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New Technologies and the Future of Arms Control
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James Acton: Thank you for everybody joining for this final session at the 2021 Virtual Carnegie International Nuclear Policy Conference. This is the last time you're going to hear from me at this conference. So before I introduce the next panel, I'd just like to say a personal thank you to everybody who helped make this conference possible, and everybody who has joined throughout this event. And to say I'm very much looking forward to seeing you in person again in October 2022.

To end this conference is a subject that's extremely close to my heart, and my research for that matter. A question of new technologies, and how to manage those technologies cooperatively through arms control. New technologies both create the potential for nuclear forces to become more survivable. For example, gliding hypersonic systems can penetrate missile defenses. At the same time they also create potential to undermine the survivability of nuclear forces, and this creates a real management challenge about how to mitigate the risks of force vulnerability in a cooperative way.

I couldn't think of a better panel to be examining these questions than the one that I'm about to introduce you, and to bring a true set of diverse national perspectives on to this critically important problem. So let me briefly introduce the panel. Andrey Baklitskiy, from Russia is a senior research fellow at MGIMO University. Wu Riqiang is an associate professor at the School of International Studies of Remnin University in China. Heather Williams is currently a Stanton Nuclear Security Fellow at the Massachusetts Institute of Technology, here in the United States. And to moderate this panel, it's my pleasure to hand over to Jane Vaynman, who is an assistant professor of political science at Temple University in sunny Philadelphia. Jane, thanks so much for taking the time today.

Jane Vaynman: Great. Thank you, James. Thanks, everyone, for joining us. I'm very excited to be moderating this panel. I have about a million questions about this topic. So I'm excited to engage with our panelists, and have a pretty active discussion. Welcome, everyone. So why don't we just dive right in. And it's interesting that James brought up are different national perspectives. I think that's really important. So it's not a surprise, I think, to any of us or to anyone watching, when we talk about new technologies, hear the words “arms control”, that intersection is going to mean a lot of different things for different people in different countries. So I think it's useful to kind of highlight those differences as we get into it.

So as previous panels, I'll start off with a couple of questions, to each of you, and then we'll lead into our back and forth, followed by q&A from the audience. So I'll start with a question to Dr. Baklitskiy. So American and Russian interest towards strategic weapons are increasingly symmetric. The United States is primarily concerned about Russia's nuclear weapons including the new exotic strategic nuclear weapons and non-strategic nuclear weapons. On Russia side, primarily concerned about US nonnuclear weapons, including ballistic missile defenses, high precision conventional weapons. So the question is, what do you see as the most plausible, cooperating, cooperative approach to start managing some of Russia's concerns? And where do the emerging or new technologies play a role in what that approach might look like?

Andrey Baklitskiy: Thanks. And thanks to the organizers for inviting me. It's a great pleasure and great honor to speak at the Carnegie Nuclear Policy Conference. And of course, this is my luck. This one had to be the one happening online and not online. To the question, my answer will be less probably about technical issues, more about the broader approach and the process. And we can totally discuss technical issues later on. I think a good start, for any of those would be to acknowledge that Russian concerns are real, and something should be done to address them. And I think it's true for any country in any negotiations. But it's not what has been happening on the US side, not at the official level, at least.

You mentioned the missile defense. And Russia has been raising this issue forever, especially since the US withdrew from the ABM treaty, because it believes that US missile defenses could degrade its second strike capability. And Russia has been proposing to limit it somehow. But US responses were basically twofold. Either you can produce countermeasures, and that would be Bush administration was saying, or let's do transparency. That's what Obama administration was saying. So we'll show you that you're wrong, and those systems are not threatening. Well, the problem with transparency is that US is already quite transparent. Russians read the same Congressional Research Service reports. They listen to the same senate testimonies, and they just make

different conclusions. Because US is big, US is very rich, and US changes its mind a lot. And you don't know what US will do tomorrow.

And I remember people ridiculing Russian estimates in something like 2018, that US will have hundreds of interceptors, but then we tested some relocked way against ICBM target, and it's becoming a reality. The US was talking nonstop that MK-41 launchers of Aegis Ashore are not capable under any conditions of launching offensive missiles. And then US they just said after leaving the INF Treaty. So this leaves us with countermeasures. And indeed, I've been hearing more and more that now that Russia has those new strategic systems. US missile defense is not a problem, and we should move on. But the reason Russia got the systems in 2018, which are very expensive, and some razor apocalyptic, was that we started working on them in the early 2000s. You cannot start developing new countermeasures when your opponent deploy his systems, you have to do it in advance. So it would be really nice if Russian government did not feel that it needs to spend huge amounts of money to produce some crazy systems to counter whatever missile defenses US might be fielding in 2013. And missile defense is just one example here, we have many more.

So getting back to your question, agreeing that such and such systems have an impact on such and such systems. And if their numbers increase or location changes, it impacts this and this, this would be a real breakthrough. And that's pretty much what Russia means when it proposes to agree on so-called security or strategic equation. It's basically what impacts what. And this would, of course, go for US concerns as well. Once we got this, we can move forward with the specifics. But talking about each systems in abstract as if they don't interact and impact each other, I think that that wouldn't bring us anywhere. Thank you.

