TRANSCRIPT

Center for Strategic and International Studies

"The 2019 Missile Defense Review: What's Next?"

EVENT DATE

Friday, February 1, 2019

TIME

1:00 p.m. EST

LOCATION

CSIS Headquarters, Washington, D.C.

FEATURING

David J. Trachtenberg
Deputy Under Secretary of Defense for Policy

Lieutenant General Samuel Greaves
Director, Missile Defense Agency

CSIS EXPERTS

Thomas Karako,
Senior Fellow, International Security Program and Director, Missile Defense Project, CSIS

Transcript by superiortranscriptions.com

Thomas Karako: Well, thanks to everyone for coming today. We're excited to be here to talk about the new Missile Defense Review. We're glad it's out. It's really kind of the beginning of kind of a national conversation that we're going to need to have about these issues and how to adapt our air and missile defense posture to the – to the strategic environment described in the National Security Strategy and the National Defense Strategy.

Thomas Karako: I might ask the folks in the back to maybe turn down the volume. I heard a little bit of echo on my mic, if you wouldn't mind. Thank you very much. So also, just before we begin, we always have to say, you know, just in case we have any reason that we need to depart the building, look to me. I'll give you directions either down the stairs or out the back. We don't have – expect any such problems, but please do look to me in case we need to depart.

Thomas Karako: So, first of all, I want to welcome to CSIS my good friend Dave Trachtenberg, who since October 2017 has been the deputy undersecretary of defense for policy. He's got more than 35 years of policy experience in the private sector and the executive and legislative branches. He served, for instance, from 2001 to 2003 as principal deputy assistant secretary of defense for international security policy, and as acting deputy assistant secretary of defense for forces. Both jobs at the same time? That's pretty good. He's headed numerous interagency delegations on missile defense, including with our Russian friends, and was previously a professional staff member with House Armed Services Committee.

Thomas Karako: Also want to welcome back to CSIS Lieutenant General Samuel Greaves. General Greaves is, of course, the director of the Missile Defense Agency. He's held a number of distinguished positions within the Air Force, including as the director of strategic plans, programs, and analyses at Air Force Space Command, as deputy director of the Missile Defense Agency, and then as commander of Space and Missile Systems Center for Air Force Space Command.

Thomas Karako: We're going to jump right into it. And I think I'm going to turn it over to Mr. Trachtenberg first with a couple questions. First, to just get us started and situate this review, what's the big new idea, or what's the big idea and its logic, especially with respect to the National Defense Strategy and the big muscle movements that are going on?

David J. Trachtenberg: Sure, Tom. But first let me just start by thanking you and CSIS for the invitation to come here and have a conversation about this issue today. It's always a pleasure to be here with General Greaves, as well as the director of the Missile Defense Agency. So my sincerely appreciation to folks. And I appreciate everybody coming out here under the circumstances, on a very snowy day here in the nation's capital. So thank you for – thank you for coming here for this conversation.

David J. Trachtenberg: In terms of big ideas, there are probably several. Let me just say that I think what we've done in this Missile Defense Review is essentially revitalize and reenergize our missile defense posture, and our programs, and our activities.

And what I mean by that basically is that we've sort of taken a holistic view. It's been a good, what, nine years almost since the last Ballistic Missile Defense Review came out. This Missile Defense Review drops the word ballistic from the title because we are now recognizing that the nature of missile threats to both the United States homeland as well as to friends and allies abroad and our deployed forces go beyond just ballistic missiles. So they involve cruise missiles, hypersonic missiles, missiles that are smaller, faster, more difficult to track, defend against.

David J. Trachtenberg: So the big message here is that we are going to do a number of things. We're going to build on our existing missile-defense capabilities, but we're also going to explore advanced technologies to move forward with things that will help us defeat missile challenges from wherever they arise as best technology will allow us to do.

David J. Trachtenberg: So for any number of reasons, this is, I think, a more expansive and necessary look at, and in some cases relook at, some of the capabilities that we think are important to defend the nation.

Thomas Karako: Thank you. Let me follow up on that. You emphasized really the spectrum of missiles, not just ballistics but everything else. I wonder if you could talk a little bit about not merely the diversity of types of missiles, but how this diversity is being used in concert; in other words, how they are being woven into an integrated – into the overall military capabilities of our adversaries and with a mixing and matching of these things. What does that mean for us?

David J. Trachtenberg: Well, a lot has changed, Tom, you know, certainly in the last decade or so just in terms of sort of the threat picture that's out there. There are now over 20 states that possess offensive-missile capabilities. And what we are seeing is we're seeing other countries approach their offensive developments from an integrated – as you said, from an integrated perspective. They are weaving their various capabilities into ways to deny us access to certain areas that we believe are in our national interest, where we need to be.

David J. Trachtenberg: Our missile-defense approach is reflected in – the MDR that we released last month basically says, from a defensive perspective, we need to take an integrated approach as well; what I would refer to as a holistic approach. So we are confronted with ballistic-missile threats, cruise-missile threats, hypersonic glide vehicles and the like.

David J. Trachtenberg: We need an integrated approach that combines our active defenses with passive defenses and with attack operations as well into one sort of holistic package where we can provide the best defense for the nation, the best defense for our friends and allies abroad.

Thomas Karako: Let me follow up one more kind of big-thing question here, and that is, just explain to us the strategic logic by which active defenses generally against a diversity of air-missile threats, how do they contribute to our overall deterrence and defense goals, especially because they're always going to be finite? They're

always going to be limited. And sometimes you hear, well, you build 10 interceptors; they're going to build 11 strike capabilities. And so, therefore, so it's a fool's errand. What's that strategic logic?

David J. Trachtenberg: Sure. Look, everything we do has limits on it. We don't have unlimited resources for everything. But when we're talking about deterrence, which really is the nature of the game here, we have to start with a fundamental understanding of what it is we're trying to do.

David J. Trachtenberg: When we talk about deterrence, we are trying to prevent an adversary or potential adversary from taking an aggressive or hostile action against us or our allies that we don't want them to take.

David J. Trachtenberg: How does missile defense factor into that? Missile defense factors into that in several ways. First of all, if we have the ability to defend our people, our country, from missile threats, we create additional uncertainty in the minds of an adversary or potential adversary as to whether or not it really makes sense for them to engage us or to launch a missile attack against us in the first place, because they can't be certain that any such attack will actually accomplish the objectives they think it might accomplish.

David J. Trachtenberg: So from a deterrence standpoint, being able to dissuade them or prevent them from launching an attack is critically important. And in that respect, missile defense plays a key role.

David J. Trachtenberg: Missile defense also plays a key role in assuring our allies. It helps assure them of our security commitments to them. It helps assure them that we are serious about defending our own people and our own country. So there's an assurance aspect also that's useful. Also, I'd say by being able to defend against missile threats, it gives our decision-makers more decision time and space to make decisions. In other words, we're not forced into a reaction quickly because if we can defend ourselves – we have the ability to wait. It gives our diplomats an opportunity to try to negotiate an end to a potential crisis. It just adds time and space to decision-makers' calculus, which, in a way, I would argue, is incredibly stabilizing. So for a variety – in a variety of ways, our missile defenses contribute to deterrence by providing those additional characteristics and capabilities.

Thomas Karako: OK. Let me say, in a way that kind of represents a bit of a culture shift in the sense that, you know, back in the early days of trying to get out of the ABM Treaty sometimes folks would say that this is purely defensive and only reactive to somebody else's attack. But the perspective here is one of integration. It's a bit of a demystifying this capability and weaving it into everything it is the United States has in its military force. Is that – is that fair?

David J. Trachtenberg: I think that's fair. I mean, it is different. What this report argues for is a fully integrated capability which includes, as I said, the active defensive component, which we've traditionally, sort of when we talk about missile defense, you know, we have tended in the past to focus just on active defenses. But it talks about

passive measures as well, hardening dispersion to even deception and it also talks about attack operations. Should deterrence fail, we want the ability to be able to defeat missiles before they are actually launched against us.

