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FEATURING
Vice Admiral Jon Hill
Director, Missile Defense Agency

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

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Tom Karako: Well, good morning, folks. I'm Tom Karako. On behalf of the CSIS Missile Defense Project, I want to welcome you to today's event, which is on the Missile Defense Agency and the PB '23 budget request. Today's event is hybrid. So for those watching online – we're great to have a live audience here today – but for those watching online please do submit some questions. And through the magical joint multidomain qualities of C2BMC it's going to come right here to my tablet, and we'll get them in live feed.

So our speaker, of course, is Vice Admiral Jon Hill, the director of the Missile Defense Agency, who's been the director for three years now. He didn't have as many gray hairs in 2019, as I recall. And I'll say it, so that he doesn't have to, of course we know that the MDS and the MDR are not out fully yet. And so we're going to keep this confined to the four corners of the Jbooks. But the good news is that there's thousands and thousands of pages in the Jbooks –

Vice Admiral Jon Hill: Absolutely.

Dr. Karako: – so we have plenty of things to talk about. And I won't give you any policy questions as well.

So, Admiral, welcome back. Appreciate your being here. We've got \$9.6 billion in your budget request. Not the biggest, but you've got a very healthy FYDP. Before we kind of get to the programs and the numbers, though, I wonder if we could kind of start really big in terms of what you see going on with the broad threat spectrum. Lots of activity going on in Ukraine, but also just a really rich and diversifying threat spectrum out there.

Vice Adm. Hill: Right. Yeah, thanks, Tom. It's great to be here. Really appreciate everybody's time today on what I consider to be, you know, a really important mission. I always like to start with the threat, so thanks for bringing that on. You know, when you look at where we are today with the advent of more advanced ballistic missiles, what we're seeing in the hypersonic world, and just the reality of cruise missile proliferation globally, you can kind of sum it up as, you know, if you're the warfighter on the deck of a ship, or sitting in a land-based battery, or in the maneuver force, it's all coming in at very high velocities.

They are maneuvering and are coming in big numbers. And typically, a mix of those threats. So that's different from when I stepped into the office, when I had more hair and less gray. It is certainly more complex today. And that is what we're seeing globally. And you kind of touched a little bit on what's happening in Europe. That's exactly what we're seeing there, is that mixed threat, high-speed maneuver.

Dr. Karako: Yeah, I was really struck by Assistant Secretary John Plumb's comments last week, where he was saying, you know, missiles are just a central function of warfare. Not an add-on, not a boutique, exotic capability. But really a common and expected facet of modern warfare, he said. And so for that reason, missile defense, air defense is important. I wonder if you might talk a little bit about what you're seeing in Ukraine, what you're doing, perhaps. If you're doing anything to help Ukraine directly, but also all of our NATO allies and other partners in Europe.

Vice Adm. Hill: Sure. And I won't go into great detail, other than to say that, you know, you want to monitor those sorts of events so that you can kind of see that threat laid down that we just talked about. and then our primary interface is with European Command. So you already mentioned command and control battle management on your iPad, but that system ties together the space assets we have today and all the land-based and sea-based radars, and so we can provide a contributing in helping European command understand and have situational awareness. So that's been our primary effort. And then, of course, working with the services as they do what they need to do to support the U.S. policy.

Dr. Karako: You know, the lessons learned of Ukraine, everybody is already kind of writing those articles. But one of the most obvious ones has been the scramble to get, you know, every Javelin, ever Stinger that we possibly can. And there's – one of the lessons learned is kind of on the material acquisition side of how do we create in the industrial base the flexibility, the surge capacity? And I wonder if you're thinking about those things, as well, for the rounds that you produce take time.

Vice Adm. Hill: Right. And we think about surge capacity all the time so when we lay down a program for – you know, just picking any missile program, one of the first things that comes to mind is what should your production rate be? And then typically, those of you who have worked on or seen a factory floor, there are some long poles that are associated with your ability to build out a different rate than what you may have facilitated for. Generally, it's the test equipment associated with missile. I know that that's a little bit boring for everybody, but if you don't have the ability to fully test end to end and all around, you can't get it off the factory floor. So I'm asked all the time, well, you produce at this rate, why couldn't you go to this rate? Why can't you double – it's not just about the shifts of people. People do matter, but at the end of the day, it's our ability to run end-to-end testing before you deliver the round. So that's the pacing function.

Vice Adm. Hill: Right.

Dr. Karako: So I wonder how you're thinking about that, how that's changing with this administration.

Vice Adm. Hill: Yeah, I think the integrated deterrence approach is a good one. You know, we know, even though we can be as stovepiped as any other organization and look through the soda straw of our mission and our mission only, we recognize we're much – that we're a part of a much broader picture. So we often talk about the missile defense enterprise as an example, and when you get into missile defense and defeat – and I'll just ask you, Tom: How do you define the "and defeat" portion of that term?

Dr. Karako: Well, as my budget guru, Russ Rumbaugh, has pointed out, the metrics for missile defense and defeat change from every PB to the next one, and I think the lack of an apples-to-apples comparison there, year to year, is problematic, because it sure just sounds like a mix of OPIR and attack operations but depends year to year what they decide to put in there. (Laughs.)

Vice Adm. Hill: Right. And maybe ambiguity is not bad as we work our way through this, but oftentimes it's defined as left of launch and just that; sometimes it's defined as adding your offensive capability; sometimes it's the all-domain capability, whether it's cyber and other aspects of missile defense and defeat. So for me I'm just always looking for clarity of that term, and I think, again, it's good to think holistically about what that fight would be because, again, we're just one part of an overall defense and integrative deterrence mechanism.

Dr. Karako: I've been asked, should there be a missile defeat agency, and I said yes, it's called the Department of Defense.

Vice Adm. Hill: That's right.

Dr. Karako: (Laughs.) I mean, the threat is (voted ?), the missiles are everywhere; it's the Department of Defense's job to comprehensively defeat them.

So let's stay at that comprehensive level. Given the salience of this threat, given the salience of and the demand signal for air and missile defense, I notice in your testimony last week for the first ask, you had a comment about the missile defense governance process, so big picture here, not just Missile Defense Agency – missile defense governance process, and you even put it in bold print so nobody would miss it. And you said, I believe the existing missile defense governance process, including the WIP, the Warfighter Involvement Process, is unique and necessary for the voices of the combatant commands and services to be heard. Why did you put that in bold? Why is that important?

Vice Adm. Hill: Yeah, so a couple things I learned in member visits and even during testimony is it's really easy to not understand the scope of what the agency does, and I'll just use ground-based midcourse defense as an example of just

absolute jointness and the governance that requires us to work across the services and the combatant commands. So if you look at the ground-based midcourse defense and you go to Fort Greely where you have soldiers on console, then transport yourself over to Clear, Alaska, where you have Space Force guardians operating that radar, which, by the way, is remotely controlled by other guardians and other soldiers and sailors, you know, out in Colorado Springs, and then you transport yourself out to Japan, where you've got Army manning two radars there that get us the track and then, of course, the Space Force that provides the space input. You, by default, have to work with all the services to support those combatant command requirements, and so it is pretty unique to the Missile Defense Agency, so that relationship we have with the combatant commands, which is why we have forums with every one of them, critically important, and why we have to meet – in fact, I just finished up a round and we have our Army board of directors this Wednesday working with the services because we really don't generate anything on our own; we do it through the services to meet those combatant command requirements, and so those relationships are key and it takes a lot of time, but it's time well spent.

Dr. Karako: And you spend a lot of time on that, but your point would be big shifts in the roles and missions would be problematic, fair to say?

Vice Adm. Hill: It would be – we could solve any problem but, right, it doesn't make it easy.

Dr. Karako: Right. So why don't we turn to PB '23?

Vice Adm. Hill: Right.