Jane Vaynman: Thanks. Dr. Wu, China has expressed concerns that are similar to Russia's about the US non-strategic capabilities and their implications for the survivability of the Chinese nuclear arsenal. If the United States expressed some willingness to try to address China's concerns, probably likely with some kind of politically binding confidence building measures and transparency as opposed to a formal treaty but maybe, the question is what, if anything, should China be prepared to offer in return in the context of cooperation?

Wu Riqiang: Yeah, thank you. Thank you again, thank you for introducing. I think China have two specific concerns. The first one is a mutual vulnerability. The second one is missile defense. Om the first one, I think, we know a couple days ago President Biden and President Xi put inside a joint statement on strategic stability in which they reaffirmed the Reagan-Gorbachev principle, that a nuclear war cannot be won and must never be fought. That is another way to say mutual vulnerability. So it seems to me that actually, China has proposed many times that P-5 should reaffirm the

Reagan-Gorbachev principle. But it seems to me that the US is ready to do that with Russia, but not with China. So here's the problem. If the US don't even recognize mutual vulnerability with China, so why China wants to do arms control with the United States. So here's the first concern.

Second one is the missile defense. As Andrey has said, very good on missile defense. I will not repeat that. I did emphasize that since China's nuclear arsenal is much smaller than Russia, so missile defense has a much higher potential impact on China than Russia. So I think, in order to get any serious arm control with China, missile defense must be on the table. So by the current US policy, it seems to me that missile, US said it will never accept any limit on missile defense. So I think any arms control proposal that seeks to limit China's nuclear capability must include US missile defense. So return to your question, it depends on US proposal. So I think if the US could propose to limit the missile defense, it doesn't have to be legally binding. It could be political binding the outcome understanding or whatever. And if that is the case, then I think China could offer to limit its own offensive nuclear capability. Could be a agreement to freeze all the SIMS at current level or whatever.

Jane Vaynman: Thanks. So one of the things that's already coming up is this asymmetric interest and asymmetric capabilities, even as you both brought up of missile defense is itself kind of an asymmetric capability between different countries. Dr. Williams, you've written about the possibility about asymmetric arms control, which might include two sides or multiple sides even an agreement, taking on commitments in different domains. So for example, one side would agree to reduce or limit nuclear forces, the other side would limit non-nuclear forces. Could this type of idea be used to manage some of the asymmetries in US interests? And on the other hand, Russian and Chinese interests on the other? And how exactly?

Heather Williams: Thanks for the question. So the short answer is yes, arms control could help manage these asymmetries. Given recent technological advances, asymmetric arms control, I recognize it's going to be challenging. But I also think that a lot of these asymmetries are just unavoidable. They are a reality of the strategic environment we live in. And so arms control is going to have to adapt to that. Just to kind of, I think, the two previous speakers really captured some concerns about this. To offer another example. China might have a smaller nuclear arsenal, but its non-nuclear strategic capabilities, its geographic proximity to US allies, this has the potential to impact crisis dynamics from the US perspective. But I also recognize Russia and China have similar perspectives on the US, on nuclear capabilities, and their impact on strategic stability, such as advanced conventional weapons and missile defense.

So if we kind of acknowledge that the strategic landscape right now, how can arms control really address this. I think there's a few guiding

principles that we should be keeping in mind. The first is really that any arms control will contribute to shared interests, as Andrey outlined, that it should acknowledge different interests and try to capture them, and be contributing to strategic stability. I don't think anyone is going to recommend arms control for the sake of arms control right now. I also think that we would benefit from agreements that allow for some flexibility, particularly in force structuring. And then the other principle I think, to keep in mind is to start small, and that might be with some trust and confidence building measures, and then meeting look towards building up more ambitious agreements. So maybe starting with something informal, and then working to more formal things. To give some specific examples of what this might look like, the examples I'm about to say, just to clarify, I have proposed some of them. But a lot of other people are also playing around with this idea and putting ideas out there. So I'm not taking credit for everything I'm about to put on the table.

But one example that would be explicitly a symmetric and a non like for like exchange, might be if the US accepted limits on future missile defense deployments in Europe in exchange for reductions in Russian tactical nuclear weapons. Another example that would really focus on flexibility and force structure. This is something that Tong Zhao has written really well on, but it would set an equal ceiling of American, Russian, and Chinese air and land launch nuclear and conventional INF range systems. But then to also offer a kind of more informal and less explicit exchange, this is more of a risk reduction approach that would incorporate multiple domains, would be something like a 21st century version of the incidents that see agreement. And that might look at cyber threats to nuclear systems, particularly nuclear command and control.

But I do also really want to caveat all of this by acknowledging those challenges, because I think that they are also unavoidable. And from the US perspective, there's three really big challenges, I think. The first is going to be getting US allies on board with this. The option that I just mentioned, with regards to missile defense, this wouldn't entail rolling back any existing deployments or systems or existing capabilities. But nonetheless, this could make some NATO allies a bit nervous about US credibility. As we heard Dr. Kahl talk about yesterday, rebuilding credibility with allies is a top priority for the administration. Second big challenge is going to be verification, like, how do you count cyber or AI? How do you get around dual use issues and secrecy? And then the final challenge is domestic politics in the US. It's really hard to envision any treaty or formal agreement being ratified by the Senate, which I think for now takes us back to my starting point, we might need to start small. These might not be treaty options for the time being. But they might provide a lot of the transparency and predictability that arms control can contribute to strengthening strategic stability.