David J. Trachtenberg: So looking at it, again, as a sort of a complete package, integration is key here. We also want to be able to integrate our capabilities with the capabilities of allies abroad as well. So we are opening the aperture, I would say. The president has talked about how we're entering a new era for missile defense and he's absolutely right. What this review does is it basically establishes the parameters of what that new era looks like and how we, as a nation, are going to approach it.

Thomas Karako: Great.

Thomas Karako: Well, General Greaves, I want to turn it over to you, and I know you've got some slides, and perhaps you could kind of situate all this in how – in what ways the Missile Defense Review is going to build on our past activities and what it's going to mean differently in the future.

Lieutenant General Samuel Greaves: Well, good. Thank you, Tom, for having us here today and, Mr. Trachtenberg, it's great to be here with you and I appreciate all the folks that are here showing the interest in this mission area.

Lt. Gen Samuel Greaves: I've got a few charts just to set the stage on what the Missile Defense Agency is all about, what the mission is, and how we believe we fit in with the Missile Defense Review and some examples of where that occurs. So if I can go to – I guess I'm in control here – go to chart two.

Lt. Gen. Samuel Greaves: First, the mission of the Missile Defense Agency: essentially, to develop and deploy a layered ballistic missile defense system. And we'll talk about ballistic plus in a – in a few minutes. But layered is extremely important, and it's an overall architecture. It's an overall system. And the purpose is to defend the United States, our deployed forces, our allies, our friends against missile attacks in all phases of flight and of all ranges. So it's globally deployed. There are some icons on the bottom of the chart that visually portray some examples of the system, from our ground-based interceptors to the Aegis weapons system with the Standard Missile – 3 family on there, to Aegis Ashore, to space systems that we use to sense activity and our ground radar. So it's globally deployed and it's a layered architecture, which is extremely important.

Lt. Gen. Samuel Greaves: Oops, hang on a second. The second chart here is a visual depiction of this architecture and it's divided into three rows – three swim lanes, as we call it. The top swim lane is probably the most important swim lane on the chart because it is the glue that ties together the entire ballistic missile defense system. It's the command and control battle management system. It is the multi-domain command and control system – you've heard that phrase in other forms – and it ties together our sensors, which is the middle swim lane, the bottom swim lane with our – with our shooters, which are in the middle, and it's all in support of the combatant commanders who operate and control these capabilities. And on the bottom there you can see again there that our sensor suites are in space,

they're on the ground, they're at sea, and they're all integrated through our command and control battle management system to designate specific shooters to go against a specific target.

Lt. Gen. Samuel Greaves: This chart is extremely important, because it lays out the priorities for the agency. And the first thing that we need to say is that the priorities are in direct support of the National Defense Strategy, and now they're also in direct support of the Missile Defense Review's outcome and guidance. But the top priority is to ensure that we continue focusing on increasing system reliability to ensure we build confidence in the combatant commander's mindset and force, that these systems will work when needed. And you'll see how that translates into the budget in a second.

Lt. Gen. Samuel Greaves: The second priority is to increase our engagement capability and capacity. And that's essentially buy more rounds for each of the systems to build out the quiver that our arrows are in, and also improving our systems to provide more capability for these deployed systems. Third priority is to rapidly address the advanced threat. And there's some icons out there on the chart which – as the hypersonic threat, the bottom-right side of the chart, which depict the advanced threat. So we're keeping our eye on all three of these areas of concern and addressing them in our budget and our activity.

Lt. Gen. Samuel Greaves: Now, as far as what the Missile Defense Review means to the Missile Defense Agency, so Trachtenberg already covered that it's an integrated approach – deterrence, active, and passive defense. And if deterrence fails, attack operations to destroy regional offensive missiles and infrastructure. And what the MDR does, it brings focus to what we're doing within the agency and it reinforces that effort, and it provides guidance and synchronization of effort and helps the department focus its energies in meeting what – the policy that's laid out in the MDR. And the last bullet specifically addresses the fact that what we're doing within the agency is completely in line with the Missile Defense Review's results and taskings.

Lt. Gen. Samuel Greaves: And I'll skip that for a second. Here's some examples of – if you – if you take the priorities, the bins, as we call them, that we got the three priorities, and you take a look at the activities within the agency, and the systems that we have on contract and we're sustaining and also developing, you can see in the first swim lane increasing system reliability to build war fighter confidence. We must sustain the ballistic missile defense system we've got out in the field – period – or the combatant commander will not have confidence that it will work.

Lt. Gen. Samuel Greaves: We are maintaining the 44 GBIs that we have out in the field today. We're working on a redesign kill vehicle to increase its reliability, sustainability, operability, to make it a more effective capability. And cybersecurity, we're paying significant attention to, to ensure that the ballistic missile defense system architecture remains secure. It is secure today, but as we all know the cyber threat changes daily if not hourly. And we're paying a lot of attention to that.

Lt. Gen. Samuel Greaves: The second swim lane, increasing our capability and capacity, things like the congressionally approved and directed 20 additional ground-based interceptors that will go into Missile Field 4 up at Fort Greely. You can read through it, the Long Range Discrimination Radar that we're building up in Alaska, the recent initiation of activity to provide a homeland defense radar on Hawaii, the SM-3 Block IIA cooperative development with the government of Japan. That work is going on. Additional THAAD interceptors and Standard Missile-3 interceptors. Those all aim at increasing our engagement capability and capacity.

Lt. Gen. Samuel Greaves: And then the bottom group is what we're spending a lot of time on also. The threat is rapidly changing. Today it's becoming more prolific and more dangerous. The hypersonic threat is something that we're paying keen focus to, and the defense against that threat. The Missile Defense Agency was designated in the FY '17 Authorization Act as the executive agent for hypersonic defense across the department. So working with the other services and within the – Dr. Griffin's organization at R&E, we are pursuing the hypersonic defense effort.

Lt. Gen. Samuel Greaves: We're also working with DARPA and the services, primarily the Air Force, on a space sensor layer. And that's primarily to go after the hypersonic threat. Unlike a ballistic threat, where the trajectory is predictable, the maneuvering capability of the hypersonic threat drives us to an integrated architecture that not only begins on the ground with ground radars, but drives us into space to use the vantage point of space to ensure we have birth-to-death custody of the threat from the beginning to the end so that we can optimize and direct our interceptors to interdict the threat at its most vulnerable point. So space combined with ground is where we need to be to ensure we know where the threat is because, as senior leaders have said, if you can't see it, you can't shoot it. So that's a big activity within the Missile Defense Agency.

Lt. Gen. Samuel Greaves: We're also looking at directed energy as – lasers, microwaves, other forms of directed energy – as potential components of the missile defense system as we seriously look at boost-phase intercept and interdicting the target over enemy territory. And we're looking seriously at scaling that capability.

Lt. Gen. Samuel Greaves: Kill assessment is also an area we're spending quite a bit of time on. We need to know if we have successfully engaged/mitigated/killed the threat vehicle. And if we can do that in a combat-relevant time period, it allows the combatant commander to optimize usage of his resources and not waste them. So kill assessment is a – is a key part to the overall optimization of assets.

Lt. Gen. Samuel Greaves: So I'll stop there and take your questions. I hope that was helpful to you.

Lt. Gen. Samuel Greaves: But the Missile Defense Review is providing focus, synchronization, guidance, direction. And it's a policy framework which allows us to help shape discussion within the department and within the administration and on the Hill to justify and rationalize the resources we need to execute the mission we've been given. So that's the value we see in the Missile Defense Review.

Lt. Gen. Samuel Greaves: In plainspeak, in any large organization there are varying opinions on how to do any project. And what we don't want is potentially the loudest or the person closest to the sled or the person in the – the last person in the meeting making a recommendation on what's best, and that's what's agreed to and moved on with. The Missile Defense Review allows us to maintain that focus, which is extremely important in providing stability to not only the government entity, but to industry, because they know what direction we've been given and they can marshal resources to support that. So that's –

Thomas Karako: I think you're jumping – chafing to get in here.

