approach. And China doesn't always succeed, but they try to pull off whole-of-society approaches which, at least since World War II, has been extremely difficult for us to pull off.

So, are we at a systematic disadvantage when it comes to these mega-challenges vis-a-vis a state capitalist system like the Chinese one?

Ms. CREEDON. Fundamentally, I would say no. But I think where we might have a disadvantage is we just haven't exercised the whole-of-government approach in a meaningful and consistent way. I think we are getting a little bit better. But, as the new administration begins to conduct its various reviews, it at least has said that it wants to do a more holistic review.

So, even though there will be, in my mind, chapters, if you will, on space, and nuclear, and all the other things that line up in a national defense or national security strategy, the thinking is that these will be substantially less stovepiped and that we will also look at how our other tools of government, so, diplomatic, including sanctions, but other diplomatic will also come into play.

So, we're not at a fundamental disadvantage, but we are going to have to learn, I think, how to do better on the whole-of-government approach.

Mr. COOPER. Thank you.

I will now turn to the ranking member, Mr. Turner.

Mr. TURNER. Thank you. I want to note to our virtual participants, I will be getting to you. I don't want to show that I am having a preference for those who are here, but my preference is actually I have two lawyers here, and so we'll be getting to you guys in just a minute.

Ms. Creedon, first off, thank you for your service. You read your resumé and it is extraordinary in the amount of both your expertise and the service in which you have provided. Thank you for that. So, and your continued contribution to the dialog and discussion is incredibly important as a result of that wealth of knowledge that you have.

You said something in your opening presentation I would like for you to return to and elaborate for a moment. And you said we need to work—as you were giving us a numerical list of what we should be doing—you said we need to work with our allies.

I want to tell you something anecdotal and then I want to ask for your advice on it.

So, you would be familiar with the RAND [Corporation] study when it came out and looked at the Baltics, and said that basically they are not defensible and it could result in nuclear war and/or loss if Russia should take actions against them. I had some parliamentarians from NATO [North Atlantic Treaty Organization] allies together at the Library of Congress where we did a tabletop exercise with RAND.

And I was so surprised at how little the parliamentarians knew about their own neighborhood. They did not know what was there. So many times, as the chairman has made the point when he opened this hearing, we are reticent to tell the story of what the adversaries are doing, so much so that our allies even are uninformed.

Ms. Creedon, what could we do, what should we do to make certain that our allies know what the real threat is from Russia and China?

Ms. CREEDON. First, thank you very much, Mr. Turner for those kind words. As you well know, these topics are quite near and dear to my heart.

So, one of the things that I have always thought interesting is General Raymond, who is the first commander of the new U.S. Space Command, for many years has said that we suffer from extensive over-classification of almost everything. It is certainly true in space, and it is true in things nuclear.

It is a delicate balance as to how we protect secrets that need to be protected, and yet at the same time convey both what our ad-

versaries are doing and what we have the capabilities to do in response.

That said, there is a tremendous amount of information that is publicly available. And we just need to have those discussions publicly. So, not only is the recommendation to work with allies, but the other rec—one of the other recommendations is to do things more publicly: have hearings like this, have the administration comment more publicly on their thinking, have them meet with various groups, and think tanks, and academics. But somehow we have to get this understanding more in the public domain.

I know we ignored it for many, many years, but it has changed. And it has changed remarkably in really the last 10 years. So, I know we always talk about sort of the end of the Cold War, and that is all well and good. But we are in something that it is not a new Cold War, it is not a post-Cold War, it is its own thing, and it is really different from where we have been before. And having those discussions about what it is, is really important.

So, I totally support this hearing and anything that this committee can do.

Mr. TURNER. Thank you. Well, with the fall of Crimea it is a hot war, not a cold war.

Mr. Morrison, with both China and Russia developing hyper-sonics; with Russia doing their tests on Skyfall, their nuclear-powered, orbiting missile; with Poseidon, with their development of a underwater, unmanned, pop-up nuclear weapon, you see in their portfolio and in China's portfolio an attempt at the element of surprise. Well, surprise tends to bend itself toward first strike. First strike bends itself to instability. And it certainly gets us past the issue of deterrence.

As you look to what our adversaries are currently doing, do you worry about the United States having vulnerability of our adversaries attacking us without warning, and without there being an ongoing conflict when you cast that in light of the capabilities that they are seeking?

Mr. MORRISON. Congressman, thank you. I do, but maybe not in the same way as, as some others.

I think we, we talk about modernizing the triad. We talk about modernizing the production and infrastructure of the NNSA [National Nuclear Security Administration]. The nuclear command and control system is an urgent priority to make sure that the President always maintains his positive control of our nuclear force so that you maintain both the assured first-strike capability, if needed, but also an assured second strike. That is the advantage of the complementarity of the triad, the large ICBM force that would take a significant incoming strike to try to, to try to knock out.

And I think this is also where you have to look at some of the proposals that have been offered that could risk upsetting the current stability that exists between the U.S. and Russia, the U.S. and China, at some point maybe the U.S. versus Russia and China together. And that is ideas like no first use, like de-alerting. These are ideas that risk upsetting stability by giving an adversary an idea that maybe they could go first and succeed in preventing a second strike.

And I think we have to be very careful about some of these nice-sounding ideas that could actually wind up creating some pretty grave consequences that weren't intended.

Mr. TURNER. So, you would say that the modernization that we have undertaken is absolutely essential in order to avoid that vulnerability?

Mr. MORRISON. Sir, more—yes. And more important than my opinion is the opinion of the current Secretary of Defense, the last four Secretaries of Defense of both administrations, the current Chairman of the Joint Chiefs, the recent Chairman of the Joint Chiefs, the serious national security consensus that exists among Republican officials and Democrat officials, this program is important and must be preserved.

Mr. TURNER. General Kehler, you have an unbelievable legacy of working on actual plans to defend the United States, looking at what our adversaries might do, and looking to the needs of modernization. Let's go back, let's go back 10 years from now and then take a look forward as to what you see.

Would you have been surprised that we are where we are? Would you be surprised that modernization had not yet happened? And would you have been surprised by the moves that our adversaries have made? Or, do you think that the signals have been there all along?

General KEHLER. Congressman, I think the signals have been there for quite some time. I think we went through a time period in the United States where we were distracted from this set of issues. And I think that showed. It showed in, I think, in a reduction in confidence in the people who are in the nuclear forces that resulted in some very unfortunate issues of discipline and those kind of things that we had to deal with.

But most importantly, I think we were a little bit like the 5-year-old soccer players who all run to the ball. And it is understandable why we did that. But the ball that was thrown onto the field on 9/11 of 2001 diverted us in a pathway for well over a decade.

And so, I think for a while it was very difficult for some of us to continue to be that kid banging the highchair with a spoon and saying, but look, these other things are going on. There's a strategic set of issues here that the country needs to be mindful of.

And even while I certainly supported the focus that we had to put on that single issue about counterterrorism and those matters that, by the way, still haven't gone away either, there still has to be a balancing act done here. But we took a holiday, I believe, from looking at these matters for far too long. And I think that holiday is over.

It doesn't surprise me that Russia and China have progressed. It disappoints me a little bit that we are still having somewhat of maybe an argument/conversation about what we should do about it. I think, like you have heard my colleagues say, there was a bipartisan agreement about how to go forward. I do think that some of those priorities have shifted. I think that we need to pay far more attention than we were giving lip service to for nuclear command, control, and communications. I think that has certainly risen, in my view, given the cyber threats and some other things that we are now facing.

So, I guess I am a little surprised by the way the cyber threat has unfolded, the pace with which and the boldness that Russia and China have been using to employ cyber capabilities. But it is time for us to stop discussing what we should do next and go do it. And I think that that will be a big disappointment to me and I think a threat to the country if we don't.

Mr. TURNER. I yield back. Thank you.

Mr. COOPER. Thank you, Mr. Turner.

Before we proceed to member questioning, I would like to urge our colleagues, at least in my opinion, when we use the term "modernization" for our nuclear weapons that leads to the possibility of false equivalency, like we are modernizing, Russians are modernizing. But it is a qualitative and quantitative difference of incredible magnitude.

So often we are, as the members know, using life extension programs which really is kind of the weakest form of modernization. We are doing no new testing. We are not even sure if these other nations, as Mr. Morrison points out in his testimony, are even complying with the Nuclear Test Ban Treaty or the chemical weapons treaties. And here we are putting our weapons on Geritol and Ensure, trying to let them eke out a few more years. That is the weakest form of modernization.

So I just think, as we consider this, we are doing, like, the minimum possible to keep what we had, you know, many decades ago. These other nations, when you mention words like "Skyfall," we know what that means, but to have orbiting nuclear weapons, or nuclear airplanes with nuclear weapons, like, forever, and even approaching us from the south, to have perpetual nuclear torpedoes, these are unthinkable sorts of things. So, we are not even approaching that level of devilment. So, we have to keep things in perspective.

The first question would be to Mr. Langevin, who is with us on Webex.

Mr. LANGEVIN. Very good. Can you hear me, Mr. Chairman?

Mr. COOPER. Yes, sir.

Mr. LANGEVIN. Very good. Well, good afternoon. Thank you, Mr. Chairman, and good afternoon. Thank you to our witnesses here today, in particular General Kehler. Great to see you again. And thank you all for your testimony. I particularly enjoyed that last exchange there with General Kehler with respect to the questions from Mr. Turner.

If I could, I will start with Mr. Morrison. As you know, automation in the NC3 [nuclear command, control, and communications] systems is not new. Yet, new AI [artificial intelligence] techniques could accelerate decision-making or dangerously lead to false positives. Are China and Russia integrating deep learning and other AI tools? And should the U.S. integrate deep learning and other AI tools into its nuclear systems? And what are the unique risks that policymakers should consider?

Mr. MORRISON. Congressman, thank you very much. So, based on public reporting there is evidence to show that Russia, for example, has automated nuclear command and control systems, the so-called Dead Hand or Perimeter system. You could find references to this

in General Ashley's statement that has been referenced here a couple times from his May 2019 speech to the Hudson Institute.

China has set out to undertake a significant artificial intelligence program to displace the U.S. as the world's leader in artificial intelligence. I am not aware of public reporting about how they are using their artificial intelligence capabilities, but I think it is safe to assume that they will include them across their military complex.

And for the U.S., there is automation at various levels of our system, primarily early warning. But we always keep the man in the loop and the President always has positive control of nuclear weapons. And that is the way it should be.

Mr. LANGEVIN. Thank you. If I could, the next question, for General Kehler, the People's Liberation Army considers cyber capabilities to be an integral part of strategic and nuclear deterrence. They could use cyber strikes on military or economic targets to intimidate and deter future action, or they could constrain adversaries' response options by hitting communications systems.

General Kehler, do we expect our nation's NC3 infrastructure to be one of these targets in the deterrence phase? And how could compromises to non-NC3 systems potentially distort decision-making by lowering trust in the NC3 proper, even if those systems are not, in fact, compromised?

General KEHLER. Congressman, good to see you again as well, and thanks for the question. I am very concerned about the cyber threat that has grown, really, in significant ways. And we see that demonstrated often. Unfortunately, we see it demonstrated from nation-states and from other sophisticated actors, criminals and others. I do think that certainly our critical nuclear command and control will be a target. We expect that it would be a kinetic target; we expect it would be a nuclear target; there is no reason to expect it would not be a cyber target, particularly in advance of any kind of other activity.

I have long believed that if we ever get into a conflict with a China or a Russia, that that conflict will begin in cyberspace and may not go kinetic for quite some time. I think space and cyberspace will be early areas of conflict in some future war.

And it leads to, as we think about modernizing our nuclear command and control system and we recognize that in the future it is going to be very hard to determine what networks serve what pieces of our military establishment, cloud operations and other things, I think drawing a bright line around that in the future is going to be increasingly difficult to do.

I think there are some things we could always point to and say that is clearly part of our nuclear command and control and we have special sensitivity about that. But I think that for us to try to differentiate, if you will, in the future is going to be very difficult to do.

I am told by cyber experts that some of the ways that we can retain confidence in our systems as we go forward is to share systems, that we have resilient pathways, and that it will be difficult for an adversary to determine where to attack.

So, I think that our notions in the past about drawing a line around those things that are related to nuclear command and con-

trol, particularly saying those 5 things, or 6 things, or 12 things, whatever it is, are part of our nuclear thin line, I think that as we share the capabilities that commercial space brings to the fight, for example, as they are being made part of the architectures that we use for resilience, I think this is going to be a tougher problem for us to try to address.

Mr. LANGEVIN. Very good. Thank you for that answer. I appreciate that. Thanks again for your service to the nation, General.

With that, Mr. Chairman, my time has expired, so I yield back.

Mr. COOPER. Thank you, Mr. Langevin.

Mr. Wilson.

Mr. WILSON. Thank you, Mr. Chairman. And we have our sympathy to you, Mr. Chairman, on the loss of your wife Martha. And you are both so well thought of here in Congress. God bless you.

Mr. COOPER. You are very kind. Thank you.

Mr. WILSON. And we appreciate very much the witnesses here today, your insight. Dr. Creedon, congratulations on your years of dedicated service to our nuclear security enterprise, including your recent tenure as the principal deputy administrator at the National Nuclear Security Administration.

Most U.S. nuclear systems have been extended far beyond their intended life cycles and require significant, consistent investment over the next two decades to maintain the expert workforce and the necessary facilities to sustain them, while we lose more critical capabilities. For example, the United States is the only nuclear weapons state that cannot currently develop a plutonium pit for deployment.

This committee sought to address this in the bipartisan fiscal year 2021 NDAA [National Defense Authorization Act] by directing the modernization of our plutonium pits, including production of 80 pits per year at 2 sites by 2030.

My question: How does our uncertain funding cycle threaten the credibility of our nuclear deterrence against Russia and China, who are building or updating their own triads? Where should our modernization priorities be focused, both in the short term and the long term?

Ms. CREEDON. Thank you very much, sir, for the kind words and also for the question.