Dr. Karako: And I just want to see – kind of talk about your big priorities. What's the top priorities for you and the agency right now?

Vice Adm. Hill: Right. Normally, when I speak of priorities I drive everybody nuts because it's a laundry list, right, because everything's important, and I recognize that. But in order to get into my five-minute, you know, opening discussion, you know, for the hearings I had to really kind of think long and hard how do I really, you know, characterize that for everybody.

So, for me, it was the no-fail mission, number one. Number two, what's going to be the most difficult thing we go do, and then, number three, how the threat is driving us, right. So that's how I end up characterizing all three. So number one is homeland defense against ballistic missiles, rogue nations, and so that is the Ground-Based Midcourse Defense program. Very important. When you look at Congress' support for service life extension of the overall system it's not just about the ground-based interceptors. Everybody likes to talk about numbers of GBIs and how are we doing on refurbishment. That's part of it.

But the service life extension program was a full kill chain service life extension program, meaning we went in and made sure we had all the redundancy in place in the ground system. When we think about this is and why I get excited about it the ground system is an operation 24/7, right. The ground-based interceptors sit in an environmentally protected silo. So they're important because that's the end game, when you think about it.

But they're well-conditioned where they are, and so as we removed the oldest interceptor, for example, and it's now back – it's been re-emplaced. We changed out the booster. We changed out the electronics. We upgraded the threat library. We took care of all the one-shot devices. And we're doing that for a number of rounds. So the rounds are important, but the overall system itself is really critical. So that's kind of step one under priority one.

And then the second piece is the Next Generation Interceptor, really driven by a hard, difficult set of requirements that we can meet. And so we have two industry – we've let those contracts March of 2021, moving at pace. Competition pretty key. I know we'll talk a little bit later about the era of competition.

One of the newest documents that my boss, the undersecretary of defense for research and engineering, put out, her number-one statement is competition. It really starts there. So for the Next Generation Interceptor we're moving out, and what's great about the overall competitive space is we've brought in all the best ideas. We've de-risked the program by having two running in parallel, and we're going to beat the timeline.

So I'm fully confident where we are now, over a year tracking, to where both companies are – it's kind of different contraction on how they're doing it. But they are definitely going to meet first in placement about a year early right now.

Now, things change as you go. There is risk in every program and this is a complex program. But we're in the best position we have been. So I will tell you that PB '23 sets up priority one, the no-fail mission of protecting the United States against a ballistic missile attack. Very solid from a service life extension program perspective, very solid from the Next Generation Interceptor, both which feature multiple kill vehicles because that's where the threat is driving us. So number one, pretty important to me.

I'll shift to number two – defense of Guam – and people ask me all the time, well, why do you say it's difficult? It's difficult because we will land capability that is required in that theater as part of the overall Pacific Defense Initiative. But it's difficult because we are going on an island where we have to kind of balance the importance of that capability against very limited

areas to go, place that capability in competition with other things that are coming to the island.

So when I say difficult, I'm talking about siting – the fundamentals of where you're going to place this equipment. But I'm also talking about respecting the beautification of that island, right. We don't want to go into a major tourist area and just over militarize, right. There are things that we can do to get the capability there without destroying the tourist industry because that actually is going to be where the bulk of the time will be spent for the island of Guam. (Laughter.)

So we got to protect the island and we know how to do this because when we put the LRD up in Alaska we had to respect the grounds there. We did lots of incredible work there. I'd love to tell you about some of that. And then as we were working on defense of Hawaii originally for the Hawaii radar, we learned an awful lot about siting and what it means to the local community. So we're very sensitized to that.

So, number two, defense of Guam. Really important. Difficult for the things that I mentioned, but we've got a great partnership with the Army and the Navy as we move those capabilities forward, and we can talk more about that if you like.

And then the third priority, hypersonic missile defense. Everyone's talking about it. It's important. Congress designated us as the executive agent for this a few years ago for good reason, because we really do need to take what we have today and build on that. So what do we have today? We have C2BMC, your favorite program, Tom, and mine. It takes the existing space architecture we have, the existing land-based and sea-based sensors, fuses that data together to give us indications and warning. So we're not starting from zero. We have the ability now to warn based on the sensor architecture that we have today.

We also have deployed sea-based terminal on Aegis destroyers. Why is that important? Well, you don't want to send a carrier inside the island chain without defending itself. And one of the key things we have to defend against is the advanced threat, the maneuvering threat. We were asked by letter by the CNO to develop that capability a few years ago. And we developed a tiered capability. And at the time, it was a ballistic threat that turned into an advanced maneuvering threat. So we have an SM-3 layer, we have an SM-6 sea-based terminal layer. And sea-based terminal is on its second increment.

And when we talk about increments of a system, what we really mean is we went after a very discrete threat set at the time – that ballistic that turns into an advanced threat. And then we opened up that threat space, which takes us into those hypersonic threats. And when we get to increment three, which is

part of PB '23, we will widen that threat set to take on a broad set of those. Terminal, however, is not sufficient. I really struggle when everyone tells me, oh, terminal, that's the most effective place to engage. It is the most difficult place to engage, mostly because you don't know where terminal is.

So it used to be they were always targeting the carrier. They'll target the cruisers. They'll target the destroyers. They'll target the amphibians. So we have to have a robust, layered defense, which is why in PB '23 we're moving out with something called the glide phase interceptor. So that takes you up to the most vulnerable place, where a glide vehicle flies. It's bleeding off heat. That's where it starts its lateral maneuvers. We need to kill it there so that you can actually survive the terminal aspects of it. So I'm pretty excited from what we're doing in the engagement side, what we have existing in the space architecture today.

But we need more space. When I talk about this global maneuvering aspects of it, what we really mean by that is they're overflying air defenses, underflying our space defenses, and going out of field of view of stationary sensors. So the only way to deal with it is to be up high, looking down. And that is space. And so our Hypersonic Ballistic Tracking Space Sensor program, HBTSS – I never like to call it "hobbits," but people do.

Dr. Karako: I've heard it.

Vice Adm. Hill: Yeah. It is what it is. So Walt Chai, our director of space, is very frustrated by that. But I said, Walt, find a better acronym. But it is what it is.

But that has two aspects. It's not just tied to hypersonic defense. We have challenges in the ballistic. I have to remind everybody that the ballistic threat has not gone away. It's still the largest number of threats that are out there. It's still the terror weapon it was meant to be. It still targets population centers. That's a problem. And they're changing – they're changing their propulsion techniques. And so we need to be able to see those, and we can see that by being either in LEO or MEO, with the full up constellation that the Space Force is developing.

But then that hypersonic piece, the H in HBTSS, is really about being able to pick those maneuvering threats – those hot maneuvering threats flying over the warm Earth, extract those out, and give us that track data. Beyond track, but to give us weapons quality, so we have the positional and the velocity accuracy to put a weapon on target. And that's critically important. And that's geek-speak from my foxhole, but it's really important. If we're going to make the investment, then we need weapons quality data to defeat those weapons.

Dr. Karako: So, last point, you still have ballistic missiles. I do have to say, my CSIS college Ian Williams likes to say that dinosaurs still walk the Earth. We still have the ballistics thing to worry about, even though there's lots of bright, shiny objects.

Vice Adm. Hill: Yeah, unfortunately. They're solving the problems with precision. They've always been hypersonic when they come back in, right, because they're falling out from space, and so they come in very fast, and they've gotten more accurate. So the problem doesn't go away. The dinosaur has evolved a bit. So I remain concerned about it. It is in our wheelhouse front and center, and that's why it's, you know, priority one for me.

Dr. Karako: Yeah. So you listed three things: homeland defense, defense of Guam, and then finally hypersonic defense. So why don't we walk through those? Let me start with homeland. Before we get to the new stuff, I wonder if you could talk a little bit just about, you know, your confidence in GMD today. And, you know, we're going to get to the next generation capability, but your confidence – you mentioned the three generations that are in the ground today. But your confidence that we are in a good place today. And maybe in passing you could help put to bed the tired, tedious idea that the average number of flight tests from 1998 to present is somehow how you calculate the efficacy of the system.