Jane Vaynman: Thanks. So I want to keep developing this question of asymmetry, and bring Andrey and Riqiang into this. Because so the question I have in thinking about some of these ideas that I've seen proposed that, even if we can make the case that asymmetric deals might be possible, even if they're very difficult, but we need to start working on them. Okay, start there. How does new technology affect this picture? Does it at all? And what I'm wondering about does the development of new technologies in the nuclear and conventional space, does it make the space for bargaining in asymmetric ways, even more challenging than it already is? Or are there ways that new technology, maybe perhaps counter intuitively, can ameliorate some of the challenges that arise from considering asymmetric forms of arms control? Maybe I'll go to Dr. Wu to weigh in on, since China has in many ways could have a more asymmetric situation than Russia. I'm curious what you think.

Wu Riqiang: Yeah, that's a good question. I think one part is, with hypersonics. I would say hypersonics actually help solve, to some extent, the assymetry problem because those missiles could help Russia or China to penetrate US missile defense. So to some extent currently, Russia has already deployed intercontinental range hypersonics missile. And China, I think is also developing that kind of weapon. So if that's the case, if both countries deployed that intercontinental range hypersonic missile, I think US missile defense maybe would be a less problem. Of course, we noticed that Russia is also developing defense capabilities against the hypersonic missiles. That's kind of technical competition.

Jane Vaynman: Andrey, what do you think, if Russia deploys more hypersonic, is it likely to have fewer concerns about US missile defense?

Andrey Baklitskiy: Yeah, everybody should deploy more hypersonics, and we'll be just fine. I'm kidding. But generally we did arms control before which included asymmetries. I'll be not going into details. But there have been quite a lot. If you look at the history. And emerging technologies, I would say it's really hard to speak in the abstract, because there are so many of them and some are more important than others in different ways. But I would like to play devil's advocate here a little bit. And to argue that the new tech issue is slightly overblown. Our main problem currently is with the old tech, is a very old tech, we cannot control missile defenses. We cannot control intermediate range systems, we cannot bend weapons in space, or agree on tactical nukes. So why is everyone so focused on controlling hypersonic weapons, which are many times there are many types of those, and they are very different. I think we should focus more on effective capabilities, than on specific systems and technologies. If something can fly 2000 kilometers, and bring certain yield to my territory, it should be addressed, no matter if it's sea, or air or ground launched, if it's crease, ballistic, or boost glide, if it's hypersonic, supersonic, or subsonic.

So if you really go down to this broad principle, and we understand what impacts what, then we can say, is this system changing anything? Where do we put in this broader equation? And when we put this system or this system? We wouldn't have to say like, and what about hypersonic? How hypersonics has a class impact everything. So that that seems like a more holistic approach to all of this.

Jane Vaynman: Thanks. I like this direction of what's overblown and what's not. And I've been wondering whether it's possible that in the sense, new technologies don't really change how we think about arms control, either the symmetric or the asymmetric varieties. Or maybe you think that all new technologies change things profoundly. Maybe there's some that do and some that don't. I'm curious Heather, do you have a sense of what you think is really worrisome versus overblown?

Heather Williams: Yeah, I thought that Andrey was going to steal my thunder on this point, but he went in a different direction. I think whether or not it's an overblown concern or not, we do have to get more specific. I agree with Andrey's point on that about talking about this in the abstract is really hard. And I'm as guilty of this as anybody, but even just using the term, sorry to use scare quotes, but emerging technologies, like it's just such a massive term, it can encompass so many different things. A lot of these aren't even really emerging technologies anymore. And so I think the more that we can do to really start whittling down into what are specific technologies, but more importantly, what are specific applications that might be of concern.

And so just to kind of go through a few ideas here like hypersonics, I'm not as concerned about hypersonics, as I was when I wrote about them a few years ago, to be frank. I think hypersonics are going to be one of the easiest new tech, newer technologies to incorporate into arms control agreements. But if you look at artificial intelligence, Jessica Cox and I wrote a piece on this a few months ago, which looks at ways that AI could actually have a stabilizing effect. Can it be used in verification and pattern recognition? And so for a lot of the technologies we're talking about, is that need for specificity.

I also think for a lot of them, I don't mean to totally punt on this question, but it really is just too soon to tell. One of the biggest challenges for applying arms control to some of these technologies is that the three countries that we're all representing on here, are still developing them. We still don't know what their full potential is, how are we going to apply them to civilian and military capabilities. We don't know what each other are doing to develop them either. And so applying arms control at that point in a technological trajectory, I think is going to be really challenging. And so yeah, whether or not they're stabilizing or destabilizing, depends on what

it is we're talking about. And I think it's just way too soon. Way too soon to tell for some of them.

Jane Vaynman: Dr.Wu, would you want to weigh in on any of these overblown versus not points?

Wu Riqiang: You mean, me?

Jane Vaynman: Yeah. Wu Riqiang.

