

The Growing Missile Threat in the Pacific and American Missile Defense

*Featuring: Vice Adm. Jon A. Hill*

*Moderated by: Bradley Bowman*

*Introduction by LTG (Ret.) Edward Cardon*

CARDON: Welcome everyone and thank you for joining us for today's event hosted by the Foundation for Defense of Democracies, or FDD. I am retired Lieutenant General Ed Cardon, a member of the board of advisors for FDD's Center on Military and Political Power.

The Director of the United States Missile Defense Agency, Vice Admiral Jon Hill, told Congress this summer that "U.S. adversaries are developing more capable ballistic, hypersonic, and cruise missiles, systems with global reach, increased speed and maneuverability, greater accuracy, and improved countermeasures."

Those capabilities challenge existing missile defense capabilities and increasingly put the American homeland, our allies and partners, and our forward deployed troops at risk.

In the Pacific, those missile threats emanate from China and North Korea.

Earlier this year, China tested an advanced fractional orbital bombardment system (FOBS) that deployed a formidable hypersonic glide vehicle capable of evading existing U.S. missile defenses.

Chairman of the Joint Chiefs of Staff General Mark Milley characterized the test as "very close" to a Sputnik moment — referring to the 1957 satellite launch by the Soviet Union that shocked America and demonstrated the Kremlin's military-technology prowess.

In its annual report to Congress on the Chinese military released on November 3, the Department of Defense noted that the People's Liberation Army Rocket Force (PLARF) launched more than 250 ballistic missiles for testing and training in 2020 alone, calling this "more than the rest of the world combined."

Meanwhile, North Korea continues to work on developing a range of missiles that threaten both South Korea and Japan, including our forward stationed forces, and increasingly threaten the United States.

There is also asymmetry as we can also expect both adversaries will increasingly attempt to use cyber capabilities to infiltrate and disrupt the U.S. missile defense systems.

Developing and deploying a layered secure missile defense system to defend the United States, its deployed forces, allies, and friends from these missiles in all phases of flight is the mission of the Missile Defense Agency.

It is difficult to imagine a more important mission and that is why we are so pleased and honored to host Vice Admiral Jon Hill for this conversation. A native of Texas, a Naval Surface Warfare Officer, and engineer, Admiral Hill is the 11th director of the Missile Defense Agency.

This discussion is just one part of the great work at FDD's Center on Military and Political Power or CMPP. CMPP promotes understanding of the defense strategies, policies, and capabilities necessary to deter and defeat threats to the freedom, security, and prosperity of America and our allies.

For more information on CMPP's work and our areas of focus, we encourage you to visit our website: [FDD.org](https://www.fdd.org). We also encourage you to follow us on Twitter @FDD.

I am now pleased to turn the floor over to my friend and colleague Bradley Bowman, senior director of FDD's Center on Military and Political Power. Brad served as a longtime Senate staffer, U.S. Army officer, and assistant professor at the United States Military Academy at West Point.

Brad, over to you.

BOWMAN: Ed, thank you very much for that introduction. Vice Admiral Jon Hill, thank you as well for joining us for this conversation on the growing missile threat in the Pacific and American missile defense. I appreciate the opportunity to discuss this important topic with you.

HILL: Great. Thanks for having me here today. I'm looking forward to the conversation. Thank you.

BOWMAN: Me too, as well. I understand you have a presentation, about a 15 minute or so presentation you'd like to present. So I'd welcome you to do that now if you like.

HILL: Great, absolutely. You can go ahead and bring up the charts and I'll come through those and then I'll look forward to the Q and A.

BOWMAN: Sounds good.

HILL: Okay. So I see the charts, that's got the title on it. And if you can go ahead and turn the charts. So I'd like to start off by having a conversation with you about the threat. And this chart is something we created back when the Missile Defense Review of 2019 was released. It was one of those reports that had the kind of information that I needed for the public sphere that I did not have prior to that. And so the fact that it's publicly releasable, it just makes it easier for me. So it includes the ranges. During that timeframe, a lot of focus on the medium range and the intermediate range, ballistic missiles, and certainly from a homeland perspective, the ICBMs. So I always think it's important to kind of give folks a little sense of scale.

And so, we show it launching out of the Northeast, heading out to the Southern Pacific there. Just to kind of give you a sense of ranges. So when we say ICBMs, this is the kind of range that we're talking about. One of the things we don't talk about typically is when you loft a trajectory or a standard trajectory for a ballistic, or when you do a depressed trajectory. When you depress the trajectory, now you have cranked that ballistic missile into a hypersonic missile. So I want to kind of clarify for folks that even though we're geared for ballistic missile defense, primarily as a homeland defense organization, we have been dealing with the hypersonic end game for a long time. And so that's why I include the speeds

at the lower left-hand side of the chart, and then put it into what my mom would say, "Will you stop talking to me in Mach numbers or kilometers, and please tell me what it is in miles per hour."

So, you can kind of get a sense of what those speeds are just at a high level. And then off to the right in the upper area, kind of shows you where the adversary systems are going. And it's really kind of a mix here of near peer and pacing threats and the rogue threats. The shame of it all is that technology is proliferating. And what we really focus our time on in the ballistic fight is what you see up in space and that's countermeasures. And it's a fancy word for decoys. And so decoys and countermeasures really suck down your radar energy. So if you've got a radar on the ground looking at that scene, it's going to want to track everything. And so you have to have exquisite algorithms to go in and do what we call discrimination, which means picking out the lethal object so that when you expend an interceptor, you're going after the lethal object and not after the tank.

Because up in space, when you go ballistically, as tanks come off or V-bands from separation or even solid fuel chuff all of that stays in a ballistic trajectory. It's all coming along with the RV. So it's kind of an interesting thing. Now, it's all different when you come back into the environment, dropping down into the atmosphere. And what we're seeing now is multiple RVs, right? Multiple independent reentry RVs, so think maneuver, depressed trajectories I already talked about. Maneuvering reentry vehicles and the hypersonic global maneuvering missile and those can be released by cruise missiles, by aircraft. And kind of typically what you see in the center of the chart there is that classic hypersonic, the gold threat there, what's ballistic initially then comes back down and it's bleeding off energy in glide. But when it's doing that, it's doing lateral movements across the globe.

And so, this is the big challenge. And so I still believe that discrimination is a major challenge for us, always will be because the ballistic threat will not go away. But as you get into these new, more high end, hypersonic maneuvering threats, it's really all about maneuver and speed. So high speed and maneuver is the challenge that we have in the Missile Defense Agency and integrating our missile defense across the force today. And at the bottom, you just see some of the normal parading of gear just to keep you up at night. So next chart, please. So, I want to pull a few things out of the press. I know we'll talk about this a little bit later. But hypersonic capability is not new. It's been around for a while, but it's being aggressively pursued, particularly by the pacing threat of China. Russia has deployed them already. The United States is working on hypersonic capabilities.

