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Event  
**“Missile Defense at 40”**

***The Missile Defense Agency’s 2024 Budget Request***

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FEATURING  
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CSIS EXPERTS  
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Tom Karako:

All right. Well, thanks, everybody, for coming back.

Our next panel is going to be with Vice Admiral Jon Hill, the director of the Missile Defense Agency. He is a good friend of CSIS and he's a regular for these kinds of events to come and talk about the – come and talk about the budget. He's going to come up for about 10, 15 minutes and give a little presentation. Then he – we'll sit down and kind of have a kind of conversation for the remainder of the time.

I just want to remind folks who are watching online or here in person that you can always submit questions, and they will come straight to my tablet, and we'll be able to offer them to the admiral.

I just want to underline a comment that we heard the kickoff this morning by Seth Jones that, yes, this is the 40th anniversary of kind of the kickoff for the Strategic Defense Initiative, but of course missile defense didn't begin there – for those that has reminded me of that, yes, I know – back to the 1940s, Project BAMBI and THUMPER, for that matter – and the sort of things that we talk about today in terms of Left of Launch. You know, they were doing that in World War II, hitting V-2 and V-1 missiles on the ground in Belgium.

But as Seth mentioned this morning, what really marks today is the beginning of and the kickoff of what you might call the missile defense enterprise or the institutionalization under one roof of all this sort of thing.

Missile Defense Agency is a big part of that, but not the only part of that. As vice admiral – excuse me – as General John Hyten, when he was the vice chairman a couple of years ago, used to say in his vision, every service would have the ability to strike deep but also defend itself. And so you see a whole lot of air and missile defense efforts going on within the services.

But for the really hard problems, those get handled and handed off to this gentleman and this agency. So, Admiral Hill, thank you for coming back. We really appreciate your being here, and over to you.

Vice Admiral Jon Hill:

Thank you, all right. Well, good morning. I always love coming to CSIS because you've got this great view out here, and it allows me to stay absolutely distracted during the whole time.

But I do have a handful of charts just to kind of stimulate the conversation, maybe stimulate some questions, and so I think they're up. We can just go ahead and turn the chart, please.

So missile defense at 40 years – if you kind of jump into the time capsule, it almost goes back to the time when I first entered the Navy. When I came into the Navy, as a surface warfare officer, I came in to a 600-ship Navy. I was commissioned by Ronald Reagan. It was a different time, it was the Soviet Union. I spent my first deployment in the Mediterranean hunting submarines, tracking submarines, watching them to enter port, watching their ships go into port – literally playing that cat-and-mouse game with the Soviet concern.

And one of the reasons I came into the Navy is I knew that we were facing the potential of a nuclear Armageddon. My father was a soldier; he was a Nike-Hercules missile guy, and so we used to talk about this all the time. So I wanted to be part of that. I wanted to be part of something that was bigger than myself. So that was my rationale for joining up and finding myself in the Mediterranean chasing submarines around. I was an undersea warfare officer.

What was different about then, too, one of my collateral duties was the nuclear weapons officer. That's right; we had nuclear-tipped ASROCs, right, our anti-submarine rockets. That was a suicide weapon. We were all in. The whole crew of that ship understood if we ever launched one of those, we were going away. But that's what we dealt with, and so if you haven't thanked a sailor, a Guardian, a Marine, airman in a while, thank them because they have similar challenges today, and they face those sorts of things.

My brother, when he was in the Army, used to tell me that his expected lifetime was 60 minutes – or 60 seconds on the battlefield because he was a communications specialist. And so those things are real. It was a different time back then, as kind of shown in this chart. I won't read them all to you, but you'll notice some things there where we didn't have a space force. We'll talk a little bit about that later today. We didn't have a deployed ballistic missile defense system to protect the homeland at the time, and we've come through some evolution over time, which is what I'll talk about in the next chart, so next chart, please.

So this is kind of the history or the framework of how we became a missile defense agency. I mentioned earlier that, you know, the far left of that chart, you know, is kind of my timeline of coming into the Navy. It really was that concern about Soviet ICBMs waxing the homeland, right, so we were going to go build the Star Wars shield. And that was really the foundation of SDIO.

Some incredible technology developed during that timeframe, much of which is deployed today, but rather than being deployed, you know, in space-based applications which was the dream at the time, it's what we have in some of our systems that are out there today, both in the ground-based missile defense within the Aegis world, and Standard Missile, and inside the theater, you know, area air defense system called THAAD. So we took what we learned then and made those investments, and we've deployed them today in a different way than what was envisioned back – way back when, right?

So then we transitioned over to kind of limited defense, right? We knew that without something up in space that we were really going to have to shoot from the ground or from the sea base, and we knew that that would be handling a limited attack. And so from that time we transitioned over to the Ballistic Missile Defense Organization, and that was really focused in now on developing something that we could deploy as fast as possible. In fact, that was the charter when we became the Missile Defense Agency, was to get it out there right away.

Now when you move with urgency – in fact I will tell my folks sometimes that there is a tyranny of urgency, right? We're all concerned about the threats today which are wildly different than what it was on the left side of this chart.

There is goodness in moving fast. And when anyone asks me is it OK to fail if you are moving fast? Well, we know that you learn a lot from that, but failure is often punished, right, and so we can talk about where we've had our failures – there's been many of them, I'll just flat out tell you, right, we fail all the time, but we do learn from that, and we are better because of it, and it's what we do today. So we deployed very quickly, and when you do that, you skip some engineering processes. You start to question the reliability of the fleet, and those sorts of things. So that's what we had to live with over the last 20 years or so. We're in a much better place today, and I'll talk about that in just a moment. Next chart, please.

So here's the threat chart – little bit hard to read, but if you look to the left – this is kind of a 20-year look, right – so you go back to when we first in place the ground-based missile defense capability, when we first brought in the initial deployment of Standard Missile-3 on Aegis ships, the world was that – ballistic missiles, pretty predictable, throw the football, comes right back down. It comes down at a hypersonic speed, so it's still very challenging, and then as they've increased the counter-measure capabilities, we got very focused in on something called discrimination. That's our ability to pick out the RV – the

reentry vehicle – from balloons and other things that are really decoys, right, up in space. That itself is hard. That's a tough battle, and we've got the technology in place to do that today, and we do it very well; again, going against a limited capability coming from the rogue nations, right, so that's the left.

If you move to the right, this is kind of the world that I felt I lived in when I first joined the Navy, and if you're the ship on the far-right corner there, or if you're a land-based battery, or if you are an Army maneuver force, you don't really care if it's ballistic, hypersonic, cruise, sub-launched, land-launched. You don't really care because it's coming at you, and it's coming at you fast, right? That's what we deal with today.

So the world has gotten crazier. Fractional orbital bombardment is in there for a reason, hypersonics are there, and again, launch from air, launch from land, boosted, hyper glide vehicles being released. In the ballistic world, we have the maneuvering RVs, which look and smell a lot like a hypersonic down in the atmosphere.

So very tough world – it's different, it's no longer the inaccurate population going after a population to freak them out. It's now going for very specific sites, and they can do that. Our adversaries have really upped their game in this area, which means you have to up your game in defense, which also mean that it's harder, which also means it's more than just the Missile Defense Agency.

You know, again, I come from an air defense background on ships. Some of you in Army uniforms over there have been working air defense for years. It's not easy, whether it's self-defense, or if it's area defense, regional defense, or homeland defense, it's complex and it's hard. But fundamentally, it is about detect, control, engage. It's your ability to see and sense the battle space; it's your ability to control and understand what that threat is doing so you can put a weapon on it, right, so detect, control, engage is kind of an old mantra that I still use today. It's applicable across all of our systems. Next chart, please.