I do think this is incredibly important. One of the things that I mentioned in my opening statement was there is a very stark contrast between Russia, which has prioritized its nuclear modernization, and the U.S., which has significant debates every year about whether the nuclear modernization should move forward.

But, fundamental to any modernization is the infrastructure and also the people. And particularly challenging is the infrastructure at the NNSA, the National Nuclear Security Administration. The science infrastructure is in pretty good shape, but we can't keep our—we can't take our eyes off that ball. We have to continue to support the science that underpins our ability to modernize and to make changes, which are going to be inevitable in the future.

But, most importantly, the production complex has really suffered from many years of neglect. There are some significant advances. There is a new uranium storage facility. The uranium processing facility is well underway; it is on schedule and on budget.

Knock on wood that it stays that way. But we do not have the ability to make plutonium pits. This is a key element of modernization. Even the life extension programs are going to require new pits, newly manufactured pits, and we have to get on with this.

Now, I know there is lots of debate about how many we need and where we build them and all that. Let's have that debate. But we truly have to get on with modernizing this infrastructure at all levels.

Mr. WILSON. Thank you very much, Doctor. And thank you for your promoting that very positive statement.

And, Mr. Morrison, thank you for your 17 years of service on Capitol Hill, including as the staff director of this very subcommittee. You have made a very positive difference.

In regard to arms control, China's lack of transparency on its nuclear policies, disposition, and development of hypersonic nuclear systems indicates it is moving away from its longstanding minimalist force structure in a direction that undermines regional and global instability.

Based on China's recent nuclear modernization and preparations to operate its test site year-round, how accurate is the assessment of their nuclear ambitions? Given that trust is a precondition of any nuclear arms treaty, how is the outlook for reasonable, verifiable nuclear arms control with China, given their lack of transparency?

Mr. MORRISON. Congressman Wilson, thank you for your kind words. Yeah, I agree that these are very difficult circumstances. The Chinese—transparency is anathema to the Chinese Communist Party's hold on power. And so, you know, that, I think, was one of the things that the previous administration was trying to accomplish by bringing China into the discussion as soon as possible. And it wasn't about bringing China into the New START Treaty, it was about bringing China to the table. They want to be a big boy. Big boys do what serious powers do; they negotiate arms control, they adhere to their Article 6 obligations under the Non-Proliferation Treaty.

And one of my concerns is the extent to which China views the extension of New START as a 5-year reprieve for their inclusion in arms control. And I will just—I will leave it at that.

Mr. WILSON. Appreciate your insight. Thank you.

I yield back.

Mr. COOPER. Thank you. The gentleman's time has expired.

Mr. Garamendi.

Mr. GARAMENDI. Mr. Chairman, thank you for this extremely important hearing and for the testimony that has been presented, as well as the comments of my colleagues.

Stepping back from all of this for just a moment, we are really, it seems to me, talking about a new and refurbished bomb, some by us and some by our adversaries; new delivery systems which are designed to not be observed; an increased dependence on space, which is increasingly vulnerable; and overarching cyber. It appears from the testimony that both Russia and China are busily addressing all of these issues, as are we.

Now, we can argue whether we are ahead or behind or equal, or whatever, but it seems to me that we are in the midst not of the

first quarter, but certainly towards the end of the first half of a new nuclear arms race. It has been going on for at least a decade, maybe longer.

So, what to do? Build new bombs? Create more sophisticated, unobservable delivery systems? Figure out how to defend ourselves in space or to attack others in space? And, of course, overarching, which nobody has yet figured out, how to be cyber secure?

My question to the four witnesses: Is it time to do what Reagan did, and Bush 1 and Bush 2, and Clinton, and Obama? Is it time for us to engage fully in arms control negotiations on all of these issues, on the delivery systems, on space, on cyber, and on the bombs themselves?

Let's start with Ms. Creedon.

Ms. CREEDON. So, the simple answer to that is yes. But we have to do this from a basis of strength. And I think we also have to do it from a basis of knowledge. And we have to do it from a basis of willing to have serious discussions.

In so many of these discussions we tend to take issues off the table peremptorily. I think we really need to listen to what is driving Russia, China, others, into their nuclear modernization, and have real discussions about what the threats are to them that they perceive. And, conversely, we need to have discussions about what the threats are to us that we perceive.

And it isn't just the three of us. Somewhere along the line we also have to bring in everybody else. We have to bring in India and Pakistan and North Korea, and even the U.K. [United Kingdom] and France, and figure out, you know, how we truly engage in some sort of multinational arms control, if possible. But, in the meantime, we really have to talk to Russia first, because between the two of us we still have the bulk of the nuclear weapons.

Mr. GARAMENDI. Thank you.

General Kehler.

General KEHLER. Congressman, thank you. I agree, and I favor talking to Russia and China and others. But I also think that we have to—we are not in equal starting points right now. And I think we have got to commit ourselves to an upgrade and a modernization of our own deterrent.

I think that there are some things—and you mentioned President Reagan. I was a young officer when President Reagan was proposing his strategic modernization program and a way to deal with the Russians, et cetera. And in those calculations what I recall was that the idea was that the United States should deal from a position, if not equality or strength, certainly not in a position where we were starting behind. And I think that we have deferred our modernization to the extent that if President Putin says that 82 percent of his triad is modern weapons, and ours is not, I don't think that is a good place for us to be negotiating from.

So I would encourage us, I think we can do more than one thing at a time. I don't think it is either modernize or talk; I think that we can do both of these things. But I think that we need to proceed in a way that, in fact, puts our deterrent in the place that it needs to be. Because, at the end of the day, this is really about deterrence. We don't want to fight a war with Russia. We don't want to fight a war with China. We don't want to fight a war with anyone.

And our deterrent has successfully prevented that for now 70-some years.

Mr. GARAMENDI. Excuse me, General. You don't have a clock in front of you; I have a clock in front of me, and we are out of time.

So, I will yield back, but first say that your answer is how we perpetuate an arms race: we will negotiate when we are at least as strong, if not stronger.

I yield back.

Mr. COOPER. Thank you, Mr. Garamendi. I appreciate your sensitivity to the time.

Now we need a drum roll because Doug Lamborn has made it officially on the committee. And that means that he is no longer the dead last questioner. He is claiming his rightful place according to arrival at the committee.

So, Mr. Lamborn.

Mr. LAMBORN. Well, thank you, Mr. Chairman. And it is an honor to be here. And these are critical issues.

Mr. Harrison, I am just going to jump right in and talk about an issue that is, unfortunately, becoming divisive, and we have got to work through it. You have been outspoken and critical of the Air Force's decision to move SPACECOM [United States Space Command] to Huntsville, Alabama. You said, "It reeks of being politically motivated." You said that you don't see how relocating the headquarters, building new facilities, and moving all those people improves our national security and space capabilities. And you said it will be a colossal waste of money. Why do you believe this decision adversely impacts and delays our national security?

Mr. HARRISON. Thank you, Representative Lamborn. And, yes, I believe that is not a wise decision. I don't think that they should have engaged in a basing analysis to begin with.

The job of U.S. Space Command, the core function, which used to be part of U.S. Strategic Command, has always been done out of Colorado, out of the Colorado Springs area. I don't see any reason why it needs to move. Will some of the facilities in Colorado Springs possibly need to be expanded and be upgraded over time? Absolutely. But I think it is important that we provide stability and continuity for the workforce of civilian employees that perform this important mission, and have done so for many years, for the military service members who support this mission, and for all of the private sector companies that support Space Command operations that are located out in the Colorado area. I just don't see any reason why we should be moving it at this time.

Building a new headquarters essentially out of scratch in Huntsville, Alabama, is going to cost, you know, upwards of possibly a billion dollars, similar to what the new headquarters at U.S. Strategic Command cost. And so I just think that that is an unforced error.

The way that it was announced, just before the previous administration left office, you know, the optics of that are not good. If this was a credible, you know, decision that was arrived at purely by the merits, without political influence, they could have easily handed that decision over, and a week later the new administration could have reviewed it and made the announcement. But that is not what happened. So I think it is unfortunate timing, and I think

it has, you know, created a distraction, quite frankly, for U.S. Space Command.

Mr. LAMBORN. Mr. Harrison, building on your answer, if right now the command people and the warfighters are working side-by-side to get the job done, does it help things operationally to split them apart and put one 1,000 miles away from the other?

Mr. HARRISON. Well, I think it is, you know, very valuable right now that, you know, the commander of Space Command is collocated with the Space Force's Space Operations Center, the SPOC. You know, that is a critical alignment that we need to have to make sure that we can operate and have, you know, insight and visibility in what is going on in the space domain in a crisis situation.

I think, you know, if they split those two functions apart geographically, that would be a big mistake and it could potentially degrade our space capabilities in the future.

Mr. LAMBORN. Okay, thank you. Changing gears, Mr. Morrison, our allies are more concerned about our lagging modernization efforts than some of the arms control folks seem to be. How are our allies viewing the dynamics of Russia and Chinese modernization versus our deferring modernization to try to, some people say, reduce provocation and save money?

Mr. MORRISON. Congressman, warily. They watch these debates. They hear the nation's senior military and civilian leaders come up here year after year and talk about programs needing to be accomplished, programs needing to be accomplished by certain dates or capabilities will be lost. And they see us miss those dates and they begin to ask how confident can we be in the continuation of the extended deterrent umbrella that we have extended over them for years and decades.

And, for some of these countries, they have a choice. They have a capability to go nuclear if they choose. We have to keep them assured that that is not a decision that they ultimately have to make.

Mr. LAMBORN. Thank you.

Mr. Chairman, I yield back.

Mr. COOPER. Thank you.

Mr. Carbajal.

Mr. CARBAJAL. Thank you, Mr. Chairman. The global space industry is expected to generate revenue of more than \$1 trillion by 2040, up from \$350 billion currently. While the United States historically has been a leader in space, and continues to be, China is rapidly growing its space industry and has been aggressively capturing space services market share in developing nations and attracting international partners that are allied with the United States.

General Kehler, what are the national security implications as China continues to grow its space industry and develop these international partnerships? And, certainly, other witnesses can chime in, as well, afterwards.

General KEHLER. Congressman, those are significant implications for our national security. I think today I would still offer that our space capabilities are the leading space capabilities, particularly national security. And I think our commercial industry has done

amazing, amazing things related to space, whether it's a SpaceX [audio interference].

So I wouldn't trade where we stand today as the United States. I wouldn't trade with what we're doing in orbit, as well. I think our capabilities are pretty significant. But, I think that the risk is that that goes away behind a determined effort, by the Chinese in particular, to take our place. And I think that is their grand global strategy, that they want to take the place of the United States as the world's leading superpower and the superpower that people should turn to. And space is one of those critical areas where they are trying to do that.

Mr. CARBAJAL. Thank you. Any other witness?

Mr. HARRISON. If I could comment, as well. I think that, you know, while China is definitely making advances in their space capabilities, you know, as General Kehler said, I wouldn't want to change places with them. I think what is more concerning, though, is that China is making advances in its counterspace weapons faster than we are making advances in our defenses against those counterspace weapons.

And so, in that respect, they are closing the gap because we have vulnerabilities that we are not addressing quickly enough. And I think ultimately, you know, that is a trend that we have to reverse.

Mr. CARBAJAL. Thank you. Mr. Harrison, does the United States have a sufficient whole-of-government strategy to ensure space superiority in the next decade?

Mr. HARRISON. I think we have the beginnings of a whole-of-government space strategy in the National Security Space Strategy, but I think its progress towards, you know, achieving that has been slow and uneven. And so I think it is something that requires the continued focus of the new administration to make sure that they don't let, you know, different government departments and agencies start to go in different directions.

So, I think it requires ongoing, close coordination among the Department of Defense, the intelligence community, the State Department, NASA [National Aeronautics and Space Administration], and the Department of Commerce, in particular. And, you know, I think one of the areas where we could do better as a whole-of-government approach is in trying to reach internal agreement within the U.S. Government about norms of behavior in space. What type of conduct, what type of activities do we think are okay, acceptable, and what do we think is unacceptable?

And until we can reach an internal agreement on what we think is unacceptable and should be banned, we are not going to have any hope of progress reaching broader international agreements, even with our allies and partners, to start to establish a consensus about norms of behavior in space.

Mr. CARBAJAL. Thank you.

General KEHLER. Congressman, if I could add just one comment to this, I would agree. I think the answer to your question is: not yet. There are lots of ingredients out there. This is like a recipe to produce something that is an end food product. The ingredients are there; the question is whether or not we can pull all those pieces together to make that sort of a comprehensive space capability that we know we need to have for the future.

Mr. CARBAJAL. Thank you. I am going to truncate my last question. How should we go about engaging China? Should the United States engage China? And what incentives would be most useful in beginning those discussions?

Actually, I am out of time. And due to respecting of our time, I am going to yield my time. And if I could get those answers submitted for the record, that would be great.

[The information referred to can be found in the Appendix on page 91.]

Mr. COOPER. Without objection, those questions will be submitted for the record. Any member is entitled to submit written questions to the witnesses.

I would like to thank the vice chair, the new vice chair of the committee, Mr. Carbajal. I appreciate your deference to the chair and to the clock.

Mr. CARBAJAL. Thank you, Mr. Chair.

Mr. COOPER. These are excellent qualities in a vice chair. Excellent. That is right, the clock rules all.

Mr. CARBAJAL. Thank you, Mr. Chairman.

Mr. COOPER. Mr. DesJarlais.

Dr. DESJARLAIS. Thank you, Mr. Chairman. I will start with Mr. Morrison. If we have time, I may have others comment, as well.

I think it is clear from your statement that you are no big fan of the decision to extend the New START Treaty, but it looks like that is what we are dealing with through the next 5 years. And so, I will try to weave this maybe two questions into one.

What would a more prudent arms control framework look like? But I also want you to touch as heavily as you can on Russia and China's penchants, it seems, for low-yield nuclear weapons and what that means to the United States. How might these weapons be deployed, such as the DF-26 in China, or other weapons that Russia has developed? And what does that mean for the U.S. and its allies? And what should we be doing about it?