Vice Adm. Hill: Right. Yeah, well, you know, it's not totally unfair. But when you work in the unclassified world, and you're just looking at numbers, and you just count up test events and then you take – you know, what are publicized as failures. And you do the math, and you come out with some numbers, and you call that reliability – well, those who work in the weapons world know that that's not a reliable number to go off of, right? So we do have older rounds, we have mid-life rounds, and we have the new rounds in the ground, and they have a discrete reliability and availability associated with them. So that's the first one.

And then the other thing that the public ought to know is whenever we do a test and we do fail, we make fixes and we make changes. So it's no longer comparable to what may have failed in flight the last time, right? So it makes the math hard, but at the end of the day from a technical perspective I have high confidence in what we have in the ground.

And I'm very thankful to Congress for funding the service life extension program because it does allow us to refurbish the older rounds, and that's pretty key. It brings them up to the level of the newer rounds, right – new boosters, expanded threat set, one-shot devices dealt with – and that's important for the country.

Now, the normal – question I’ll normally get is: Well, why don’t you just keep on SLEPping forever? Just go SLEP them all. And you won’t get a number out of me because I don’t like to talk about it in public, because I don’t like helping the adversary, but we have some number in the ground. You could continue to SLEP, but the – what I will say in the unclassified world, because everybody knows this, is that they’re a unitary missile. And I mentioned the multiple kill vehicles earlier. You’ll have to shoot a fair number of these if you have multiple objects. And generally, with the improvements we have seen in ballistic flight and what you can do with countermeasures and decoys, you’ll use up your rounds pretty quickly if you’re not careful. And so the multiple kill vehicle’s very important on the Next Generation Interceptor side.

We need to maintain the fields as we have them now. We need to keep that inventory in place. We will probably get additional inventory through the SLEP program, but it’s important just to note that, yeah, scorecard approach isn’t the most accurate.

Now, I would say if you go to General VanHerck – and I never like to speak for a combatant commander, but he will tell you – since we just sat next to each other in a testimony the other day – that he’s got high confidence that the current capability we have can deal with the current threat. And to me, that is a confidence-builder for us on the technical geek side that we’re doing the right things. And we’re going to continue – my commitment to him is we’re going to continue to push through the SLEP program and make sure that we’ve got high availability and high reliability across the board for the overall ground-based mid-course defense system, and that we will deliver him the Next Generation Interceptors on time.

Dr. Karako: And you’ve been highlighting the – some of the characteristics of NGI, multiple versus unitary lately. But just to confirm, the multiple is about the discrimination of even a rogue-state threat, not about hang up in space and wait for other ICBMs to come in.

Vice Adm. Hill: Oh, absolutely not. So it gives him more flexibility in his shot doctrine, or what I call a firing salvo. It gives him flexibility to do that and to take on a larger number of threats, but really the complexity of threats. Because the threats – you know, we talk a lot about speed of maneuver, but you know, when you look at multiple reentry vehicles and multiple maneuvering reentry vehicles, you’d need a Next Generation Interceptor to deal with that. So if the goal is to pace the threat, you need NGI to pace the threat.

Dr. Karako: So let me talk a little bit about the acquisition strategy for NGI. You’ve talked about – many times about the desire to keep the competition, per your boss, going as long as possible. You’ve endorsed the two CDR. But you’re also talking – and you were asked about this by Congress multiple times,

including last week – about potentially even going into production with two. And I wonder if you could talk to that. What are you alluding to? Obviously, these are policy decisions. But if you were to go into production with two, is that kind of splitting the baby or is it – that would be for ramping up for a higher number for those two contractors?

Vice Adm. Hill: Yeah. I think it's going to be real world threat driven when that decision is made. I don't make that decision. We'll get lots of help within the department. You mentioned policy. We'll certainly get it from the warfighter.

What I – what we want to do in the acquisition geek world is to provide options, right? So the options that we have now, carrying two really qualified contractors, is you could have a dual production line. It wouldn't be unusual, right? There are plenty of other programs that either have a second source or they have a dual production line, right? Competition in production, pretty good idea, right? But if we decide to down select – and by the way, we have the flexibility to do that anytime we want, right? So if one of the performers doesn't perform or we see issues, we can drop down and we still have the one to carry through and go to production.

But where we stand right now, you have maximum trade space. We get there early. We fly before you buy. That's an important part of the overall strategy. Right now, what we have in the test plan is a single salvo intercept and then we have a dual intercept. So that'll be really important before we make that decision to go to production.

And then the other question I normally get is: Well, are you just going to replace the older ones or are you going to add to the current inventory? Another decision that has not been made, maximum trade space. You could have dual production line, a backup production line. You can add to the current inventory or you could replace the older ones. So that's all open for now, and we'll just continue pressing forward so that we keep those options open for the warfighter, for the department, for the nation.

Dr. Karako: And as you say, it's a policy decision, but I did notice Sasha Baker did reference the prospect of replacing those old GBIs with NGIs in testimony this –

Vice Adm. Hill: Yeah. And just to be clear, the acquisition strategy that we have on the table today adds to the current inventory. That's the plan right now. But again, when we finalize the production decision, that's when we'll decide whether or not we backfill or add or go with two.

Dr. Karako: So staying in the – in the acquisition world, without commenting on the merits of anybody – I know you don't want to go there – just any comments

on timeframe for things like in-service fleet awards, ground weapons system, and STTR, just when you expect those things to come?

Vice Adm. Hill: Yeah. So back to the competition piece. You know, so those of you who have been tracking missile defense for a long time and think that it's just the ballistic missile defense of the homeland. It used to be under one big lead service integration contract, right? So when we competed the Next Generation Interceptor, we took a close look at the ground weapons systems that I mentioned earlier as being so critical, right? You do nothing with an interceptor if you don't have the ground architecture and infrastructure in place to do that. So we are competing the ground-based weapon system portion. And then we have something called systems integration tests and readiness, also a competition is in – I can't say much, other than the timeline. We are evaluating now. We're in the evaluation process for both of those, and I'll come back and talk to you whenever we do the award.

Dr. Karako: OK. (Laughs.) All right.

Vice Adm. Hill: But it's – again, competition is really fantastic. There are some areas where we want to continue to sole source, and we'll continue – you know, we'll do that. And I'll give you the whole story once we kind of complete these current evaluations. But they're in play right now and I don't want any undue influence on the other folks that are working on this.

Dr. Karako: Do you want to say anything about the issue of Heidi Shyu Era of Competition documents?

Vice Adm. Hill: Sure.

Dr. Karako: Bring it up, yeah.

Vice Adm. Hill: Absolutely. It's a fantastic look into the future, I would say, and it's kind of in the last paragraph or so. It is a bridge to the future.

What my boss, the Honorable Heidi Shyu, is trying to do is position the department writ large, to include the Missile Defense Agency, to take a hard look at competition. We mentioned that. But you know, "competition" sometimes is a word that bothers people, right? So she wove in the collaboration piece. And when she wove that into her, you know, competition or the technology innovation in the era of competition, what she was trying to message is that our government labs and field activities are an important part of this. We leverage those every day. And in fact, we don't talk about it enough.

You know, one of the things that we do in the science and technology world is not only do we fund small business and others, but we want to make sure

that our government labs and field activities, where the nation has made, you know, very discrete investments and having that talent base there – and I think it's critically important for the future. We've talked mostly about things that are developed and that are being deployed today, but to the left side of that lifecycle are some really incredible scientists and engineers that are developing that technology that we will need tomorrow.