So, you're seeing a lot of reporting on that. And kind of going back to the prior chart, global maneuver becomes the issue. And I'll talk about how that affects the sensor architecture, how that has an impact on Command and Control and what that means for the weapons that we've developed to counter these sorts of threats. So pretty tough world out there. Lots of testing going on. Lots of demonstrations. Next chart, please. So this is the overall mission statement of the agency. And you can see it up in the top there, I always like to highlight the three main takeaways. One, is a layered defense. And when I say layered, what that means is I want the adversary to deal with more than one layer of defense. Meaning if we can, on a hypersonic threat, take it off course during the glide phase, and then hit it again in terminal, then we're in a much better place. We're protecting our sons and daughters who are out there deployed around the world if we have a layered capability.

Our mission is to defend the United States, so that's the homeland, our deployed forces, that tends to be what we call the regional. And I'll talk more about that later. And our allies and friends. And we say all phases of flight, typically that's boost phase, ascent, midcourse, and terminal. And we can talk more about that as we go. But at the end of the day, it's pretty easy knowing what the mission is when you work for an organization called the Missile Defense Agency, you know what your mission is. And for us, it's about delivering capability as fast as we can, credible capability to the war fighters. Next chart, please. This is an update to something we used to call the placeman. And I think I've had a little run time on this one now. It's kind of a way to look at the capabilities that we have against the different threats.

You can think of life through three different views, homeland defense, which we call Battle 1, regional defense, Battle 2, and then self defense. What we do from an agency perspective, and you can kind of see it by just the assets vertically there, very focused in on homeland defense against the rogue nations, right? So North Korea and Iran is what you see. The sensor architecture is geared towards that. Ballistic missiles, because that's a terror weapon. They go after population centers. That's totally different than what you see in the regional aspect where they're actually going after specific assets. If you're talking about cruise missiles, now you're going after critical infrastructure and those sorts of things. So the regional defense tends to be more, very service oriented. And when you get into self defense, which is where the Missile Defense Agency doesn't necessarily do a lot in the self-defense area. That's really left up to the services.

But we have been asked in the past to go in and work as discreet self-defense pieces, like defending the sea base. And I'll talk more about sea-based terminal as we go. So I look at life through another three pieces here, and that's detect, control, engage. So sensors across the top, space, terrestrial base, sea-based sensors. You can see an array of those across the top. The Command and Control aspects. This is where the warfighters tend to touch the system. So, if they're in a Maritime Operation Center or an Air Operations Center, or at one of the Combatant and Command Control Centers, that's where they're going to touch the system. So, lots of different ways to look at Command and Control, but I also view it as the networking and where the fire control solutions are developed and how those then go to the weapons that are across the bottom.

So, from a homeland defense perspective, the GMD system, Ground-based Midcourse Defense, and then you go into the regional side, we have Aegis Ashore. We have Aegis ships all around the globe. And we have the THAAD batteries that are transportable and the Patriot batteries. And that's kind of the layers of defense to take those on. All right, next chart, please. So, this is a view of the importance of space. And so just going back to that threat chart, when you think about maneuver, high speed maneuver, being the challenge of the day, when you maneuver, that allows you to go around fixed assets, it allows you to avoid sensing, allows you to overfly air defense and under fly space defenses. And so the real way you deal with that is to elevate yourself up into space so that you're now looking down. And there's challenges to that. Hot targets that are streaming across a warm earth.

You have to be able to pull that out. And we've shown that we can do that on the ground. We're going to deploy something called a Hypersonic Ballistic Tracking Space Sensor. That's in the center of the chart. That's a low earth orbit capability that will allow us to see the dim targets that you see in the ballistic world, but allows us also to have that coverage of the earth so that we can get full track custody in hypersonic shot, as an example. So space is very important. It's kind of where we all start. If you're

looking at a ballistic launch from an indication warning perspective, you're going to see the flash. That's what we'll see from our space assets. And then we transition over to the field of view of a radar, so we can get a very discreet fire control solution. And when I say fire control, it's got to be good enough for us to put a weapon on it. So when you think about the various sizes of weapons, whether it's a missile this big or a missile this wide, it's got a field of view associated with it.

So, you got to take the error out of that equation or the uncertainties out of that flight. And so we're going to talk to these missiles as they're going up, and we're going to use this fire control solution to get to the impact and to be able to take the threat out. So there's just a couple things on space. We can come back to that as we need to. Next chart please. So I want to talk to you a little bit about hypersonic defense. And so I've heard it said before that we have no capability. I will tell you that we do. I mentioned before that we deal with depressed trajectories and ballistics. I mentioned the sea-based terminal earlier. That's really the nation's first hypersonic capability to defend the sea base. And the way that works, if you just look at the threat on this, in this case it's coming from right to the left. And that's the threat trajectory, the ballistic flight down into a glide phase and then into terminal.

So, we started with terminal based on a requirement coming from the Navy to be able to take on what is normally referred to as the Carrier-Killer, which is kind of a mix of ballistic and then high maneuver, high Gs in the atmosphere kind of threat to the sea base. And so we used a highly maneuverable missile to be able to do that in the atmosphere, we started there. And where we're going next, and we've got three contracts out now, so we can really understand the requirements is we want to go back up and get to that layered capability for hypersonic defense and go after it in the glide phase. Because it turns out if you look at a hypersonic threat and the way they fly, when they're in that glide phase, that's when they're the most vulnerable. So if you knock them off course or you do something to disturb that glide phase there's less of a chance that you're going to have to deal with the precision within the atmosphere when it comes back down.

In fact, if you kill it there even better. If you disturb it, that's great. But that gives you that first look. And so, we think we can get there pretty quickly, which is why we brought three companies on board to make sure we've got our requirements ready. But we're going to leverage something called Engage on Remote in Aegis fleet that's been proven. We have closed the fire control loop and engaged using space sensors already. We use land-based sensors all the time and of course sea-based sensors. So, in the meantime, while we're waiting to proliferate space, we can leverage the sensors that we do have. If it's an up-range ship, it happens to be in the right place, gets a track, it can pass that information back to the shooting ship. And that's really the concept here. In the future as we get the Hypersonic and Ballistic Tracking Space Sensor deployed along with other space assets, pipe that information through [Command and Control, Battle Management, and Communications] C2BMC, get it down to the ship, then the ship can prosecute that engagement and hopefully get a glide phase shot and a terminal shot.