Mr. MORRISON. So, Congressman, you are correct. I was not a fan of the decision to extend the New START Treaty for 5 years. I thought it gave up leverage that the Biden administration had to try to negotiate a better deal or a more comprehensive deal.

I mentioned in my statement Secretary Pompeo's comment about how much of our stockpile is limited by arms control versus how much of the Russian stockpile. I think the Biden administration should have taken some time, should have picked up where the previous administration had left off and pursued a shorter-term extension and not given up that leverage. Because I think we are at a point now where, you know, Russian leaders have already talked about they—you know, we blinked and they won in the decision to extend. And we have nothing to give up now to bring the Russians back to the table before 2026. So I think they are just going to sit back and they are going to wait to see what we offer. And I think that was a mistake.

But could I ask you, sir, to repeat your second question? I want to make sure I get it right.

Dr. DESJARLAIS. I just wanted you to talk a minute about how you feel about what Russia and China have been doing in terms of pursuit of low-yield nuclear weapons and developing weapons

with dual capabilities in terms of delivery systems. You know, China has the DF-26. How might these weapons be deployed and what does it mean for the U.S. and our allies moving forward?

Mr. MORRISON. Congressman, thank you. I think it shows, to some extent, an alarming shift in how the powers think about nuclear weapons. We think about nuclear weapons as a deterrent. Russia clearly thinks about nuclear weapons as warfighting tools. They have blurred the lines between the conventional and the nuclear threshold. And I fear that China may be following suit. It is early to tell.

You know, we have narrowly responded by creating a more credible option for a President to choose to employ: the low-yield D-5, which the previous administration deployed, largely at the urging of the military to close a gap in deterrence. And I think one of the things we have to look at: Are there other things that we need to do, similarly, to send a message to the Russians and the Chinese that we have a credible option to deter any of these lower-yield weapons that they may choose to use?

For example, the previous administration proposed a sea-launched cruise missile. That is an important option to keep on the table, to keep in deployment as this new administration decides how it might adjust our nuclear force and posture.

Dr. DESJARLAIS. Thanks. Do any of our other witnesses have any comments, just overview on low-yield nuclear weapons and how much that keeps you up at night?

General KEHLER. Congressman, I would only add that, again, the objective is deterrence. And so I think in our declaratory policy we need to continue to make it clear that we would choose to respond to someone crossing the nuclear threshold in a way that may not match what it is that they just did. And I think dissuading or deterring the use of nuclear weapons is about risks and costs. And I think that we need to make it clear that there is no deterrent sanctuary, if you will, for an adversary to operate in. And I think you do that by deploying a similar capability in limited numbers, and I also think we do that through the way we declare what our policies would be.

Dr. DESJARLAIS. Okay. My time is short. I would like to talk more about that in the future, but appreciate all your attendance and contributions today. I yield back.

Mr. COOPER. Thank you, Mr. DesJarlais.

Now Mr. Panetta.

Mr. PANETTA. Thank you, Mr. Chairman. Appreciate this, appreciate this hearing, appreciate being on the committee. Thank you very much.

Mr. Morrison, welcome back. And let me kind of throw you a softball, if I may. Obviously, Russia says that it has a 10-year state armament plan to invest, what, 330, I think, billion—or million, I'm sorry about that. Or a significant amount into advancing its delivery systems. But, you know, you quoted John McCain as calling Russia a Mafia-run gas station. And the other day I read *The Economist*, they called it “an economic pygmy.”

In your opinion, will Russia be able to find the money to invest and to field these types of delivery systems based on their domestic

situation? Or are these statements just a distraction from its domestic issues?

Mr. MORRISON. Congressman, thank you for the question. I guess I will start by answering, judging by how much it cost me to fill up my car last weekend, the price of oil is going up. That will take a lot of stress off the Russian budget. But I think the Russians look at their nuclear force—it is a cheap option. They can't afford to compete with a large conventional military. They are not having enough babies. They can't meet their conscription quotas. Nuclear weapons are a cheap way for them to stay at the great power table.

Mr. PANETTA. Understood. Understood. So, obviously, with that goal in mind, how will that impact the United States and NATO's missile defense architecture?

Mr. MORRISON. Well, sir, I don't know whether the new administration will undertake a ballistic missile defense review. The last administration did. It largely chose to maintain the longtime Cold War posture of not seeking to use our missile defense to deter a Russian strategic attack. That is a choice that the new administration may or may not choose to make.

I think one of the things we have to understand is, as the North Korean threat continues to develop, they talk about submarine-launched ballistic missiles, any number of capabilities, as we continue to try to pace the North Korean capability, that capability will begin to have an impact on China's force and Russia's force.

So, we are going to have to come to a conclusion here of how do we expect to continue to have this idea of a missile defense capability that is only capable against a North Korean or an Iranian threat, but not a Russian or a Chinese threat? It is not going to be tenable as the North Korean threat continues to develop and the Iranian threat develops.

Mr. PANETTA. Understood. Thank you. Moving on. General Kehler, in regards to our command and control system, obviously, you mentioned earlier about some of the cyber risks and threats that it can pose to our command and control system that allows our President to have unilateral authority. And, in 2017, you also mentioned in front of the Senate Foreign Relations Committee that the decision time for these types of decisions are much longer.

And I was wondering, based on the current environment today, do you have any thoughts on how our nuclear command and control could be reformed to reduce these types of risks associated with the President having unilateral authority?

General KEHLER. Well, sir, that is a little bit of an apples and oranges question. So, let me try it this way.

First of all, the decision process, putting it in the hands to release nuclear weapons, and that authority in the hands of the nation's most senior elected official, I think is something that evolved out of the Cold War. I think that was a national choice to do. I think that is one of the hallmarks of our nuclear command and control system. And I fully support that. I think that this is all about positive control from the highest official, the highest civilian official in the land.

I am confident in the current nuclear decision process and the layers of safeguards that go with it. I am convinced that the decision process would come to a stop and no orders would be issued

if there were legitimate issues of necessity or legality that arose. And I understand the concerns that have been voiced by some about how that authority string should work.

That is separate and distinct from the command and control system that would support decision-making. There, I think it is important for us to continue to bring that up to 21st century standards. And I think that means that it has to become more resilient. And there are ways, I am told by experts, to make it more resilient against cyber threat. Not to put a moat around it, so to speak, a figurative moat, and protect it from everything, but make sure that it can respond with high confidence in the face of the threats that are going to come along.

And one more point about decision time. I hope I didn't say that there was no longer a scenario that was time-urgent. What I hope I said was there are a lot more scenarios today that we have to consider for the use of nuclear weapons. And the most time-urgent, bolt-from-the-blue attack that we worried about in the Cold War may be the least likely of those, but it is not off the table.

Mr. PANETTA. Great. Thank you for the clarification and distinction. I am out of time. Thank you. I yield back.

Mr. COOPER. I thank the gentleman. I am assuming there is no more member interest in continuing this hearing, although it has been excellent.

Mr. WILSON. Mr. Chairman.

Mr. COOPER. Mr. Wilson.

Mr. WILSON. Mr. Wilson, one last question?

Mr. COOPER. Okay. Mr. Wilson.

Mr. WILSON. Hey, how fortunate we are to get Tim Morrison here. We could ask him questions and he has to answer.

Nuclear stockpiles. The DIA [Defense Intelligence Agency] estimates China's total warhead stockpile to be in the low 200s. But the then-DIA Director General Robert Ashley, in 2019, stated he expected over the next decade China will likely at least double the size of their nuclear stockpile. Admiral Charles Richard, commander of the Strategic Forces Command, just last month publicly wrote that he expected China's nuclear weapons stockpile is expected to double, if not triple or quadruple, over the next decade.

What do these numbers tell us about China's nuclear weapons programs, its intention to expand their forces, and how should we respond?

Mr. MORRISON. Congressman, thank you very much for the kind words, and I appreciate it. You know, I think one of the issues here is China is still a hard target. I think the chairman spoke at the outset about just how often we have been disappointed when it comes to China. I think we have to worry the extent to which some of these predictions, which are being made at an unclassified level and may have, you know, a different richness and depth to them at a classified level, the extent to which these could also be wrong, as we have been wrong about China for, I think the chairman correctly said, approximately 25 years.

You know, I think one of the points that General Ashley also made in those remarks was General Secretary Xi had given direction for the Chinese military to become a first tier force by 2050. Who are the first tier forces? The U.S., Russia has many thousands

of nuclear weapons. And I think we have to ask ourselves not only what happens if China gets to that level, but we are not just deterring China, we are deterring Russia, as well. So we have to have a stockpile sized to deter Russian misdeeds and Chinese misdeeds at the same time.

And it is not our view of what it takes to deter them; it is what deters the Chinese, it is what we can hold at risk that they don't want to lose. It is not always about what we think does the job.

Mr. WILSON. Thank you very much. And, again, Mr. Chairman, I want to thank you. I agree with you about our concerns about China. And I had such high hopes. My father served there with the Flying Tigers, and he had such a deep affection for the people of China and hopes for their future. So, thank you again for your efforts.

Mr. COOPER. Thank you, Mr. Wilson.

Now Mr. Garamendi would like the remaining two panelists to be able to answer the question he had posed to all four panelists. So, let's let Mr. Garamendi tee it up.

Mr. GARAMENDI. The question was about arms control. Should we pursue arms control negotiations?

Mr. COOPER. Should be Mr. Harrison.

Mr. GARAMENDI. I guess, Mr. Harrison, you are up and then followed by Mr. Morrison, just the order of presentation.

Mr. HARRISON. Yes. Thank you, Representative Garamendi, for the opportunity to answer this question. You know, when it comes to space, I think arms control is not something that is easy to verify, quite frankly. There are many disagreements over basic terms and concepts and how they would apply to space.

We have seen this play out over the past decade or so at the United Nations, with Russia and China proposing a treaty that, you know, they say would prevent the placement of weapons in space, but actually it would ban some types of space weapons but not others. And the ones it would not ban are the things that they have in very large numbers that can hold our space systems at risk.

So I think, you know, a better approach in space is to actually start small, in two ways. One, of course, is a one-sided vulnerability in space, you know, really invites aggression and is ultimately destabilizing. So we need to address our vulnerabilities in space and build better defenses and defensive capabilities.

The other thing we need to do is work to build consensus around a set of norms of behavior in space. And we can start small: simple things like, you know, responsible nations in space don't, you know, conduct anti-satellite tests that produce debris. You know, start with some small measures like that and gradually build up.

And, you know, as General Kehler I have heard say many times before, you know, norms of behavior in space are kind of like speed limits: they don't stop people from speeding; they just let you identify who the speeders are. I think we need to have these norms of behavior in space so that we can identify and call out the bad actors that we see in space.

Mr. GARAMENDI. Thank you, Mr. Harrison.

Mr. Morrison.

Mr. MORRISON. Congressman, we do have arms control in the nuclear domain with Russia. The previous administration tried to get the Chinese to engage in arms control discussions, and the Chinese held back. And I earnestly hope that the new administration, the Biden administration, tries to bring the Chinese to the table. You know, if not now, at whatever the number is—do we want to wait till they get to 800 weapons, or 1,000 weapons, or 1,550 weapons? Now is the time to try to get China to the table.

I agree with everything Todd said on space. Successive administrations have found that the problem with space arms control is it is not verifiable. There are too many dual-use capabilities. The Russians long held that the space shuttle could be an ASAT weapon. Our missile defenses are an ASAT weapon.

It is worth talking to them. It is worth making sure that they understand what happens if they touch SBIRS [Space-Based Infrared System], or what happens if they touch GPS. But the prospect of concluding truly effective arms control, which depends upon its verifiability, it strikes me as elusive right now. It is worth talking, but I think we should understand what the likely outcome is.

Mr. GARAMENDI. Thank you very much.

Mr. Chairman, thank you.

General KEHLER. Mr. Chairman, could I just add one more thing in this discussion for Mr. Garamendi?

Mr. COOPER. Sure. General, go ahead.

General KEHLER. I think I left you with the wrong impression of what I was trying to say earlier. My point is that I don't think arms control and modernization are an either/or kind of a proposition. In my view, we have benefited from arms control agreements that have limited the numbers of weapons that can be aimed at us and our allies. I think that those, when they have been verifiable and we have had intrusive ways to oversee those agreements, I think they have been effective and I think that those agreements have made us more secure.

But I think the other piece of that is, then you deter the rest. And we need to invest to make sure that our deterrence remains strong so that we can do that while we are going down this road, hopefully, to reestablish some kind of talks, and establish them to begin with with the Chinese.

Mr. GARAMENDI. If I might, Mr. Chairman, I want to refer to our colleague Mr. Panetta's presentation, and specifically the map he had behind him. It was a fine, fine map to argue for gerrymandering. If that doesn't look like a dragon, I don't know what is. With that, I yield back.

Mr. COOPER. I thank the gentleman. I was wondering what that map was behind him.

Mr. GARAMENDI. That is his district.

Mr. COOPER. That is his district? It does look like a dragon or a salamander or a gerrymander or something. Wow.

Mr. GARAMENDI. And that was developed by a commission.

Mr. COOPER. Well, we all know California is a complex State.

I want to thank all the members of the subcommittee. But I really want to thank the A-Team of witnesses that we have today. This was an excellent discussion and a historic one because it was not classified, it is in the public domain. So, hopefully, more of the gen-

eral public will pay attention to these existential issues. I thank the witnesses.

The hearing is adjourned.

[Whereupon, at 4:39 p.m., the subcommittee was adjourned.]

A P P E N D I X

FEBRUARY 23, 2021

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

FEBRUARY 23, 2021

Opening Statement
Hon. Jim Cooper
Chairman, Subcommittee on Strategic Forces
Hearing on “Near-Peer Advancements in Space and Nuclear Weapons”
February 23, 2021

Good afternoon. Let’s start by thanking our excellent witnesses for testifying at today’s hearing: Ms. Madelyn Creedon, Chair of the Nuclear Security Working Group at the George Washington University; General (Retired) Robert Kehler, affiliated with the Center for International Security and Cooperation at Stanford University, Mr. Todd Harrison, Director of the Aerospace Security Project at the Center for Strategic and International Studies; and, Mr. Tim Morrison, Senior Fellow at the Hudson Institute.