So if you don't mind, I'll kind of marry in what the good Honorable Shyu was doing with what DepSecDef Hicks talks about when she gets in two to three FYDPs, right? So when you say bridge to the future, that is like the third FYDP, right? And so that's the long view look, right? A lot of folks say that the U.S. government doesn't know how to have a long view. I'm very inspired by the three FYDP look from DepSecDef Hicks, but also the innovation for the new era from Honorable Shyu because, really, they're taking a hard look at competition, looking at collaboration. How do we go to nontraditional areas? How do we innovate early, take advantage of what's being done in industry, full well knowing that the adversaries are leveraging the commercial world quickly? And so how do we get out in front of that and how do we make sure that we're innovating so that we're set up for that third FYDP? So the bridge that's talked about in Honorable Shyu's memo, the third FYDP that DepSecDef Hicks talks about, they are closely related.

And then, on the MDA front, when you look into that third FYDP that's around a '33 to '37 timeframe, in there. I may have my math wrong. But we started looking at 2035 a couple years ago for a reason. 2035 is a great way to unleash yourself from the current force structure. So, you know, I'm picked at often for, well, you guys are just a missile-on-missile agency. Well, no, we're not. We are looking at other ways and we have other ways to defeat. But when you look at it in the 2035 timeframe, it takes you away from the current infrastructure and allows you to kind of open your mind and really pull in and imagine where this technology can take you. Whether it's machine learning, you know, artificial intelligence, those sorts of things, how would you leverage that in the future?

Because the answer to missile defense isn't always going to be directed energy. That's the question I'm always asked. It's not always going to be that. It'll have a play, particularly in that timeframe. It becomes real and robust. But that's the – that's the bridge that Miss Shyu talks –

Dr. Karako:

Well, I was going to bring this up later, but this is probably a good time, is, on that front, A, you know, you've been kind of getting some tough questions from Congress about, hey, where's the lasers at for MDA. You used to have lasers for track on the MQ-9s and don't have that right now, apparently. And your technological maturation initiative I think has zeroed out. And you've got RFI for short-pulse lasers, but other than that it doesn't seem like there's a whole lot there. So can you – you know, how do we get from here to 2035?

Which in terms of – you know, if you want to get to even that second or third FYDP, you got to start planning now. How are you getting there?

Vice Adm. Hill: I think part of the strategy – and this goes back a couple years ago, right – was to – you know, rather than moving in a lot of different directions, shotgun blasts across the services and across the different agencies, why don't you consolidate the funding and consolidate the efforts, and let's pick a few areas that we're going to go after. So specifically, for directed energy, when the budget was removed from MDA, it went to the R&E consolidation. That drove it into a focus in two areas, right? One was to get to increased power levels. And when you do that, right, also working on the space, weight, and power, and cooling issues, right? Those are real. And so focus in on that and move quickly.

And then transition a lot of these things out of those government laboratories that I mentioned. Move them into industry, so you can go into development. Because what you want to do is get it into the hands of the warfighter as soon as possible. I know when the Navy put a kind of a low-power laser on the USS Ponce a few years ago there was some – you know, some folks that were skeptics around it. But I would tell you, I think the CNO at the time called "getting it wet." By having the directed energy on board the ship we learned, sailors learned, not to shine them up in space, because that's not good for satellites, for example, right? And they also learned to use it as a sensor, right? So directed energy really has a lot of possibilities because it's a great sensing capability and it is a fantastic weapons capability, once we get to power and we can actually get that power on the target.

Dr. Karako: Great. Great. Let's stay with homeland before we move to defense of Guam. Again, Assistant Secretary Plumb highlighted something like \$278 million in the FYDP for OTHRs. So let's – this is the other piece of the homeland that's not really legacy BMDS by definition. I'm talking homeland cruise missile defense. And he and I think General VanHerck have really been highlighting the OTHRs. Again, not been there, because the ballistic missile things you kind of look up. But for the cruise, for the hypersonic things, looking down. So how do you think about that? And how are you thinking about that capability for that threat? Again, I know you're coming from the Aegis world, and you know the cruise missile world well. So how might that get incorporated to the MDS?

Vice Adm. Hill: Yeah, so I agree with General VanHerck that, you know, we really do need to have a full recognition of what that threat to the homeland is. We also need to have the policies and strategy in place to get to programs that help them. He's got a mission that right now, you know, you will hear him say – and he said it last week – he cannot execute the mission because of just lack of that kind of capability. And it's a really complex one, right? You have everything

from the unmanned air vehicles, and there's different classes of those, right? And there's different responsibilities for those.

And then the cruise missiles that come in, it's just a different threat, the way it flies. They tend to fly low. And, you know, they were subsonic, now they're supersonic. So they no longer look like an aircraft, right? So they're just harder to defend against. Then you have to figure out what you're going to defend against, right? What will be your critical asset list, what will be your defended asset list? So it's really difficult and complex. And so the department is getting its arms around how to move forward with that.

And so when you talk about over the horizon radars, that is that really first robust investment that's being made in PB '23 that recognizes the fact that you need broad area surveillance. Those that study over the horizon radars know that they can see far and they can give you a pretty good picture. Then where you'll go from there is you'll take that broad surveillance, and you'll neck it down and go to tracking radars. So you talked about the difference between up in space looking down at maneuvering hypersonics that are, you know, in that glide phase, 50 to 70 kilometers up. These are down low, right? So what I'm used to, having grown up in a sort of cruiser role, is 15 feet off the deck. That is challenging, right?

So if that sort of threat is going to threaten the homeland, you're going to see some sort of sensing capability that's different from what you have in space, and certainly, you know, a land-based static radar is not going to handle it for you. So what you'll see in the NORTHCOM's unfunded priorities list, and you'll see it in the MDA unfunded requirements list, is an elevated radar. So if you take a sensor that you can put up – and people call it a radar on a pole. That's kind of what we're saying. You'll see that other countries have used aerostats or blimps to carry those. You know, so you're not up in space, but you're down in a relevant elevation to where you can see those cruise missiles and then you can get the track fire control weapons-quality data on them. And that's kind of where we need to go.

So it's recognized by the department. They are working on it. And you'll see that first investment – really robust investment – going towards over-the-horizon radars. And the next step is – and we're working very closely with both the Air Force and Northern Command on how you integrate those into a broad system to protect the country.

Dr. Karako:

Well, back to the comment by policy, you know, this is a weapon of choice. And we're seeing how it's been used in Ukraine and other places. You mentioned the PB '23, you – first by just yourself and NORTHCOM. There was also – you referred to both yourself and NORTHCOM in '22, if I'm not mistaken. So is there any progress going on that initial investment for towers, or what have you?

Vice Adm. Hill: I think the first big investment went out towards surveillance with the over the horizon. I think when you talk specifically about an elevated sensor, that's to get you to some sort of limited area defense capability. Typically, you go demo that first, prove that it works, and then move from there. And everything's interconnected, as you know. So what we learn on Guam is also something that can be applied here. Because you got to remember, Guam is really about the size of Chicago, right? We're defending the size of a very large city. So I think it's very applicable to what we'll do in the United States. And then it just gets harder when you think about – you know, same issue they've got in Guam, right – weaponizing, right? So.

Dr. Karako: All right. So shifting to Guam – shifting to Guam, it is U.S. territory. It is the homeland. And attack on Guam would be an attack on the homeland. But it's not about just the tourist location there. It's the military assets there, of course, in terms of the mission. So before we get into the details of that, just what are you hearing from INDOPACOM? Why is it that this has been the top priority for the last, I think, three INDOPACOM commanders, has only now made it in the budget PB '22?

Vice Adm. Hill: Right. So location does matter. And if you just go look at where Guam is on the map, it is inside an area that is absolutely tactically relevant. You mentioned the other capabilities that are there. And so given the fact that you've got repair facilities there, that you've got the Marine Corps there, we're going to be stationing long-range fires there, it needs to be defended. So that was really at the root of it and why it was on the priority list for so long.