David J. Trachtenberg: No, I – no, no, I was just going to say one thing. I think General Greaves is exactly right in the way he's characterized what we're doing with respect to the program. But I'd like to foot-stomp one particular thing – one thing in particular, which kind of comes back to your initial question, Tom, in terms of what's new and different.

David J. Trachtenberg: I would say among the things that are new and different, number one, is the emphasis on space and the importance of space for the missile defense mission.

David J. Trachtenberg: The other thing I think is important to focus on is the focus in the review and in our efforts on the development of advanced technologies and new ways of doing things in connection with the missile defense mission, to include things like directed energy that General Greaves mentioned, to include a relook at boost-phase interception options and capabilities. Those are things that we sort of looked at in the past, but we sort of haven't in more recent years focused a lot of attention or a lot of energy on those. This review says it's time to take a relook at that.

David J. Trachtenberg: As we all know, technology advances tremendously at tremendous speed, and the technology that exists today is not the same as the technology that existed decades ago. And so we do believe it's critically important to look at the advances that have been made with respect to technology that are applicable to the missile defense mission, and to see where and how those can be integrated into improving our overall capabilities.

Thomas Karako: We've got a lot to cover. A lot has already been put on the table, our appetites are whet, but let me – let me stay high for a minute and talk kind of about the higher level of strategy. You know, for so long we've had a kind of bifurcated missile defense effort, that we've relied on deterrence for Russia and China generally, and we're going to focus on both regional and ICBMs from the likes of North Korea and Iran. And the 2010 review put a special emphasis on regional missiles, explicitly about rogue states still. And this review begins to change that. It begins to change it by saying we're going to rely on deterrence for ICBMs specifically from Russia and China, but we're presumably going to defend and aggressively defend against regional missiles from Russia and China. But we're also doing long-range glide-vehicle things.

So what's kind of the exact line around the things that we're not going to defend against. Is it ICBMs and SLBMs? What exactly is it that's kind of not defended? The line begins to get a little fuzzy.

David J. Trachtenberg: I think that's a wrong way sort of to look at the question here. What the review makes clear is that you're exactly correct. When it comes to the strategic arsenals of Russia and China, we still remain reliant on deterrence as part of our strategy; again, to prevent both Russia and China from taking an aggressive action against us or our allies.

David J. Trachtenberg: However, the Missile Defense Review also makes clear that we are not going to artificially constrain the development and evolution of our missile-defense capabilities so that, you know, if we have the capability to go forward with the kinds of advanced technologies that we've been talking about, we're going to do that. And frankly, I will tell you it's our view that any missile that is launched against the United States from anywhere at any time, we're going to do our best to defend against, plain and simple.

David J. Trachtenberg: I represent the Department of Defense. And the mission of the Department of Defense is to defend. And we are certainly going to defend the American people. We're going to do the best we can with the resources we have to make sure that that defense is not only credible and effective, but contributes to our overall deterrent and prevents adversaries or potential adversaries from taking hostile action against us or from considering any kind of attack against us or our interests.

David J. Trachtenberg: One other point I would make in terms of the regional context. Obviously when we talk about missile defense, when we talk about these capabilities, the ultimate goal is deterrence. And, first and foremost, we want to prevent any kind of conflict from escalating to a nuclear conflict.

David J. Trachtenberg: Both Russia and China in particular are developing all kinds of missile capabilities integrated into their strategy and doctrine that can be used in a regional context. Well, regional conflicts occasionally run the risk of escalating into greater conflicts. And so we are – our approach is to be unconstrained in how we deal with regional threats that we face from any actor in the hope that we can bolster our overall deterrent and make conflict at any level less likely.

Thomas Karako: So another kind of still high-level conceptual way here is we're looking – and the MDA is the lead on the counter-hypersonic glide threat. Ought we to think about the counter-hypersonic glide system as something that is separate from the BMDS? Is there going to be a single MDS to rule them all? You know, in what way ought we to think about the ballistic, the cruise missiles and hypersonic glide vehicles as a system, as opposed to just particular niche capabilities?

Lt. Gen. Samuel Greaves: It starts with the top swim lane on the visual chart I showed, the Command and Control Battle Management system. It is being designed and we are testing it to deal with those threats. It will understand the difference between a ballistic threat or a hypersonic threat and will be able to designate the appropriate

interceptor or capability to mitigate that threat. And that's an important distinction, because we can't tell what the adversary will do.

Lt. Gen. Samuel Greaves: But once they have initiated whatever action they're taking, that Command and Control Battle Management system through the sensor network that we're requesting – ground, space, sea, air – we'll be able to designate the appropriate threat vector as well as response.

Thomas Karako: Let me stay with you, General Greaves. The review talked about – kind of bragged about the RKV, the MSE, the PAC-3 MSE, the SM-3 IIA, and the upcoming ICBM test for the IIA. And yet, those have already kind of been in the program of record. Is it – there's not kind of a new block of incremental capability that was announced for really any of the four families of missile interceptors. Do you foresee continued block or incremental development across the board, either of you, on that, really, as the threat advances, to continue to evolve the several families?

Lt. Gen. Samuel Greaves: Absolutely. The first thing we need to do is ensure – before we ask for any new capability, any additional resources to add to the resources we have today, we must look at the capability of the systems we have existing today and what incremental improvements could be added to those systems to apply additional capability. And it's only when we cannot incrementally add that capability that we ask for new systems – or, if the threat is radically different, and technology allows us to pursue some – an alternate approach. Then we would go after that. Directed energy is a good example of that.

Thomas Karako: And you would include kinetic factors to go after live vehicles within that look for the block and incremental approach first?

Lt. Gen. Samuel Greaves: Absolutely. We would – and we're looking across both directed energy as well as kinetic capability. And we're assessing those with industry. We intend to test that capability, and then make decisions. It most likely will not be either/or. It will be a mixture of both, because both have – both have advantages and disadvantages. Both have the ability to be deployed in various numbers and various AORs, areas of responsibility. So it will be an integrated architecture that's layered. I keep using that word because it's not one size fit all. It's a – it's a graceful degradation sort of an approach to our capability.

Thomas Karako: Great.

Thomas Karako: David, you mentioned the – I was glad you used the phrase, "hardening and dispersal." And of course, the National Defense Strategy kind of points to the fact that the United States doesn't have a monopoly on precision strike anymore. We've got these iron mountains of stuff on our bases abroad. And guess what? Our adversaries are able to target that now. And it kind of – the MDS pointed to the need for agile and mobile basing to make it harder for the adversary to strike us. So how do you see hardening and dispersal playing into especially the elements of the BMDS, to make it harder on the other guys to find them?

David J. Trachtenberg: Well, I can let General Greaves talk to the specifics of the programmatic elements of that, but sort of from the strategic perspective I think it's critically important to make sure that we integrate those elements into what we are doing. You're exactly right, our adversaries have not stood still in terms of their ability to work to target us, our systems, our capabilities. And so really what the review says is we need to look at the entire spectrum of approaches here in terms of dealing with a response. And passive defense is just one part of it, but it is an important part.

David J. Trachtenberg: Our job should be to make it harder, not easier, for others to target us and the important capabilities on which we rely for our security. Part of that is a reliance on our offensive capability. Part of that is a reliance on our active defensive capability. Part of that is integrating new concepts into what we do and how we do it, to include dispersion, and hardening, and things like that. But I'll defer to the general in terms of the actual architectural issues there.