Today’s hearing concerns advances that Russia and China are making in their space and nuclear weapons programs – and how the U.S. should respond to these advances. Discussions like this are usually held in secret, but both I and my ranking member and I think that we should highlight these issues for the public so that the public can be included in the debate.

To give you a small example of what we are talking about, decades ago the U.S. Air Force created the GPS navigation and timing system not just for itself but for the entire world. Yes, GPS is one of the benefits of the U.S. military. Because the U.S. offered it completely free, not even thinking of charging for the service, GPS is one of the largest gifts in the history of diplomacy, worth an estimated one trillion dollars annually to all the nations of the world. This gift approaches the magnitude of freedom of the seas and even world peace as benefits to the globe.

Enjoying such a gift, why would our potential adversaries and even some of our allies spend billions of dollars to copy GPS with their own proprietary versions, and then to develop technologies that could destroy our GPS satellites? Is there an innocent explanation for this behavior? Wouldn’t they be worried if the roles were reversed? Their actions seem to be much worse than ingratitude. They are, in effect, looking at our gift horses in the mouth and then going to the extraordinary trouble of breeding their own stable of horses while conspiring to possibly kill all of ours. Friendly neighbors don’t do that.

Similar examples can be found in countless other areas of strategic competition. Why are our potential adversaries spending so much time and trouble developing so many low-yield nuclear weapons? Why would Vladimir Putin, the dictator that President Trump never criticized once during his term in office, have a showy press conference where he delighted in describing virtually every possible variety of nuclear weapon? Why are the Chinese on a path to multiply their arsenal of nuclear weapons after many years of stability?

These and other questions are the subject of this hearing.

I now turn to my Ranking Member, Mr. Turner, for any opening remarks he may have.

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Statement of
Madelyn R. Creedon

Non-Resident Senior Fellow, The Brookings Institution

Former Assistant Secretary of Defense for Global Strategic Affairs
and
Former Principal Deputy Administration for the
National Nuclear Security Administration

Before the

House Committee on Armed Services Subcommittee on
Strategic Forces

Near-Peer Advancements in Space and Nuclear Weapons

February 23, 2021

Madelyn Creedon
Testimony before the
House Armed Services
Subcommittee on Strategic Forces
February 23, 2021

Good afternoon. It is always an honor to appear before the Strategic Forces Subcommittee of the House Armed Services Committee.

Thank you for the invitation and the opportunity to discuss the advancements being made by Russia and China in nuclear weapons and in space, and how these developments impact American security, policy, and investment decisions. These are important and complex topics, and I commend this subcommittee for addressing them at the very outset of a new Congress.

Before we start I want to be clear that today I share with you my own personal thoughts and do not represent or speak on behalf of any organization or entity.

The world today is more dangerous, more chaotic, and more uncertain than at any time since the end of the Cold War. A world that, depending on your point of view, is either on the cusp of a new arms race or already in one. A world in which international norms are being flaunted, agreements are being violated and abrogated, and only one nuclear arms control treaty remains in force—the New START agreement, which thankfully was recently extended with only hours to spare before it expired. Today the world is neither in the midst of the Cold War nor an extension of it; many lessons of the past may need to be fundamentally re-thought as new technologies, capabilities, and operational domains change the security environment in ways we have just begun to understand. But it is also a world in which Allies and whole of government approaches are needed more than ever before.

Russia and China are engaged in significant military modernization programs both to support their own, evolving military doctrines and to counter perceived threats from the United States and its Allies.

Russia has more limited finances to devote to full scale military growth and diversification and has thus chosen to place greater emphasis on its nuclear forces. Russia's primary goal is to counter US missile defense and other conventional forces while bolstering its own self image as a great power. Its programs to modernize all three legs of its strategic nuclear triad are already well underway. Russia is also developing a wider range of dual capable systems, as well as a variety of non-strategic nuclear weapons.

With more resources than Russia, China continues to grow its overall defense budget. While primarily focused on its conventional forces, it is also improving its nuclear capabilities, increasing the survivability of its land-based ICBMS, and developing a nuclear triad of its own.

Both countries are also increasing their reliance on space systems to support military operations, while developing a variety of anti-satellite and other capabilities to prevent the US from taking full advantage of its space assets in the event of a crisis or conflict.

In addition to their nuclear and space programs, both countries are also harnessing new and emerging technologies to challenge and compete with the United States and its Allies in other operational domains. Russia is already using its cyber capabilities to attack the United States and to undermine US institutions, while China uses its cyber capabilities to steal US intellectual property and improve its economic fortunes.

Over the longer term, China most likely poses the greatest threat to the United States. Beijing has a stated goal of being a world class military power by 2049 and is employing a whole of government approach to exert its influence globally through initiatives such as the "One Belt One Road" project. In an excellent article in *Foreign Affairs* from March/April 2018, entitled "The China Reckoning," Kurt Campbell and Ely Ratner chronicle how the US expectations with respect to China's role in the established order have been dashed in the last 25 years. Instead, China has written its own rules and has developed into the "most dynamic and formidable competitor in modern history."

The authors argue "the starting point for a better approach is a new degree of humility about the United States' ability to change China. Neither seeking to isolate and weaken it nor trying to transform it for the better should be the lodestar of U.S. strategy in Asia." With Ely Ratner now heading up the

recently announced China review at DOD, there is an opportunity to change the relationship dynamic. And as Secretary of State Tony Blinken said recently, the US should engage China in all aspects of the relationship, adversarial, competitive or cooperative “from a position of strength not weakness.”

The Challenge Confronting Us

How then does the United States fashion this posture of strength that can compete with but not isolate China and balance and reduce those threats from Russia that this subcommittee is focused on today?

Both China and Russia are improving their nuclear and space capabilities but what is the United States doing and is it enough to counter and offset these capabilities? Simple numerical parity is not the answer. The solution is more complex, more nuanced and requires analytical rigor.

Providing the necessary deterrent is an all domain, whole of government effort that must be capable but also not drive adversaries and the US into a costly and unsustainable arms race. The military deterrent should be coupled with diplomacy where possible, improving transparency, reducing tensions, improving understanding of reciprocal misunderstandings, and finding common ground to reduce, limit or eliminate capabilities, while ensuring stability.

The US faced a significant challenge with space systems in the late 1990s and early 2000s as almost all of the military space systems and some of the intelligence space systems were being replaced. This “bow wave” was the result of many decisions, such as postponing the system replacements, over ambitious technical desires, poor acquisition management, budget overruns, developmental issues, funding swings, and program cancellations. GAO has studied and reported on these issues and other issues at length but suffice it to say it was a very difficult time for space. And as the replacement systems, SBIRS, AEHF, GPS etc., were finally launched, years later than planned, they were launched into a very different security environment.

Russia and China and others had seen the significant advantages space capabilities provided to the U.S. military, the intelligence community, and the economy generally and adopted two courses of action. The first was to develop the same or similar capabilities to support their respective

countries and the second was to deny the United States and its Allies the advantage of space.

Similarly, the U.S. nuclear systems are now in the midst of their own bow wave. While, thankfully, the size of the U.S. and Russian strategic nuclear arsenals decreased significantly following the end of the Cold War, the remaining U.S. systems, infrastructure, and warheads were aging. While the science of nuclear weapons had been well supported since the end of explosive nuclear testing in 1992, with a few exceptions, notably the introduction of the B2 bomber, the rest of the nuclear complex was living on the investments made in the past, as new system decisions and programs were put off and attention was focused elsewhere. Multiple reports and investigations, in some cases the result of mishaps, examined the problems and made recommendations that were either ignored, or instituted and not sustained.

This started to change about 10 years ago when the Obama Administration and Congress realized that there was no more margin to defer the needed investments. The delivery systems, the warheads and the infrastructure all needed attention to ensure that our nuclear forces were up-to-date and fully capable of maintaining an effective deterrent against attack on our homeland, on our military forces stationed abroad, and on our Allies.

With strong bipartisan support, across two presidential administrations, all of the nation's nuclear delivery platforms are being replaced or scheduled for replacement over the next two decades. The warheads associated with these systems are undergoing life extension programs. And the Department of Energy's National Nuclear Security Administration (NNSA) is in the process of modernizing its ageing production complex, recapturing the ability to make nuclear and electronic parts, and producing sufficient quantities of materials, such as tritium and lithium, that are essential to maintaining nuclear weapons.

As the nuclear systems, warheads and infrastructure are being replaced, they will no doubt encounter similar issues that the space systems encountered in their bow wave of modernization; in fact, some have encountered technical and production challenges already. The open question is when these systems are deployed, will they, like the space systems be launched into a very different security environment?

Open Questions

These are the questions for the new Biden Administration and Congress. Can the advantage of space be preserved, space situational awareness expanded, and the assets protected? Do we as a nation really understand how space resiliency and redundancy translate to programs, tactics and procedures? Can we better employ commercial space assets and partner with commercial entities and Allies in creative measures to ensure access to space?

As the DoD's Annual China Military and Security report from last year stated, "We assess that China and Russia are training and equipping their military space forces and fielding new antisatellite (ASAT) weapons to hold US and allied space services at risk, even as they push for international agreements on the nonweaponization of space."

Do we understand the threat and how it will evolve? With respect to nuclear systems do we have the correct type and number of nuclear delivery platforms and warheads to ensure a safe, secure and reliable nuclear deterrent? Do we have the capable, flexible infrastructure and the people with the necessary skills to make sure that the United States can respond to whatever the future presents in the way of changing threats, opportunities, and challenges? Can the infrastructure support verification, if new treaties and other agreements are possible, and provide the ability to hedge in any manner? Is the science of nuclear weapons supported to ensure both a robust deterrent and a robust non- and counter-proliferation program?

These are just a few of the questions that must be asked and answered.

Conclusion

Each Administration should review deterrence policy, strategy, and posture to ensure that the U.S. capabilities are appropriate and adequate for purpose. And when the review is complete, ask: do the resulting decisions provide a credible, safe, secure, and reliable deterrent for us and our Allies? The reviews should be open to the public to the extent that they can be, and they must fully include our Allies, and the Congress. Most importantly, in the end we need to ensure that the decisions are supported and funded and that the U.S is stronger as a result.

Thank you and I look forward to your questions and discussion.

Honorable Madelyn R. Creedon

Madelyn Creedon has had a long career in U.S. government service, most recently as Principal Deputy Administrator of the National Nuclear Security Administration (NNSA) within the Department of Energy, a position she held from 2014 to 2017. She served in the Pentagon as Assistant Secretary of Defense for Global Strategic Affairs from 2011 to 2014, overseeing policy development in the areas of missile defense, nuclear security, cybersecurity, and space. She served as counsel for the U.S. Senate Committee on Armed Services for many years, beginning in 1990; assignments and focus areas included the Subcommittee on Strategic Forces as well as threat reduction and nuclear nonproliferation. During that time, she also served as Deputy Administrator for Defense Programs at the NNSA, Associate Deputy Secretary of Energy, and General Counsel for the Defense Base Closure and Realignment Commission. She started her career as a trial attorney at the Department of Energy.

Following retirement from Federal Service in 2017, Madelyn established Green Marble Group, LLC, a consulting company and currently serves on a number of advisory boards related to national security. She is also a research professor at the George Washington University Elliott School of International affairs and a non-resident senior fellow at The Brookings Institution. In addition, she is a member of the board of the Planetary Sciences Institute, a non-profit corporation dedicated to solar system research.

She holds a J.D. from St. Louis University School of Law, and a B.A. from the University of Evansville.

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Hearing Date: February 23, 2021

Hearing Subject:

Strategic Forces Subcommittee, House Committee on Armed Services "Near Peer Advancements in Space and Nuclear Weapons"

Witness name: Hon. Madelyn R Creedon

Position/Title: Non-resident Senior Fellow Brookings

Capacity in which appearing: (check one)

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N/A			

2020

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N/A			

2019

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N/A			

2018

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N/A			

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2021

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
N/A			

2020

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
N/A			

2019

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
Alliance Fellowship, University of Sydney	Australia/US	\$10,000	Alliance relations

2018

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
N/A			

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Organization or entity	Brief description of the fiduciary relationship
N/A	

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2021

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
N/A			

2020

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
N/A			

2019

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
N/A			

2018

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
N/A			

STATEMENT OF
GENERAL C. ROBERT KEHLER
UNITED STATES AIR FORCE (RETIRED)
BEFORE THE
HOUSE ARMED SERVICES COMMITTEE SUBCOMMITTEE ON STRATEGIC FORCES
23 FEBRUARY 2021

Chairman Cooper, Ranking Member Turner, and distinguished members of the subcommittee, I am honored to join you today and pleased to offer my perspective on near-peer advancements in space and nuclear weapons. These are my personal views and do not represent the official policy or position of United States Strategic Command, the Department of Defense, or the United States Government. To put my bottom line up front:

- China and Russia continue to invest in decades-long military modernization programs that are delivering highly capable weapon systems that can threaten the U.S. homeland and our regional allies and territories and disrupt our ability to project power and conduct military campaigns.
- Nuclear and space modernization efforts have received particular attention in both countries, as has the development of non-kinetic (i.e., cyberspace) capabilities. Some programs are near completion.
- China and Russia have backed their impressive programmatic progress with updated strategies and doctrine, new organizations, and aggressive and realistic training. Some of the results have been ably demonstrated in contingencies (e.g., the Russian invasion into Ukraine; Russian and Chinese cyber activities; etc.).
- The United States can no longer defer or delay our own modernization efforts. To preserve deterrence and underwrite the security of the United States and our allies and partners, we must update our nuclear triad and improve the resilience and performance of the nuclear command, control, and communications (NC3) system; modernize our conventional kinetic and non-kinetic capabilities; deploy effective surveillance and limited missile defense systems; embrace multi-domain operational concepts; and ensure our forces continue to be staffed and led by highly qualified people.