The big debate on why it was probably on the list for so long is what approach you want to take. And so through lots of extensive work over the last couple years, we came to an architecture that's now reflected in PB '23 that answers the mail on what Admiral Aquilino, INDOPACOM, was asking for, which is 360-degree sensor coverage. He needs a command center. I would say, if you were to pluck out the most important thing about what we're doing on Guam it is going to be that command center.

Because if you look at how you fight the battle in the INDOPACOM region today, it's fairly dispersed in terms of command and control. So you really need to have an area that brings in all the space and land-based and sea-based assets from a sensor perspective, and fuses that data, and then selects the appropriate way to go after it, right? There's classification in there so you know what targets you're going after. You're going to have to deal with ballistic missiles. Sorry, they don't go away. You're going to deal with cruise missiles and you're going to deal with hypersonic threats. So that's really what's reflected in the PB '23 is that sort of capability on the island, because it deserves to be defended.

Dr. Karako: So let's talk about that architecture. You said – I've heard you say that the defense of Guam is going to be the hardest thing you do as an agency, which is saying something for an agency that has all kinds of hard jobs to do. But that command and control strikes me as the hardest part of this job. So just to make it explicit, you got systems that don't currently have common command and control. You know, the Army, the AFATADS or Patriots. You have the Aegis combat system, things like that. So if you don't want confliction or shooting at the same thing with multiple effects, how are you going to do that? And doesn't there need to be one ring to rule them all? Somebody's going to have to be in charge or some mechanism. How are you thinking about that?

Vice Adm. Hill: Yeah. I think we have all the tools necessary in the overall architecture in PB '23 to go do exactly that. And I'm not ready to really talk about details other than the fact that we are going to build it in advance. And I'm going to have Admiral Aquilino and his team in there walking and kicking consoles, making sure we have the chairs in the right place. The way we used to do it all these years ago when we were doing that ship design, for example, since that's my background, we actually have had cardboard boxes laying around. And we would use different colors of thread for the types of communications that we needed to have.

And we're way beyond that sort of analog way of doing things, but we're going to physically build out what that space should be and make sure that we can accommodate everything. If you go look at what PB '23 is directing, it is to mature technologies now that enables the incorporation of future technologies and even beyond that. And so we have to have an eye towards bringing in the ones you already mentioned, right: Aegis combat control with the IBCS control; that in itself is its own challenge, right, to get it onto a single screen. Well, what I want to do and what my team wants to do for INDOPACOM is to have what we've all talked about for years, the single integrated air picture, the single coherent air picture – whatever you want to call it, right? We've got the data streams, now we've got to bring them together so that the warfighter knows how to handle that, right? Everything from classification combat ID to the tracking and the engagement of it. And so yes, it is a challenge. I think it is the hardest thing we're going to do, and that is the most important aspect about Guam. You could talk about radars and launchers and weapons all day long, but if we don't get command and control right, none of that will matter.

Dr. Karako: So talk about the effectors. I mean, the mission that – the 360-degree mission is for the whole threat spectrum; we don't just get to pick one piece of that threat spectrum to defend.

Vice Adm. Hill: That's right.

Dr. Karako: And so what are the effectors you're thinking about, to the extent you're comfortable? We've got THAAD there now; obviously, you're talking Aegis and some Army effects. But what are the rounds that we're thinking about?

Vice Adm. Hill: Yeah, because everybody loves just talking about the interceptors, Tom. Thanks for doing that.

Dr. Karako: But I started with C2. (Laughs.)

Vice Adm. Hill: OK, good. So let's just start with where we are today, right? So where we are today is we do have a THAAD battery on the island now and you have a ship station up forward, so if we can go do this right, we will release those ships that are patrolling to provide that umbrella today, right. And when you think about those ships, it's a single site but it takes three to four of those ships, right? You've got one on station, one returning, one on its way, one in maintenance going through certification training and all that, right, so it's tough for the Navy, it takes maneuver assets away from the maneuver force in the Navy. We want to be able to give that back. That was sort of underwritten in the whole strategy behind Guam. So what we're going to do then is we're going to bring in a number of sensors that gives you that 360-degree coverage.

We talked about the command center and whether or not we're going to put that on wheels or not – I'm still discussing that with Admiral Aquilino – and then the effectors. We've got a nice little split – you'll see this in PB '23 – between MDA and the Army. So what MDA will do from the mission space perspective is leverage the Aegis fire control for ballistic missile attack and for hypersonics, so think SM-3, SM-6 Sea-Based Terminal. So you kind of see a pretty strong, you know, MDA presence there leveraging a lot of Navy capability. And then you swing on over to IBCS and the IFPC capability; now you're talking. We're going to still have THAAD on the island. We were going to bring in Patriot within the IBCS world, and then of course the Sentinel radar is bringing in the IFPC interceptors. So we've got it from top all the way to bottom in terms of that layered defense.

Dr. Karako: And in terms of the launchers, though, I mean, you've got today's THAAD launchers, you've got today's Patriots, and obviously the IFPC launcher in the works here. But like for the Aegis things, I've heard you say repeatedly it's not going to be Aegis ashore and look like what's in Romania. But, like, is the Army's midrange capability – what role do you think that will have here?

Vice Adm. Hill: Yeah, so right now, if you take a look at where we are in PB '23, it is a mobile launcher, which I think is good for the country. We'll have to make some modifications to ensure that they are – this mobile launcher was originally built for offensive missile types and so there's a difference, right? So

offensive missiles, kind of shoot and scoot, right, come on out. It's like a tell, right? Transporter erector launcher, goes out, does its business, goes back to where it was, right? For defense, it's a little bit different, right? Generally, you've got to be ready 24/7 so that means you're in the erect position, so you want to have all the environmental controls in place; you want to make sure that you account for your explosive arcs on where you place them, right? So when I say Guam will be hard, that's part of the hardness is that there's about 27 percent of the land that's available for competing issues going on to Guam, right? So it's not just Missile Defense and the Army landing assets in that 27 percent. We're in competition there, right? But we've got a very close relationship with the joint regional Marianas commander out there who will allocate, and we're about ready to finalize the 19 or so sites where we will land these assets. So that's kind of the plan.

Dr. Karako: But let me pull the thread on the mobility. You said – we're going, potentially, mobile across the board, maybe the C2; we'll see. But you've also said that for readiness reasons, operational reasons, there's utility to being fixed; there's utility to being not hidden or, you know, drive around the island at all times. And so there's costs to that mobility. How do you think about those trades there?

Vice Adm. Hill: Yeah, so it's a tough trade but when I lay it out in the end I think it's good for Guam to have that capability, which you sacrifice, though, because the limited numbers in a mobile launcher. Well, you've added in some logistics, right, whether they've got to go back to some other facility for reload. So you have that, right? We've got to worry about that. If you have a fixed site, then it's likely more targetable. But again, you're in an area that's the size of Chicago, so there's always a good argument on that. You get a lot of capacity out of using this sort of configuration that we have in Poland or Romania now and you have all the environmental controls, all the explosive issues, taken care of, right.

So we have some work to do on the mobile launchers. But, like I said last week, it's pretty straightforward. At the end of the day, I don't get wrapped around the axle on launchers, right. I think it was my chief engineer, Dennis Mays, that once looked at me and said, you know, a launcher is nothing but pig iron. You know, you're right. It's really about the signals that we send to it, right, and – but it does come down to environmental controls and explosive controls. We need to have all that in. We know how to go do that so I'm not real worried about it.

Dr. Karako: Well, I know we want to get to hypersonics advances, but before we do that let's talk about another island in the Pacific. And you've talked about how the lessons from the defense of Guam would be applied to the homeland defense because North America is a region, too, but let's also talk about defense of Hawaii.

Vice Adm. Hill: Right.

Dr. Karako: This is getting a little bit of attention.