Lt. Gen. Samuel Greaves: Yeah. What I'll say is that each one of our systems, and the overall architecture, is governed by a set of requirements that dictate the capability to operate within the environment that they're going to be tasked to operate within. If it's at sea, if it's on land, if it's an endo-atmospheric, or something that operates within the atmosphere, or versus operating in space. Those requirements are very different with respect to hardening, as an example. But it all begins with the requirement set that each system – any architecture has to satisfy. And that is what we work very closely with industry to build capability to meet those requirements, and then test them to ensure they meet those requirements that would then allow the – well, the operational testers, but more importantly the combatant commander to have the confidence that those systems will work when tasked.

Thomas Karako: But it's fair to say that given the specter of complex, integrated attack, hardening, dispersal, deception, those are the kinds of things that are going to contribute to the survivability, and therefore the effectiveness, of the BMDS, of the counter-hypersonic capability, all that kind of stuff.

Lt. Gen. Samuel Greaves: That's correct. Absolutely.

Thomas Karako: So segueing from that – that's fundamentally passive defense. But staying with the theme of survivability for a moment, this is – it's still very much a BMDS-centric focus here, understandably. One of the first questions I had when I looked at the review was: Where is the air defense? You know, North Korea flies a UAV down to surveil our THAAD battery in South Korea. The Houthis brag about using UAVs to target Patriot radars in the Yemen missile war. Russia shows the potential for integrating UAVs and artillery/ballistic attacks in Syria and Ukraine, things like that. So, as we look at the need for survivability, aren't we going to need air defense for our ballistic missile defense elements to protect them against cruise missile attack or anything else?

Lt. Gen. Samuel Greaves:

The answer is yes. And, as with any high-value asset, the combatant commander, wherever that asset is stationed, that is one of the responsibilities that comes from that geographical commander. And they assess and assign forces to perform that function where designated. So yes.

David J. Trachtenberg: Yeah, I would agree – certainly agree with that. Take an unarmed UAV or unmanned aerial system, put a weapon on it, you essentially have a version of a cruise missile. And the difficulty, of course, is as these platforms get smaller, faster, more maneuverable, more agile, they become more difficult to counter. Which is why part of what we are advocating here is sort of a reinvigorated effort to look at ways to do that using not just existing technology – we have some limited capabilities today, both air-based, sea-based, and land-based, to deal with smaller types of cruise missile threats. But this is also where the development of more advanced technologies comes into play. And it is very important because you're absolutely right, that is part and parcel of the evolving threat that we are facing as a nation that is equally important to deal with.

Thomas Karako: So, and I'll take, for instance, the Aegis Combat System, right? It's designed to do multiple things, Aegis BMD but also a lot of other missions, including air defense. So maybe let's talk about a particular instance of this, and that's the EPAA, the European Phased Adaptive Approach. The first A in EPAA stands for "adaptive." I was struck, however, by the fact that the program for EPAA was – it was very constant. It's a lot of continuity. I'm curious about kind of why there wasn't any adaptation for that. And if you – given the threat, might we not need to change or adapt the EPAA program in the future?

David J. Trachtenberg: Well, I think the A for "adaptive" is particularly relevant, you're absolutely right. The EPAA represents an element of continuity that this Missile Defense Review says we need to continue with, but we are not simply standing still as we go forward here. We are always seeking to develop and improve the capabilities of existing systems. General Greaves talked about some of them, certainly in the homeland defense context. But we always want to improve and get better.

David J. Trachtenberg: I mean, I talked about technology and the evolution of technology. What General Greaves and the Missile Defense Agency have done really, when you think about it, is nothing short of remarkable. You know, there were points in time when it was thought we could not hit the proverbial bullet with a bullet. We've demonstrated we can do that. And we can do more, and we will be able to do more, by going forward and investing the necessary resources in these kinds of advanced technologies, to include a directed-energy system. And they can have applicability – things like boost-phase defense can have applicability both in a – in a sort of a theater context, as well as in a homeland defense context.

David J. Trachtenberg: So I'm relatively optimistic. I think it's critically important from a strategic and policy perspective that we focus on these kinds of threats because these are – you're exactly right, these are the kinds of threats that are growing. The threat is

not standing still, and our ability to counter it can't stand still also. While we do rely on deterrence to deal with the larger, more sophisticated, strategic nuclear forces of China and Russia, we are absolutely committed to making sure that we are not just pacing the threat from rogue states like North Korea and Iran but we are outpacing the threat. We have to be on the front end, not on the back end of that calculus.

Lt. Gen. Samuel Greaves: You know, as an example of adapting and changing and improving, take Aegis Ashore as an example. Just last night at our test facility – at Pacific test facility on Kauai, there was a fairly challenging test done last night where a challenging target was launched and both the Navy's future program of record, SPY-6 radar, as well as the current SPY-1 radar that we have with Aegis Ashore, both were part of that test and both are being evaluated for performance against that very challenging target.

Lt. Gen. Samuel Greaves: So it is in the Navy's program of record but we are assessing capability on our side for Aegis Ashore, as an example, to integrate that future capability at some point in time. But those are the sorts of things that are going on routinely to both demonstrate capability as well as integrate future capability and make things – make it – make it better in the future.

Thomas Karako: And in terms of that – the agility of the agency to do those things, I'm thinking of the threat upgrade to the SM-3 IB. You know, some folks have said that if it weren't for the MDA's focus on this mission and acquisition authorities, the idea that a threat upgrade to the IB would have ever been done by, let's just say, the Navy, if it had been transferred to them, it might have taken a lot longer. Do you think that's fair?

Lt. Gen. Samuel Greaves: I'd say that the advantage the agency has is in fact the unique responsibilities and authorities given to the agency to, essentially, allow rapid decision making by any complex organization if you've got multiple stovepipes or multiple individual organizations with varying responsibilities and authorities.

Lt. Gen. Samuel Greaves: Somehow, someone's got to integrate that and that integration time is what slows things down relative to an organization like the Missile Defense Agency or the National Reconnaissance Office where in one single position in the agency you not only have the agency director but you've got the head of the contracting authority with full contracting authority, you've got the program manager, you've got the acquisition executive all in one slot. So things are able to be done a whole lot faster than having to coordinate amongst 50 or 60 different people. And that results in time saved, incredible decision making to expend precious resources that are provided by the Congress.

Lt. Gen. Samuel Greaves: So it could have been done in the Navy. I spent my time in the Air Force and was under the 5000 process – DOD 5000. I spent time in the Missile Defense Agency, and that is the difference – the fact that it's a smaller number of authorized individuals and it's people – it's people that are allowed to make those decisions.

Lt. Gen. Samuel Greaves: Now, with that responsibility and authority comes accountability. So you need experienced people making those decisions to make the best possible outcomes.

David J. Trachtenberg: If I could add just briefly to that. If anyone is familiar with that big defense acquisition process slide that looks like a bunch of spaghetti, you understand the complexity of the overall DOD acquisition process. One of the things that the Missile Defense Review calls for is to look for ways where applicable to streamline that acquisition process in order to introduce more capability into the system in a shorter period of time. So we will continue to look for ways to accelerate that process where appropriate in order to deliver capabilities to the warfighter as necessary to deal with the threats as they evolve.

Lt. Gen. Samuel Greaves: I am an engineer but I'm also an acquisition officer. I have worked under both systems. Both systems work. But the 5000 system is slowed down when everyone believes they have a role to play in the decision or the opportunity to say no. You know, I'm just trying to be very blunt with you.

Thomas Karako: Well, as long as we're on this, you know, some folks say that what MDA really needs is to return to that 5000 series and that will really improve the reliability of your acquisition, notwithstanding of the fact that THAAD and other – you know, SM-3 and other things were developed under this process. What's your answer to that?

Lt. Gen. Samuel Greaves: I absolutely oppose that. It's wrong. As I mentioned, I've spent quite a bit of time within the Air Force under the 5000 principles and processes. I've spent time equally within the National Reconnaissance Office and the Missile Defense Agency, and it's the – having qualified people in responsible positions with the authority to make those decisions. That is what's – that is the secret sauce, I think, with the Missile Defense Agency and an organization like the National Reconnaissance Office. It's when you've got multiple separate organizations, each having the opportunity to follow their process and say no or slow it down or not do the coordination. That's when things really slow down.