Today's global security situation is not a repeat of the Cold War. As I testified while still in uniform, today's national security landscape is highly complex and uncertain. Yesterday's regional battlefield is becoming today's global battle-space as near-peer and other adversaries acquire technologies and exploit the interconnected nature of our world to quickly transit

political, geographic, and physical domain boundaries. The potential threats to our security and the security of our allies are diverse, can arrive at our doorsteps rapidly, and can range from small arms in the hands of terrorists to nuclear weapons in the hands of hostile state leaders. The possible intersection of violent extremism and weapons of mass destruction remains a significant concern that requires constant vigilance. State and non-state actors alike can stress our intelligence capabilities and contingency plans by employing highly adaptive, hybrid combinations of strategies, tactics, and capabilities and by using the speed of information to mask their activities behind a veil of deception and ambiguity. New capabilities like cyber weapons and unmanned vehicles are emerging and familiar weapons like ballistic missiles and advanced conventional capabilities are more available, affordable, and lethal. Adversaries are also threatening the U.S. in and through the strategically important and militarily critical areas of space and cyberspace.

At the near-peer level, open source reporting continues to validate what I saw on active duty. While China and Russia are pursuing different global grand strategies (China to replace the U.S. as the world's most important and dominant superpower; Russia to preserve a position of relevance and influence on the global stage), military modernization is serving a similar purpose in both places. While different in emphasis, Chinese and Russian leaders see their modernization efforts (and their supporting disinformation campaigns) as a means to negate the significant military advantages we have demonstrated for the last two decades—and to convince our regional allies that we cannot or will not come to their aid.

Chinese and Russian modernization programs are expansive and formidable. Both countries are upgrading their significant long-range conventional strike capabilities and exercise them realistically and routinely; both are active in cyberspace; both are deploying anti-satellite weapons and other means to threaten our national security space assets; both are improving their defensive and anti-access capabilities; and both can quickly inflict enormous casualties and damage on the U.S. and our allies with nuclear forces that they are modernizing. While either Russia or, to a lesser extent China, can unleash large-scale nuclear attacks against the U.S. and our allies, both have also developed sophisticated employment doctrines that include the potential use (perhaps first use) of nuclear weapons in regional conflict situations. While

China still professes a “no first use” policy, some interpret Chinese nuclear ambitions (and their emerging capabilities) to represent a pathway to a first-strike capability. Russia still retains the ability to attack the U.S. with a massive nuclear strike with little to no warning and has deployed low-yield weapons for regional contingencies. Russia is also pursuing new types of nuclear weapon delivery platforms, some of which are not covered under the existing New START Treaty extension.

Another significant change has occurred since the end of the Cold War. Nuclear weapons no longer pose the sole credible near-peer strategic threat to the U.S. and our allies. While a large-scale nuclear attack of any kind remains the worst-case scenario, China and Russia see the ability to threaten high-value targets in the U.S. and allied homelands and territories with conventional, cyber, and the limited use of nuclear weapons as a strategic game changer. For the first time since the beginning of the nuclear age China and Russia are developing the capabilities to realistically attack important facilities and critical infrastructure in the U.S. and allied homelands and territories with long-range conventional (including hypersonic) weapons without having to cross the nuclear threshold. They can also attack targets with cyber weapons without having to cross the kinetic threshold; a threat that both countries have demonstrated in real-world operations against industry and infrastructure around the world. These modern capabilities pose a credible threat to escalate a conflict to the strategic level without initially having to resort to nuclear weapons; thereby raising the risks and costs of U.S. intervention to unacceptable levels and enabling more assertive foreign policies and aggressive actions.

China and Russia are also reorganizing their military establishments for 21st Century warfare. For example, Russia has combined its air, space, and air defense forces into the Russian Aerospace Forces command and has reorganized its tactical units to synchronize activities across domains. Similarly, China established the Strategic Support Force to integrate space, cyberspace, and related activities into military operations. Both China and Russia have carefully observed U.S. military operations over the last 20 years and have concluded that a new type of warfare has emerged. These new organizations reflect both countries’ views of the strategic importance of what the U.S. would call multi-domain operations.

While I am concerned about the commitment and progress China and Russia are demonstrating in their nuclear modernization programs, I am especially concerned about their activities in space and cyberspace. Of course, given the extreme threat posed by nuclear weapons, the U.S. cannot permit such extensive modernization to go unchallenged. We must ensure a strong nuclear deterrent remains the bedrock of our security and the security of our allies and partners. But nuclear modernization, while troubling, is comparatively straightforward to understand and address. Space and cyberspace are different in that operations in both domains are out of sight and the tangible evidence of modernization is difficult to discern. In particular, I am concerned about the on-orbit activities the U.S. has reportedly observed from both China and Russia. As reported in open press, objects from both countries have approached some of our important satellites to perform what look like intelligence gathering and rehearsals to attack them in some way. I am equally concerned about the threat through cyberspace and other electronic means to our satellite networks and the data that flows through them. These and other asymmetric space- and cyberspace-related threats are being developed within aggressive national space and electronic warfare programs supported by determined investment efforts

I cannot recall a time during my professional career when potential threats to our security were more varied or pronounced than they are today. The 21st Century has brought complex problems and new dynamics that challenge us in different ways than we experienced in the 20th Century. While nuclear weapons remain foundational to our security strategy and those of our allies, 21st Century deterrence and extended deterrence policy and doctrine must now account for a wide variety of potential adversaries with differing motivations and objectives and posing different strategic threats. The U.S. is no longer either deterring a single potential nuclear adversary or assuring a single alliance or ally and cannot rely on a “one size fits all” approach to deterrence or investment. The new asymmetric strategies and capabilities presented by our adversaries, especially China and Russia, demand a contemporary approach. Nuclear weapons remain foundational to the security of the U.S. and our allies, but today’s deterrence strategies and plans must integrate all elements of military and national power together to maintain credibility and be effectively used if conflict ever erupts. It is increasingly

clear to me that we must carefully match our strategies and plans to individual actors and deploy a range of conventional and nuclear capabilities that can either deter (if possible) or defeat them in multiple scenarios.

The U.S. has embarked on a strategic modernization program of our own, but the nation has reached a critical decision point with many competing priorities. I believe we have to stay the course to maintain our global position relative to these near-peer nations. We are out of time and cannot afford to defer or delay. In my view, the nation should continue on the important pathway that has had bi-partisan support for the last decade or more. These priority efforts continue to stand out:

- Modernize the nuclear triad (including ICBMs), and the critical nuclear C3 system. The nuclear triad remains the foundation of our strategic deterrent and the bedrock of our national security. Replacement bomber and ballistic missile submarine programs are underway, and it is of the highest importance to modernize the ICBM force without further delay. ICBMs have high deterrent value and provide an important hedge capability against technical failure, advances in adversary anti-submarine capabilities, or geopolitical change.
- Modernize the highly specialized industrial complex that sustains the weapons stockpile and support a weapons strategy that preserves the ability to extend the life of current weapons as well as produce and test new weapons if ever needed. The U.S. must have a strong nuclear industrial complex to preserve the safety, security, and effectiveness of our nuclear weapons and stockpile.
- Invest in space capabilities. Congress took a bold and historic step by creating the United States Space Force. It is important to look for opportunities to grow that military service sensibly and to support improvements in the resilience of our space architectures along with capabilities to deny adversary use of that medium if necessary.
- Invest in cyberspace capabilities. Improvements must occur across the whole of the government, nation, and alliances.

Mr. Chairman and subcommittee members, for many reasons this is a critical time for our national security. Thank you for your continued focus on these important strategic issues and for inviting me to share my personal views. I am looking forward to your questions.

General C. Robert Kehler, USAF (ret.)**Affiliate, Stanford University Center for International Security and Cooperation**

General Bob Kehler retired from the United States Air Force in December 2013 after almost 39 years of distinguished service. From January 2011 until November 2013 he served as the Commander, United States Strategic Command (USSTRATCOM), where he was directly responsible to the Secretary of Defense and President for the plans and operations of all U. S. forces conducting strategic deterrence, nuclear alert, global strike, space, cyberspace and associated operations. While in command, he crafted and implemented policies and plans to deter strategic attacks against the U.S. and its key allies and led a joint team of over 160,000 military and civilian members conducting global deterrence operations while supporting combat actions in the Middle East and North Africa. General Kehler's military career encompassed progressively important operational, command, staff, and joint assignments. Prior to commanding USSTRATCOM, the general commanded United States Air Force Space Command and two operational space wings conducting space launch, missile warning, and space control missions. He also commanded an intercontinental ballistic missile (ICBM) squadron and group. At Air Force Space Command, he designed the Air Force's inaugural blueprint, operating concept, organizational structure, and personnel program to meet rapidly growing cyberspace challenges.

General Kehler entered the Air Force in 1975 as a Distinguished Graduate of the Pennsylvania State University R.O.T.C. program, has master's degrees in Public Administration and National Security and Strategic Studies, and completed executive development programs at Carnegie-Mellon University, Syracuse University, and Harvard University. His military awards include the Defense Distinguished Service Medal, Defense Superior Service Medal, the Distinguished Service Medal (2 awards), Legion of Merit (3 awards), and the French Legion of Honor (Officer). General Kehler continues to offer his expertise as a consultant, non-executive corporate director of two international aerospace companies, and as a Trustee of the Mitre Corporation. He speaks widely on matters of national security and is highly sought for panels, studies, Congressional testimony, and workshops addressing the most compelling issues of national security in the 21st Century.

General Kehler was the S.T. Lee Distinguished Lecturer at Stanford University's Freeman Spogli Institute for International Studies for academic year 2014-2015 and remains an Affiliate of Stanford's Center for International Security and Cooperation. He is a Senior Fellow of the National Defense University. A Distinguished Alumnus of the Pennsylvania State University, General Kehler and his wife have two married sons and a grandson. In his spare time Bob enjoys playing the guitar, swinging enthusiastically at a golf ball, and family activities.

**DISCLOSURE FORM FOR WITNESSES
COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES**

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Hearing Date: February 23, 2021

Hearing Subject:

Near-Peer Advancements in Space and Nuclear Weapons

Witness name: C. Robert Kehler

Position/Title: General, USAF (retired)

Capacity in which appearing: (check one)



Individual



Representative

If appearing in a representative capacity, name of the organization or entity represented:

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Organization or entity	Brief description of the fiduciary relationship
Inmarsat	Independent Director
MAXAR Technologies	Independent Director
AerSale Technologies	Independent Director

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2019

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2018

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**Statement before the House Armed Services
Subcommittee on Strategic Forces**

***“Near-Peer Advancements in Space and
Nuclear Weapons.”***

A Testimony by:

Todd Harrison

Director, Defense Budget Analysis, Director, Aerospace Security Project
and Senior Fellow, International Security Program, CSIS

February 23, 2021

2118 Rayburn/WebEx

Chairman Cooper, Ranking Member Turner, and distinguished members of the Subcommittee, thank you for the opportunity to testify today. Space has traditionally been viewed by many as a domain of science, commerce, and exploration. While that continues to be true, it is also a warfighting domain. Since the beginning of the space age, satellites have provided important military capabilities, ranging from communications and weather forecasting to missile warning and reconnaissance. Once the military potential of space became apparent, nations started developing ways to deny others the military benefits of space. In 1959, just two years after the launch of *Sputnik*, the United States tested the first anti-satellite (ASAT) weapon—a Bold Orion missile launched from a B-47 bomber.¹ The Soviets soon followed suit, beginning tests of a space-based co-orbital ASAT weapon system in 1963 and declaring the system fully operational by 1973.²

There are some hard truths many in the space community and national security enterprise may find difficult to accept. Space was never really a sanctuary.³ Space was militarized from the beginning. And if one considers a satellite that can attack other satellites a space weapon, then space has already been weaponized as well.⁴

In the United States, we often think about space as separate and distinct from nuclear forces and missile defense. But from our adversaries' perspective, they are intricately linked. Both Russia and China fear that advances in U.S. missile defense systems could one day undermine the credibility of their nuclear deterrent by reducing the chances that they could deliver an effective retaliatory strike. From their perspective, attacks against U.S. space systems are a way to disrupt our battle networks and, in a strategic conflict, are effectively a penetration aid for nuclear-armed ballistic missiles.⁵

With this in mind, the Russian and Chinese proposal at the United Nations to ban some types of space and counterspace weapons is not surprising. Their proposal would ban space-based weapons that could attack other satellites or targets on Earth, but it would not limit their terrestrially based counterspace weapons that hold many of our satellites at risk.⁶

¹ Robert Bowman, *Star Wars: A Defense Insider's Case Against the Strategic Defense Initiative* (Los Angeles, CA: Teachers Publications, 1986), 14.

² Laura Grego, "A History of Anti-Satellite Programs," Union of Concerned Scientists, January 2012, 3, https://www.ucsusa.org/sites/default/files/2019-09/a-history-of-ASAT-programs_lo-res.pdf.

³ Robin Dickey, *The Rise and Fall of Space Sanctuary in U.S. Policy* (Washington, DC: Aerospace Corporation, September 1, 2020), 5, <https://aerospace.org/paper/rise-and-fall-space-sanctuary-us-policy>.

⁴ Todd Harrison, *International Perspectives on Space Weapons* (Washington, DC: CSIS, May 2020), 5, <https://www.csis.org/analysis/international-perspectives-space-weapons>.

⁵ Kaitlyn Johnson, "A Balance of Instability: Effects of Direct-Ascent Anti-Satellite Weapons Ban on Nuclear Stability," Defense360, CSIS, October 21, 2020, 9–10, http://defense360.csis.org/wp-content/uploads/2020/10/2Kaitlyn_A-Balance-of-Instability.pdf.

⁶ Harrison, *International Perspectives on Space Weapons*, 13–14.