So this is the mission, and it has been unchanged. You may have saw it in the BMDO, MDA transition side, right, and it's because it's so fundamentally true, right? I could take that mission statement, when I was working Navy air defense back with the Navy, and apply that to my problem set on a destroyer or a cruiser, right? You want layered defense.

What does that mean? That is expanding your battle space, and that means taking more than one shot at the threat and not waiting for terminal, which is the hardest, dirtiest environment to engage, and in fact, you'll likely end up with the debris coming on a ship and killing sailors, right? If you wait that long, that's what happens.

But that's the reason why, when you go to ship, they have the close-in weapon system, they may have a rolling airframe missile, they may have Evolved Sea Sparrow, they may have SM-2, SM-6 for the long fight and SM-3 for the ballistic fight, right? That is a great defensive layer on a ship, and if you look at the Army, when they deploy with the IBCS, if you have IFPC, and you've got Patriot, and you've got THAAD, then you're in a pretty good place in terms of layers. So that's what we mean by that. So that's our mission, right – layered defense.

Defending the United States – number one priority for the agency, right, so our core mission – that started out in SDIO, came to BMDO and MDA, really was about protecting the homeland against the rogue threat, right, and, you know, you can ask me questions about inventory – I won't answer them – but I'll tell you what we can do from a limited defense perspective.

And then our deployed forces – they mean a lot to me, not just because of my own experience, because I've got, you know, family members that are deployed today in the Army, in the Navy, Marine Corps. Many of you also have that. I'll just say less than one percent of the country serves in the military, all right – less than one percent of them, and most of the sons and daughters that serve today are the children of those people that are serving now, so we're becoming a cloistered community, which means a lot of people don't understand us, how we think and what we do. And so, again, when you see anybody a uniform you ought to thank them for what they do because it's critical for the defense of this country and for the overall success of the nation.

All phases of flight – what does that mean? You want to interrogate the threat from the time it launches all the way to the time you kill it, right, which means you have to have track custody. Hard to do, we're always sensor poor. Pick any mission. You never have enough to really fully understand what the threat is doing, and when they maneuver, when they extend in space, when they go at high speeds or large raids, that's all done to break that down, right, so you have to interrogate them in all phases of flight, and then you want to engage them in all phases of flight if you can, right?

Some of them are really hard. I was asked a question recently about boost phase – very hard to do. That's a very short time cycle, right? When you boost, you go pretty quickly up into the atmosphere, so that means you have to have really exquisite intelligence and warning. You've got to know where the launch site is – whether it's at sea with a pop-up submarine, or if it's from a land-based site, or from a tell that's moving – and then you have to be there.

So let's just pick combat air patrol. If you're launching out of North Korea, where would the combat air patrol be? And you have to ask yourself, do we want to actually be flying over China, right? So that's kind of the reality on why boost phase can be so hard. Ascent phase, just as hard because you're accelerating, you're going up into space.

So we go after mid-course. We go after the descent phase. We go after the terminal phase. That's what the hallmark of really what the ground-based midcourse defense is; that's what Aegis with SM-3 does, to include a sea-based terminal when you get down into the atmosphere. It's what THAAD does right on the edge of the atmosphere, what Patriot does down inside the atmosphere against multiple threat types.

So I think we're in great shape from a missile defense perspective, defense of the homeland against a rogue nation. I continue to worry about our carriers operating forward inside the island chain. I continue to worry about forward air bases. I worry about the Army maneuver force because sensor poor, right, we may not have everything we need because seeing these threats and the numbers they come in, at the speeds they fly, and the maneuver capability is the challenge for the future. All right, next chart, please.

All right, so this is – when people ask me what we're doing in PB '23 and where we're carrying it into '24, this is kind of a summary to look at that. You'll notice that C2BMC there is prominently displayed in the center. It really is the connective tissue, and we built it for a reason. It's our version of JADC2 and within our budget you'll see that we're integrating with JADC2.

But why did we do it? Well, think about indications and warning coming from space as really the first hit, right, then think about radars that are in Japan that are putting it into track. Think about SBX, which just got underway after her maintenance availability, giving us that exquisite discrimination. Think about the launch sites up in Alaska and in California, and the control from Colorado. We had to synchronize that all together. And then we took that and we

leveraged it by being able to tie Aegis and THAAD together, down in CENTCOM, for an example. So we're across the globe with C2MC, and it's an important connective tissue. It is the technical integration portion of the Missile Defense Agency that leverages the fire control systems within ground-based midcourse, fire control systems within Aegis, and in THAAD and in Patriot. And it's a very effective system, and it's really our foundation.

Off to the left you'll see the space capability, and when you look at these kind of threats – you know, I've been talking a lot about sea-based and land-based sensors, right, looking at curvature of the Earth issues – any flat Earthers in here? (Laughter.) All right, the Earth is round, and so it's very hard. And so we have to go to space to be able to see, maneuver across the globe, and that's where we're going, and that is the strategy of the department. It's not just for the missile defense mission. There are so many other missions that we can do from space, and it's critically important.

We're going to launch our first two Hypersonic and Ballistic Space Sensors later this year. We're going to get them up in an inclination that's over the INDOPACOM region so we can leverage them when we're doing flight testing so we can characterize them in space. That's an important piece that we handed off to the Space Force for proliferation.

Off to the right you see the long-range discrimination radar up in Alaska – fantastic. If you haven't been up to Clear, Alaska, recommend you go. You want to see a modern-day pyramid, that it is.

In the center of the chart, that's the Ground-Based Midcourse program; again, the hallmark of Missile Defense Agency. You see some missiles coming out of the field, you see them being transported, you see them being taken apart and torn down, that is our Service Life Extension program. We need a Service Life Extension program – always have – and I'm thankful to Congress that they funded that early on so that we can extend the life, improve the fleet out there today while we wait for the Next Generation Interceptor, which is on track. And I'll talk more about that later.

Down in the lower left you see Aegis ships and you see Aegis ashore. Great technology – I've already mentioned the midcourse capability with SM-3, talked about sea-based terminal going against hypersonic threats – deployed today and in constant state of improvement with sea-based terminal and SM-6, and we're getting ready to deliver the Poland Aegis Ashore site, going through full-up testing of it now, so



that will be ready for inserv within the next month or so, then we go to CNO acceptance, and then EUCOM acceptance, and NATO acceptance, so on path and doing well there.

Defense of Guam – I'll talk more about that when I sit down with Dr. Karako, and then THAAD/Patriot integration, and we completed the test campaign for that. We've delivered that to one unit in the INDOPACOM region, and we're working with the Army to do global deployment of that. Pretty excited about that, great capability – our ability to interchange and interoperate between, you know, X-band and C-band radars, as an example; and the ability to control Patriot using a THAAD battery; the ability to take a THAAD radar TPY2, provide data to Patriot to launch it out; our ability to separate the launchers from the fire control to give you more flexibility depending on what your geography is.

So that's what we've been working on in '23, we'll continue to work on, and that's where we're going in '24, kind of in a nutshell. OK, next chart – and I think that wraps it up.

So let me introduce Dr. Tom Karako. (Laughter, applause.)

Dr. Karako: All right. Well, thank you, sir – really appreciated the historical slides. That was a lot of fun. I remember the cellphones, at least, from the '90s, not so much the '80s.

Vice Admiral Hill: The first one I was issued was a big brick.

Dr. Karako: So you did have that threat chart, and you talked about all the crazy things that are there – the hypersonic, and the FOBs, and things like that. You know, five years ago, we were thinking about these things and describing these things as the emerging threat, the advanced threat.

Where are we going to be five years from now? Where are we going to be ten years from now? And therefore, how do you think and begin to plan for even more complex threats than we have today?