Lt. Gen. Samuel Greaves: I get – the Missile Defense Agency gets requirements from U.S. Strategic Command. We work with the Joint Staff through the JROC if we need to. But most of the requirements come directly in a priority-capabilities list from U.S. STRATCOM. It is very clean. It's very succinct. It's very streamlined. And that is what we execute against.

Lt. Gen. Samuel Greaves: There are other challenges working within the – since I was in the service at one point, working within the services to get to those decision points, because the process is so complex. It will work. It just takes longer, and it's a lot more complicated.

Thomas Karako: So one particular capability you both mentioned with some interest a couple of minutes ago, and that's directed energy in different forms. You know, I often think that politically, as well as technologically, it was kind of the Desert Storm

that captured the imagination about the missile-defense mission. We've seen directed energy out there on Navy ships, on Army trucks.

Thomas Karako: You know, what's the – when is it going to be getting out in the field to begin to see and capture the imagination more? And when's it going to kind of be here for even the lower regional missile-defense mission, do you think? What kind of – what's in our near future here?

David J. Trachtenberg: I would hope sooner rather than later. But one thing is clear. In order to bring a capability like that to fruition, you have to invest in the development of that capability. If we don't invest, if we don't devote the necessary resources into the development of that capability, one thing I can tell you with certainty is we'll never get there.

David J. Trachtenberg: And I think one of the things that we are trying to do with this particular review is shift the focus a little bit, to make sure that we sort of rebalance our efforts in a way that allows us to invest the time and the energy and the resources necessary to move that needle forward sooner rather than later.

Lt. Gen. Samuel Greaves: I'll answer in two different manners. One is power level. So the power-level requirements are very different between what's on a Humvee or what's on a ship or what's required to interdict either a liquid-threat missile or a solid missile. And then the other one is stabilized funding and support over time. If you look at the history of directed-energy funding across the department over the years, it's been cyclic. And that has slowed down the development of directed energy for the higher power levels. The lower power levels are now in work.

Lt. Gen. Samuel Greaves: The Missile Defense Agency, the missile-defense mission, is on the higher end of the delivered-power spectrum. You can just – we're into the hundreds of kilowatts to the megawatt range. But we've got the brightest minds across the nation working on this. And I will tell you that it is feasible. With sustained resourcing, it is feasible. And we're seeing rapid progress in increasing the demonstrated power levels for lasers, as an example.

Thomas Karako: So one of the new things in the review is talking about the F-35, which, of course, is the biggest program in the department. Some folks, I think, are a little bit confused by this. You know, the F-35 has a limited gas tank. And so the persistence is not quite there. But what's the right way to think about weaving in other platforms and assets like F-35?

Lt. Gen. Samuel Greaves: I'll start with, as I mentioned before, any sensor connected to any shooter by the Command and Control Battle Management system. That's how I would look at it. And if you think about the F-35 as an example and where and when those platforms will be deployed, they will be deployed in numbers and areas where we have concern. So those platforms will be there.

Lt. Gen. Samuel Greaves: You take a look at the F-35 by itself and the powerful sensor suite that's inherent on the platform, the question that we had was why are we not thinking outside the box and taking advantage of that existing capability as a minimum as

a sensor, to integrate that into the ballistic-missile defense system not to do the entire mission, but to do certain key portions of the mission, because those assets are going to be there in the first place. It's a re-designation of mission, as an example. And of course, the operational community will have to decide what portion and to what extent that goes.

Lt. Gen. Samuel Greaves: And then you flip it on the other side, as a – simplistically speaking – a different loadout of the weapon that are hung on the bottom of or inside the jet. And the development of faster interceptors, as an example, could be a significant addition to the ballistic missile defense – missile defense suite within the architecture. So it's a question of why are we not looking at it? And why are we trying to invent something new when the capability would be there and exist? So that's what we're investing in.

David J. Trachtenberg: I couldn't agree with that more. I think thinking outside the box is something that we certainly needed to do more of. And looking at the F-35, or even a similar platform, generally considered to be on the offensive side of the ledger, looking at that to contribute to the defensive side of the ledger is one example of sort of the integration of capabilities between offensive and defense.

David J. Trachtenberg: Whether we use an F-35 in a particular missile defense role or not, the fact that it might have a capability – a sensor capability or other capability that makes it applicable to the missile defense mission, doesn't mean that all our F-35s are going to be exclusively devoted to the missile defense mission, any more than giving all of our Aegis ships a missile defense capability – which is where we are seeking to go here – means that they are all going to be exclusively devoted to a missile defense mission. But this is part of sort of the holistic approach and the integration of capabilities that we are – we are trying to call out and we are trying to emphasize as a result of this review.

Thomas Karako: It's also a kind of a bit of a cultural shift, right, from just relying on dedicated assets within the BMDS to, again, rather than this niche capability, something that is fully woven into everything, and vice versa. It's opportunistic, right, as opposed to being dedicated. And it's bringing in everything else. But it's a cultural shift, right?

David J. Trachtenberg: Absolutely. But why shouldn't we – why shouldn't we make that shift? Or why shouldn't we try to go there? There are all the reasons in the world to try to exploit the capabilities that we have to try to see how we can bring them all together in a coherent whole in order to deal with the anti-access and area denial strategy that our adversaries and potential adversaries are developing.

Thomas Karako: So on the – it's a fantastic vision of integration, the desire for integrated air missile defenses has been out there for a long time. I think it was the National Defense Strategy Commission actually recommended – when it delivered its report a couple months ago, they recommended a defense wide official, kind of an integration czar, who – with some acquisitional authority – who could, you know, buy stuff or tell the services, OK, you actually need to integrate. There's always that – those service equities and everybody's doing their own mission.

And the idea of integration's been out there. How's it going to be different this time? And how are we going to get to, no kidding, forcing that integration to realize that mission – that vision?

Lt. Gen. Samuel Greaves: It's already begun. If you take a look at European Command, that is a major focus of General Scaparrotti and the folks in EUCOM, as an example. It's also a focus of the other combatant commanders, but they are if not leading the discussion a major player in that discussion. So it will begin and continue to be influenced by the combatant commanders and the war fighters. But within the department, it is something that we need to continue pursuing because it's beneficial to integrate, as you mentioned, the capabilities across the services to produce the missile defense capability that we're hoping for, we're integrating with the air defense. So it's something that's got to keep happening.

Thomas Karako: OK. One last question, and then we'll kind of open it up to the audience. And that's kind of the role of allies. So that's, again, kind of emphasized in the review. There's a lot more demand signal out there for active defenses – you know, whether it's the Saudis and Emirates in the Middle East, Poles, Romanians and Swedes in Europe, Japan, South Korea and Australia in the Asia Pacific. Your comments on just kind of the importance of that, and kind of a vision for what new avenues of cooperation are of interest there.

David J. Trachtenberg: Let me start just from a policy perspective. I'd say it's critically important to roll the allies into this. Number one, what we are proposing is entirely consistent, as General Greaves noted at the outset, with the strategy reflected in the National Defense Strategy, where it's very clear that strengthening our alliances, building new partnerships is a key element of that overall strategy. That applies to our approach on missile defense as well as other things as well. There are capabilities that allies can bring to the table.

David J. Trachtenberg: Beyond that, we want to make sure that we are integrated with what allies are doing. The general also referred to the joint development program with the Japanese government in terms of the SM-3. That is one example. There are cooperative development programs that the United States engages with with Israel, for example. If you want an example – or sort of a real-world example of how missile defense saves lives, ask the Israelis because they can give you any number of examples there.

David J. Trachtenberg: So definitely we want to – we want to strengthen those relationships and we want to partner with our allies. We want to make sure that our allies bring things to the table as well. This is not just the United States looking to defend everyone else. But we want to be able to engage collaboratively and build upon the relationships that we currently have with existing partners, as well as look for opportunities with new partners where we can, to draw them into this because we are talking about a global capability here.