Vice Adm. Hill: Sure.

Dr. Karako: And it's not just about the BMD ICBM thing.

Vice Adm. Hill: Right.

Dr. Karako: You know, Pearl Harbor has been attacked by aerial attacks before-

Vice Adm. Hill: Right.

Dr. Karako: – and that spectrum of attacks is an issue for those assets as well today. How are you thinking about the defense of Hawaii today?

Vice Adm. Hill: Yeah. I always – I'll steal the line from General VanHerck because he uses this when it comes to cruise missile defense. You know, we're asked all the time about how are you going to protect it and he's always – he'll always ask the question, protect against what, right. The threat spectrum is outrageous right now, right. We're living in a really interesting time. So when it comes to defense of Hawaii, that deserves a much more in-depth study than what we had back in 2014 when we said we would put a singular, you know, right down the threat access radar to defend against ballistic missiles from a rogue nation, right?

So we know that that's not going to be sufficient to protect that state, and so the study that's kicking off – it's, basically, in running now and it'll inform POM '24 – is about what should the overall defensive capability of the islands be, and it's a tough one, right. So in my simplistic world of just thinking of the rule of three, you're going to have to have some sort of sensor architecture, you're going to need that command-and-control architecture, and you're going to need some number of weapons, right. Whether those are hard kill, soft kill, whatever, we'll figure that out as we come to the study.

But it is a – I think it's a high priority for the department. It's a high priority for the agency. You know, at least from the missile perspective, you know, from my soda straw view, we got to defend against that because that is real. You mentioned December 7th. I mention that all the time – strategic location of Hawaii. We'll have to defend it, and it's going to be a broad array of issues to deal with.

What was different back in 2014 when we first had the sensor architecture laid down, it really did not address the way the threat has evolved today. So that's why we are where we are.

Dr. Karako: So it may just be pig iron but the Mark 41 is an amazing, exquisite piece of iron.

Vice Adm. Hill: It is. Yeah.

Dr. Karako: Talk to me about the risk reduction efforts that are going on on Mark 41.

Vice Adm. Hill: Well, let me tell you a little bit about the protections that come from a vertical launching system, because we had to deal with this when we got to Romania and Poland, right. So let's just think of an exquisite missile like an SM-3 that's got a fancy focal plane array on it and it's got propulsion that you always want to work 24/7 all the time, right.

So it's in its own canister. Then it's inside the VLS frame, so to speak. Then it's got the protection and the environmental, right – the air conditioning, the heating, and the cooling and all of that around it. Then – a lot of folks don't recognize this – the extra protection of the ship's hull is there.

So our challenge back when we were doing Romania and Poland was to take a land-based launcher, and at the time the decision was to put it up on the ground. But we had to account for the safety that comes from the hull of the ship. So we had to go build that in, right.

So when you look at a mobile launcher where the only commonality between a mobile launcher and the VLS, really, is just the frame that the canister goes in, there's work to be done. It will not be sufficient for a missile that is erect all the time, and we can argue that all day long so maybe it's the time to erect. We're going to work our way through that. So, again, it's pig iron. It's important pig iron. But you have to deal with those fundamentals of explosive safety, which means how many of these you can park together in one farm and what sort of distances do you need in them. You have to come through things like: Are you going to reload on a normal basis? Are you going to constantly take them out and put them back in and relocate? So we'll work our way through all of that.

Dr. Karako: Good. Well, the Mark 41 is a beautiful launching system. It's in high demand for many things, including that's your specs for hypersonic events, your next –

Vice Adm. Hill: Right.

Dr. Karako: – big priority here. So, you know, Secretary Austin, he's been testifying lately. He's been saying the importance of hypersonic defense. He called all the COs together saying, hey, let's go faster on the defense side as well.

So I wonder if you'd give us a little update on the mission overall. Glide phase interceptor – as I look at the budget, I see the budget's a little bit of a bathtub right now. The GPI timeline seems to have been pushed out a little bit. But at the same time you've got something like 292 million (dollars) in your UFR for GPI. So what's kind of going on with that program?

Vice Adm. Hill: So let me go back to – I mentioned before that one of the things I learned in talking to various members and coming through testimony last week and in a couple of other interviews is that there's – the full scope of MDA is not well understood, right?

I would say the other thing that's not well understood is the phase that a program is in, right? We tend to talk about technologies like they're going to be here tomorrow. The reality is they take investment. They take time to bake. Hence, why Honorable Shyu put out her note as to why we have to make investments now to hit a timeline out there in the third FYDP, right. So that's really important to know.

So where we are with the glide-phase interceptor, we're just getting started. And it's in a new regime. It's in a new environment. So does the existing propulsion stack we have today get us into that regime? I think the answer is yes. We think we can get there. Does the current front end allow us to operate in that environment where there's a lot of investment being done by our adversaries to survive that environment, whether it's the thermal-protection systems, whether it's the seekers? How long can they keep a seeker open? Was there a hardness you have to have on the vehicle? We have to worry about that same stuff on the defensive side. So by having three contractors under an OTA agreement today, that allows us to do a lot of de-risking along the way.

You asked about or you mentioned our unfunded-priorities list. The items that are listed there are very educational in terms of where we see risk, and it's typically in the front end. There's concerns about seeker, seeker-window materials. We have concerns about propulsion and diverting the attitude control systems because it's a different environment.

So operating in space, that's one environment. Operating in the atmosphere, that's a different environment. And that glide environment that's 50 to 70 kilometers up, that is a different environment. And we're going in against a different kind of threat that's in a maneuver state. So those investments are being done really to just overall de-risk hypersonic defense from a hard-kill

perspective. But you'll also see some things in it that allow us to kind of extend into other areas that I won't talk about.

Dr. Karako: Having said that, the – whether it's the secretary or Congress, everybody's coming to you and say, hey, faster, faster, faster.

Vice Adm. Hill: Yeah.

Dr. Karako: And likewise with the defense of Guam. We don't get to decide we don't defend against the hypersonic stuff. We have to do it all.

Vice Adm. Hill: That's right.

Dr. Karako: And so the timeline for this – you know, if it's a 2020s thing versus a 2030s thing, it matters a lot.

Vice Adm. Hill: It does.

Dr. Karako: And does that 292 (million dollars) – does that potentially get you the possibility of bringing it back to the left?

Vice Adm. Hill: Yeah, we argue this all the time, right. You'll have one program manager tell you, hey, this is going to be a 2030s thing. You have others that say why can't you have it now. You know, all you need is the kick stage and you're there. So I would say, again, we're a little bit too early for me to declare a timeline. You know, having been a program manager, when you're in the area where you're bringing the technology together and you haven't even assigned what the configuration is, there's lots of trades that have to be done.

I mentioned the rough environment, right. A lot of your sensor architecture can solve your problem, right, of when you open your seeker, for example. If you open it early because you've got a robust seeker and you can see it and you've got acquisition, great. You need less sensor-architecture support. But if you don't have the seeker capability that can survive that environment, well, then you're going to need a more robust wait-for-space kind of thing, right.

So there's still a lot of trades to be done. It's a new area to engage in that arena. But we're moving out on it. And for me, I'm not ready to declare a date. I want to see how we do, because we haven't even done the first down-select yet, which we'll do, you know, later this year. But right now we've got three really great proposals. And we may decide to stay on three. We may drop to two. We may drop to one. So it just really kind of all depends.

Dr. Karako: And what's your timeframe, do you think? You said this year for making that decision.

Vice Adm. Hill: Oh, yeah. It'll happen into the summer. So we're kind of almost there.

Dr. Karako: Great.

Vice Adm. Hill: So we're finishing up evaluations.

Dr. Karako: But the G in GPI is for the glide phase.

Vice Adm. Hill: That's right.