Right, well, the first point I make is that projections – when I first came in back in 2019 as director, many of those were projections, and they're here now. And so the world we live in now is what I kind of showed you on that chart. Those were projected to be downstream a bit.

If you go look at the number of tests that our adversaries are doing today, it's on the order of 60 to 100 in a year. It's stunning, right, while we test, you know, in handfals, right – you can count them on a hand. So it's a different pace and it's coming quick.

When I look at the future, and I think about the problems we'll face kind of beyond all those different trajectory types and warhead types, for me it becomes the electronic attack and protection side of the house. We have to make we are as resilient as possible.

We've been working on the cyber aspects. Part of the Service Life Extension Program is not an interceptor service life extension program; it is a full-up weapons system program, which means we're hardening, we're building in redundancy and making sure we're cyber secure. We're never going to be done with that, right? We're going to continue to do that across all of our programs.

But in the future, since we don't live in a world anymore to where, you know, we're the big boys on the planet and we don't have to worry about anybody else, the homeland is no longer a sanctuary – that's been said – and I will tell you that the electronic attack and protecting our systems against that is the next adventure. So discrimination has always been a huge thing for us – fancy word for picking out the lethal object in any complex, in a complex that's difficult to go see. Radars love that stuff so we have to go have the right algorithms in there, and we're constantly adjusting those because the threat is always adjusting. But the future is how do you deal with these different kind of attacks that we'll have on the system that are beyond just jamming, right? It's going to be hard, so that's the new frontier.

Dr. Karako: Yeah, so big picture – you know, you've got your order of priorities, you've got 10.9 billion dollars requests for PB '24, and your priority is operations and readiness, production fulfilling and deployment, and then sort of the technology development sort of thing.

But as I cut at it, in terms of the origin of the threat – the National Defense Strategy talks about China – very clear is the pacing threat – and yet so much of what the agency historically has dealt with is kind of the rogue threat.

Vice Admiral Hill: Right.

Dr. Karako: So how do you think in terms of the relative prioritization of China, Russia, the rogues? Where are you beginning to focus in that sense?

Vice Admiral Hill: Yeah, I would say that the policy makes it very clear for us. You know, in the department we talk about strategy, then policy, then budget, and then programs, and that is real, right? You want to start with that first.

So the strategy for homeland defense still remains against the limited attack from the rogue nations, right – primarily North Korea, right – so we have to worry about that because that threat, unfortunately, doesn't go away, right? But our regional systems – gloves off, right? – so when you get down to reaction time, which really matters if you are a ship deployed forward, an Army maneuver force, or for protecting an air base, reaction time drives the fact that, you know, you don't care about attribution. If something is coming in, you have to take it out. So the policy is very realistic in terms of, you know where we do it.

So the way I think about it – and I always tell my folks that when we're doing ballistic missile defense of the homeland, yes, that is against the rogue nations. When we're forward deployed, we are up against near peers, for sure. We're going against the acute threat and against the pacing challenge that you already mentioned, right? That's what we have to deal with when we're forward. So it's very clear to me.

Dr. Karako: Gotcha. The acute threat, as you say – we're going to talk about Ukraine, but I'm not going to ask you what you are doing with EUCOM on the day-to-day basis.

Vice Admiral Hill: Right.

Dr. Karako: I know that's – you shouldn't talk about that and I know you're not going to talk about that, but I nevertheless want to ask, because it is such a big object of attention – speaking rather as an acquisition professional – you know, we look at Ukraine and we see so much, I would say, McGyvering going on, whether they're trying to, you know, put together everything from a Stinger to a Hawk to a German, you know, flak gun into some coherent air defense. They have so much stuff, they have innovation. They're trying to shoot a Sea Sparrow off a Soviet Buk launcher, stuff like that.

And so when you see that – and it kind of resonates with the go-fast acquisition –

Vice Admiral Hill: Right.

Dr. Karako: – and innovative kind of solutions, how do you look at this, and maybe how are you anticipating the lessons learned for the acquisition world?

Vice Admiral Hill: Yeah. So one thing I will say, and I don't think anybody would be surprised by this, is we leverage the existing sensor architecture today to do real-world – so that's why I can count numbers, right? I know what our adversaries are doing in terms of testing, and I see the data because we have, you know, exquisite sensors. We've got a connected and integrated architecture that allows us to not only collect that data to assess it ourselves, but working closely with the intelligence community to have that data, as well. So whether in the EUCOM theater, INDOPACOM, CENTCOM, we're going to do that. It's a global capability that the United States has, working with our allies.

And so, if you ask specifically about lessons learned from and acquisition-geek perspective in Ukraine, it goes right back to that threat chart, right – large numbers, right – a raid will overwhelm any sensor, right, speed will overwhelm a sensor, and maneuver challenges the sensor architecture. So we're learning kind of what we expected.

You know, as we projected forward a few years ago as we started looking at, you know, bringing in hypersonic tracking filters into our radars around the world, we knew we needed to go do that, and I'm glad we did because that threat is here now.

Dr. Karako: Gotcha. And then closely connected to that – you know, for instance, Undersecretary LaPlante, for Acquisition and Sustainment, who is kind of the John the Baptist, crying in the wilderness – (laughter) – on procurement and munitions production-type issues.

Section 1244 of the NDA last year, you know, had all this authority for certain types of munitions, and SMs, I think, were in the mix, for instance. But how are you, in kind of this big mix – I mean, everybody around Washington is talking munitions production, multi-year this, that or the other thing. How is that coming downstream to the Missile Defense Agency?

Vice Admiral Hill: Yeah, I'll tell you, I'm really appreciative of Honorable LaPlante's focus in that area, and I will tell you, every time I meet with him – Jon, I'm sorry I'm late, I was just coming back from a munitions discussion.

Dr. Karako: (Laughs.)

Vice Admiral Hill: So, see, he does – he is the John the Baptist on that one, and for good reason.

So we are doing the same thing, right, so it's less about replenishment for us. It's really about getting to the numbers that really matter, right, and so – and you are, unfortunately, throttled by budget in a lot of cases, right, so we try to do the best to stabilize a configuration and go to multi-year procurement, right? So this is the last year, as an example, for the SM-3 Block 1B, the workhorse of the fleet, where we're not going to be in multi-year procurement, right? We'll finish that up, and why? Well, we have an evolving threat, so we're going to go and make changes to that missile until we're satisfied that those changes are incorporated and we fully test it.

We will do bundle buys, we'll do the best we can to get the best pricing that we can, and then we'll move to multi-year again. Multi-year, in my view, is a trust factor with the people, and with Congress, and within the department, right? If I can't get to a stabilized production, I have no business asking for multi-year, right, but when we're ready for multi-year, we'll go to multi-year, get the best pricing we can to increase the inventory because that's really what it's all about.

I won't talk inventory numbers today, but we've got a great inventory number on SM-3. We're doing really well on SM-6. We're doing really well on THAAD. We're doing really well on Patriot. Some of that lift comes from foreign military sales. That helps to stabilize the production line and also allows us to incorporate fixes as we go.

So I think multi-year is important. I'm all in on what Honorable LaPlante is saying, but he's all in when I tell him I'm not ready to do that yet, but I will bundle buy.

I'm also looking for ways to bring commonality between SM-3 Block 1B and the SM-3 Block 2A, and so by working through that, that's another reason why we'll bundle buy, get the best deals that we can, then we'll go to multi-year when we're ready. But I'm excited that we're in production on SM-3 Block 2A. That's an incredibly capability. I was on the ground floor of that one so I'm very proud of it.

Dr. Karako: Excellent, excellent. We'll come back to that in terms of Japan, for instance.