Wu Riqiang: So I think it's... Yeah, I agree. I think that just said the hypersonics issue is not a big problem. I see the cyber issue, we talked a lot. But I think it's a separate issue or problem or seperate issue that we cannot verify that. Everybody said everybody said, everybody agree that there could be a problem. But we don't know to what extent it is a problem. And even we are going to negotiate honor uncontrolled treaty, but we don't know how to verify that. So that's a big problem. So our cyber issue, I don't know the degree it is overblown or not.

Jane Vaynman: Let me ask you a follow up to that. So as we're thinking about looking forward in evaluating whether any particular technology or any set of technologies kind of should be included in an arms control process, what are some of the good criteria we should use in order to evaluate whether this technology should be on the table in some way? For example, should we be asking, like, does this technology affect strategic stability? Or are these capabilities, is the set of capabilities particularly expensive to build? Andrey already mentioned the expense of countermeasures. Should cost savings be a big goal? And so I'm curious what you think about what the criteria for evaluating as we start to learn more, as it becomes clearer what these technology, what role these technologies are playing. I'm going to let's out, turn to Dr. Wu first, and then we'll see if anybody else wants to weight in, just looking at whose mics are on.

Wu Riqiang: Yeah, I think the strategic stability is a good criteria. So actually, I think there are two problems. The first issue is that how do we apply new technology to the old definition of strategic stability, or the definitions about nuclear? How do we apply new technology into that definition? Secondly, is actually, from China's perspective, how to develop asymmetric definition of strategic stability, because during the Cold War is all about US and the Soviet Union or US-Russia, the traditional definition of strategic stability. Now how to develop a definition of US-China strategic stability, that's another issue.

Jane Vaynman: Andrey?

Andrey Baklitskiy: If I may, I think the good rule of thumb would be to go with concerns. It doesn't really matter to a certain extent what is like real and

what is not, is more like what certain country feels is real and is a problem. Since all arms control is voluntary and since it's always a negotiation between two parties, then like a great rule, we just go with whatever the other side is saying and see how we can work with that. Because that's the most logical sense. And even if this doesn't impact strategic stability, but the other side believes it's a problem, then you would have to address it somehow.

Jane Vaynman: Dr. Williams, I know, you've done some thinking about not just contemporary emerging technologies, but emerging technologies in general. So how do we assess what matters and what criteria should be for understanding what role that technology will play in arms control?

Heather Williams: I think that those priorities are really going to be up to the individual countries, they're going to be different for all of them. I think the more challenging question maybe, is going to be where we talk about it. Because we're each going to have our different priorities. If we want to convert that into some sort of risk reduction, arms control, stabilizing mechanism, whatever we're calling it, where does that conversation happen? I'm pretty optimistic based on what Deputy Foreign Minister Ryabkov said, and also what Dr. Kahl said during this conference about these technologies being part of the strategic stability dialogues between the US and Russia. I think that is a really important step in the right direction. I kind of wish that the US and China could have similar conversations to talk about, what are the technologies that are most concerning from those different perspectives? So I mean, that's just one of the forum challenges.

One of the recommendations that I hear a lot is, let's put all of this in the P-5 process. And that has its pros and its cons. I think the P-5 process is already helping to kind of tease out the different concerns through the doctrine and transparency as part of the discussion, they are talking a lot more about space. And so I think there's some opportunities there. Also hopefully there's going to be some progress on a P-5 version of the Reagan-Gorbachev statement. That would be really great to have before revcon. But within the P-5, there's only so much that that process can do. And trying to talk about it amongst the five has its real limits. Also that process has a lot going on within it. I think we're running a risk of overloading the P-5 process. And so while it's going to be up to the individual countries to decide what is worth it financially, what's the most concerning. When they come to those conclusions, what do we do with that? Who do we go talk to about it and try to work towards some risk reduction or arms control measure?

Jane Vaynman: Thanks. So I'm going to start pulling on some questions that I'm seeing coming in from the audience as they relate to this conversation. And one question just caught my attention. Because I think it's directly relates to

this problem that you're all identifying that, it's very hard to talk about these things without some more specific, which technology is what we're talking about. And Mikhail Kupriyanov asks, "I have a question about combining arms control conventional nuclear with cyber security. Is there any talk about combining the two? And what could be the potential framework for it?" And I find this interesting, because I don't see a huge amount of discussion for it. But I'm curious if you see something different. And my take or my initial impression will be one of hesitation, like maybe this is kind of a bad idea to mix things and potentially have one hold up the other. So I'm curious whether you think combining either nuclear and cyber or nuclear and something else might actually, I don't know, hold up the old technology that we know quite well, as Andrey said. Andrey, do you want to weigh in on that point?

Andrey Baklitskiy: Right. So I'm not a cyber person. And I try to distance myself from cyber because that's like, completely different beast, and a lot of smart people are working on it. But I often visualize cyber capabilities as good old espionage and sabotage. So do we need a treaty prohibiting sending spies to other countries to blow up nuclear facilities with TNT? I don't know. We don't do at this moment, though it's a possibility that could happen. Instead, we just protect our facilities. On the other hand, I can imagine cases like with Iran and Israel, when this is happening, and where this could be an issue. And they could agree on no physical sabotage against nuclear facilities premium. But that probably, again, would be unverifiable. And the only way you would know that it's being violated when you catch a spy with TNT at your facility. And you can trace it back to the other country.