And that's really the concept behind the layered defense for hypersonics. Next chart, please. So, takes me right back to the mission, and that kind of wraps up my charts. And I know I went a little bit faster, but we can take our time in the Q and A. Next chart please. I think that is the end. Okay, great.

BOWMAN: All right. Well, Admiral, thank you so much for that. That was, I think, a very helpful overview, especially for viewers that some of this missile defense may be new to them. So I thought that

was very well done. Thank you for that. Perhaps I can start with where you started and that is just with threat, right? Because that's obviously determining what kind of missile defenses we want to build. As General Cardon said in his introduction, we now know we, the general public know that China conducted a very concerning test this summer. Not putting words in your mouth or anyone else's mouth, but according to public reporting and some comments by Pentagon leaders, it was, I'm trying to avoid wonky terms here, but here's one, fractional orbital bombardment system or FOBS.

Essentially as you'll know better than me, that means a hypersonic glide vehicle was put into orbit. The word fractional comes from whether it was a complete orbit or partial orbit. It then de-orbited and apparently glided with high-speed maneuvering toward a simulated target. I heard one expert describe it, basically think of an enemy space shuttle with a nuclear weapon on it. No landing gear coming in really fast. I'm sure that's a huge oversimplification, but maybe one way for our viewers to think of it. Admiral Hill, I won't ask you to describe what happened beyond what other leaders have already said, but do we, as Americans, have anything currently that could deal with a threat of that nature?

HILL: So, it kind of depends on how you want to take on that threat, right? So if you break down the problem and you kind of described it really well and I'll just kind of break it down a little bit, right? So initially it's ballistic, right? It's heading up into space. And if you read some of the other work that's out in the press is that, it was a space vehicle. All right, so we track the launching of space vehicles all the time. So our ability to capture and maintain a track in the ballistic phase, we know how to do that. And if we have the assets placed correctly, we could engage in the ballistic phase of something like that, right? Now, as you come around the globe, as you described in the fractional orbit, now you're kind of in a different arena, right?

You're kind of passing through lots of different sensor architectures. So we're not at that point now to where I can really talk about that on this network today. But when it comes back down into the atmosphere, now we're having the same conversation I had a little bit earlier when I was describing a typical hypersonic flight. Rather than the ballistic, and then going into the glide, this is dropping out of space into the atmosphere, it's now in glide and it's now going terminal, right? So that starts to look a lot like what I was describing earlier. And if you have your assets placed in the right place, and you're able to get a track as it comes down from space, and if you get a track in glide and if you can engage in glide, great. And then today, if you have a sea-based terminal ship in the area, then you can have the ability to engage there, if we know where the terminal point is. But in these tests, a lot of times they're not necessarily operational or geographically set up to represent that, but that's how we could break the problem down today in the near-term, and it's really informing where we're going with future development.

BOWMAN: Thank you for that. And I really appreciate the nuance you brought to that. For viewers, a term that you kept using, Admiral, was track. And to track, and correct me if I get this wrong, you've got to be able to see it throughout. And if you have periods where you don't see it and you have a maneuvering vehicle—

HILL: Right.

BOWMAN: It could maneuver in unexpected ways, and that becomes a problem. Do I have that about right?

HILL: You have that about right, and that is the challenge of air defense and ballistic missile defense, cruise missile defense, is— So when I say track custody, my preference is to have it at launch, all the way through demise, right?

BOWMAN: Right.

HILL: That's what we want. I don't always get that.

BOWMAN: Right.

HILL: And sometimes you have to use multiple sensors. In a case of a global threat like that, you're going to need multiple sensors that can hand off to each other and really classify that threat, know what it is, and be able to maintain that track.

BOWMAN: That makes sense. So for viewers, at risk of seriously oversimplifying, and you know this, you live it every day, Admiral, but the Combatant Commands, the U.S. divides the world up into Combatant Commands, areas of responsibility. They report, "Hey, here are things we're concerned about. Here's what we need to do to accomplish our missions." That comes into the Pentagon, decisions are made, and then they look to you to develop and field those capabilities, right? That's kind of it in a nutshell.

So, interested in what— Obviously, all unclassified here and whatever you feel comfortable or not comfortable sharing, I respect, but what are you hearing from Strategic Command, Northern Command, and Indo-Pacific Command, in terms of the missile threats that China and North Korea are developing that they find most concerning?

HILL: One of the reasons I walked you through a detect, control, engage kind of view when I showed you the place mat, what they're all consistent about, whether it's hypersonic, ballistic, or long-range cruise missiles, they'll always tell you, you have to have a resilient sensor architecture, right? So it's the old, if you can't see it, you can't shoot it discussion, right.

General VanHerck likes to poke me in the chest often, and I love it. He'll always come in and say, "Jon, my number one requirement is All Domain Awareness." So he's saying the same thing there too, right? I have to know where it is. So warning is really important, and then if we're going to engage at track level, quality is really important.

And just to kind of go a little bit more on what you said before, as you were explaining track to a really diverse audience here, is it comes down to positional accuracy, velocity accuracy, and acceleration accuracy. That's how you go build a track, right? So you have to get measurements, then you got to

smooth that data, then you got to get another measurement, and then you're building that track. And once you have that track, then you can get the weapon to it.

So, it's kind of— I would say from a broad— I can't speak for the Combatant Commands, but I will tell you what I receive is very consistent. They need All Domain Awareness. They have to have a sensor architecture for the range of threats.

Then they need to have command and control that they can trust, and networking and fire control capability. And then they need a mix of weapons to deal with them, right? And then probably one of the hardest ones is they would like to deal with fewer configurations of weapons. And that's a tough one because what it takes to kill a ballistic missile in space is different than what it takes to kill a missile flying in, or along the edge of the atmosphere as in glide, and then is also different from what you do when you're killing something in the atmosphere that's maneuvering. And it would probably be too costly to try to build a one-size-fits-all weapon, which is why we have so many different pieces.

So, they're very consistent, All Domain Awareness, command and control, and then different weapons options, and that's hard kill and soft kill, by the way. So there's a mix of those things.

BOWMAN: Right. And so, when we're talking about a missile, whatever type it is, going from launch to hopefully demise before it hits its target, an adversary missile, you start to appreciate how important space is to that. It gives us that additional visibility, that some terrestrial or ground-based radars may not give us.

I noticed, Admiral, on slide six, you kind of gave us a helpful overview of kind of that space sensor picture. And I couldn't help, but noticing a lot of them on there said, "Future" or "demo." In other words, We don't have those yet. They're not on orbit. As much as we'd like to have them in place, they're not.