Dr. Karako: And you talked – and the T in SBT is for terminal. And you've emphasized that you don't really want to be in terminal; don't know where it. That's really speaking to area defense as opposed to point defense, in a way. But you know, there's still this persistent, I would say, argument out there in the water that, well, if we just – let's do everything from terminal. Let's let the threat come to us. Let's have the razzle dazzle of missile defeat, or maybe they'll fail in flight and then we won't have to do anything. You know, how do you think about that? Is letting the threat come to us, which is the opposite of the layer-defense philosophy, how do we think about that for the enterprise broadly?

Vice Adm. Hill: So I think if you talk to an Army air defender and you talk to a surface-warfare officer – shoot, talk to a submarine officer; talk to anybody from the Space Force or Air Force – they'll all tell you that expanding the battle space is one of the most important things that you do. So if you're going to wait to terminal, you're always going to have and will experience some level of damage, right, because if you're able to destroy the threat in close – when I say in close, it's usually inside of 20 kilometers. That's really close. And when you're flying at those kind of speeds, you're going to take debris, right.

The last thing I want to see is a dead sailor or a dead soldier, dead airman, dead Guardsman, right? So you want to kill it as early as you can, right. This goes back to the, you know, kill the archer, then get the arrow, right. I mean, it's in our history. It's what works. And so the earlier you take something out of flight, the less you have to worry about in the hardest place to engage.

So waiting for it to come to you, I don't quite understand that mentality. It's really easy to draw pictures of a lot of different trajectories and different missile types and show them going to one spot, saying, therefore, that's the most effective. No, it is not. That is the most difficult place to engage.

And if you can thin the raid – more language from yesterday – thin the raid, expand your battle space, layer defense, that's valid. It's what works. And that's what we ought to be doing. And it doesn't always have to be hard kill.

There's lots of different ways that you can do this. But we ought to have a mentality of layered. That's what we've always done, because it works.

Dr. Karako: So let's shift to the sensor side, HBTSS. I'm not going to use the phrase.

Vice Adm. Hill: Thanks, Tom.

Dr. Karako: But where are you on that? I think you've got some stuff going up maybe early '23, as I recall. But then I look at the budget and I see dollars for '23 – maybe not as much as last year – and then it goes down quite a bit, '24. And then it kind of disappears. So what's kind of the next steps and what's the vision? Is MDA going to stay in that space?

Vice Adm. Hill: Yeah, so just to kind of – what I'll do is I'll focus on the hypersonic aspects. I already mentioned the fact that the propulsion types are changing for ballistics, and we really do need that ability to look down on something that may not be flying as hot anymore from a ballistic perspective.

But when it comes to the global-maneuvering threat, which is really the hypersonic threat, you have to be able to track it and you have to get to weapons quality, meaning, again, positional and velocity error that you have to take out so that when the seeker opens, it knows what it's going after. So that's critically important. And it is really the only capability within the overall architecture that gives us that weapons-quality data against hypersonics.

So here's where the confusion is. So we're going to put up our first two HBTSS satellites built by two separate companies. They're going to be interoperable. We'll get them up in March of '23. So that's coming pretty soon. What we did on the ground was to prove what I mentioned earlier, that you can, in fact, extract the hot target out of the warm background. That's hard stuff. That's varsity-level algorithm and software work, right. So that's important.

We don't want to lose that. So we're working very closely with the Space Force so that, when we go up into space, when we finally lock down the overall architecture, that there's a place for that capability. You want to have missile warning, you want to have missile track, and you want to have missile defeat or defense.

So when you talk about those three things, that third piece is that fire-control capability or the weapons-quality capability that comes from HTBSS. So it's part of a broader architecture that we will – that we've got lots of insight into now. It's just not finalized. So that's why our program reflects putting two on orbit, collecting that data. They're in the inclination to track test events on

the Indo-PACOM region, so they're up in a relevant area. But where we go forward is in the decision space today.

Dr. Karako: I heard you highlight the importance of focusing those orbits on Indo-PACOM. But connect us back to your previous discussion about competition and the need for quantity. I mean, we've been talking about P-LEO, right, for the past four years and such.

Vice Adm. Hill: Sure.

Dr. Karako: I mean, is there anything to be said for carrying two contractors into production for – to get that proliferation?

Vice Adm. Hill: Sort of the same story here, right. So we have the two. And we have high confidence in both designs, because, again, both of those companies proved on the ground that they could extract those targets out of that mess. And what we gave them were a lot of targets and, you know, closely spaced objects. All of that was a part of that assessment.

So they'll go up on orbit and they'll prove themselves. And if they do well, I do think, again, that the department has lots of options – carry two, drop one; you know, just proliferate with the ones that you have. So those opportunities are there. And they fit right into the overall architecture of warning and track, you know, generally will be queued by the tracking layers into that fire-control or weapons-quality layer of HBTSS.

Dr. Karako: Five, six-plus years ago, MDA was talking a lot about MEO, PTSS and these other things.

Vice Adm. Hill: Right.

Dr. Karako: And then – I don't know – four or so years ago, it became very quickly all P-LEO all the time.

But now you're hearing a little bit more MEO again. Talk to us about what you're thinking about that. And I'm talking about for the tracking, not just the whole SDA thing, but for the tracking mission. What are the trades between the different orbits? How do you think about that? And why – why are we hearing from you and other folks kind of the value of mixed and layered orbitologies, as it were.

Vice Adm. Hill: Right. So I'm sure your audience is tracking just between LEO, low-earth orbit, and medium-earth orbit and beyond. You know, obviously the further away you are, the more field of view that you have, so fewer sensors. And that was kind of the mindset of a few years ago, right, we could go with fewer of those capabilities because we're going to be riding higher. When everyone

got excited about PLEO it was driven, really, by two things. It was the proximity of space really helps, so being low Earth orbit very helpful for tracking targets and being able to see them. But it was really about cost. We had not really proven to ourselves yet that we could actually put kilograms on orbit, you know, with commercial-type pricing. And that's what we're doing now, and that's what we'll be demonstrating when we put the first two HBTSSes up.

So you have flexibility, and – depending on what orbits you go into, and I think the right answer is mixed. So we went from one extreme of just a handful of birds because we were concerned about cost, and survivability's another piece of that, and then we flipped over to the, you know, everything's got to be in LEO. Well, now that you've got the Space Force established and in play, and they've got an architect and they're working their way through, there's great value in having a mix.

You know, so we openly talk about it all the time. I don't really feel like helping our adversaries any more, other than to say that we're going to come in with a mix, more than likely.

Dr. Karako: Fair enough.

Vice Adm. Hill: But I'll leave that to the Space Force. And we're very closely aligned with the Space Force.

Dr. Karako: Fair enough.

We've covered a lot of ground, but I want to see if you want to talk a little bit about kind of where THAAD capability development and Aegis IIA and related things – I think you may have some tests coming up.

Vice Adm. Hill: Right.

Dr. Karako: Where are those programs?

Vice Adm. Hill: Yeah. If you don't mind, I'll walk you from, you know, sensor down to the sea base or down to the – to the ground. I don't want to leave out the Long Range Discrimination Radar, so I'd like to start there, part of the ground-based missile defense piece. I should have mentioned it earlier. But we did our first initial delivery back in December up in Clear, Alaska. You know, operated by the Space Force. That's our lead service. Classic transition and transfer story, really great.

The radar is tracking satellites as we speak right now. It's going through its integration with the ground-based fire control through the command-and-control battle management. We did our first remote operations on it I think

it was about a week or so ago. We are working with the Space Force to get them in the chairs early to operate the radar early so they can go through their techniques, tactics, and procedures. That's a little unusual and we're on a tight development schedule, but we're working closely with the Space Force because we want them to touch and feel and learn how to use it. It'll do space domain awareness, but its primary mission, you know, ballistic missile defense of the homeland. All going very well, and we'll do a full transition over to the Space Force in 2023. So we are in that endgame right now. But radar's up and operating, doing very well, so we're really pleased about that.