Would it be similar is cyber? I think so. And probably will have cyber included, it will be quite different from what we have, with arms control, much more basic, much more political agreement like statements, than like formal treaties. But then again, as I said, I'm not a cyber person. Maybe cyber people who say it's all nonsense, and you can have verification and what have you.

Jane Vaynman: Heather, Riqiang, do you want to weigh in?

Heather Williams: I'll jump in on that. Just one idea that I have heard floated around, and Jackie Schneider and others have written on this, is the idea of the cyber no-first-use agreement. So just a declaration not to use cyber, not to launch cyber attacks on each other's nuclear command and control. I'm simplifying the recommendation here. And I think that that gets a little bit of traction in some policy circles. The obvious challenge with it is to how credible are these? During a crisis, is anybody going to believe those sorts of statements? Other challenge would be, I mean, this isn't just for cyber no-first-use agreement, but really, for any cyber arms control, kind of along the lines I think the question would going in is verification,

specifically, also involving the private sector. A lot of the technologies we're talking about aren't always being controlled solely by government officials. They're not always developed by governments.

And just to piggyback on one of Andrey's points that, if we're going to talk about cyber security arms control. I think from the US perspective, it would be really hard to have that conversation without also talking about ransomware attacks, which it seems to be a little bit of a gray area for who is responsible for these. But in conversations with Russia, as an American, I would really hope that any cyber arms control conversation that that would come up. And so I just don't, it's really hard to see overcoming a lot of these. I think the cyber no-first-use agreement, something like that, within the P-5 could potentially be a useful conversation. I'm just not sure how much value it's going to add in terms of strategic stability.

Jane Vaynman: So on the strategic stability point, Erin Dumbacher asked a question. On these particular technology applications which could be controlled to improve strategic stability. So what are the most priority applications? What's the most dangerous, short and long term stability applications that where they might be most interested in controlling. Dr. Wu, I think you've talked a lot quite a bit about strategic stability as a concern. What kinds of scenarios or applications do you think would be most important?

Wu Riqiang: I think I would prefer other eyes are, like a US intelligence capability. The survivability of China's nuclear forces depends on the uncertainty of their locations, which means we hide somewhere you cannot find it, you cannot destroy it. But allies, US have very good eyes are calculating, and if US could detect and locate China's mobile missiles, that will be a big problem for China. And eventually, if you have AI enabled eyes or capabilities, that could be a big problem. But I don't know. Again, I don't know to what degree it is a problem. I don't know.

Jane Vaynman: Heather, Andrey, other priority areas in the strategic stability context that come to mind? Heather?

Heather Williams: Sure. I'll point to three, I think. So I think the first which there seems to be a little bit of consensus about in the policy and academic communities are threats to nuclear or to NC3 systems. And like James Acton's work on entanglement with this, I think, was really important milestone in advancing that conversation. Second one I would point to, it's not specific technology, it's more a suite of technologies that could have the effect of increasing the pace of war, or increasing the speed of escalation. So that might include hypersonics in a regional crisis, for example, but also AI and cyber, where if you're just compressing decision-making time, you're increasing use-it-or-lose-it scenarios. And so that is, again, it isn't just one technology. It's really how they intersect with each

other, but also how they're going to interact in different regional and geopolitical environments.

And then the last one to flag, I mean, this isn't the one that would keep me up at night, but it's the one that I don't think gets enough discussion is the role of disinformation campaigns and social media, and how those could potentially thicken the fog of war, how they could change domestic conversations and threat perceptions. I don't think that a tweet is going to be the thing that starts a nuclear war necessarily, but it is kind of the longer term impacts of social media and disinformation on broader geopolitics.

Jane Vaynman: Andrey, priority areas.

Andrey Baklitskiy: Yeah. So on strategic like, since the one technology which has the potential to be a game changer was, as Dr. Riqiang said, is ASR and AI, which would revolutionize it, and will get to all the new capabilities. The seas becomes transparent, and submarines will lose their invulnerability. That would be a huge change. That would make us rethink some of the basics of strategic stabilities, of our triads, of how we think about secure second strike capability, that would be like huge. That hasn't happened yet. It might never happen, partly because, as Heather was alluding to, you can also use AI for protecting targets, for covering targets. Task AI to come up with protection, which will show the as AI the pattern, it would confuse with just random noise. But that would be a big problem going forward, which probably should be thought through now.

On a shorter time frame, one thing which is happening now, and which is somewhat concerning, is the proliferation of conventional long range strikes, especially post INF Treaty, especially with the inclusion of hypersonics. And especially these, it's spiraling to the allies. So, for example, we see US planning to provide (inaudible) with ranges in excess of 1000 kilometers to some of its allies. And all of this is making war, like conventional war slightly more likely, because if you can hit more targets, you can hit them safely, you can use standoff weapons without getting into those quote unquote, bubbles, and to access area denial bubbles. And once you go there, once you really go into maybe we can find this conventional war and it'll be fine, then you have all these collation problems. So I would say that this race with all those new capabilities going online, maybe without very thought through repercussions, that could be an issue in the near term.