And one of those, you explicitly mentioned HBTSS, Hypersonic and Ballistic Tracking Space Sensor. For the audience, Admiral, what is that? Why do we need it? And then for me, where is the program now? What are some upcoming milestones, decision points, and challenges that you see there?

HILL: Yeah. Thank you. So first of all, let me just say, I hate acronyms, drives me nuts because—

BOWMAN: It's a long one, but you got to do it.

HILL: Yeah. I get graded at home all the time. My wife and my daughters they—

BOWMAN: My wife makes fun of me when I use acronyms, so I try to avoid them. But we're going to have a few of them in this presentation. Oh, well.

HILL: Yeah. Well, but in this particular case though, we wanted to make sure that we touched on every aspect of what we're trying to do as we go to demo in '23. So we started off with nine different companies. We necked down to four, and now we're down to two, and we're going to put up two interoperable birds in the LEO.

And what we're really trying to do is go after that—

BOWMAN: So, a low earth orbit-- lower than some of the others that we have farther out.

HILL: You bet, you bet. And you can Google different orbitologies if you want to know, a 1,000 kilometers is p-LEO, proliferated LEO. And you can go up to GEO and HEO because I don't like to do the math in public, but we wanted to go after the driving threat, which we believe is a hypersonic threat. So when we started this back in 2013, we saw this threat coming.

So hypersonic, first piece of that. Ballistic missile, well, it turns out that as the adversaries continue to improve their ballistic capability, which I used to call kind of the poor man terror weapon, because you just launch them up. It's like throwing football. It's going to go ballistic, it's very predictable. You know where it's going to go, so that's a pretty straightforward weapon to use and it's a great terror weapon because you don't really care about accuracy in general.

But what they're doing now is they're doing extensions in space. They have a maneuvering atmosphere vehicle on the end game of that. But if you ignore all that, the other thing they're doing is they're changing the propulsion types that they use in these upper stages. So as they come through boost, where they're really bright and hot, where we can see them and we can track them, when they get into that second, third stage with the type of propulsion they're using, and just sort of thinking about taking aluminum out to where you're not burning as hot, is just one example of what you could do in your propulsion stack.

They're very dim, so they're very hard to see from space at that point, but if you have the right sort of sensitivity and it's not new science, by the way, then you can now see those. And so we don't want to lose, and right back to your point earlier, Brad, is you have to have custody, from launch all the way to the demise. Well, we can't demise this thing if we lose sight of it.

And so, we're taking on the maneuvering threat globally by having a proliferated Low Earth Orbit constellation. And then we take on this dim target on the boost side with the sensitivity, and that we need the sensitivity to extract the hypersonic tracks. They're hot off of the warm earth, and so, that's some exquisite algorithm work, which we've proven on the ground, and now we're going to take it to space and do a demo on it.

BOWMAN: That's a really helpful answer.

HILL: Does that answer your question?

BOWMAN: It does. Very good. No, thank you for that. And every now and then, I get questions, obviously don't know as much as you do about this. I get questions about, "Oh, the X and Y country just tested this exotic new weapon." And my response is, you know what? We don't need to match them for every exotic new weapon. But what we need to do is to have an improved sensing capability, and a vital component of that is what you're describing, I would argue, in space. And so, I think that was very helpful. Thank you.

So, I actually have a few questions from reporters that I'd be honored to kind of throw in there as well. And so, here's the first. The growing missile defense footprint in space brings up a question from Theresa Hitchens from *Breaking Defense*. And she's interested in the division of labor, if you will, between MDA's mission, which you've described, and the Space Force, specifically when it comes to missile warning tracking.

So, we're talking a lot about space. Well, how do you work with what's their job, what's your job? Can you just talk through that a bit?

HILL: Sure. That's a great question, thank you. So, when I mentioned HBTSS, I view that, and I called it a demo program, and again, back to the acronym, space sensor, right? So what we're focused in is on that missile defense capability that we need in space to go after hypersonics and ballistics. That has to be coordinated with the Space Force, particularly with the architecture, and then close coordination with the Space Development Agency.

And so, if you kind of put HBTSS as we know it today, and let's say we get those first two in orbit, and then we want to take advantage of SDAs transport layer. So, as we move data between satellites and down to ground stations for processing, or if we process in space and move that down, that's the problem that I don't want to go solve. I also don't want to do constellation management. I want the Space Force to go do that.

And so, we are heavily connected between Space Force, SDA, and MDA, to execute that broader mission. But my big piece in this is I got to have track level quality, right? When I mentioned position, velocity, acceleration, that's what we need. The other sensors will do things like missile warning, so they don't have to be as sensitive, and they can be used as a queuing source to HBTSS as an example.

Today we can use ground-based radars as a way to get a queuing source. And so, it all has to be coordinated. So we're all tied together in the same architecture.

BOWMAN: Thank you. So we've been talking a bit about space, let's bring it down to earth. So the growing importance and need, I would argue, for space-based sensors doesn't mean we don't need terrestrial, or our ground-based radars. And actually, the U.S. is building the Long Range Discrimination Radar as we speak, in Alaska. So just what value does that radar bring? And when do you expect it to be fully operational?

HILL: Yeah. Great question. So in fact, I'll be getting on a plane over the next couple days to head up to Clear, Alaska. So Clear Alaska Space Force Station is where the radar is being built, and it's strategically located there because its main mission is to contribute to homeland defense, ballistic missile defense, and then to do the Space Domain Awareness mission.

So that radar, it's called a discriminating radar because it's got the ability to go in and not only see that complex that I mentioned earlier, boosters and V-bands and solid fuel chuff and that kind of stuff and pick out the RV so that we're very dutifully going in and launching towards the lethal object only.

So that radar is going to go through what we call initial delivery next week, so we're pretty excited about that. What that means is all the major construction is complete. So despite the pandemic, despite Alaskan weather, we were able to get construction complete, so we're really excited about that.

The next phase, and we've started in on this, it's not a serial kind of thing, is integrating it into Command and Control, Battle Management. So when I talked about the war fighters looking into the system through C2BMC, that's how they control it. The control of that radar will be done remotely, away from that radar.

And so, we need to have that fully integrated. We've got that now, so once we do initial delivery, if some massive national emergency goes off, we have a capability. But what we need to do is complete that integration. We need to get the war fighters on the console and train them through that. And they'll go through—In '22 is the integration with the Ground-Based Midcourse Defense system, and then in '23, the focus will be on what I call the operational acceptance, and this is where Space Force takes over full operations.