I'll bounce down to the Aegis program. Aegis, since I mentioned space domain awareness, one of the things over the last couple years that we started doing was taking advantage of the fact that we generally will calibrate our radars by tracking satellites. So why could we not also contribute to the Space Force's situational awareness of what's going on up in space by taking a tasking from space command and control through command-and-control battle management to the ship, have the ship track those resident space objects, and send that back? And we did two tests last year that were very successful, showed that we could do that over and over and over again, and that it doesn't take away from our surveillance or our missile defense mission that we would do otherwise. So that's just something –

Dr. Karako: But really, it's additive to the joint force.

Vice Adm. Hill: It's additive to the joint force and it really takes nothing away from the missile defense mission. It's just part of what our sailors and our officers do those ships today. So we're pretty excited about that. And we'll have, like, 29 ships in 2024, so that's a big deal when you think about global coverage. So Aegis doing very well there.

Now, kind of related to Aegis is the Japanese program, and the reason I mention that is we had the – we had the minister of defense, Kishi, visit our headquarters a couple weeks ago, and we have the director general for their armaments coming in later – first part of June. That partnership is really strong and it's really important because they're making investments – they used to have two Aegis Ashore sites. They're going to have two purpose-built sea vessels, and they're about ready to lock that decision down. So I'll come back and talk to you about that later.

But what's incredible about that is that capability is in the Indo-Pacific region, right? And so our partnership with Japan has always been great. The SM-3 is a cooperative development for the Block IIA. But having that capability landing at the same time that we're also gearing up on Guam I think will give us a lot of situational awareness, a lot of capability across INDOPACOM. So very excited about where Aegis is going there.

And I can't leave out Aegis Ashore in Poland. That's the one we're always asked. We have our Aegis light-off now firmly scheduled on the 8th of June, and what does that mean? So in the shipbuilding world what that means is all the combat system spaces are complete. So we worked very closely with the Army Corps to get all the Aegis gear that had been in storage for a while while we were having construction problems, but as Army Corps really got very focused in on finishing things up, the sailors are living onboard now in Poland. All of the gear's in place. And when we do light-off, that means we're going to functionally operate the system. So we put the arrays up early as a forcing function for construction. That went along really well. So our partnership with the Army remains strong, and we're excited to have the sailors on board there in Poland and –

Dr. Karako: It's the radar lighting off, not the missiles?

Vice Adm. Hill: That's right. But when you do an Aegis light off, you're doing full functional checks all the way through the system. So that's huge. And that's going to get us in the position to, you know, come through – got to go through a lot of certifications, right? We'll have to have CNO acceptance. We'll come to EUCOM, we'll go through NATO. And all that sort of is out of our control. But our ability to say this is now ready is coming. And so we're excited about that.

Then in the THAAD side of the house, a lot of people may not know that we finally had – not finally – we had our first operational engagements and they were successful, you know, within the UAE. So we had some missile launches at the medium-range ballistic missile level. And the system performed flawlessly. So we've been working with Central Command to get access to that data, because we always want to know how those engagements went, so that we can provide feedback into development. And we're pretty excited about where we're going to go with THAAD in the future. You know, THAAD operates in that edge of endo and exo.

And, you know, we talked about the glide phase region. And so I think there's great potential for THAAD – great potential for THAAD as part of IBCS. So with the Army I had a call with General Rasch before I came over here this morning. We're going to be working Guam together, and we're going to continue to work on upgrading THAAD in the future. So I think those are – those are the other two issues I wanted to hit.

Dr. Karako: And you've got some tests coming up, I think. Do you want – are you able to talk about that?

Vice Adm. Hill: Yeah, we do. I probably should have just woven them right in. But LRDR, we're going to fly a separating missile across the face of the radar, so it can

go through all of its discrimination functions. We got that tracking for later this summer. And then we've got a bunch of tests in sea-based terminal for Aegis. We'll be doing the Japanese testing, which ties right back to their Aegis surface – their Aegis system-equipped vessel. They call it ASEV. We've got the next THAAD test on the THAAD Patriot integration company. We finished a third in a series of, you know, kind of completing an emergent requirement for the Army. That's going through its normal global material release now, but then we're going to do a concurrent THAAD and Patriot in there at the same time, test coming up in the '23 timeframe.

Dr. Karako: And then another bit department priority, cybersecurity. I know you're doing a lot there.

Vice Adm. Hill: We are. I tell you, that's an endless Christmas present every day, right? So when we started a few years ago, like the services did, we needed to kind of set the baseline on where we were. So we went in and really leveraged our test processes, working with the DOT&E to really go through adversarial assessments, penetration testing. So that was pretty important. That kind of set the baseline. Then we walked ourselves further to the left.

So we got into the development side, made sure that all of our systems – not just the enterprise administrative networks but the actual weapon system networks that those were solid in – we walked ourselves even further back to how are we putting this on contract and how are we holding them accountable for that? You know, not just the normal risk management framework, but how do you make sure it's in the system and that we're robustly testing as we get to the delivery to the warfighter? So it's a pretty dynamic world because that threat is dynamic. And that's one of the many threats that keep you up at night.

Dr. Karako: So with lots of other threats coming down the pike, I'd like to just close us out. Now, you stole my thunder about the three FYDPs from Kath, of course. But big picture, you know –

Vice Adm. Hill: Who's Kath? (Laughter.) Oh, I know.

Dr. Karako: Deputy Secretary, yes. How do you think about the 2035-2045 – you know, where do you see the agency at the end of those three FYDPs?

Vice Adm. Hill: I first heard DepSec Hicks talk about the three FYDPs during one of our Navy flag officer conferences. And I loved it for what I mentioned earlier, the fact that it was a long view. I really liked that a lot. It was a recognition that in the near term the FYDP now, that is, you know, really constrained by the force structure you have in play today. So the focus is on improving that. And you see that across all of our programs within the FYDP, improving that capability out there, right? Then you flip it.

And the way she described it is she talked about the third FYDP next, because that's when we transition to the next force, right? What is that future force? And we could probably spend hours talking about that. And then the FYDP in the middle she kind of referred to as the most difficult because that's your transition. And it is hard. And you've heard lots of rhetoric out there, right? Divest to invest and, you know, that's all debatable. But that is going to be the hardest one. And so I think she got it right in terms of laying out that overall program. So what does the Missile Defense Agency look like in that timeframe of 2035?

I'll tell you, it's been really tough. You know, when we established our war room and started assessing what the threat would be and projecting forward, it flipped me out because most of that stuff we were talking about exists right now, right? So the threat has really moved and evolved very quickly. So what we're seeing now will be enabled or how we counter that will be enabled by Honorable Shyu's strategy to invest early, whether it's directed energy or there's enablers like artificial intelligence, machine learning, that kind of thing, what we could do to cyber to make that better.

I think it's really hard to peer into the future. I'm probably not the right guy to do that. I look at a lot of different technologies and I look at where we want to go. You hear a lot about non-kinetic capability. I think that is real. We have that kind of capability today, but we need to grow it in the future so that we're not killing ourselves by missile-on-missile. I'm the first one to criticize ourselves internally all the time, right? Does the answer have to be a missile? Well, today's technology and what we're dealing with, the answer is yes almost across the board. But do I want other technologies? Yes, I do. So we have to invest there, which is what we're doing.

Dr. Karako: Great. Well, look, we've covered a lot of ground. Thanks again for coming out.

Vice Adm. Hill: Yeah, Tom, thank you.

Dr. Karako: I know you've got a lot of decisions and awards and announcements, all this sort of stuff coming up, but I appreciate your taking the time. Thanks, everybody, for the questions. I think I wove them all in along the way. So thanks.

Vice Adm. Hill: Yeah, great. Thanks, Tom. Appreciate it. Thanks, everybody.

Dr. Karako: Cheers.