Jane Vaynman: There's a question that came up about some of these kind of other capabilities, robotics and artificial intelligence. And can you please shed some light on the assumption that robotics and artificial intelligence would dramatically impact future wars and also strategic stability? I think Heather, you've written particularly on the AI side of whether it does or

does not impact on strategic stability. I'm curious what you think of whether that assumption is correct or not.

Heather Williams: Yeah, thanks. I'm really grateful for getting this question. Because I do think that it is a misrepresentation of AI in a lot of the literature which does... Jane, you had asked earlier, like, are we overhyping any of these? I mean, AI is the epitome of this where it really, really depends. And we need to have that more specificity. I can't claim authorship of this. But there is that thing that AI is more like electricity than like a light bulb, that it's just so pervasive, and it's going to be so ubiquitous and civilian and military applications, that whether or not it is something to upset strategic stability, depends on these applications that we're talking about. And so I think that Doctors Baklitskiy and Wu, the scenarios that they're talking about are one example. But another one would be using AI for things like pattern recognition. Can it improve intelligence operations to increase situational awareness that might de-escalate crises? So there's kind of the other side to it. And so I do think that anytime that we're reading or thinking about AI, is this is where we really need to get down to those specifics.

Jane Vaynman: Let me go back to an earlier question that was asked that was a little bit more broad for Dr. Wu. Jane Kinninmont asks, I'll just shorten this just a little bit. And you mentioned that you questioned whether the US would be ever willing to repeat the Nuclear War Should Never Be Fought with China. And do you think that there's a wide perception in China that the US might not apply the same principle to China? That it's really just kind of a statement about US and Russia?

Wu Riqiang: That's a good question. Currently, my understanding is that that principle is equals to the recognition of mutual vulnerability. So United States is reluctant to see that with China. But I don't know. China has proposed that many times that people see that. But United States didn't do that. So I don't know if, it could be just because it means mutual vulnerability. So US don't want to do that. Could be just because China proposed that, so United States doesn't want to do that. I don't know which one is the case. But so I think if people could see that together, I think it would be a great progress.

Jane Vaynman: And maybe a similar, slightly broader question from Niels Renssen. Do you think that economic asymmetries between China, Russia, and the US, drive adventurism, or timing of deployments of new systems? How do you think arms control and risk reduction measures can accommodate economic rather than just technological asymmetries? I think this is a super interesting question. And we haven't really talked as much about the costs of all these things, and who can afford them and who can't as part of the picture. And I think, especially given the expenses of other priorities in

the world today, where does this fit in? Let's go to Andrey. Do you want to...

Andrey Baklitskiy: No, it's a great question. And it also touches on... We are talking about sometimes about those systems as if they're happening in vacuum, and the systems somehow create themselves, and then we're just sitting there in or just trying to figure out what to do with them. Systems are created by people. And there are a lot of reasons for why people create systems, including some of them are just because some people in military industrial complex created a new cool thing, and they pitched it to their defense minister and defense minister says, "Sure, this looks great. Let's build some of those." So especially when you don't have dialogue, especially when you don't have limits, like arms control treaties, or what have you, you have much less reasons to say no to those people because, they would say like, "If we don't do this, our adversary would do it tomorrow. So we really need to have this." And then you start this whole cycle.

Apparently, somehow this has happened because hypersonics because Russia and China have them and developed them, US certainly needs like a lot of them. A lot of different things. Like each of the branches needs one. And we'll see where it goes. It indeed is interesting. Of course, US military budget dwarfs anything that other country, or pretty much any countries can produce together. So US can just do all kinds of things in different directions, in different dimensions, do a lot of R&D. And it is for other countries, it is for Russia, it is for China, to look at these and try to make sense of where US is even going with this. Are they creating new crazy project, which will materialize in some near future, and then we'll have to fight it. Or they just throw it away, and start 10 new programs because they can. So it's a big issue. And ya, I don't know, dialogue might help on this. But not always, because especially if you have a reason to suspect that the other side is doing something sinister, then you can look at the US R&D and say, "Aha. Well, this is obviously shows you that they are up to something."

Jane Vaynman: That's really interesting. Riqiang, do you think, are economic concerns an issue for China? Does China look at the US or Russia and think about to what extent what is being spent on systems an indicator of where something is going or an indicator of what might be bargained over?

Wu Riqiang: Hopefully not. I think it's very easily because I think nuclear weapons are expensive, but currently the US, China, Russia, deploy and develop nuclear weapons. But currently still, the number is still very limited. So I think the nuclear program is not a big burden for the whole GDP. So this is a good especially compared to the Cold War. This is good. Hopefully, we don't go that state. So this is one part. Secondly, I want to mention the old story about a first defense computation. during since the 1960s, there's that kind

of debate on missile defense that if you build missile defense, I could build more defensive missiles. And defensive missiles are cheaper. So that kind of story. And so if your economy is roughly at the same level, so offensive side will have some advantage. Hopefully, we will go that level. That kind of US deploy more interceptors, and China decided to deploy more ICBMs, hopefully not.

Jane Vaynman: Heather, the cost of missile defense is definitely an issue that comes up on the US side. And I think the people who argue in favor of putting US missile defense on the table in some shape or form do bring up the, it's super expensive point. I'm curious, what do you think about factoring costs in.