The choice facing the United States today in space is not whether we should militarize or weaponize space—that has already happened. Our decision is how to respond to the threats we face in the space domain. As General Dickenson, the commander of United States Space Command, recently noted, “a day without space is not an option.”⁷

In our annual CSIS Space Threat Assessment, we document publicly available information on the counterspace capabilities of other nations.⁸ Counterspace weapons come in many forms, some of which are more visible and attributable in their effects than others. Perhaps the most visible and widely known example of a counterspace weapons test was the 2007 Chinese ASAT test, which destroyed one of China’s own satellites and created thousands of pieces of space debris. What is less known is that China has continued testing its direct-ascent ASAT weapons at a pace of about once each year, although subsequent tests have been designed to avoid creating large amounts of space debris.

Russia has been testing similar direct-ascent ASAT weapons, with its most recent test in December 2020, and it has revived its co-orbital ASAT program. Last summer the Russian *Cosmos 2543* satellite maneuvered near another Russian satellite and fired what was believed to be a projectile.⁹ This test is particularly noteworthy because Russia has publicly declared that it will not be the first nation to put weapons in space.¹⁰

While kinetic forms of attack such as these often receive the most attention, there are many other types of counterspace weapons being developed and proliferated by Russia, China, and others. For example, lasers can be used to temporarily dazzle or permanently blind the sensors on satellites, and high-powered microwave (HPM) weapons can disrupt a satellite’s electronics or cause permanent damage to electrical circuits and processors in a satellite. These attacks operate at the speed of light and, in some cases, can be less visible to third-party observers and potentially more difficult to attribute. China has been working on a satellite lasing system since at least 2006 when it reportedly illuminated a U.S. government satellite flying over Chinese territory.¹¹ Similarly, Russia has deployed satellite lasing systems on aircraft and ground vehicles.¹²

⁷ “Never a Day without Space: Commander’s Strategic Vision,” United States Space Command, February 3, 2021, <https://www.spacecom.mil/Portals/32/Images/cc-vision/usspacecom-strategic-narrative-2021.pdf?ver=QcJDDJDeJL.DweADraPD0ew%63d%63d>.

⁸ Todd Harrison et al., *Space Threat Assessment 2020* (Washington, DC: CSIS, March 2020), https://aerospace.csis.org/wp-content/uploads/2020/03/Harrison_SpaceThreatAssessment20_WEB_FINAL-min.pdf.

⁹ U.S. Space Command Public Affairs, “Russia tests direct-ascent anti-satellite missile,” <https://www.spacecom.mil/MEDIA/NEWS-ARTICLES/Article/2285098/russia-conducts-space-based-anti-satellite-weapons-test/>.

¹⁰ “Letter from the Permanent Representatives of the Bolivarian Republic of Venezuela and the Russian Federation to the Secretary-General of the Conference on Disarmament,” United Nations, April 4, 2016.

¹¹ Andrea Shalal-Esa, “China Jamming Test Sparks U.S. Satellite Concerns,” Reuters, October 5, 2006, as quoted in Yousaf Butt, “Effects of Chinese Laser Ranging on Imaging Satellites,” *Science & Global Security* 17, no. 1 (2009): 20–35, <http://scienceandglobalsecurity.org/archive/sgs17butt.pdf>.

¹² Harrison et al., *Space Threat Assessment*, 24–25.

Both Russia and China have advanced satellite jamming and spoofing capabilities, as do nations like Iran and North Korea. China has been implicated or suspected in several cyberattacks against U.S. satellites, to include an attack against the ground station controlling the *Landsat-7* satellite in 2007 and an attack against NASA's *Terra* satellite in 2008.¹³ In September 2014, Chinese hackers attacked the National Oceanographic and Atmospheric Administration's (NOAA) satellite information and weather systems, forcing NOAA to take down the system and stop transmitting satellite images to the National Weather Service for two days.¹⁴

The data is clear—both Russia and China pose serious threats to commercial, civil, and military space systems. But the lack of public discourse about how to defend against space threats may have led some to conclude that space is not defensible and should not be relied upon by the military.¹⁵ The fact that space is contested does not mean that space is undefendable. Rather, it means that the United States will have to fight to protect its ability to operate in this domain, just as it does in the air, land, and maritime domains.

A wide array of defenses is available to improve the protection of space systems from counterspace weapons. These include passive defenses that make space systems more difficult to attack and active defenses that target the threats themselves. In a forthcoming CSIS report, we detail a broad range of these space defenses and make seven recommendations for investment priorities, actions, and additional analysis to improve U.S. space defense capabilities.

1. A priority should be placed on improving space domain awareness capabilities, to include more space-based sensors, better integration with commercial and friendly foreign government space surveillance networks, and the use of artificial intelligence to analyze data and form a better understanding of adversary capabilities and intentions.
2. Additional effort should be placed on developing improved indications and warnings for space that give decisionmakers more time and information to tailor defensive responses to the specific circumstances of a conflict.
3. New space architectures are needed that use a combination of distribution, proliferation, and diversification of orbits. These new architectures do not necessarily need to replace legacy architectures but rather should be used to supplement and diversify capabilities that already exist.

¹³ Sui-Lee Wee, "China Denies It Is behind Hacking of U.S. Satellites," Reuters, October 31, 2011; U.S.-China Economic and Security Review Commission, *2015 Report to Congress* (Washington, DC: 2015), 296, https://www.uscc.gov/sites/default/files/annual_reports/2015%20Annual%20Report%20to%20Congress.PDF.

¹⁴ Office of the Inspector General, *Cybersecurity Management and Oversight at the Jet Propulsion Laboratory* (Washington, DC: NASA, 2019), 8–9, <https://oig.nasa.gov/docs/IG-19-022.pdf>.

¹⁵ Paul Scharre, "The US Military Should Not Be Doubling Down on Space," Defense One, August 1, 2018, <https://www.defenseone.com/ideas/2018/08/us-military-should-not-be-doubling-down-space/150194/?oref=d-river>.

4. Non-kinetic active defenses, such as onboard jamming and lasing systems, are needed to thwart kinetic attacks against high-value satellites. A physical seizure capability should also be explored that could double as an inspector and on-orbit servicing satellite.
5. New options should be considered to improve DoD's integration with commercial space operators, such as creating a program like the Civil Reserve Air Fleet (CRAF) with commercial space companies.
6. A better understanding is needed of the operational, political, and strategic risks involved in the use of stealth, maneuver, rapid deployment, and reconstitution before committing significant resources to these areas.
7. Further analysis and gaming are needed to explore gray zone competition in space and how to respond to a reversible attack or the threat of attack.

Progress is being made in some but not all of these areas. Investments in space defenses are especially important now because the U.S. military is in the process of modernizing many of its key satellite constellations. The decisions made over the coming months and years about what types of space architectures to build and which defenses to incorporate will have repercussions for the life of these systems.

Todd Harrison
Director, Defense Budget Analysis, Director, Aerospace Security Project and
Senior Fellow, International Security Program

Todd Harrison is the director of Defense Budget Analysis and director of the Aerospace Security Project at CSIS. As a senior fellow in the International Security Program, he leads the Center's efforts to provide in-depth, nonpartisan research and analysis of defense funding, space security, and air power issues. He has authored publications on trends in the defense budget, military space systems, threats to space systems, civil space exploration, defense acquisitions, military compensation and readiness, and military force structure, among other topics. He teaches classes on military space systems and the defense budget at the Johns Hopkins School of Advanced International Studies.

Mr. Harrison joined CSIS from the Center for Strategic and Budgetary Assessments, where he was a senior fellow for defense budget studies. He previously worked at Booz Allen Hamilton, where he consulted for the U.S. Air Force on satellite communications systems and supported a variety of other clients evaluating the performance of acquisition programs. Prior to Booz Allen, he worked for AeroAstro Inc. developing advanced space technologies and as a management consultant at Diamond Cluster International. Mr. Harrison served as a captain in the U.S. Air Force Reserves. He is a graduate of the Massachusetts Institute of Technology with both a B.S. and an M.S. in aeronautics and astronautics.

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Hearing Date: 2/23/2021

Hearing Subject:

Near-Peer Advancements in Space and Nuclear Weapons

Witness name: Todd Harrison

Position/Title: Director, Defense Budget Analysis and Aerospace Security Project and Senior Fellow, CSIS

Capacity in which appearing: (check one)



Individual



Representative

If appearing in a representative capacity, name of the organization or entity represented:

Center for Strategic and International Studies

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2021

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
see attached			

2020

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
see attached			

2019

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
see attached			

2018

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
see attached			

Fiduciary Relationships: If you are a fiduciary of any organization or entity that has an interest in the subject matter of the hearing, please provide the following information:

Organization or entity	Brief description of the fiduciary relationship

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2021

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
n/a			

2020

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
n/a			

2019

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
n/a			

2018

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
n/a			

Federal Grants

[illegible]

Foreign Grants

Source	Date	Amount	Project
Embassy of Australia	2019-03-25	\$3,500.00	Donation
Embassy of Australia	2019-03-25	\$3,500.00	2019 Salary of Music Defense
Government of Canada	2019-12-01	\$56,011.86	Principled approaches to hybrid warfare
Government of Canada	2019-12-01	\$6011.86	Principled approaches to hybrid warfare

Private

Date	Source	Amount	Project
2018-01-01	Aerospace Industries Association	\$75,000.00	Space Threats Assessment 2018 Report
2018-02-26	Northing Gummann Corporation	\$50,000.00	PONI NPI Conference
2018-05-23	Lus Alamos National Laboratory	\$763,183.33	LANI Support for PONI and Wild-Catnet Workshop
2018-06-01	Sandia National Laboratories	\$74,990.00	Sandia Support for PONI
2018-07-19	International Crisis Group	\$835.00	Verifying North Korean Democraticization
2018-08-31	Northing Gummann Corporation	\$75,000.00	Future of Arms Control Event
2018-09-03	Lus Alamos National Laboratory	\$900,000.00	LANI FY19 Support for PONI
2019-01-31	Rochester Foundation	\$40,000.00	New Approaches to Nuclear Nonproliferation
2019-01-31	Rochester Foundation	\$900,000.00	NSC FY19 Support for PONI General Support
2019-10-01	Northing Gummann Corporation	\$875,000.00	Assessing the Impact of Space Systems on Counterspace Weapons
2019-10-03	Northing Gummann Corporation	\$75,000.00	Funding for Spring 2020 Ball Conference
2019-10-21	Smith Richardson Foundation	\$200,000.00	Defense Against the Dark Arts: Fr
2019-10-25	Northing Gummann Corporation	\$50,000.00	PONI Support for PONI
2020-03-26	SASAC	\$40,000.00	International Perspectives on Space Weapons
2020-04-01	SASAC	\$120,000.00	International Views of Space Law, Policy, and Norms
2020-04-01	Lus Alamos National Laboratory	\$50,000.00	Contract
2020-04-01	Lus Alamos National Laboratory	\$50,000.00	Contract

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Prepared statement by:

Tim Morrison
Senior Fellow, Hudson Institute

House Armed Services Committee
Subcommittee on Strategic Forces

February 23, 2021

“Near-Peer Advancements in Space and Nuclear Weapons”

Chairman Cooper, Ranking Member Turner, Members of the Subcommittee, thank you for the invitation to testify today and for holding a public hearing on this most important topic. I’m pleased to be part of such a distinguished panel.

There is little more important to our national security, indeed, our nation’s existence, than the threat posed by foreign nuclear weapons development.

There is an arms race underway; today, the U.S. is sitting on the sidelines.

We have long known about Russia’s reliance on its nuclear forces. Russia is a failing state. A declining power. To paraphrase former Senator John McCain, “Russia is a mafia-run gas station with nuclear weapons.” Its nuclear forces are just another example of Putin’s need to cheaply create relevance for a formerly great power he is steering into the ground at an increasing rate of speed.

More recently, the activities of the Chinese Communist Party, including with respect to its nuclear forces, have become increasingly alarming to the U.S. national security apparatus.

The People’s Republic of China (PRC) had been growing its nuclear forces behind what the then-Special Presidential Envoy for Arms Control, Ambassador Marshall Billingslea, called the “Great Wall of Secrecy.”ⁱ

The prior administration, in which I served, made a concerted effort to reveal what it knew about the Chinese Communist Party’s plans to better inform Congress, the American people, and America’s allies.

Recently, in the U.S. Navy journal *Proceedings*, the Commander of U.S. Strategic Command, Admiral Charles Richards, U.S. Navy, wrote, “China’s nuclear weapons

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stockpile is expected to double (if not triple or quadruple) over the next decade.”ⁱⁱ

This statement ought not to have been a surprise, it is entirely consistent with the previous warnings of senior military and intelligence leaders.

For example, the previous director of the Defense Intelligence Agency, Lieutenant General Robert Ashley, U.S. Army, stated in an event at the think tank at which I now work, “their trajectory is consistent with President Xi’s vision for China’s military, which was laid out at the 19th Party Congress, and stated that China’s military will be fully transformed into a first-tier force by 2050.”ⁱⁱⁱ

Who are the first-tier forces? Russia and the U.S., of course, at many thousands of nuclear weapons each.

General Ashley, at that event, provided additional details that the House Armed Services Committee should consider:

- “China has developed a new road-mobile ICBM, a new multi-warhead version of its silo-based ICBM, and a new submarine-launched ballistic missile”; and
- “With its announcement of a new nuclear-capable strategic bomber, China will soon field their own nuclear triad, demonstrating China’s commitment to expanding the role and centrality of nuclear forces in Beijing’s military aspirations.”^{iv}

So while some in this country suggest the U.S. has no need for a triad, the Chinese Communist Party proceeds in the exact opposite direction.

More recently, the Department of Defense found that:

- “PRC strategists have highlighted the need for lower-yield nuclear weapons in order to increase the deterrence value of China’s nuclear force”;
- “The DF26 is China’s first nuclear-capable missile system that can conduct precision strikes, and therefore, is the most likely weapon system to field a lower-yield warhead in the near-term”; and
- “Increasing evidence emerged in 2019 indicates that China seeks to keep at least a portion of its force on a LOW posture.”^v

Last year, the *Global Times*—a media outlet that answers to the Chinese Communist Party—called for the radical expansion of the PRC nuclear force and argued that that nuclear force should grow to at least 1,000 nuclear warheads, with a significant expansion of its nuclear missiles expressly targeted at the United States.^{vi}

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That General Secretary Xi Jinping would do this should not be surprising. It's been clear since he took power in 2012 that he was a Chinese leader who was done with the practice of the previous Chinese Communist Party leadership to "hide and bide".