Lt. Gen. Samuel Greaves: I'd say it's absolutely essential, and it's a major part of our outreach and our interface with the allies. One quick example. There's an exercise called

Formidable Shield ’17, and we’re about to work with our allies and partners again in a few months on Formidable Shield ’19. Integrated air and missile defense activity off the coast of Scotland in ’17 with ships from various nations, various capabilities, radars, CONOPS, test procedures, demonstrating the ability to cooperatively work together to interdict both air and missile targets. Huge success within the EUCOM AOR two years ago. And it’s a – it’s a(n) increase in capability sort of test we’re going to do this year, same sort of thing to demonstrate not only what we’re saying, but to show, in fact, that it does work. And the allies stepped up in ’17 and they’re really onboard again for the tests we’re going to run in ’19. Plus, all the other activities we’re having across the world with the various allies.

Thomas Karako: Great.

Thomas Karako: All right. Why don’t we open up to questions? I’ve got a number of hands already in line. I saw Sydney first, then we’ll come over here to Voice of America. So get the microphone, state your name and affiliation, and keep it in the interrogative sense.

Q: Yes. Sydney Freedberg, Breaking Defense and professional loud person. But I’ll use the mic anyway. (Laughter.)

Tomorrow the administration is initiating the formal final withdrawal from the INF Treaty. Now, you know, how does – obviously, you guys created the Missile Defense Review before that has happened, but, you know, presumably that was in your minds. It creates at least the potential for proliferation both of incoming threats – ground-based intermediate-range systems – but also for, you know, much of the attack systems for a whole new class of ground-based surface-to-surface attack systems to, you know, take out the threats left of launch. So, you know, what – you know, how does the end of INF, which seems to be inevitable now, affect the MDR? And how does the MDR principle sort of apply to a post-INF world?

David J. Trachtenberg: Let me try and deal with that question, Sydney. I don’t think the demise of the INF Treaty really affects the approach that we’ve taken in the MDR at all because the MDR essentially says we need to defend against a growing proliferation of missile threats, period. The demise of the INF Treaty – and let’s be clear about this – is because the Russians have violated it, and have repeatedly violated it for years. So the Russians really have no one else to blame but themselves for not complying with the terms of that particular treaty. And our announced intention to remove ourselves from the constraints of the treaty is directly attributable to what the Russians have done over time. Despite the fact that we’ve tried repeatedly to get them back into compliance by removing and destroying their prohibited cruise missile system, what we designated as the SSC-8, they simply refused to do it. They’ve even refused to acknowledge it even is a violation. So that is – that is indicative of part of the problem that is in general terms captured here within the MDR, and that is the proliferation of missile capabilities that we need to be prepared to defend against.

Thomas Karako: Can I redirect that a little bit?

David J. Trachtenberg: Yeah, sure.

Thomas Karako: You know, in a sense we've kind of woken up to the fact that we have a Russia problem. But one way in which INF connects here is a greater realization that we have a Russia missile problem. And, you know, the MDR to its credit, I think, endorses cruise missile defense. Doesn't matter whether it's launched from a ground platform or a sea platform. If you're the target of that cruise missile, you don't really care where it comes from. And so could you talk a little bit about the desire to have some kind of active defense against cruise missiles, let's just say like the SSC-8, for our forward forces, and what we're doing about that?

David J. Trachtenberg: It's important. It's important to be able to address those kinds of threats, which are likely to proliferate. Remember, you know, the INF Treaty essentially constrained the United States and the Soviet Union, then Russia. We are the only party that has been constrained by that particular – by that particular treaty.

But, again, it's a – it's a reflection of the fact that missile technology is advancing. And we need to be able to – we need to be able to keep up with it and stay ahead of the threat as it evolves, which is why there is so much emphasis in the report in terms of Russia and Chinese regional missile capability development and the need for us to – the need for us to be able to counter it.

Thomas Karako: OK. Got a lot of questions. I think, John (sp), yeah, so we can just keep it up here. I think just about everybody in the front row has a question. (Laughs.)

Q: Thank you very much. Voice of America Russian Service. Colleague [inaudible] hijacked two of my questions, but I'll try.

First question is to Mr. Trachtenberg. What do you expect from European allies of the United States when U.S. will stop fulfilling INF Treaty? Do you expect them to have, I don't know, new U.S. missiles to be based there in Europe? Or what reaction, what development will be for Europe with this withdrawal?

Thomas Karako: So what do you expect from Russia.

Q: From European allies.

Thomas Karako: Oh, OK.

David J. Trachtenberg: From our European allies.

Q: Because this treaty actually was signed years ago because of Europe, mostly.

David J. Trachtenberg: Sure.

Q: And now there will be consequences.

And my question to General Greaves. Many experts expected sensors in missile defense report but some of them were surprised with interceptors. So that is – are, like, long-term plans, short-term plans? When do you think it will be – how it will go and when it will be developed in space?

David J. Trachtenberg: I'd be happy to start with the first question, although I don't want to divert too much from the missile defense focus here.

David J. Trachtenberg: With respect to our European allies and our decision on the INF Treaty, what I can tell you is that we've been in constant consultation with our European allies. They fully understand the rationale for the U.S. decision to move away from the INF Treaty. They are fully onboard with an understanding that that decision was predicated on the fact that the Russians have failed to comply with the treaty. And so I would expect that they – that they not only understand, but will be supportive of our – of our decision.

David J. Trachtenberg: That said, there are no plans that we have, similar to what – the situation that led to the INF Treaty in the 1980s, to go forward and deploy missiles in Europe or nuclear-armed systems in Europe. Obviously, the United States would not even consider taking a step like that without consulting with allies first, but we have no plans to do that.

David J. Trachtenberg: What we – what we are planning to do and what we have been doing has been engaged in the research and development on conventionally armed systems within the range that are – is currently limited by the INF Treaty, 500 to 5,500 kilometers. And, in fact, the Congress a year or so ago specifically directed that we engage in that program, set aside I think it was $48 million for us to begin the process of doing that. So what we're doing is entirely consistent, I think, with congressional direction and it's entirely understood by our friends and allies abroad who have been very much a partner with us in the consultative process.

Thomas Karako: All right. So the second part of that was about space-based interceptors. I wonder if you could speak to that in terms of especially what we might expect with the six-month – from the study six months from now.

Lt. Gen. Samuel Greaves: Yeah. The first thing I'll mention is that if you look at the tasking – the 12 tasks that are in the Missile Defense Review, what you should notice is a crawl-walk-run approach, as in under promising and over delivering. So not jumping to the ultimate capability of the system but ensuring that we have the technology we need to pursue whatever the requirement is, that we adequately work with industry to develop it, we test it, demonstrate it in the lab, demonstrate it on the ground, and demonstrate it wherever it needs to be. So that's the underlying theme of each of the tasks, if you read them very carefully within the Missile Defense Review.

Lt. Gen. Samuel Greaves: As Tom mentioned, the first thing we need to do, and it's tasked by the Congress originally but also within the Missile Defense Review, is to study the potential for space-based interceptors and what it would take to deliver that

capability. Then have the discussion and debate within the department, the administration, and with the Congress on what we do next with it, and that study is due in six months from the day of the Missile Defense Review release to both the undersecretary of defense for policy as well as the undersecretary of defense for research and engineering, and that's when the discussion will take place on what happens next.

Thomas Karako: Great. All right. I believe Jon Harper is next.

Q: Sure. Thank you. Jon Harper with National Defense Magazine.

You gentlemen talked about incrementally improving existing interceptors over time. But to get after this emerging hypersonics threat, does the U.S. need a new interceptor that's faster and more maneuverable than legacy systems and, if so, what are your plans for pursuing that and when would you hope to field that new capability?