So before we get into any programs; in fact, before we get into more sort of budget deep down, let's just, if you don't mind, kind of nerd out a little bit –

Vice Admiral Hill: Sure.

Dr. Karako: – on some concepts, and we've talk about this before, and I mean, of course, kind of integration. It's one of the – it's one of the adjectives in your definition of the MDS as integrated, layered, and it's got to be one of the most commonly used words in the department.

So let me just say, I'm not asking you about integrated deterrence, and I'm not asking you about offense-defense integration or anything like that. What does integration mean to you in terms of active air and missile defense?

Vice Admiral Hill: Yeah, I often try not to use that word. I mean, I came from PEO Integrated Warfare Systems, and there was a definition there, and I would bet in this crowd here, if we were to ask everybody what they thought it was, you would get, you know, 50 different answers, right?

So for me, it's really three vectors, right, so we need to integrate into the threat, right, so that's where I always start: what is the threat, right, so we're going to integrate our capability to go after that threat. That's one definition of integration.

Then, because we deliver integrated capability increments to our combatant commanders, we need to integrate into that framework, right, so when we deliver NGI, it's going to integrate with the ground-based weapon system along with the existing fleet. That's a hard putt, but that's what we're working to do, and that's another level of integration.

And then I do need to integrate into comprehensive missile defeat and think of that as left of launch, and right of launch, we're dead center on active missile defense. So we don't own everything in left of launch, but we need to be integrated with that, meaning if there are sensors out there that contribute to our ability to have indications of warning as early as possible, then we want to pull that from the left and bring that into the system.

And so that's – those are kind of three ways that I think of integration. And you and I have had the fun time of talking about the math version of it, right? It's the area under the curve. And if you take a look at C2BMC, and if you look at GMD and all of its variants, and Aegis and all that, they're under a curve, but they're not perfect, right? They're

at different levels. It's hard to get that curve just right. But that's what we mean by integration. We want them to be interoperable first. So when I mention Aegis and THAAD and CENTCOM, for example, they're wildly interoperable. Are they integrated to the definition someone may have out here that they're sharing discrete track measurement levels? No, they don't need to do that. They can do that by sharing a track state and then bringing that into their own fire control and processing that on their own. You can get a little crazy with integration.

Dr. Karako: So, I got it – the engineer's version of integration, the integrated equation as opposed to the derivative bring things together as opposed to kind of taking them apart.

Vice Admiral Hill: Right.

Dr. Karako: But integrations bring things together to work for some common purpose.

Vice Admiral Hill: Right.

Dr. Karako: So let me just sort of dwell on that, and you've already kind of distinguished between interoperability and integration, but you mentioned, you know, certain track measurement sharing. You've got programs like the Joint Track Management bridge.

Talk to me about the functions. Talk to me about the work that things – especially at the tactical or the operational level – are the functions that you integrate things for. You mentioned Patriot and THAAD for, you know, fire control, but talk about the functions that will inform from the bottom up the integration discussion.

Vice Admiral Hill: Sure, so I'll go back to C2BMC since I mentioned that a little bit earlier, you know. So that is what I would call track-based integration, so we're sharing track-level information, which means that we've taken all of our sensors, we've fused that data through C2BMC, and that's what we're providing to an Aegis ship, as an example, right? That's what goes into the ground-based fire control system, and then you let that fire control system do its thing based on – based on that track.

They'll more than likely look for it in their organic sensor, and then now they've got that track to – it's easier to correlate and associate if you can see it yourself, right. And engaging on remote engagements, that's just a little bit harder, right, and we have plenty of architectures that leverage that.

So when you get into track-based measurements, that means you are going to direct tap off that sensor, which means you're inviting all of those measurements into your system. And I will tell you that's hard because you've got to associate and correlate, and you've got to make sure it matches your track stores that you've got, say, within Aegis, right? So we've spent a lot of time over the last couple decades getting to an Engage on Remote that we can trust, right? So generally we talk about, you know, acute engagement; we talk about the engage on full remote, and then we talk about organic engagements.

You want to get to your own native sensor as soon as you can in that world, but you may not always be able to get there so you have to be able to handle maybe a fire control quality track that is good enough, but not perfect in the way that you would look at it, if that makes sense.

Dr. Karako: So you describe C2BMC as sharing that track information, those track measurements –

Vice Admiral Hill: Yeah.

Dr. Karako: – but fundamentally it's the – it's the – it's the JFIC for GMD or it's the Aegis fire control. They are doing their own kind of computations –

Vice Admiral Hill: That's right.

Dr. Karako: – after being queued or something like that.

Vice Admiral Hill: Right. Right.

Dr. Karako: And so that's a little bit of a distance as it were.

Vice Admiral Hill: Sure.

Dr. Karako: And where I'm going with this, you know – I think you know – you know where I'm going with this, which is Guam.

Vice Admiral Hill: Yeah, that's – Guam is a great example.

Dr. Karako: And so, you know, I make that distinction because you are going to have IBCS, you're going to have Aegis fire control, you're going to have THAAD fire control, maybe some other stuff as well.

Vice Admiral Hill: Right.

Dr. Karako: And to put all those pieces together – well, we say that's integrated, but what do we really mean by that?



Vice Admiral Hill: Yeah, so this goes back to the tyranny of urgency, right – how fast do you need to get there, right? We're on a very short timetable on Guam, so I don't want to do anything that creates a massive new development, right? So our entering argument going into Guam is that you're going to have Aegis and IBCS and THAAD connected through C2BMC. That's the entering argument, and that's where we're going to go for the first substantiation of it.

Downstream, we may get to the full Joint Track Management bridge, and what that is, is where you directly connect the Aegis fire control to IBCS fire control, right? You do that, it now requires a commitment on either side of that interface –

Dr. Karako: To not shoot.

Vice Admiral Hill: – because – well, what you've got it maybe a track coming through Aegis that you're not seeing in IBCS, and you have to somehow associate that with a track in your track stores. You can end up dealing with dual tracks because, oh, by the way, you still have the C2BMC track coming over, right? And so you can end up with duplicates and those sorts of things.

And that comes from my background working with Aegis Cooperative Engagement all those years ago. We came through all that, but it is not simple. It is hard, hard work, and I would say that the value of getting to Joint Track Management – I view it as a vision, right, because it's really just a demo program. That's all that is, right – a few lines of code. It's a translator between the two systems, a lot of work to get done to where we can feel confident that we're not going to screw up the track picture, we're not going to screw up native fire control in IBCS or Aegis. So we're going to go with C2BMC first – track based, pretty easy to go do.

But the reality is on Guam, the big radar that's associated with Aegis is going to see cruise missiles, and we want IBCS to have that track data. So what's the best way to do it – C2BMC, direct TAF to the radar, or through the bridge? So we're running lots of studies on that right now to see which is the best, and I will tell you, the reality of budget always comes home, right? We could spend a lot of time trying to mix tracks between those two systems, or we could just do what we know how to do right now, just to meet the time block, and then just continuously improve.

So we'll get there, but it won't be in the first substantiation because it's just very hard engineering work, and it does, unfortunately, mean bills on the Aegis side and bills on the IBCS side, particularly for cruise missiles – maneuvering, many, many numbers. It's hard work.

Dr. Karako: But you said that the problem, you know – dual tracks, I mean, it's not just one versus two; is it six or is it 12 kind of a thing?

Vice Admiral Hill: Right, right. Yeah, so that's – you know, so when people oversimplify it, like, oh, let's just integrate the systems, well, what level of integration are you talking about, right? So we're going to go with what works, what we have confidence in, what has been tested and proven. We'll deliver that early, and then we'll go to the next level to make sure that IBCS has access to every sensor on that island, and a couple different ways to do that, right? And so then we'll go there. And then if we see value in full-up integration, mixing the track management systems together, then we'll maybe do that. I'm not there yet.