General Secretary Xi promises the "eventual demise of capitalism". He promises that Chinese socialism will "win the initiative and have the dominant position."^{vii} This is not a promise of peaceful co-existence between competing world views.

We have not heard such rhetoric since Soviet First Secretary Nikita Khrushchev warned the West "we will bury you."^{viii}

Speaking of Soviet leaders, there is the nuclear program of Vladimir Putin to consider.

When the Obama Administration decided to negotiate that treaty, it maintained the Cold War legacy of only covering certain types of Russian nuclear forces.

At that time, 2009-10, it was already known that Russia possessed a ten-to-one advantage over the U.S. in terms of so-called "nonstrategic" or "unconstrained" nuclear weapons.^{ix}

Because of that Administration's misjudgment, the Senate's Resolution of Ratification for New START, which passed by the narrowest margin in the long history of arms control treaties, included a requirement that the Administration immediately seek to pursue a follow-on treaty that would capture those weapons.^x

Of course, the Russians saw no need to seriously consider any limit on them for the remainder of that Administration.

It's important to understand how we got to where we are with Russia's nuclear forces today: New START was a one-sided deal.

The Russians grew their nuclear force to reach the central limits of that treaty (up to 1550 strategic deployed nuclear warheads and up to 700 deployed strategic delivery vehicles); only the U.S. was obligated to cut those weapons.^{xi}

What has Russia done in the intervening ten years since New START entered-into-force?

Indeed, a decade after New START was ratified, Russia's accomplishment was clear: Putin had managed to exempt from arms control the bulk of his nuclear modernization program.

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I previously mentioned Admiral Richard's statement from *Proceedings*; his warnings about Russia were just as attention-worthy as his warnings about China:

“[m]ore than a decade ago, Russia began aggressively modernizing its nuclear forces...Russia is building new and novel systems, such as hypersonic glide vehicles, nuclear-armed and nuclear-powered torpedoes and cruise missiles, and other capabilities.”^{xii}

Further, according to the U.S. Intelligence Community Russia has built up an enormous capability to deploy a stockpile of non-deployed strategic nuclear warheads in the event it chooses to do so.^{xiii}

Likewise, “Russia possesses up to 2,000 such non-strategic nuclear warheads not covered by the New Start Treaty” and has “dozens of these [nonstrategic delivery] systems already deployed or in development”.^{xiv}

Among these weapons,

“Russia is adding new military capabilities to its existing stockpile of nonstrategic nuclear weapons, including those employable by ships, aircraft, and ground forces. These nuclear warheads include theater- and tactical-range systems that Russia relies on to deter and defeat NATO or China in a conflict” and many are fielded on delivery systems that have a “dual-capable nature”.^{xv}

Fielding these “new military capabilities” may explain why Russia (and apparently the People's Republic of China) is assessed to be conducting low yield nuclear weapons tests in violation of the Comprehensive Nuclear Test Ban Treaty (CTBT) as it is understood to apply; these are tests the United States last conducted in 1992 and foreswore in 1995.^{xvi}

Then Secretary of State Pompeo stated, “[o]nly 45 percent of Russia's nuclear arsenal is subject to numerical limits...[m]eanwhile, that agreement restricts 92 percent of America's arsenal.”^{xvii xviii}

It's the simple fact that virtually every nuclear weapons delivery system the U.S. can deploy, and every type of nuclear weapon we deploy, is limited by arms control; that is simply not the case with the Russian Federation.

We have recently seen the Biden Administration pursue the five-year extension of the New START Treaty. We have locked in these Russian advantages for five more years. I believe this was a mistake.

I encourage you to also consider the role adversary chemical and biological weapons and weapons related activities play with respect to our nuclear posture.

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Since joining the Chemical Weapons Convention and the Biological Weapons Convention, and eliminating our related weapons capabilities, the U.S. has deterred attacks on itself, and its allies, with these weapons with its nuclear weapons.

Understanding the rapidly materializing threats from these weapons is directly in your jurisdiction, even if some of the defenses and responses belong within other committees and subcommittees.

It is increasingly clear that the COVID-19 pandemic originated from the Wuhan Institute of Virology, likely accidentally, reminding us of the intrinsic risks of dual-use biological research.

This is a good reminder that the U.S. Department of State, in its annual arms control compliance reports, has never, not once, been able to certify that the People's Republic of China^{xix} (nor the Russian Federation^{xx}, for that matter) is in compliance with its Biological Weapons Convention obligations.

Of course, Russia's flagrant disregard for its obligations under the Chemical Weapons Convention^{xxi}, (CWC) and the conduct of its puppet in Syria^{xxii}, show that these weapons are, sadly, still with us. Likewise, the Islamic Republic of Iran continues to be in violation of its commitments under the CWC^{xxiii}.

As I mentioned, these are matters, the consequences of which, directly relate to this subcommittee's jurisdiction.

For example, many ideologues in the disarmament community feverishly proclaim the need for the United States to forswear the use of U.S. nuclear weapons other than in response to a nuclear attack.

This so-called "Sole Purpose" doctrine would have you overlook these adversary weapons programs along with assurances made at the time of the ratification of the CWC, for example, that the US would always possess nuclear weapons and therefore these other types of weapons of mass destruction were simply no longer needed.^{xxiv}

But there is a bipartisan approach to defend the United States and its dozens of allies from the threats posed by weapons of mass destruction that I urge you to continue to support.

Now-Secretary of Defense Lloyd Austin stated to the Senate Armed Services Committee, "I agree that nuclear deterrence is the Department's highest priority mission and that updating and overhauling our nation's nuclear forces is a critical national security priority."^{xxv}

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He joins a long line of our nation's senior national security leaders, military and civilian, who have stated that nuclear deterrence is the top priority for the Department of Defense.

Four Secretaries of Defense from both political parties have endorsed the same principle in favor of the nuclear modernization program developed by President Obama and carried forward by President Trump.

What this subcommittee should do to counter the aforementioned threats is recommit to the bipartisan Obama-Trump nuclear modernization program.

This bipartisan plan means modernizing the complementary three-legged stool of nuclear weapons delivery systems – heavy bombers capable of fielding gravity bombs and air-launched cruise missiles and dual-capable aircraft; ballistic missile submarines, with missiles capable of carrying low-yield and larger-yield warheads; and, land-based intercontinental ballistic missiles.

This bipartisan modernization program also includes the Manhattan Project era complex of nuclear weapons production facilities. A modernized plutonium pit production and uranium manufacture capability were integral elements of the bipartisan Obama-Trump nuclear deterrent modernization program.

While these programs are often far less visible in public debates than the higher-profile DOD weapons systems, they are the *sine qua non* of the U.S. nuclear deterrent.

If the National Nuclear Security Administration can't produce the weapons to put on top of the missiles and under the wings of the bombers, as our adversaries are able to do in great numbers, those weapons systems are not able to serve the purpose of nuclear deterrence.^{xxvi}

I'd be surprised if anyone in this room owns a car as old as any one of these delivery systems, all of which are beyond their design life.^{xxvii} A classic 1964 Ford Mustang would be a perfect exception, but probably not something you'd want to depend on. Also, that's likely younger than the B52s we operate today.

These systems either must be modernized or they will no longer be available to defend the American people.^{xxviii}

Allowing these systems to atrophy into irrelevance would mean disregarding the advice of the nation's senior military officer, the Chairman of the Joint Chiefs General, Mark Milley, U.S. Army, who stated "[t]he nuclear Triad has kept the peace since nuclear weapons were introduced and has sustained the test of time."^{xxix}

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Likewise, this panel should make a bipartisan call for a new Nuclear Posture Review before any significant changes are made to the nation's nuclear force or its posture.

Presidents Clinton, Bush (43), Obama and Trump all undertook Nuclear Posture Reviews.

The question for the Biden Administration is whether it will undertake a similar review, and will it propose changes to the U.S. nuclear force and posture before or in the absence of one?

There is a loud disarmament clerisy that is arguing for adopting a series of destabilizing and reckless steps – like abandoning the modernization of the ICBM leg of the triad or adopting a so-called no-first use policy and even “de-alerting” our nuclear weapons – and simply bypassing the Nuclear Posture Review process.

Even the NPR process is not perfect: we saw during the Obama Administration a series of steps, idealistic and naïve, to show “moral leadership” to the world in furtherance of nuclear disarmament.

For example, the Obama NPR eliminated the TLAM-N cruise missile (at the risk of undermining confidence of key allies in the extended deterrent), de-MIRVed our land-based missile force, and adopted a narrower nuclear use policies.

None of these steps were reciprocated by a U.S. adversary; in fact, our adversaries proceeded in the opposite direction.

The world is decidedly less safe than it was prior to the Obama Nuclear Posture Review's decisions. No other nuclear power followed President's Obama's lead.

I encourage the subcommittee to consider these facts as you undertake your oversight this year, as you consider the appropriate level for the budgets for the Department of Defense and the National Nuclear Security Administration, and as you draft the National Defense Authorization Act.

Thank you for the opportunity to testify today.

ⁱ <https://www.heritage.org/arms-control/event/virtual-event-behind-the-great-wall-secrecy-chinas-nuclear-buildup>

ⁱⁱ <https://www.usni.org/magazines/proceedings/2021/february/forging-21st-century-strategic-deterrence>

ⁱⁱⁱ <https://www.hudson.org/research/15063-transcript-the-arms-control-landscape-ft-dia-lt-gen-robert-p-ashley->

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iv Id.

v <https://media.defense.gov/2020/Sep/01/2002488689/-1/-1/1/2020-DOD-CHINA-MILITARY-POWER-REPORT-FINAL.PDF>

vi <https://www.globaltimes.cn/content/1187766.shtml>

vii <https://palladiummag.com/2019/05/31/xi-jinping-in-translation-chinas-guiding-ideology/>

viii https://archive.org/stream/khrushchevinamer006997mbp/khrushchevinamer006997mbp_djvu.txt

ix <https://www.tandfonline.com/doi/full/10.1080/01495930903563128?scroll=top&needAccess=true&>

x <https://2009-2017.state.gov/t/avc/rls/153910.htm>

xi <https://2009-2017.state.gov/t/avc/rls/164722.htm>

xii <https://www.usni.org/magazines/proceedings/2021/february/forging-21st-century-strategic-deterrence>

xiii <https://www.dia.mil/News/Speeches-and-Testimonies/Article-View/Article/1859890/russian-and-chinese-nuclear-modernization-trends/>

xiv Id.

xv Id.

xvi <https://www.dia.mil/News/Speeches-and-Testimonies/Article-View/Article/1875351/dia-statement-on-lt-gen-ashleys-remarks-at-hudson-institute/>

xvii <https://fas.org/blogs/security/2020/10/nuclear-arsenal-confusion/>

xviii <https://www.pbs.org/newshour/show/u-s-russia-close-to-a-deal-on-nuclear-arms-control-says-special-envoy>

xix <https://www.state.gov/wp-content/uploads/2020/06/2020-Adherence-to-and-Compliance-with-Arms-Control-Nonproliferation-and-Disarmament-Agreements-and-Commitments-Compliance-Report-1.pdf>

xx Id.

xxi <https://www.state.gov/wp-content/uploads/2020/06/2020-10C-Report-Unclassified-Version-for-H.pdf>

xxii Id.

xxiii Id.

xxiv <https://www.congress.gov/congressional-report/104th-congress/executive-report/33/1>

xxv Austin Advanced Policy Questions responses, Senate Armed Services Committee, January 15, 2021.

xxvi <https://www.hudson.org/research/15063-transcript-the-arms-control-landscape-ft-dia-lt-gen-robert-p-ashley-jr>

xxvii <https://media.defense.gov/2020/Nov/24/2002541293/-1/-1/1/FACTSHEET-THE-IMPORTANCE-OF-MODERNIZING-THE-NUCLEAR-TRIAD.PDF>

xxviii <https://www.airforcemag.com/Hyten-Says-Nuclear-Modernization-Cannot-be-Delayed/>

xxix <https://media.defense.gov/2020/Nov/24/2002541293/-1/-1/1/FACTSHEET-THE-IMPORTANCE-OF-MODERNIZING-THE-NUCLEAR-TRIAD.PDF>

Tim Morrison
Senior Fellow, Hudson Institute

Tim Morrison is a senior fellow at Hudson Institute, specializing in Asia-Pacific security, missile defense, nuclear deterrent modernization, and arms control.

Morrison currently serves on the U.S. Strategic Command Strategic Advisory Group; the Lawrence Livermore National Laboratory Expert Review Committees for the Weapons and Complex Integration Directorate; and the Sandia National Laboratory External Advisory Board for Global Security.

Most recently, Mr. Morrison was deputy assistant to the president for national security in the Trump administration. He served as senior director on the National Security Council for European affairs, where he was responsible for coordinating U.S. government policy for 52 countries and three multilateral organizations. Prior to that post, he was senior director for counterproliferation and biodefense, where he coordinated policy on arms control, North Korean and Iranian weapons of mass destruction programs, export controls and technology transfers, and implementation of the Trump administration's Conventional Arms Transfer policy.

For 17 years, Mr. Morrison worked in a variety of roles on Capitol Hill. From 2011 through July 2018, he served on the House Armed Services Committee staff, initially as staff director of the Subcommittee on Strategic Forces and ultimately as policy director of the Committee. As policy director, Mr. Morrison led implementation of Chairman Mac Thornberry's priorities, including overseeing implementation of the Trump administration's National Security Strategy and National Defense Strategy, prohibition of Chinese Communist Party-linked information technology and video surveillance technology, and House-passage of the Foreign Investment Risk Review Modernization Act (FIRRMA) and the Export Control Reform Act (ECRA) as part of the Fiscal Year 2019 National Defense Authorization Act.

From 2007 until 2011, Mr. Morrison was the national security advisor to U.S. Senator Jon Kyl (AZ), the Senate Republican Whip, where he assisted in coordinating national security policy and strategy for the Senate Republican Conference and led policy initiatives on nuclear weapons, arms control, export controls, and economic sanctions.