So, in the meantime, we're doing the work with the Space Force today, to get them ready to take it on. Does that answer the question? I know that was long.

BOWMAN: No, it does. That's a big deal and a positive deal. Congratulations on that. I remember when I was staffing a member of the Senate Armed Service Committee, that going through the authorization process and appropriation process, and here we are. We're actually talking about it being a real, fielded operational capability, and that no doubt, you guys have worked through a lot of difficulties with COVID and everything else, like you said.

But for me, it's just a reminder that these things take time and we got to get started sooner rather than later, because you can have patriotic hard-working people, but it takes time to get these created. And discrimination, you described it well, discriminating between decoys and the lethal threat that we need to intercept. But also, just for the viewers, discrimination, did you hit it? After you hit it, do you have to fire again?

So that's an element of the discrimination mission as well. Do you need to fire a second time, correct?

HILL: That is correct, and one of the things I didn't point out in the space chart earlier, you'll see something called Spacebased Kill Assessment. We put that constellation up a couple years ago, and what we're doing now is doing constellation management. And then we are moving from just being able to detect that we had an impact, right? So in the IR space, you can see that you've had a direct hit.

Now, the question is, did you kill it so that you can hold your interceptors and not fire again? And so, we'll move in from hit to full kill assessment. We'll provide that capability to Northern Command. So as General VanHerck continues to hit me in the chest, "Where's my Domain Awareness?" LRDR definitely plays into that, and the discrimination aspects, all the way from what we can do with existing sensors to the new space sensors is also part of that story.

BOWMAN: That was good. So I wanted to ask you about the Missile Defense Review. For the viewers, this is a document—every administration produces that, basically kind of lays out broad strategic policy for missile defense. It's my understanding that this administration is in the process of drafting this one, that it may be published sometime next year, presumably after the National Defense Strategy.

Not asking you to what it will say or anything like that, but I'm just generally speaking, if you're willing, what are some of the key developments, differences, or shifts from the last MDR, that you believe this new one may need to address? And when do you expect it to be published?

HILL: Yeah. So I don't own the Missile Defense Review, and that's actually a good thing. You don't want the agency writing its own homework and grading its own homework. So I really can't speak to it because it's exactly as you said, it's coming through the process now, and there are decisions to be made on how we want to roll out that strategic view, because it's put out in the unclassified domain for a reason.

And so, it is very strategic. I would say that it's consistent with what we have seen in prior reviews, and that's good. I would say the one thing that I can talk about here that I know will be reflected in that document, and it's been out in the press already, is the overall integrated deterrence view. So although I'm a missile defender, I full well know that I'm one piece in a much larger enterprise. And so you'll see that view in this review.

BOWMAN: That's great. Thank you. I won't go down the integrated deterrence lane too much. No doubt any military officer knows you got to integrate your forces for effect within the department. When we're talking about integrated deterrence across the U.S. government, then that becomes another question. Certainly, we need effective diplomacy and development, but we also need an effective DoD, and we need our DoD to have sufficient resources to do that. I won't ask you to respond to that, but a little editorial comment there from me.

All right, so now let's move to homeland missile defense, and then regional missile defense. You laid out those two categories. We'd love to just drill down real quickly on each of those. In terms of homeland missile defense, defending our homeland against attack, you described currently what we have. What would you say is your top one or two priorities for improving our current homeland missile defenses?

HILL: Yeah, I think the homeland defense is in a really great place today with sensors like LRDR, the upgrades that we've done to the early warning radars. And these don't get as much attention as they should, but in rock solid coordination with the Department of the Air Force and specifically the Space Force today, we have gone in and digitized the back ends of these radars. So, you may look at one of the early warning radars and say, "Oh, that was built back in the '50s and the '60s." But I will tell you under the hood, those are very, very capable sensors, and they are going to contribute to the All Domain Awareness that the Northern Command needs to protect the homeland. So, very excited about where we're going with the overall sensing capability.

Now we can also leverage the capability that we have for homeland defense for Space Domain Awareness. And so, I view that as a rising mission within the agency. And the reason I say that is it's pretty easy to incorporate those requirements into a sensor like Long Range Discrimination Radar up in Alaska. And you can do that in our forward deployed TPY-2 radars, which we have done, and you can also do that on Aegis ships, which we have done, and are testing out, and will declare that capability as soon. Because we generally calibrate our radars by tracking satellites, as an example.

So to me, I think homeland defense from a sensor perspective is in a really great place. And then the administration came in and gave us permission to award two contracts for the Next Generation Interceptor. So when you have a weapon system as complex as a Ground-Based Midcourse Defense, and you've got deployed ground-based interceptors of different ages and models, you need to upgrade as often as you can, so that you're pacing the threat. NGI definitely paces the threat, and having two really great industry folks moving down the path in a competitive environment adds speed to the equation. Number one requirement for us was earliest in placement possible.

So having two horses running down the track, we're going to see speed. And I'm pretty excited about that, because we're seeing it already, even though we're very early in the development.

BOWMAN: And as some viewers may not know, that's not always the case. Sometimes if you'll give the contract to one company because they're particularly good at what you want them to do, but like you just described well, by having two competing, if the goal is urgent deployment, then that's a way to hopefully move things along. So that makes sense to me.

HILL: Yeah. So, it's not just urgent deployment, but it's also just, since we talked about the threat earlier and how it's evolving and becoming more and more complex, we're going to require a lot out of the— And we do require a lot of the Next Generation Interceptors. So you want high end companies going after it, and you want to burn down the risk. So it's really for me, as a technical geek, it's less about time, it's more about, do I have a fallback position? Can I manage the risk in something that's this important for the country? This is the no fail mission of defense, defending the homeland, so NGI is very important, and that we've got a lot of support for it.

BOWMAN: Sometimes redundancy is a good thing when you're talking about a particularly important mission. And maybe what one or two things you would say that the NGI would provide that we don't currently have? What are the new capabilities it would bring that you're most excited about?

HILL: I'm excited about its ability to take on, and I can't unfortunately get into on this network, say a lot about it, but what we have seen from the rogue nations and what we're seeing proliferate are what I mentioned on that threat chart earlier. So when you've got multiple maneuvering warheads and you've got other capabilities coming at us, we have to take that on. And so, that's really what I'm excited about and what separates this capability from what we have on the ground today. It's really geared towards the future, and we have some really great—we've done a lot of great work with the intelligence community, a lot of great work with our commands who set the requirements for us, and we're on a good path there. So, homeland defense is rock solid, and Spacebased Kill Assessment tied to that. I'm very excited about where we are with that.