Heather Williams: So I think economics could be a great driver for arms control in these areas. It can provide tangible benefits. And as you say, as everyone has said, these systems aren't cheap. Competing in these areas isn't cheap. The US has a lot of other strategic priorities, such as modernizing the arsenal, such as missile defense, and commitments to reassuring allies, also aren't always cheap. I think that it seems like there would be a lot more incentives for Russia, in particular, to join some arms control agreements in these areas, just because its economy is so much smaller than the US and China's. And so I do think that economics might open up some opportunities here. I feel also a little bit like, some of these questions are trying to push us towards arms control or some cooperation. And I almost feel like that's jumping ahead just a little bit too much here.

Again, from the US perspective, I think, before pursuing any additional arms control, there's going to be the really big challenge of dealing of questions of compliance. There are obvious concerns about Russia's and legacies of non compliance, but also Chinese lack of experience with arms control agreements. Also China has repeatedly told the US in no uncertain terms that it isn't interested in arms control, as we know it right now. The previous administration didn't really accept that answer. The current administration seems to be more respectful of that position. But I think that trying to work towards those types of agreements, it is going to be a longer term process. It's really hard to envision the US entering some new agreement that might be ambitious and might involve these new technologies with Russia, after a Russian track record that leaves a lot to be desired in terms of compliance.

Jane Vaynman: Andrey, you can give a comment on this. You had a point.

Heather Williams: Yeah. To finger on Heather's statement. So we heard this rhetoric before from no one other than previous US Presidential Envoy for Arms Control on the President Trump who said that, well, if there's no arms control, we're going to spend Russia into oblivion. I'm not sure that was the greatest approach toward this. You're right. US economy is much

bigger than Russia. It's military budget is much bigger. But also, Russia has probably more ways to manage its budget and its economy, less problem in Parliament to approve your budget, less concerns and constraints in that part. And if you put this question of national security is at stake, then a lot of those concerns go away, and you're just willing to spend much more. So, yeah, I wouldn't say that the size of Russian economy would necessarily be a reason for Russia to spend less.

Jane Vaynman: That is a very interesting point, because this is a question that historically has come up as well in the late 1980s, there was the same conversations about whether the US could just outspend Russia or not. So this is a perpetual question as to whether it matters for arms control or not. Let me turn to a question that's gotten some high interest from the audience. From Michael Klare. How is the increased speed of combat increasing the inclination of military forces to rely on computer-assisted decision making, removing humans from critical life and death decisions, and increasing the pace of escalation? And I'll add the arms control piece to that, which is, should we be using any kind of international cooperation to address that problem, if you think that problem exists? Why don't I go to Heather, do you want to start this one off?

Heather Williams: I think I understood the question as being about questions of keeping a human in the loop of nuclear decision making. Is that correct?

Jane Vaynman: I think. Yeah, I think in part, but also the the effect on speed of conflict as being a problem, I think.

Heather Williams: Right. So the human in the loop component, I think it would be great if the P-5 could all jointly agree to keep a human in the loop in nuclear decision making. As I understand there's one member of the P-5 that is consistently opposed to those sorts of statements about AI and automation. So I don't know if that is a kind of strategic challenge. It's a doctrinal challenge, or if it's just a perception, maybe we're just phrasing this issue wrong. But I think it's committing to human in the loop in any decision to use the most destructive weapons on earth, that would seem like a pretty good step in the right direction. In terms of the increasing speed of conflict, I think it's not necessarily an arms control solution. This isn't a new idea at all. It isn't, is somehow increasing crisis communication, conversations. And that's something where I think the US and Russia, in particular have a pretty good track record. And I think that there have been some efforts to bring China into that.

But that seems like an area that is worth exploring further in light of these emerging technologies. Do we need additional communication channels? What might those look like? And is there some aspect of this that we just haven't thought of in light of things like hypersonics? Again, I would hope that this is on the agenda at the strategic stability talks.

Jane Vaynman: Yeah, that's a really good point, that having to slow down the pace of decision making in order to check certain things, again, prior problem, but we might need potentially somewhat different solutions to do essentially the same thing, when we're talking about computer assisted decision making, we might need a different tool. I find that really interesting. Dr. Wu, do you want to weigh in on this kind of human in the loop questions from China's perspective?

Wu Riqiang: Oh, not much. I just want to say the combat increased, I'm not sure because we talked about hypersonics. Actually hypersonics is slower than traditional blades missiles. This is a technical point. Second, I agree with Heather that we don't have to react quickly, we could extend our decision making times.

Jane Vaynman: Andrey?

Andrey Baklitskiy: Yeah, I would maybe agree. So we're talking not about the speed of any combat, we are speaking about speed of great power combat between nuclear armed states. So I'm not sure that any, quote unquote, combat between the US and China between Russia and China would be of increased speed, in which somehow in 10 minutes, we'll find half of Russia occupied, that's probably not going to happen. So I think we would still have more time to process all of these.