David J. Trachtenberg: I think – it's a good question. Do we need a new interceptor to deal with that capability? I would prefer to leave that to the technical experts, of which I am not one, in terms of what the best approach for dealing with that – with that threat capability is. Is it a new kinetic interceptor? Is it the application of directed energy, which we've talked about, through a different system – delivery system? I don't – I don't fully profess to know what the – what the best approach is.

David J. Trachtenberg: Perhaps General Greaves has a better understanding based on the state of the various technologies or what have you. But I think that's one of the reasons why we are looking at and investigating a variety of options here because whatever we do we want to do in the most effective, least costly, and most – really, most practical way.

Lt. Gen. Samuel Greaves: I'll say the answer is yes to your question. The agency, with the department, has completed an analysis of alternatives, looking at hypersonic defense, of which fast interceptors are part of that solution. They are – they are one option, directed energy is another, and there are some other options in there. And it's essentially assessing the current suite of available interceptors to see if they're fast enough to get to the target and win the tail chase, as you might say. But that AOA is now in final coordination and review within the department and should be released sometime soon.

Q: OK. And as part of that AOA you've looked at new interceptors?

Lt. Gen. Samuel Greaves: Absolutely.

Q: And your sort of preliminary assessment is that the U.S. does need new faster interceptors?

Lt. Gen. Samuel Greaves: We have worked with industry to assess available interceptors as well as potential new interceptors to execute that mission. I cannot say today that – definitively that we need a new interceptor. I will await the results of the

analysis of alternatives because it needs to be coordinated and vetted and agreed to within the department, and if it is determined after that coordinated review that the current suite will not meet the need, the threat is there so we'll need to develop something else if it's decided to pursue a kinetic interceptor as the solution.

Thomas Karako: All right. Let's move over here in the middle. This gentleman right here.

Q: Thank you. I'm Andrew Clevenger from CQ.

Q: Could you talk about how the priorities reflected in the MDR are going to be a part of the budget submission that's due – that's coming for fiscal 2020? And are there concerns that the handful of six-month reviews that are within the MDR might cause those priorities to slip a budget cycle?

David J. Trachtenberg: I wondered when I would get a budget question. (Laughs.)

Q: They're all budget questions.

David J. Trachtenberg: Yeah. Ultimately it all comes down to funding, right?

David J. Trachtenberg: You know, not to sort of deflect the question, but I think we'll have to wait and see when the budget rollout occurs in the next couple of weeks or whenever it does. So I don't want to get ahead of the process here.

David J. Trachtenberg: What I would say is that clearly what we are calling for in the Missile Defense Review is a sort of series of focused efforts that will require the investment of budgetary resources. There's no way around that. And what we're proposing to do and what we have outlined here is not something that is essentially one-and-done kind of thing; you know, one year's funding and, you know, next year, what do you know, we're there.

David J. Trachtenberg: It will require the application of resources over time, much like what we said when we rolled out the Nuclear Posture Review in terms of modernizing the nuclear deterrent. It's a longer-term effort. We're going to track it. We're going to look at what the studies produce. We will adapt accordingly. We will try to keep to the schedules that we outline. But really we're looking at a long-term effort here.

David J. Trachtenberg: So while I can't talk about the specifics of this coming year's proposed budget submission, I mean, suffice it to say that what we're going to do is we're going to do our best to try to align resources to strategy here; so more to follow on that.

Thomas Karako: OK. We've got a question up here; actually, two questions up here, and then over here. Yeah, Bob, then Peter.

Q: Hi. Bob Vince from SPA.

Q. Going back to the arms-control concept, arms control, first of all, has to have arms to control, so there has to be a capability. And with the ABM Treaty, we had to walk away from that because of the proliferation of missile capabilities around the world. We're getting to the point now with INF to step away as that starts to proliferate.

Q. Some treaties made sense when they were bilateral, when the world was more bilateral. As we increase strength and capabilities of sensors – look at space sensors; look at space, perhaps, weapons capabilities, as well as greater missile-defense capabilities – is there a mix here someplace that we get to a stronger position where we can bring people back to a negotiating table and have arms control sometime in the future? Is there a future view of arms control?

David J. Trachtenberg: Look, I think that's a very good question. And I would answer it this way. Number one, I would say the purpose of arms control is not necessarily to control arms. The purpose of arms control is to reduce the risk of war, to reduce the risk of conflict. If arms control can't contribute to that – and there are ways that arms control can contribute to that. We should look for those ways.

However, the prospect for arms control, particularly between the United States and the Russian Federation today, doesn't look very bright. And it doesn't look very bright because of Russian behavior to this day.

David J. Trachtenberg: I would argue that one of the best ways of ensuring that arms control does, in fact, have a future and can be useful is to make sure that we hold the parties to arms-control agreements to their obligations, which means they must comply. There needs to be a penalty for noncompliance. Otherwise treaties are not worth any more than the paper on which they are written.

David J. Trachtenberg: So from that standpoint, I don't see, you know, what's happening currently with respect to arms control as disadvantaging the prospects for arms control going forth. I see it sort of from an opposite perspective. I think we need to be serious about it. And to be serious about arms control means being serious about compliance and making sure that parties to an agreement adhere to their obligations.

Thomas Karako: Let me just follow up real quick on that. The Trump – the 2019 Missile Defense Review continued the Obama administration and Bush administration's policy that we would not have negotiated restraints on missile defense in terms of arms control. Is there a sense – you know, I wonder if you might ask, that is a long-standing policy now, across three administrations. What would have to change before missile defense to be a viable object of negotiated restraints? Do you envision that being possible?

David J. Trachtenberg: This administration is not interested in resuscitating the ABM Treaty, or in placing restrictions in the ability of ourselves to defend this country. So I don't see that as part and parcel of what we are talking about here. We think missile defense has positive benefits across the board from a variety of perspectives, some of which we've talked about – deterrence, assurance of allies, increasing

decision space, stability – all of those – all of those factors. In and of itself, I would argue missile defense is a good thing. Therefore, I'm not necessarily enthralled with the idea that says we need to constrain our ability to defend against threats which are noticeably growing, and evolving, and becoming more challenging. I hope that addresses the question.

Thomas Karako: Got it. Got it. Peter, can we get the microphone – yeah.

Q: Thank you, General Greaves. And thank you, David Trachtenberg. Two questions.

Q: First one is, we have an Israel with Hamas and the Houthis in Yemen – real-world missile defenses that work. What are the lessons that we can learn from both of those conflicts in terms of how it helps us better tell the story? The second issue is, with respect to boost phase, one of our – one of the critics' response to the review was you can't do boost phase unless you loiter over the territory of the bad guys. And that will prompt them to start a war. So you can't do it. I'd like you to address both those issues.

David J. Trachtenberg: Let me start with the first question, Peter. Just in terms of lessons learned, I think lessons learned can be summed up very succinctly. And it goes back to the example that I mentioned before, in terms of the Israeli experience. The lessons learned are that missile defenses work, and that missile defenses save lives. We've seen that in operations. We've seen that in the real world today. And so we ought to – we ought to bank that. And we ought to develop that further. For those that say missile defenses don't really work, or can't be as effective, I think that argument is shown to be false.

David J. Trachtenberg: And I'm reminded of so many – so many historic predictions made in the past by "experts," quote-unquote, that turned out to be not the case. One of the experts that advised Harry Truman on the atomic bomb back in 1945 said: That atomic bomb will never work. And I speak as an expert on explosives. Some of my other favorite historic predictions were the prediction of one American back, I think it was probably the last century or earlier, talking about high-speed rail travel. Saying, high-speed rail travel is impossible because the passengers, unable to breath, would die of asphyxia.

David J. Trachtenberg: OK, now history is replete with those kinds of predictions of things that aren't and cannot work. And I would say in probably, you know, most if not all cases we've proven those predictions – those predictions to be wrong. I'm sorry, your second question was?

Q: Loitering, you have to be on top of the target.