BOWMAN: Excellent. One last question on homeland defense. In November 2020, working with the Navy MDA conducted, as you know well, a flight test Aegis Weapons System-44, where you launched an SM-3 Block IIA interceptor from the USS John Finn and successfully intercepted a simple rogue state threat representative ICBM target. So not really what that missile, right, correct me if I'm wrong, was designed for, but it's a capability that it apparently has. It raises this question. What role do you see going forward for the SM-3 Block IIA interceptor in terms of homeland missile defense?

HILL: Yeah. It's a great policy question, so I can't really get to it. What I will tell you, I want to give you a little bit more about FTM-44, just because it is pretty exciting for me. First of all, that was a new construction destroyer. So, if you look at the partnerships between the Missile Defense Agency and, in this case, the United States Navy, we're talking about a ship that just came off the blocks a couple years ago. So brand spanking new ship, and they're doing ballistic missile defense, integrating our missile defense. Coming off the blocks, they're building that in stride, in new construction, in the DDG-51 program.

We've also upgraded the oldest of the ships. So the mighty John Paul Jones and the Arleigh Burke, and I was just on USS Barry recently, same capability on the older ships. And so it's really impressive.

So, the fact that we had a new construction ship out on the range who had been out there in during our most recent GMD test, so that she could go out and track, was part of the risk reduction. Can she actually see and track this inbound ICBM? The answer was yes. And then we got her in shooting position, and the ship does what they always do, is they maneuver to get the best shot that they can. And so, it was really just fantastic.

Building that target during COVID-19 pandemic, in a country like the Republic of the Marshall Islands that took a lot of coordination and hard work. And I tell you, the range management we had, the Coast Guard out there clearing fishing boats out of the way, the U.S. Army making sure that the target was maintained during the pandemic, pretty amazing. I would say an all service joint event to pull off that exercise.

So then now what do we do with that capability? Well, you mentioned it, a simple ICBM. And that's code word for it wasn't brimming with a lot of counter measures. And so now it's really a question for the nation. Do you want to leverage ships? Do you want to leverage that sort of capability for homeland

defense? And right now, we've put that in the parking lot. We're going to continue to improve the system for its regional capabilities, which are critically important. The Navy's a maneuver force, so we want them out there forward, taking the fight forward, away from the nation. And so, we're kind of parking, waiting for that.

One of the reasons we want to execute that test and why it was mandated by Congress was we had some concerns before we ever awarded the NCI contracts, that the overall reliability of the GMD system as it exists today would go down and fall off. Because we didn't have good data on that. Because we're hardware poor, meaning we put everything into the silos because we just want to be ready. So we didn't have a lot of extra material laying around.

So, we were plussed up by Congress to do something called a Service Life Extension Program, which has now given us confidence that, in fact, these missiles are really great on taking on this threat. So we've been able to extend the life and have much higher confidence in reliability, while we also have NCI closing the other part of the gap.

So, right now it's in the decision space, no decision has been made, but the capability for SM-3 Block IIA is out there. We're going to production now. We're releasing some of the earlier missiles to the fleet. And so, sailors would get to look and feel and practice their techniques, tactics, and procedures on how they're going to leverage that capability. And we'll see where we go.

BOWMAN: Great thank you.

HILL: Long answer. Sorry about that.

BOWMAN: No, no, no. It was a helpful answer. So we've talked about homeland defense. Let's shift, with your permission, to regional defense. And just to remind the viewers, we're talking about missile threats to our forward deployed forces, our allies and partners. And in that context, Admiral, if you wouldn't mind, could you give us a quick update on where we're at with the Glide Phase Interceptor program? Why do we need it, and where are we at with that program?

HILL: Yeah. I showed you a little concept chart earlier where we've got defense of the sea base against those sorts of really tough maneuvering threats, high speed with sea-based terminal. Terminal's okay, but that's the Hail Mary shot. Not good enough, in my view, if you want to protect the ship. I've been on the range many, many times where we've done short range shots and terminal engagements, where the debris just comes in and either damages the ship or hurts somebody. We don't want that. So the earlier we engage, the better. So that was really the idea behind the Glide Phase.

Based on real world data collection, we knew that taking our time and getting an exquisite capability out there in the 2030s, 2040s was not good enough, given the fact that the threat is here right now. So, at the time, the Under Secretary of Defense for Research and Engineering, my boss, turned around and said, "Why are we not moving quickly? Let's take what we've got and let's go in and crawl into that glide

phase and intercept there. What's it going to go take to do that?" And that's what we pivoted to, and that's what we've had a lot of support on the Hill within the department to go do.

And so, the Glide Phase Interceptor is that intercept in the glide phase before it comes back into the atmosphere and does the heavy maneuver engagement on a critical asset or ship or something like that. Does that make sense?

BOWMAN: Are you happy with where that program is, in terms of progress and timeline? Do you have any concerns in terms of timeline? Are you happy?

HILL: We're going to know more over the course of the next few months. So, like any new engagement space, when you get – I mentioned that, where you're right along the edge of the atmosphere, 700 kilometers, 800 kilometers up, that's just different. We're not really engaging there today. So you're going to require maybe different materials on the seeker, you're going to require either a kick stage or some sort of propulsion upgrade. So we went out to industry and said, "How would you take this problem on?" And we got back lots of different answers.

So, part of our strategy right now is to fund industry to further refine their concepts, so that we can get a firm – I have a warfighter requirement sitting on the shelf to go do this. Now I need to set the right technical requirements, so that we can then move forward with an acquisition strategy that gets us to delivery quicker.

BOWMAN: Thank you. When we talk about regional missile defense in Indo-Pacific, a topic that regularly comes up, which has been a research and publication interest of mine is Guam. So just for the viewers, Guam, home to 170,000 plus American citizens, an American territory, very important American naval base and runway there, other military facilities there that are necessary to defend and would be vital, I would say, most likely in any contingencies one might imagine in the Taiwan Strait or South China Sea, in terms of reinforcing forces coming in, in a contingency.

So, no wonder the previous commander of Indo-Pacific command and the command itself has called it our most important operating location in the Western Pacific. And so, that brings up a question, if I may, Admiral, from Jen Judson at *Defense News*. She'd like to know what has been decided within the administration in terms of the strategy or missile defense architecture for Guam. And if no decision has been made yet, she'd like to know when you expect a decision to be made and what risks, if any, do you see in delaying the decision?

HILL: Yeah, so I would say a decision was made as part of pulling together present budget '22. Dollars were placed into the budget so that we can move quickly when the budget is appropriated. And at the time, we said, "Well, we're going to go with procurement of things that are agnostic to any final answer." And I think that was a good move. And it also showed that the department was serious about taking this on now.