Dr. Karako: But to your point – back to the lesson from Ukraine – is it's going to be really hard, there's going to be a lot of stuff coming in, and sorting that out, that is no small problem.

Vice Admiral Hill: It's not. Right.

Dr. Karako: And plugging a radar of one frequency into another radar – into an EOIR –

Vice Admiral Hill: The formats are different, right, data standards are different, interfaces are different, so it's not that easy. But what I want to do is to make sure that the combatant command or the fleet staff – whoever is manning that command and control center – has confidence in the track picture they see, right? We want that. Really easy to go screw that up if you get crazy with however you define integration.

Dr. Karako: Gotcha. All right, well, we could probably spend the rest of the hour here on that.

Vice Admiral Hill: Well, you wanted to geek out, so – (laughter) –

Dr. Karako: I know, I know. But the – so let me – before we kind of get into the programs and more on Guam, for instance, I always want to kind of check in on MDA. I think you might – the department might be kind of updating the charter, kind of revisiting that. I think the Trump

directive-type memorandum from however many years ago is still kind of floating out there. Any update on kind of the status of those things?

Vice Admiral Hill: Yeah, sure. The directive-type memo made some changes in where decisions are made. And I think it was really the outcome of taking AT&L and creating R&E and A&S. That's really the root of that. And so when you take a look at the MDA charter with its unique authorities and all, that was one of the areas that kind of said, well, you know, who should be making decisions where, right? It kind of started with that, right? Should it be R&E, should it be A&S? And I'm totally fine with that. That's a good debate to have, right, because frankly I wanted that solved, right?

I always wanted to update the charter from the day I walked in because there were just administrative changes that needed to be made, right, organizational changes had happened, so I wanted those reflected in the charter. But in the end, we know what goodness came out of the directive-type memo. There were things that we were already doing that were best practices, and so we want to lock those in, and the department has agreed these are the right things, and where we are now is rewriting the directives. There's two of them, right? There's one that kind of says here what MDA does and how they do it, and then this is the support that's required from other organizations in order to achieve that mission. So that's in play right now. There's probably not much more to say other than I've got a great relationship with both R&E and A&S, and whenever I've asked for a delegation of decision, the answer has been yes. So it's – you know, it's hard to argue.

Dr. Karako: Great. Well, why don't we move to what I call the Biden administration's really signature effort on missile defense, which is the defense of Guam, which we've already started to talk about. But, you know, how do you think about the strategic logic? Why are we spending \$5 billion this decade to try to put these things together and defend what is, after all, a relatively small number of assets on one island in the Pacific? Why are we doing that?

Vice Admiral Hill: Yeah, she hates it when I do this, but my daughter asks me that question all the time. So this is for you, Carly.

We're doing it because of location, location, location, right? When I look at the globe – and anyone can go do this – and you look at where Guam is situated, it is a strategic location. So then go away from location. What do we have there, right? It's a major ship repair site.

We've got to protect that. It's a major air site. We're going to be stationing Marines there, we're going to have the Army on board, right? It's a critical part of any skirmish that might happen in the Indo-Pacific.

And then when you think about where the battle is controlled today, at the combatant command level. That's way back in Hawaii, right? So one of the big lifts that, you know, really wasn't seen when the architecture was laid down is a command and control center there on Guam that is very useful for, you know, every service and for the INDOPACOM commander. So it is location, and it is capability.

Today the island is defended by THAAD on the island, you know, really against the North Korean threat because that's why we put it there, and then an Aegis ship that's in a very discreet station. And really what the requirement was, was 360-degree coverage, and that meant sensor coverage for the island. That also meant weapons effects coverage for the island.

So it is no small feat to get there, but it is a stationary aircraft carrier, and it deserves to be defended because of the people that are there, American citizens, along with the capability that's on that island now and what will be on the island in future.

Dr. Karako: So you've been working on this for a couple of years – probably since you came in 2019 as director. As of right now, in terms of the '24 budget, for instance, and recognizing that you are working very closely with the Army and other folks, as well, describe for us what's the architecture, what's the several pieces that are – perhaps over different phases – going to be brought in.

Vice Admiral Hill: Yeah, so if you go back to the original INDOPACOM requirement, which was 360-degree coverage – again, sensors, weapons effects, right – we have to hit that mark. Then it's really a question about persistence, right, when you ask about the importance of Guam. Well, a ship that's in a station could get called away to go do something else, right?

Now in today's world, if the bubble goes up and there's an issue, we can always marshal more ships in the air to protect the island, right, we can drop more THAAD batteries, we can put Patriot batteries on the island. We can do all of that. But what the INDOPACOM commander was looking for was that persistent capability because of what we're going to have on that island, right – the command and control nodes, all the other things.

So a description of the architecture, we kind of – highly kind of mentioned, it's Aegis and IBCS. We'll put the integration discussion aside for a moment, but we've worked very hard with the Army. Where we are today in '23 and where we'll be in '24, really, is coming through all the site selections. We've selected the sites already, working very closely with the Joint Marianas commander, which is, you know a Naval officer for good reason – they are kind of landlords there on Guam – working very close with the governor there because where we site things matters to her, for good reason, right? It's a tourist location, right?

So we have a version of Aegis that will be on the island, and we have radars that will be associated with Aegis because we'll be taking on ballistics, we'll be taking on hypersonic threats, leveraging the existing capability within Aegis to do so. And then IBCS comes on the island with its sensor suite and its control suites, and it will leverage the capabilities of Patriot, it will leverage the capabilities of the IFPC, you know, short-range kind of stuff to give us that full layered defense on Guam.

So it is – it is a great example of integrated air and missile defense; two systems that were built for different reasons and bringing them together because that capability, when you sum it all up, is really formidable, and it will defend the island.

Dr. Karako: So you mentioned that Aegis is a really important part of this, but this is not going to look like Romania.

Vice Admiral Hill: Not at all.

Dr. Karako: And so how would you – you mentioned the control, the command centers.

Vice Admiral Hill: Right.

Dr. Karako: You mentioned the – we've talked about the ground-based VLSes that kind of look like – look like – Romania. But what is, I would say, the relative kind of similarities and differences between Aegis Ashore in Romania and what you are thinking about there.

Vice Admiral Hill: Yeah, I think when we first looked at the problem set, the prior INDOPACOM commander said, I've got to have an Aegis Ashore there, right, and that meant single-deck house, 360-degrees was what was in his head, right – I've got 360-degree coverage of that. But once

we took a look at the island and its – love this word – topology, right, we knew that a singular deck house would have blind spots. So what that meant was taking those radar arrays and moving them out, and making – you can get 360-degree coverage by placing them in certain areas. And so that's – that's what the Aegis portion will be. So it will not be a deck house. It will be a command suite with radars located around the island.

And then we challenged ourselves to go mobile, so those radars will be relocatable, which is pretty exciting, and that's really more of a mechanical engineering kind of effort to go do that. We have the technology to go do it, so we'll do it.

And then with IBCS, they'll bring, again, other sensor suites; things like the LTAMDS radar, and what IBCS is doing, you know, with the launching systems, and with Patriot and IFPC and those sorts of thing – Sentinel radars – all that will be tied together. So that's really kind of a quick overview of what that looks like, and there are other capabilities I just won't talk about today that we'll integrate into it.

Dr. Karako:

And you mentioned the mobility piece, but there are some costs – maybe some risks, maybe some developmental risks associated with the both mobile radars and launchers. Is that fair?