Mr. Morrison has a B.A. in political science and history from the University of Minnesota. He also has a J.D. from the George Washington University Law School. He is an intelligence officer in the United States Navy Reserve, serving since 2011.

**DISCLOSURE FORM FOR WITNESSES
COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES**

INSTRUCTION TO WITNESSES: Rule 11, clause 2(g)(5), of the Rules of the House of Representatives for the 117th Congress requires nongovernmental witnesses appearing before House committees to include in their written statements a curriculum vitae and a disclosure of the amount and source of any federal contracts or grants (including subcontracts and subgrants), and contracts or grants (including subcontracts and subgrants), or payments originating with a foreign government, received during the past 36 months either by the witness or by an entity represented by the witness and related to the subject matter of the hearing. Rule 11, clause 2(g)(5) also requires nongovernmental witnesses to disclose whether they are a fiduciary (including, but not limited to, a director, officer, advisor, or resident agent) of any organization or entity that has an interest in the subject matter of the hearing. As a matter of committee policy, the House Committee on Armed Services further requires nongovernmental witnesses to disclose the amount and source of any contracts or grants (including subcontracts and subgrants), or payments originating with any organization or entity, whether public or private, that has a material interest in the subject matter of the hearing, received during the past 36 months either by the witness or by an entity represented by the witness. Please note that a copy of these statements, with appropriate redactions to protect the witness's personal privacy (including home address and phone number), will be made publicly available in electronic form 24 hours before the witness appears to the extent practicable, but not later than one day after the witness's appearance before the committee. Witnesses may list additional grants, contracts, or payments on additional sheets, if necessary. Please complete this form electronically.

2/23/2021

Hearing Date: _____

Hearing Subject:

Subcommittee on Strategic Forces: "Near Peer Advancements in Space and Nuclear Weapons."

Witness name: Tim Morrison, Hudson Institute

Position/Title: Senior Fellow

Capacity in which appearing: (check one)

☒ Individual ☐ Representative

If appearing in a representative capacity, name of the organization or entity represented:

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Federal Contract or Grant Information: If you or the entity you represent before the Committee on Armed Services has contracts (including subcontracts) or grants (including subgrants) with the federal government, received during the past 36 months and related to the subject matter of the hearing, please provide the following information:

2021

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
Morrison - Sandia	NNSA	up to \$12,500.00	Global Security Advisory
Morrison - LLNL	NNSA	up to \$36,000.00	WCI Advisory Board
Morrison - University of Nebraska	Dept of State	up to \$5,000	Contractor support

2020

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
Hudson - Contract	Defense Threat Reduction Agency	\$99,967	Countering Emerging Russian and Chinese Hypersonic threats
Morrison - Sandia	NNSA	\$0	Global Security Advisory Board
Morrison - LLNL	NNSA	\$5000.00	WCI Advisory Board
Morrison - University of Nebraska	Dept of State	approx \$50,000	Contractor support

2019

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant

2018

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant

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2021

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2020

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment

2019

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment

2018

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment

Fiduciary Relationships: If you are a fiduciary of any organization or entity that has an interest in the subject matter of the hearing, please provide the following information:

Organization or entity	Brief description of the fiduciary relationship

Organization or Entity Contract, Grant or Payment Information: If you or the entity you represent before the Committee on Armed Services has contracts or grants (including subcontracts or subgrants) or payments originating from an organization or entity, whether public or private, that has a material interest in the subject matter of the hearing, received during the past 36 months, please provide the following information:

2021

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
Hudson - Payment	Northrop Grumman Corporation	\$75,000	Defense Research

2020

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
Hudson - Payment	Lockheed Martin Corporation	\$75,000	General Support

2019

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
Hudson - Payment	Lockheed Martin Corporation	\$85,000	General Support
Hudson - Payment	Raytheon	\$50,000	General Support
Hudson - Payment	Northrop Grumman	\$50,000	Missile Defense Research

2018

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
Hudson - Payment	Lockheed Martin Corporation	\$60,000	General Support
Hudson - Payment	Northrop Grumman Corporation	\$50,000	Missile Defense Research
Hudson - Payment	General Atomics	\$150,000	General Support

**WITNESS RESPONSES TO QUESTIONS ASKED DURING
THE HEARING**

FEBRUARY 23, 2021

RESPONSES TO QUESTIONS SUBMITTED BY MR. CARBAJAL

Ms. CREEDON. [No answer was available at the time of printing.] [See page 24.]

General KEHLER. The United States and Soviet Union developed mutual understanding on many critical issues as a result of ongoing strategic dialogue during the Cold War. That mutual understanding helped inform our judgment, reduce risks, and contribute to stability. The lack of such routine dialogue today complicates our relationship with contemporary Russia and results in great uncertainties in our relationship with China. As China continues to emerge as a nuclear-armed global power, it is critical that we engage with them in meaningful discussions that can contribute to understanding and stability as it did with the Soviet Union. I believe military-to-military discussions among professionals who have much in common even when serving vastly different political systems is a sound place to start. [See page 24.]

Mr. HARRISON. It is possible to compete with China in some areas while also cooperating and engaging with China in other areas. In space, Chinese advancements in counterspace weapons indicate that we are clearly competing with them militarily. But that competition should not preclude the possibility of cooperating with China in space for science and exploration missions, as we did with the Soviets throughout the Cold War. Cooperation can open new channels of communication, provide valuable insights into Chinese space programs and capabilities, and create a foundation for confidence building and mutual understanding. In the space domain, communication, transparency, and mutual understanding would help establish norms for acceptable behavior in space. To make this type of cooperation possible, Congress should lift the limitations on NASA's ability to engage with China where our two nations have shared scientific objectives, where partnering will be mutual beneficial to achieving these goals, where the transfer of technology or other sensitive data can be effectively prohibited, and where it will not adversely affect our existing alliances and partnerships. [See page 24.]

Mr. MORRISON. [No answer was available at the time of printing.] [See page 24.]

QUESTIONS SUBMITTED BY MEMBERS POST HEARING

FEBRUARY 23, 2021

QUESTIONS SUBMITTED BY MR. LANGEVIN

Mr. LANGEVIN. What capabilities within space and hypersonics should the U.S. incorporate into nonproliferation negotiations with Russia and China?

Ms. CREEDON. [No answer was available at the time of printing.]

Mr. LANGEVIN. How will nuclear-armed hypersonics affect current deterrence relationships that the U.S. has with Russia and China? What will keep these relationships stable as technology progresses?

General KEHLER. The principles of deterrence remain the same regardless of the weapons or delivery systems. An adversary must believe that they cannot achieve their objectives by attacking the U.S. and our allies, that they will suffer unacceptable consequences if they try, or both. Nuclear-armed hypersonic weapons cannot provide any adversary a perceived advantage in their decision calculations. While the U.S. has faced "hypersonic" nuclear weapons in the form of nuclear reentry vehicles delivered by ballistic missiles, the introduction of modern hypersonic nuclear weapons in the form of cruise missiles or other sea or air-delivered systems will complicate detection, mask intent (whether the warhead is nuclear or non-nuclear will be difficult to discern), and compress decision and reaction time. These are challenges that can lead to instability and miscalculation. The U.S. must clearly communicate to Russia and China that hypersonic weapons (or, for that matter, other excursions like low-yield nuclear weapons or long range underwater drones) will not provide them with a decisive strategic or tactical advantage, and that crossing the nuclear threshold with any type of delivery system will result in unacceptable consequences. To reduce the chances for such miscalculations, I believe it is vitally important for the U.S. and Russia and China to engage in strategic dialogues as hypersonic weapons and other new technologies emerge

QUESTIONS SUBMITTED BY MR. MOULTON

Mr. MOULTON. I appreciate your comments on the need to exercise a whole-of-government approach to address complex topics like Russian and Chinese advancements in nuclear weapons and space, and how these developments impact American security, policy, and investment decisions. One of the recommendations in the Future of Defense Task Force, which I co-led, calls for the U.S. to reconfigure and reimagine the national security structure to partner the Department of State with the Department of Defense, promoting diplomatic leadership and a whole of government effort to thwart emerging threats and compete with adversaries. Do you agree with these recommendations and do you think this type of reconfiguration will help develop a comprehensive strategy to address the challenges posed by China and Russia with their developments in nuclear weapons and space?

Ms. CREEDON. [No answer was available at the time of printing.]

Mr. MOULTON. The current Commander of U.S. Strategic Command, Admiral Richards, was quoted by your fellow witnesses saying that "China's nuclear weapons stockpile is expected to double (if not triple or quadruple) over the next decade." Given the previous administration's inability to make any deal which brought China to the table on arms control, and leveraging your prior executive experience in the Executive Branch with nuclear security, what steps can we take now to guide China towards joining a future arms control treaty?

Ms. CREEDON. [No answer was available at the time of printing.]

Mr. MOULTON. In your recent report on "Protecting Space Systems from Counter-space Weapons", you describe a growing trend where major military powers are viewing space less as a information domain for remote sensing and communications and more as a physical domain with emphasis on the application of force in or from space and the use of space for transportation, logistics, and other physical support functions. Can you please elaborate on how this gradual shift will impact the types of defenses that we will have to prioritize and develop?

Mr. HARRISON. The gradual shift to viewing space as more of a physical domain means that the United States will need to begin looking more carefully at active defenses for the space domain. Specifically, we will need defensive capabilities that can protect against adversary attempts to limit or degrade our freedom of action in

the space domain and our ability to use space for transportation and logistics support to forces on the ground. In particular, a physical seizure capability may prove particularly useful because it would allow us to capture non-cooperative objects in space that pose a physical threat to safety or are otherwise interfering with space operations.

QUESTIONS SUBMITTED BY MR. WALTZ

Mr. WALTZ. Russia is modernizing all three legs of its strategic deterrent capability, including new ICBMs (both silo and road-mobile), new ballistic missile submarines, and new strategic bombers. These modernization efforts, which began in the late 1990s, resulted in new systems fielding in the 2010s and are ongoing today. Likewise China is investing in modernizing its nuclear deterrent capabilities, including several new variants of ICBMs, new ballistic missile submarines, and air-launched nuclear missiles that will enable it to field a strategic triad. While China is less open about its activities, it is believed that China began investing significantly in its strategic deterrent capabilities starting in the 2010s with a goal of surpassing America as the dominant power in the Asia-Pacific region by 2049. Meanwhile, the U.S. deferred modernizing its strategic deterrent capabilities several times, finally initiating programs in the mid-to-late 2010s. And these modernization efforts, are criticized as being unneeded.

Do you believe that Russia and China are watching whether the U.S. executes its nuclear modernization programs? How might they view any vulnerabilities if aspects of the U.S. nuclear triad are delayed or degraded? What does the U.S. need to do to raise our deterrence value and to reduce the risk that China and Russia may try to take advantage of any U.S. vulnerabilities?

Ms. CREEDON. [No answer was available at the time of printing.]

Mr. WALTZ. Russia is modernizing all three legs of its strategic deterrent capability, including new ICBMs (both silo and road-mobile), new ballistic missile submarines, and new strategic bombers. These modernization efforts, which began in the late 1990s, resulted in new systems fielding in the 2010s and are ongoing today. Likewise China is investing in modernizing its nuclear deterrent capabilities, including several new variants of ICBMs, new ballistic missile submarines, and air-launched nuclear missiles that will enable it to field a strategic triad. While China is less open about its activities, it is believed that China began investing significantly in its strategic deterrent capabilities starting in the 2010s with a goal of surpassing America as the dominant power in the Asia-Pacific region by 2049. Meanwhile, the U.S. deferred modernizing its strategic deterrent capabilities several times, finally initiating programs in the mid-to-late 2010s. And these modernization efforts, are criticized as being unneeded.

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General KEHLER. Russia and China watch our strategic forces and track our modernization efforts very carefully. The credibility of the U.S. nuclear deterrent is based on demonstrated capabilities and the willpower to use them in extreme circumstances when vital national interests are at stake; both of which must be clearly communicated to and understood by any potential adversary. Therefore, it is vitally important for the U.S. to proceed with the bi-partisan strategic modernization program that Congress has supported for well over a decade. That program retains and modernizes the triad, upgrades the critical nuclear C3 system, and ensures that the highly specialized nuclear weapon laboratories and industrial base can ensure the weapons remain safe, secure, and effective. Completing that comprehensive modernization program is the most important step Congress can take to ensure the credibility and value of our deterrent.

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Mr. HARRISON. I believe nuclear modernization is important to maintaining the credibility of our nuclear deterrent in the eyes of adversaries. We have little schedule margin left in replacing our existing Ohio-class submarines and Minuteman III ICBMs before they reach the end of their useful life. Any delays in these programs, whether due to technical challenges or budgetary issues, would likely mean that the United States will not be able to field the full quantity of delivery systems allowed under New START. Modernization of the bomber leg of the triad through the B-21 program is a pressing concern because of a lack of stealthy, long-range strike aircraft in the inventory for both conventional and nuclear missions.

Besides keeping these three main modernization programs on track, the United States needs to address vulnerabilities and shortfalls in its nuclear command and control systems. Space systems that support NC2 are of particular concern because modernization of these programs have been delayed and the space environment is less forgiving. A top priority should be building more resilient architectures for protected communications and missile warning that do not rely on small numbers are "juicy targets" in geostationary orbit. These next-generation systems should use dispersed, proliferated, and diversified architectures to improve their resilience to attack and make them less attractive targets for adversaries.

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Mr. MORRISON. [No answer was available at the time of printing.]

QUESTIONS SUBMITTED BY MR. MORELLE

Mr. MORELLE. There has been much discussion recently on Chinese and Russian activities regarding very low yield nuclear testing in potential violation of the Comprehensive Test Ban Treaty. Given your experience at the NNSA, do you see a need for the U.S. to return to testing? Or are U.S. capabilities, such as the Omega Laser facility, adequate?

Ms. CREEDON. [No answer was available at the time of printing.]