Here's where sitting right now, Brad, it's a hard one. We don't have the '22 appropriation, so I can't really talk about what we would do if we had what at this point. And then POM '23 is part of that decision process to lock down that architecture. I'm going to stick to what I said to Jen the last time I talked to her, because this hasn't changed. It's broad, and unfortunately, it's not going to answer to the detail you want. I do not want to affect the decision space at all, but I will tell you that what has been consistent as we went into '22 and as we go into '23, is this going to be a mix of existing regional capabilities, and that system's going to be extensible so that we can capture new capabilities as they evolve and become available. So, we're going to take care of Guam, but I can't get into details of it right now, because it is in the decision space.

BOWMAN: Understood. And I respect that. And just for the viewers, let me foot stomp one thing that Admiral said. Here we are in early December, two months after the new fiscal year, and the Department of Defense still does not have a National Defense Authorization Act and still does not have a defense appropriations bill, so they're operating on a continuing resolution, which slows things down and makes it more difficult for the Admiral to do many of the things or almost everything that he's doing that we're talking about, at a time when our adversaries are sprinting. So just a little commentary from me on there. You don't need to respond unless you want to, Admiral.

Coming back, if I may, to Guam. So, as you know well, Congress required a report from INDOPACOM, the Pacific Deterrence Initiative. Congress, as these bills have progressed, have added money, large amounts of money, a lot of it for Pacific Deterrence Initiative purposes, and including for the Guam Defense System. I do not want to press you to go where you don't want to go, but can you speak generally, based on what others have said in the past publicly, about what a likely or possible solution for Guam defense might look like? Just in terms of broad elements. It's not Aegis Ashore exactly, like we have in Europe, but it is an Aegis system. Can you just speak generally at that level that you're comfortable with? What kind of the broad components might be for a solution there?

HILL: And Bradley, in fact, I'm going to go actually more general than what you just stated.

BOWMAN: Okay. Okay.

HILL: Also, because I think it's important for the audience to understand, if you've got a multi-access missile threat coming to anything, but in this case considered a stationary aircraft carrier, you're going to want 360-degree sensor coverage. So I will guarantee you whatever the architecture looks like, it's going to have 360-degree sensor coverage. It's going to have to have a resilient Command and Control network to build the fire control and to task what weapons and to control weapons. And then it's going to have weapons associated with it. And that's really all I want to say, because I do not want to get into the decision space that my boss has.

BOWMAN: Okay. Fair enough. I tried a second time. I won't try a third—even though I'm tempted—I won't. You and others have talked about the value in the past of having a disaggregated solution—so we don't want to have the radar and the missiles and the Command Control and the processors ideally in one spot. So that's why some people like me on the outside say that we want to have it disaggregated. It is an island. There's only so much you can do. There's been some talk about maybe having some aspects

mobile to make it more difficult, having some aspects underground, perhaps learning from what we've done in Alaska. And then there's the question of radar, and I think I won't ask this because I think you won't want to answer it, but as I understand it, one of the questions are because it all ultimately comes down to budget is what kind of radar do we want there?

And I'll just say that two of the radars that I understand that are under consideration, are the SPY-6 and SPY-7. These are very powerful radars. They give a lot of Space Domain Awareness and help with midcourse corrections. And if we try to do Guam missile defense on the cheap, and go for a less powerful radar, seems to me you would be sacrificing some important capability there. So, I will do a tactical pause, give you a chance to respond if you want to—Okay. Or move on. Okay.

HILL: Well, so Brad, that was an awesome third opportunity. And, and I think that's it.

BOWMAN: I said I wouldn't do a third. So it wasn't really a third. Okay. All right. So future missile defense. So much of what we've been talking about, or almost everything, in terms of—has been kind of kinetic, right? Something metal hitting something else metal to kill it. Much, again, you'd know better than me, much of what for future missile defense is maybe non-kinetic, or what we call soft kill. Can you talk a little bit about what MDA's doing or thinking about in terms of the soft kill non-kinetic space?

HILL: You know, since you mentioned the prior INDOPACOM Commander Admiral Davidson I'll use one of his lines that I just thought was hilarious when you use this, I'll use it on you, which is, "Hey, I don't want to help out the adversary any more than I have to." This one of those areas to where if we were in a different environment, I would love to talk about, what the art of the possible is and what we have programmed and what we have deployed. But on this network, I can't do that without being helpful to folks I don't want to help.

BOWMAN: Yeah. Amen to that for sure. Okay. I guess my point would be that it seems to me that would be important to complement what we have in the future. And it's probably something worthy of congressional support in the future. That's my motive for asking, so right—But of course we want it classified, we like to keep it that way. So very good.

One of the things you talked about in your presentation was Command and Control, Battle Management, and Communications System—C2BMC—and in congressional testimony, public unclassified testimony this summer, you described it as the "brain" of the integrated missile defense system operating in a joint, multiple service, combined, multiple countries environment, supporting both homeland and regional missile defense, linking sensors and shooters, in this massive system of systems. Speaking of adversaries, whom we don't want to help, but who are independent actors doing things that we don't like, seems to me that if you're having such a massive system of systems, that is the brain that, you know, that may be a cyber target for them. And I know that you've testified before about the importance of protecting our systems from cyber intrusion, cyber-attack, that sort of thing. I just want to give you an opportunity to say anything you'd like on the cyber front in terms of your work.

HILL: Yeah. That was actually a great description of Command and Control, Battle Management, by the way, so well done. And it certainly is a globally distributed system. And yes, we have to worry about cyber hardening. And we take that very seriously, what I've said before. And it's absolutely true—if you go look at our budget, you will see it that every element of the missile defense system that we have purview over, has cyber security associated with it.

So, in fact, I just walked away from a conversation we're having about persistent cyber operations, which means we're going to go in and we're going to, to persist with cyber-attacks on the system, and then respond to those and heal to that. So we're taking that very seriously. We just finished up a cooperative vulnerability, penetration assessment on one of our major assets. And then we're moving to a full adversarial—that means we're going to go in and attack it cyber wise. So we do that with all that aspects of the system. We do that with all the major cyber commands that you're aware of, but with the Director of Operational Test and Evaluation. So it is something we take very seriously and you can see it in our budget, because we take it that seriously. We want to make sure it's very visible.

BOWMAN: Thank you for that. I mentioned earlier, joint services working together, and then combined countries working together—MDA as, as you know, but some of the viewers may not, does a lot of work with other countries. And so I just want to touch on kind of that element very quickly. How do foreign military sales, so when American defense companies sell, sell to other countries, how does that affect or help MDA when we sell American missile defense capabilities to other countries?