Vice Admiral Hill:

That is fair, and our focus right now in '23 is on siting. And I just have to say this, Tom, right? This is the unfun stuff that nobody likes to talk about, right, but you have to stay within the NEPA process, the Environmental Protection Act, and you've got to make sure that you take care of the island, you know. We just have to do that.

Hard place, though, right? In World War II, a lot of expended ordnance still resides on that island. So when we go in and say we're going to put a radar in an area, well, we're going to have to dig that up, we're going to follow all the naval policies for unexploded ordnance. You've got to do that and set it straight. And it's tough, and then, you know, then laying down all the communication pathways and that on the island, it's a real challenge.

So that's kind of what we're doing in '23 while we are in parallel developing those capabilities – Army is developing those capabilities, and we start our first delivery in '24, so we intend to be on the island with a detect, control, engage string at the end of '24 because that's what Admiral Aquilino has told me I had to do, and so we're geared to go do it. And –

Dr. Karako: So that's phase one.

Vice Admiral Hill: That's phase one, right.

Dr. Karako: And what are the second and third phases' timeline, do we think?

Vice Admiral Hill: So we refer to it as initial deployment, and so we'll do the initial deployment in that late '24 timeframe, and then we're going to continually, incrementally add capability every single year, you know, until we're done. And I don't think that we'll ever be done –

Dr. Karako: OK.

Vice Admiral Hill: – because there's a lot of capability that will mature as we go, there will be changes. We talked about the integration, how we do track management – that will evolve as we go. But that's our timeline. We're going to drop new things every year.

Dr. Karako: So it's 360-degrees, every direction, and it's also – you kind of have to be worried about all the threats at the same time.

Vice Admiral Hill: That's right. The basis of that architecture we described came from not only the intelligence community, but a really comprehensive work by the Joint Staff called the JRICM study, and that's what laid down the threat sets. And then there was an update right before we laid the final architecture down to make sure that we were bringing the capability that we needed on to the island. So, yeah, it's – that's what we're doing.

Dr. Karako: But if you have to worry about all the threats, kind of simultaneously as we heard this morning from two members of Congress – you know, China is doing a lot of the hypersonic stuff – you are building hypersonic defense around the Aegis combat system –

Vice Admiral Hill: We are.

Dr. Karako: – and that has to be part of the defense of Guam –

Vice Admiral Hill: It does.

Dr. Karako: – solution as well. So you've got a couple of contracts out there. I wonder if you could kind of talk to us about what the PB '24 does on hypersonic defense, how you see that going, and what the timeline is.

Vice Admiral Hill: Yeah, so for Guam we're lifting the capability that's deployed today called Sea-Based Terminal, leverages the SM-6 missile – great

airframe, and it can handle high maneuvers, does really well down in the atmosphere. I mean, it's just an incredible weapon, right, so we can't – I probably get a phone call every day from someone in the fleet that says we need more of that missile, right?

So that is today's capability against that hypersonic threat. Again, it kind of started from some of the early maneuvering, fast-flying threats that we saw they were a threat to the fleet. So we started there, and we said we need to get to that broader layered defense and area defense.

So there something called the Glide Phase Interceptor that you will see in the budget that is in its analysis phase right now. We've got two companies in an OTA. They are really delivering on high-fidelity models; we gave them a really tough threat set. It's a very – it's an expanded threat set, well beyond Sea-Based Terminal that takes on some of those acute and – what was the other one? The –

Dr. Karako: Acute and pacing. (Laughs.)

Vice Admiral Hill: Yes – and the pacing threat, right, so yeah – China and Russia. So we're building against that. And that's a – we're ready to transition over to technology development. We had a really great risk review conducted by the undersecretary for R&E. It's called an ITRA, the technical risk assessment, and also have the CAPE analysis that is taking a look at where the budget is.

And so we're addressing that in this next phase that we'll pivot to here shortly. We're just getting ready to go over – we go to the JROC next week and then we have an MDEB – Missile Defense Executive Board after that. And we'll transition over to that hard technical development, and so that's when you start to get into real hardware components and those sorts of things to fly in that environment, while we're also continuing the science and technology to make sure that we can actually operate in that glide phase.

Operating in space is different than operating down low in the atmosphere, different when you are on the edge of the atmosphere where these things glide. And we'll deploy that first in the Sea-Based, and then we're also in parallel looking at what we can do for forward-deployed air bases and Army maneuver force.

Dr. Karako: So your acquisition strategy for GPI – I know you've mentioned you're going to the JROC and such, but you've talked – and I'll skip ahead a little bit to the NGI – you've talked occasionally about awarding two



contracts for NGI going into production; you know, if the threat warrants it, things like that.

Vice Admiral Hill: Sure.

Dr. Karako: Is that something you ever think about for GPI, given the gravity of that threat?

Vice Admiral Hill: Yeah, so let's all go back to why the department wanted us to carry two. So we started with three and then we did do a down select very early in the concept piece, right, because if you have a set of requirements and they are not being met, well, then, that's the criteria for down selecting to two, right? So we're with two today on the Glide Phase Intercept program for hypersonic defense. And we'll carry those two, and then we'll get to a preliminary design review.

In that program right now the acquisition strategy has a down select happening at preliminary design review. So that's a little bit different from the Next Generation Interceptor, which is for ballistic missile defense. Two companies now, firm development contracts, heading towards preliminary design review, so they're in a different stage of maturity. And that one is funded for two all the way through critical design review, and then the acquisition strategy has a down select there.

But what I mean by opportunity, it doesn't take away the decision space of the department to say, we just should carry two all the way through flight testing and in production.

Dr. Karako: For GPI.

Vice Admiral Hill: Right. So we'll go back to the – what is it – John the Baptist of, you know, weapons and inventory.

It could be that Honorable LaPlante and others in the building want us to carry two and have dual production lines in the world that we're in. I don't know yet. But right now the acquisition strategy on Next Generation Interceptor for ground-based has us down selecting at CDR to currently add to the inventory. It's about adding to the inventory. You could say I want to replace older inventories – lots of flexibility there.

So for Glide Phase Interceptor – probably too early to say, you know, again, because of where we are, right? We're in that concept portion moving to hard technical development before we go into a full-up let's

pull this together into an actual capability. We're not there yet, so lots of decisions to be made between now and then.

Dr. Karako: So the – let me just ask – staying on GPI for a minute – the timeline relative to the hopeful availability of the sensors that it's going to tell it where to open its eyes over the horizon.

Vice Admiral Hill: So one of the reasons we didn't want to hitch ourselves to the Hypersonic and Ballistic Tracking Space Sensor is we had the existing capability that Sea-Based Terminal uses today. You can have a ship up forward, you can have existing space sensor, land-based sensors that give you the track early, and then that allows you to use Engage on Remote or Launch on Remote, or organic if you can see it, right, from a singular ship.

So that's our first instantiation, is assume a picket ship forward that can see it that sends it back to the shooting ship. And then space-based capability comes on line, they will obviously go leverage that. So we're designing to the quality of service and the latency of what will be in space. We already know what that is for a forward-based ship and what we can get from C2BMC from land-based sensors.

Dr. Karako: But that's really important and I don't think it gets said much – is GPI, as you are approaching it right now, isn't – doesn't necessarily need to wait around until the full space sensor –

Vice Admiral Hill: No, it doesn't.

Dr. Karako: – constellation.

Vice Admiral Hill: Yeah, I view it as the next logical step, as a complementary capability to Sea-Based Terminal. Again, if you kill it in glide, then your terminal battle becomes a lot easier. And so it's a layered defense approach. It's just the next layer for what we're already deployed with today.