David J. Trachtenberg: Boost phase. I think there are probably a number of options for dealing with that, and a number of capabilities that we are going to look at in terms of how boost phase might work or might be useful. But, again, you know, from a programmatic perspective, I'll defer to General Greaves on that.

Lt. Gen. Samuel Greaves: Yeah. Let me say that – I may have mentioned it before – that no one solution will meet all the threats and all the requirements. So we need to look within the complete set of capabilities that we've got to apply boost phase intercept, for instance, if it's limited by range, as an example, and current technology to the theater or the area where it could have most effect. So by saying it can't work, Mr. Trachtenberg said it, you know, a few decades ago you could never hit a bullet with a bullet. Now, that discussion doesn't take place anymore. The discussion is, well, how effective can you do it? How many times can you do it? How dependable is it? This is a very different discussion than it'll never happen.

Lt. Gen. Samuel Greaves: As far as the second question, the lessons learned from looking at – I'll take Israel as an example – we need to look at the fact that they've got a layered system. So Iron Dome doesn't go after the same targets as David's Sling or the Arrow weapon system will go after. The confidence that that provides to the population is – you can't describe it. It's tremendous. Command and control, that is another lesson learned that we're benefitting from. How do you orchestrate and optimize usage of those assets, so you put the right interceptor type on the right sort of target to husband your resources? Integration's another one. And how do you – and they're doing it in real time to defend their nation. It's not part of a test sequence.

Lt. Gen. Samuel Greaves: And recently, it's been in the news, the usage of that system to protect against attacks. So it's real time. We are working very closely with them. We're learning, we're adapting, and we're benefitting from those lessons learned.

Thomas Karako: Great. I think we had a gentleman over here waiting as well, in the front row.

Q. How you doing, guys? My name is Andrew Thadres (sp). I'm a student from Worcester State.

Q. My question is simple: The United States as a superpower nation, how can we defend our allies, specifically Israel, from threats such as Iran without conflicts with great nations such as China and Russia, with the resources we have? How can we work out things with those nations in order to defend our allies, specifically Israel?

Thomas Karako: A lot of different challenges. How can we afford to do all these things, both going after some rouge threats, but also the great power missiles, OK? Comments on maybe some resource tradeoffs, for instance? Making choices?

David J. Trachtenberg: Well, there are always resource tradeoffs. So we always – you know, we always have to make those – have to make those difficult decisions. But, you know, defending our allies, in a sense, is also part of defending ourselves. And we rely on our allies for a lot of things. And, you know, defense of Israel I would certainly consider critical from the standpoint of our own security.

David J. Trachtenberg: But it's – defending our allies is not something that – it's not a burden the United States should absorb unilaterally, which is why we have co-development

programs, and which is why we rely on allies to sort of step up to the plate as well. And we need to – we need to look for opportunities for allies to share more of that burden, and do more of that with us, in order to help us deal with the resource constraints that we face.

David J. Trachtenberg: Now, I'm reasonably optimistic that we can do that, not only with Israel but with the other allies as well that are – that are looking for protection against missile threats from Iran and other places.

Thomas Karako: Actually, to maybe follow up on the Israel question, you know, over the past decade the funding for – to support Israel R&D and procurement to missile defenses has been very cyclical, up and down as well, within – you know, from the U.S. taxpayer. Sometimes it's been as high as 9 ½ percent of the Missile Defense Agency's budget that has gone to this program. But a couple years ago it was kind of – an agreement was reached to kind of keep that flat and steady at 500 million (dollars) a year. From a policy position, do you see that remaining in place going forward, or any possible changes there?

David J. Trachtenberg: Well, look, there's – adaptive is the key word here. So there's always the prospect that things will change based on circumstances changing. But, look, what I would say, simply, is that we continue to work with the Israelis on this. We want to be supportive to their needs. We want them to continue to work with us, as they have been, collaboratively. General Greaves mentioned any number of layered systems that the Israelis have. I don't really – I don't really see that as an issue, because between the two of us the alliance – you know, the relationship that we have with Israel is so close and so collaborative that I'm optimistic that, you know, we can make it work, we can find the resources we need, we can adapt as necessary to the changing threat environment. And we can do what we need to do both for our security and for the Israelis. Is that fair?

Lt. Gen. Samuel Greaves: Yes. The – as stated in the Missile Defense Review, the memorandum of understanding between the United States and Israel, stabilizing that funding over 10 years, and it provides a predictable resource base to make decisions on research and development versus procurement. And it allows us to work very closely with them because they're living that environment every single day, they're facing that threat every single day. We're learning quite a bit about risk acceptance, risk decision-making, where to – where to – how to shepherd our resources, where to place them to optimize defense so it's mutually beneficial to both.

Thomas Karako: So we have time for one more question. This gentleman right here was waiting I think, yeah.

Q: Hi. Thank you, gentlemen. Paul Damphousse, I'm with a company called Spire Global. We currently have a constellation of 72 small satellites in orbit and we're generating revenue for a number of government and commercial customers.

Q. My question is, obviously, about the space sensor layer. And I know, Tom, that this is something you've asked about before. You know, we have the ability to crank out about one finished spacecraft per week. And so as part of this – call it a new space economy – we're really actually getting to the point where we are responsive, and with some of our colleagues in the audience who operate responsive launch, we have the ability to put things in low-earth orbit at scale. We think that we have the ability to play in the space sensor layer with the ability to put a large number of call it nodes that would help short circuit that tipping and queuing and that kill chain going directly from the sensor to the shooter.

Q. You know, I know that the space sensor layer is moving into phase two right now and we're going to down select from nine potentially down to three players. What our fear is is that we're going to go again with an – with an exquisite solution, whereas we have a lot of players that can offer, you know, something fast and responsive.

Q. So the question really is, how do we – how do we leverage and further catalyze some of these new space capabilities, particularly for space sensor layer?

Thomas Karako: Let me rephrase that. Is there anything about Mike Griffin that doesn't say go fast? (Laughter.)

Lt. Gen. Samuel Greaves: You took the words out of my mouth. Dr. Griffin will not allow this exquisite solution to dominate the end solution or way ahead. I'll just say that categorically. I have total confidence in that.

Lt. Gen. Samuel Greaves: The first thing I'll say is, being a space guy, it's not about the spacecraft, it's about the architecture and how those space platforms fit into the architecture. The space sensor layer, you will note our research and development activities being led by DARPA, their business is agility, their business is looking for optimum solutions, potentially out-of-box solutions to the questions and requirements that are out there. So that's where it starts.

Lt. Gen. Samuel Greaves: Within the organizational construct, within the Department of Defense under Dr. Griffin, DARPA works for him, Missile Defense Agency works for him, we're in the same staff meetings. We are working together cooperatively through the Space and Missile Systems Center SpEC OTA. That was not by accident, that was deliberate.

Lt. Gen. Samuel Greaves: The fact that the responses that we requested from industry have gone out from both organizations, that was not by accident, that is deliberate, because what we intend to do is not end up with that exquisite solution, to leverage the capabilities like yours to produce the proliferated LEO architecture that Secretary Griffin is pursuing, and to do that using commercially hosted or, you know, dedicated buses integrated into that overall architecture to do multiple missions – not only missile defense, it can be doing a communications mission; it can be doing some other missions that are out there.

Lt. Gen. Samuel Greaves: So I would encourage you to ensure you maintain your best, you know, proposal capabilities, make sure we get them. And I will guarantee you that he's paying personal – in fact, I have a – I'll be talking about that with him today when I get back. But he's paying very close attention to that. And I see great potential there.

Thomas Karako: Well, we are at time. I want to make sure you get on to that meeting. Thank you, General Greaves. Thank you, Dave Trachtenberg. Really appreciate this and look forward to continuing the conversation.

David J. Trachtenberg: Thank you.

Lt. Gen. Samuel Greaves: Thanks. (Applause.)

(END)