HILL: Well, the first thing that comes to mind is you immediately have interoperability. So if you have similar or the same systems, you're inter-operating. And so, since we are, kind of focused on the Pacific today, great partnership with Japan, they have an Aegis fleet, they were building each to shore. They're shifting that now to sea-based assets, but it's U.S. technology, incorporating the best of what Japan can bring along. And that's going to be interoperable. It's going to contribute to the operating picture in the Pacific. When you think about Japan with its capability, Aegis ships and Aegis purpose-built for national missile defense with what we're going to do in other areas around Pacific, it brings interoperability—but then it also means that we're operating together. And that's the key thing.

If you're operating together, you know how to burn through barriers on data sharing, right? Because the unfortunate thing is that sometimes there are barriers and we learned to power through those. We just finished up a major operation earlier in the year, out at the Hebrides Islands in Scotland, we call it Formidable Shield. And we're pivoting now to go do Pacific Dragon. And that's where we are launching ballistic targets, cruise missile targets, hypersonic targets, we're launching all of that. And then we're taking it on as a joint coalition force. And that to me is the key because then you learn from that and you swing that right back around into your engineering.

BOWMAN: No, that makes sense. So when we sell missile defense to allies and partners, we help them secure themselves. We potentially lighten the burden on ourselves. We create opportunities for our systems to work together, and to kind help build that picture that launch to demise picture more effectively with our allies contributing to that and there by thereby lightening our burden and making us and them more secure. So kind of feels like a win-win to me.

HILL: It is. And you can lighten that burden throughout the whole life cycle. Cause if you look at, it's not just about sales, we'll go work architectures together, we'll go do studies together, we'll go cooperatively develop it— like the SM-3 Block IIA, that's a Japan-U.S. built missile. And you talk about burden sharing. Now you've dropped the costs on both sides, you can get a much higher capacity in that capability by having that kind of cooperation.

BOWMAN: And that's a key point. Some people focus on, X or Y company making this, I personally don't really care about that. I care about the fact that we're maintaining a healthy and vibrant defense innovation industrial base that makes stuff cheaper for the taxpayer. Right. And also makes our systems more advanced. So just that's why I, from my humble foxhole are generally speaking a big fan of these sorts of things.

Speaking of that, you mentioned Japan and how they have Aegis—if we had some sort of Aegis-type system deployed on some unnamed island in the Indo-Pacific that involved Aegis, could one get to a point where you're integrating that Aegis type system with Japan and Australia? You're really starting to go from just, "Hey, we're going to protect this one particular island"— to a much broader defense. Is that something in the realm of possibility, because the Japanese and maybe the Australians will be operating an Aegis system?

HILL: Yeah. We actually do that today, right. So, you already mentioned Australia as an Aegis country, Japan, South Korea. And so yes, as we continue to build out in that region. Yes, they're all, they're inter-operating. C2BMC plays a major role in that because that's how we tie them together, move data back and forth, take things from space and from other sensors and get it to those engagement capabilities.

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BOWMAN: So, Admiral moving on to a missile defense, just kind of at a level that I think is important. And if you're not comfortable answering any of this, I respect it, but I wanted to ask—some who oppose U.S. missile defense spending or investments argue that American missile defenses simply force the Chinese or Russians to develop more advanced striking capabilities for fear of our missile defense capabilities. I know you've seen that argument, I'm sure you've heard it through the years, I'm giving you chance now to respond to that. How would you respond to that argument?

HILL: You know, I'm not a policy guy. I'm really a technical guy Brad, but I will tell you that—I guess I'll go back to what my old football coaches say. Right, "We got to have a great defense if you're going to have a great offense." So they're complimentary. And so, when we mentioned integrated deterrence earlier, defense is an important part of the equation. You're not going to go inside the second island chain without a strong defense.

BOWMAN: Exactly. And, I won't ask you to comment. I'll just say, if we're going to deploy, you use the term, our sons and daughters, husband, wives, loved ones into harm's way, right—we want to give them the best means to accomplish their mission, and be safe and come home, and missile defense is a huge part of that. Not to mention deterrence by denial and so forth, which we'll save for another day, unless yeah.

So some argue that American missile defense is destabilizing, and the Kremlin I've noticed, likes to make a big deal about American missile defenses that they know they can easily overwhelm and defeat, but nonetheless, they make a very big deal about it. Here's my question— don't the Russians have more homeland missile defense interceptors than we do? Isn't that true?

HILL: You know, Brad, I honestly don't know. That's a great question for the Intel community. I have, out of curiosity, asked the question before, but I'm not an expert in that area. It's pretty dynamic.

BOWMAN: Fair enough. For viewers, the answer is yes. They have more missile defense interceptors than the United States does.

HILL: Thanks Brad, I didn't know that.

BOWMAN: By the way, some of them are nuclear-tipped Admiral— you might be interested in that. And yes, they're using nuclear-tipped homeland missiles, and they have more than we do. So next time you hear the Kremlin complain about American missile defense you might want to remember that.

Admiral you've been so gracious in answering my questions. I always like to give folks a chance to conclude with anything they'd like to—is there anything that I should have asked you or that you want to add here at the end?

HILL: No, Brad, I guess where I'll land on—it comes down to you can't do anything with that industry. So the defense industrial base has to be strong, right? So we have to continue to invest there. You already talked about allied sales and co-development, things like that. That's critically important. For me every day, it's really about how simple and clean our mission is, right? So, I call it a noble mission—but at the end of the day, it's the quality of the people that we have here.

I've spent my time since being the Deputy and as the Director, trying to build an organization that can take on what we see in the future. So, I just want to thank the men and women at the Missile Defense Agency—they are dedicated professionals, our government field activities and laboratories, they're the best. And you can read the papers and walk away and think that the United States isn't ready to take this on. I will tell you, I have a team that can take this on. And we are doing that now. And I thank you for the time today.

BOWMAN: No, thank you. And as someone who's watched the MDA from the outside for many, many years, both of where I'm currently at a think tank and also on Capitol Hill, I completely concur with what you said, and please extend our thanks to them. Thank you personally, for your decades of service to our country. Sometimes we say, thanks for keeping us safe. You're literally keeping us safe. So thank you for that. Your successes is our success. Thank you much for your time.

For our audience, this concludes our discussion. Thanks for watching.

For more on FDD and our Center on Military and Political Power, please visit us at [fdd.org](http://fdd.org).

Thank you very much.