Dr. Karako: So on HBTSS, you've been emphasizing lately – I can remember if it was testimony or some other talk you did, but you really talked about your program – HBTSS, Hypersonic and Ballistic Tracking Space Sensor – is the only – the only space-sensor program among all those that are out there for missile warning, this, that, and the other thing – but the only one that's focused on fire control quality data.

Vice Admiral Hill: Right.

Dr. Karako: What is that, and talk about the only-ness that you are emphasizing.

Vice Admiral Hill: Yeah, last year during testimony Senator King picked on me for using the term “fire control,” and he goes, I don’t know what that is.

Dr. Karako: (Laughs.) I remember.

Vice Admiral Hill: And I said, well, it’s weapons quality data for targeting, right? You need to have that, and what really means is, in time and space you understand what the error is around the position and velocity of a flying target, right? You need to be as exquisite as possible so that when you launch a weapon against that, you are going towards the right thing, right? You don’t want a fly-by, right; you want to kill it, right? So if you don’t have that level of data coming down from HBTSS, then you are not at the fire control level.

You can’t get that generally from a tracking sensor, right, so a tracking sensor will be a wider field of view, right, so it’s trying to do surveillance. So now you’ve got the queuing to HBTSS that allows you to get to that quality of service, latency position and velocity – you know, what you really need to do to put a weapon on target.

You’ve just got to remember what we put in a VLS on a ship. You know, how big is that? Well, that’s a 21-inch missile – that’s it. So if it’s looking over here, it’s not going to hit the target, so it’s got to be on that target – and I’m looking at Dave right now because I love him.

And so there you go.

Dr. Karako: So the more narrow field of view –

Vice Admiral Hill: Right.

Dr. Karako: You’re building the payload; you’re not building the satellites.

Vice Admiral Hill: That’s right – just building the sensor.

Dr. Karako: You emphasized that you’ve got the combined program office, and you’re working very closely with Space Force and all these other folks, but their attention seems to be on the wide field of view.

Vice Admiral Hill: Sure.

Dr. Karako: And so if the HBTSS payload doesn’t continue on, frankly the rug gets pulled out of the active engagement part of this piece.

Vice Admiral Hill: It makes it harder because you really need to be in space looking down on the globe when you have a globally maneuvering threat. You can’t pick those up, due to field-of-view issues, with radars

either at sea or on land, right? We need to be in space. Everyone agrees with that.

Everyone will also agree that we understand the requirements for missile defense better than anybody, right? It's what we do for a living. We're not space operators, we're not a space organization, so we need to work with Space Force to deliver that sensor, meeting the requirements that we need, and then Space Force will proliferate.

It's a lot like when we delivered the Ballistic Missile signal processor to the destroyer fleet, right? We tested it at sea, we proved it out, and then Navy picked up the bill to proliferate across the destroyer fleet – very similar story.

Dr. Karako: Yeah, but the – that is what you do. That's the mission that you do.

The Space Force has historically had a little different culture –

Vice Admiral Hill: Sure.

Dr. Karako: – focused on warning, focused on other things going on up there, but the engagement piece, not so much.

You know, the head of Space Command, General Dickinson, former – well, once an air defender always an air defender – excuse me – but how would you kind of characterize the relationship there, and kind of the connectivity of keeping that mission alive?

Vice Admiral Hill: Yeah, I think we have very strong relationships across all of those, right, so Space Command is now taking over the Missile Defense Advocacy under a unifying command policy that will be released, you know, sometime soon. And we've been working this transition from Strategic Command over to Space Command.

So Space Command understands, and in fact, General Dickinson is not shy about saying what he needs or expects from our program, so when I mentioned the Long Range Discrimination Radar earlier, it was, hey, I don't want just a radar that is a one-trick pony, you know, for doing ballistic missile defense; I want you to also help me track space objects. So we have incorporated that capability into that radar, as an example.

On the Space Force side, great relationship. You mentioned the Combined Program Office with Space Systems Command, with Space Force and MDA. It's so that we can have missile warning, missile

tracking to missile defense and make sure there is no overlap or duplication of that work because we need that whole chain to work for the missile defense mission, and many other folks – depending on what their missions are – need a very similar chain.

But our fire control requirements are well understood within the Space Force, and we're relying on them to proliferate.

Dr. Karako: Great. You hit NGI. You also mentioned SLEP in your opening remarks there. You know, SLEP – Service Life Extension for the GMD program doesn't – isn't maybe the most exotic sort of thing, but it's important.

Vice Admiral Hill: It is.

Dr. Karako: And we're coming up on 20 years next year that the first GBIs were in placed. So, you know, what's going on there that perhaps – that is important that is not getting the attention it deserves on SLEP?

Vice Admiral Hill: What's not happening in SLEP?

Dr. Karako: What is happening?

Vice Admiral Hill: Oh, yeah. So Service Life Extension – you had that on every major weapons program, right, and when you have a strategic capability like Ground-Based Midcourse Defense, you need to make sure that you are upgrading very simple things, right?

So, for example, one-shot devices in a booster – you need to check the propellant to make sure that that solid propellant doesn't have cracks in it, right? You want to make sure that your threat library is up to date – and I'm looking over at Tay Fitzgerald, who works very hard on this problem of taking older kill vehicles and making sure they've got updated processing so they can deal with the new threats of the future – update the Seekers, right?

So we send those back to Raytheon, and they rebuild those, right? We send the boosters back to Northrop Grumman; they go work those. We send the whole thing back to Boeing to put it together and put it back in the hole.

So we're just marching right through the oldest missiles, and through that process we can gain additional capacity, so we're pretty excited about that – like all programs, somewhat hardware poor, right? Sometimes you don't get the sparing money that you need –

it's the first thing that you cut in a budget, right – sparing, logistics and training. And that's a heartbreak, right?

But I'm really excited about this program now because we've reinvigorated that – through that Service Life Extension Program across the whole system. It's really critical to keep that program alive and make that it's ready for the Next Generation Interceptor, to include missile fields that we're building out to make sure we can – that we've got them, and we've got flexibility geographically to move them around. So, yeah, I'm pretty excited about it.

Dr. Karako: A couple of years ago you announced you were going to kind of completely change the contract structure for all this. NGI was a piece of that, but so were – you alluded to – I think to some of the sole source, but to ground weapons system and Systems Integration Test and Readiness – SITR.

Vice Admiral Hill: Yeah.

Dr. Karako: You've awarded those now, or we're on the other side of that?

Vice Admiral Hill: Yeah.

Dr. Karako: What's going on there?

Vice Admiral Hill: Yeah, so first, you know, every program's got an acquisition strategy, right? It just so happens that 20 years ago there was a lead systems integrator, right, and so that has served us well. We've delivered a fleet, and I need that team to stay in place to take care of that existing fleet, right? Can't let them go, can't let them atrophy.

So that's a hard balance when you move into a new strategy that now says, well, the government really needs to own that technical baseline; that's where the Systems Integration Test and Readiness contract comes into play. We need to maintain sole source ability to take care of the existing EKV's, for example, and then we need to move forward with the Next Generation Interceptor.

So I think the contract structure that we've laid down, although it may sound complex, it's pretty much the way a lot of programs operate. We've got to worry about sensors. That's not part of that contract piece, but that's all part of the Ground-Based Weapon System and what comes in. You have to have a really tight integration to make sure that the readiness and the testing piece is covered down on, right, and then you have to have the weapon itself. So it's a – it's a nice – it's the acquisition strategy that we have for

today. Maybe we'll change it in the future, but it's going to carry us forward to the Next Generation Interceptor.

Dr. Karako: I just noticed a question has come in from Marcus Weisgerber, and before we get any further away from Guam, he wants to know that – you've got, what, \$147 million, I guess, in INDOPACOM's UFR list. What's going on with that? Why wasn't that in the budget in the first place?