One thing I would have to mention, is that currently we have, let's call it fire breaks between. So our nuclear forces, our strategic nuclear forces are not very, you cannot destroy them very fast. There is no way you can take out all the Russian ICBM silos or submarines, or the same about China. And partly, that's because we don't have a lot of ground launch intermediate range systems next to each other. So we can launch ICBMs. But you can see them. That takes half an hour, and then you can ask for military aid. If we have a lot of intermediate range systems at our borders, if US deploys thousands of them on island chains near China or in Europe and Asia targeting Russia, that would put pressure on all of this. So maybe thinking about how we can preserve those fire breaks between making our strategic nuclear systems vulnerable to the point that we would even have to saying that maybe we should speed up the process of decision making. So that would probably be something to think about.

Jane Vaynman: I think, yeah, that point for me, is what I'm hearing, it seems to tie in to the point you made earlier about the ISR capabilities and the vulnerabilities of ISR capabilities, because at least I think that's a another area where I'd imagine that attacks on ISR capabilities could potentially create that problem of driving the speed of conflict, creating communication problems and escalation in a way that increases crisis instability.

Let me see. There's a lot of, a number of incredibly great questions coming in. Too many to bring it all together. But I want to try to maybe give this opportunity to our speakers to respond to kind of a more general closing question which I've had for a long time, which is that, I'm curious what you... As you study this area, you're all are experts in both arms control and the intersection with new technologies, I'm curious what you think, is an important question that is not being asked right now that we should, as scholars, practitioners, be thinking about and be investigating, but hasn't been done yet. And you would encourage people to be focusing more on as we continue to think about these issues. That's the big question. So maybe I'll see who anybody wants to volunteer to go first. As I see everyone look up and thinking.

Heather Williams: I'll have the first go here. Because this is kind of the question that I mean, I've been researching arms control on emerging tech for a while now. But as a lot of people know, I also do some work on the NPT. And so it's, I think, the intersection of these issues. I'm not convinced that arms control efforts incorporating emerging technologies will be seen as contributions to Article Six of the NPT. And that might seem like a so-what, why-care question. But if from the US perspective, at least, we only have so much political capital and time to spend on arms control. And how we spend that, we can't go for everything in arms control. It really does have to be focused. And we can't take everything in the basket all at once. How do we prioritize that?

On the one hand, I would like to see a nuclear arms control prioritized for the sake of the NPT, for the sake of strategic stability. On the other hand, I do think that some of these technologies are potentially more immediate and pressing threat, and that perhaps we should be focusing on kind of risk reduction, crisis communication, informal trust and confidence building measures. That's a really hard choice. I've heard a few people kind of bouncing that around, but that's one big question. So what arms control and emerging tech contribute to Article Six?

Jane Vaynman: Yeah, that's an excellent question. The question of priorities and how do we evaluate priorities, I think is huge. Riqiang, do you want to-

Wu Riqiang: It's a difficult question. Maybe not that nobody asked. But I think not enough work on that. I think we should develop a new definition or asymmetric strategic stability between China and the United States. Especially we are discussing about the future arms control opportunities to countries, and we should develop a capitalist order.

Jane Vaynman: Andrey, final thoughts?

Andrey Baklitskiy: Yeah, it's a great question. I would like to think more about it. But for now, one thing you don't often really understand is, until you start to

try to put this all in one context, and this has been happening very recently, just try to lay down how some kind of arms control agreements or limitations could look like with different things put into them. Because when you put it on the paper, when you put it as a coherent text, then you can see that, "Okay, so this part doesn't fit. Okay, this part would be problematic. Okay, this wouldn't fly," and so on, so forth. So a lot of what we are talking about is often very theoretical or very broad pictures. But once you start to put it in concrete and its specifics, like a lot of issues people haven't even thought about are coming up. And I think it's great. And we need more of this.

Jane Vaynman: Great. Well, thank you very much. I want to thank all our excellent panelists and participants for their questions, for an incredibly thought stimulating panel. And now I will turn it over to George Perkovich, for some closing comments. Thank you.

George Perkovich: Thank you, Jane. I have the easiest five-point agenda to deliver that one could have, and it's a pleasant agenda. I want to first of all, thank all the speakers and moderators for the last three days. It'd been tremendous sessions. Obviously want to thank all the people who tuned in, either on the web or through YouTube. We really appreciate it. This was an experiment for us. Of course, need to thank on everybody's behalf, the funders of this operation. And so that's the Carnegie Corporation of New York, the MacArthur Foundation in Chicago, the foreign ministries of the Netherlands, Germany, Finland, Norway, and Switzerland, the New Land Foundation, the Prospect Hill Foundation, and the Edgerton Foundation. We are very grateful for their enabling us to do this.

Obviously, the people who made this happen are Toby Dalton, James Acton, the heroic and unsung Erin McLaughlin, who's really made our program work the last few years and for we're delighted to keep working, Katherine Buchanan, Megan Dubois, and Fiona Cunningham in particular for organizing the young professionals activities, which again was an experiment that we were delighted to be able to try, and by all accounts, was worth trying. Other Carnegie colleagues have pitched in their time to do this.

So the last two points are to remind you to complete the post conference survey, so the next conference can be better still. And then speaking of the next conference, it will be in October ‘22, and we assume and hope in-person. So whatever deity you believe in or not, hopefully will conspire with science to enable us all to do this again in October 2022. Thank you all again, and we look forward to seeing you. Bye.