Vice Admiral Hill: Yeah, it's always – so timing for me in talking about Unfunded Priority Lists is a little bit awkward, right, because we have not released ours yet. I know the combatant commands have put those on the Hill, but I would say that not having read the combatant command's INDOPACOM's Unfunded Requirement List, I think what that is, if you take a close look at it, it's a priority area for the INDOPACOM commander. I just don't – I'm not ready to talk about that.

Dr. Karako: Gotcha. (Laughs.) OK, all right.

Vice Admiral Hill: But I appreciate the support from INDOPACOM and especially from Congress if they consider it.

Dr. Karako: Indeed. THAAD – you know, lots of interest there and, you know, other foreign partners – the Kingdom of Saudi Arabia will soon have as many batteries, or maybe more than the United States is operating.

Vice Admiral Hill: Right, right.

Dr. Karako: UAE had a combat engagement using a THAAD, and yet, as we were talking earlier, THAAD number 500 is the same as THAAD number one.

Vice Admiral Hill: Yeah.

Dr. Karako: So that program has had a lot of block or incremental improvements. So how are you thinking about that? Is the missile – there's been a lot of software updates and things like that in the radar, but is the THAAD missile kind of ready for an evolution?

Vice Admiral Hill: It is, and part of what we wove into the Saudi Arabia case was to leverage an upgraded front end, and that will be incorporated in the U.S. fleet when the time is right to go do that. So we're excited about that lift that you get. Any time you have a foreign military sales

customer, it helps the U.S. production lines, it helps with our unit costs and those sorts of things. And it helps you to deal with obsolescence and other things that are going wrong in a program – or that are a risk to the program just from aging.

So we'll get a lot of lift, and those are great partnerships, and it will help the U.S. fleet on the THAAD side of the house.

Dr. Karako: What's kind of the timeline for the Eighth and Ninth Batteries there?

Vice Admiral Hill: Yeah, so we – the Eighth Battery, I think, is in '25 on the timeline. I don't remember beyond that.

Dr. Karako: It's coming.

Vice Admiral Hill: The Eighth Battery's coming. And that will be a fully up-gunned version of the radar, for example. So right now, most of the deployed fleet is in a gallium arsenide – for you geeks out there.

Dr. Karako: There's a few.

Vice Admiral Hill: Yeah. OK, good! So the new radar will be fully gallium nitride. We're starting to incorporate gallium nitride, you know, front ends in the receiver/transmitters into the existing fleet today. I wish we had more funding in the program to fully outfit all the existing THAAD batteries. The Army is constantly saying, Jon, when are we going to get gallium nitride? Well, we want to deliver that, but it's on a repair/replace kind of process, so over time we're replacing that. What's really cool is we've got some great engineers that know how handle a mix of gallium arsenide and nitride with the front end of these radars.

So we're modernizing them over a period of time. I would like it to go faster like all of us do, but it's where we're at, and I think it's going to be good for the fleet, and it's good for the Army. It gets – it helps us with that crazy threat that's coming. It's going to give us more power and sensitivity, which really matters.

Dr. Karako: The crazy threats – we had the emerging threat and the – now we have the crazy threats.

Vice Admiral Hill: Yeah, I just wanted to give you a technical term.



Dr. Karako: You also emphasized in your opening the – you said we’re going to take the JION capability of plugging the M903 Launcher into the THAAD command and control and get that out globally.

Vice Admiral Hill: Yes.

Dr. Karako: What’s kind of the timeline to be able to have that flexibility?

Vice Admiral Hill: Yeah, so it’s a great partnership with the Army, so when we did it, it was really based on a Joint Urgent Operational Need, right, out in INDOPACOM. And what they were really looking for was that flexibility in a constrained space, for example, so separating the launchers really allows you to put things forward, keep the fire control back. It allows you to handle back-range shots and things like that. Being able to shoot the right missile at the right target, also important. Taking advantage of the TPY-2’s capability – very important – and so by doing that – we kind of thought, hey, we’ll do that for that very specific area there, and the Army came in last year, I think, and said, hey, could you put it in your budget to do global release on it? And we said yes – again, reflects a great, you know, partnership with the service because that’s really how we do things for the combatant commands. We deliver through the services, and THAAD is an Army operated and sustained system, and we work with the Army to upgrade it. And GaN’s part of that story. THAAD-Patriot Integration, part of that story. And we want to give as much flexibility to the Army as possible.

Dr. Karako: Yeah. So probably your favorite topic of the past couple of months –

Vice Admiral Hill: OK.

Dr. Karako: – the balloon – the Chinese balloon issue. When Mike McCord rolled out the budget, what, last – two weeks ago, whenever that was – he got a question. Where’s the balloon defense piece? And he says, well, as a matter of fact, there is \$90 million in there to kind of go back and fix the data filters on NORAD for looking for things that don’t look like a bomber that are flying in different configurations.

And so where I’m going with this is, you know, different kinds of threats –

Vice Admiral Hill: Right.

Dr. Karako: – cruise missile threats. In fact, Mike McCord immediately went there in response to that question.

Now homeland cruise missile defense has now been assigned to the Air Force as the lead service on that, but you all – your agency and working closely with NORAD and NORTHCOM in previous years have done quite a bit of work on that. And so I wondered if you might be able to talk a little bit about the kind of work that you did and that you handed off to the Air Force, recognizing that they've got the lead on it now.

Vice Admiral Hill:

Right, so one of the things we do within the agency is we're very sensitive to timelines, very sensitive to when the threat is either going to emerge or if it's already here, right? So we get throttled within that timeline, and we go back to roots on being capability based.

So for the cruise missile defense mission, back when General Shaughnessy was first concerned about it, and now General VanHerck, we said, well, in order to move quick, we've got to roll with the sensor capability that we've got now, we should roll with the weapons capability we have now, and roll with the command and control capabilities that we have so we can deliver it quickly.

It's a very complex problem, though, because you start – it's not like a Guam; it's different, right? If you decide that you're going to weaponize every state in the union, right, they're all going to be different, you know – where you place them. It is the Guam story again in terms of, you know, environmental, those issues – are you protecting, you know, what critical assets we needed to know and understand what that was.

So we did a lot of those laydowns. We did a full air budget analysis – for your geeks out there – on the sensor capability, what it would take to get, you know, long-range looks; how you get that to the fighters as maybe the first wave of defense; and then how you handle from a point defense and maybe beyond that, depending on what you are trying to protect. It's just different based on which part of the geography you are working with.

So we've taken all of that. We've provided that to the Air Force, and we were asked by the department to continue forward with a limited-area defense demonstration that we're doing that would really tie together Navy and Army assets together to defend the National Capital Region, as an example.

So we've come through the first hardware in the loop. We've got another one coming up; we're learning from each one of those, and then we'll go do the live flight test on that in the August timeframe. All of that is being observed by the Air Force; all that data goes to the Air Force.

We'll continue to work with all the services. There are some, you know, pesky things like Combat ID that just aren't resolved everywhere, right, and so as you work –

Dr. Karako: A lot of aircraft on the Eastern Seaboard there.

Vice Admiral Hill: Yeah. So as you work JADC2, you have to worry about Combat ID, you got to worry about track associations, you know, depending on what approach you take in that integration world. So we're going to continue to work that area.

Dr. Karako: Gotcha. This morning we heard Mr. Lamborn – or Mr. Lamborn and Mr. Moulton talk about kind of the non-kinetic – the promise of various non-kinetic means of kill. You've talked about, you know, HPMS, short-pulse lasers, RF, but also I've heard you talk lately about electronic attack and things like that.

So how do you think about that, recognizing that, you know, there will always be a kinetic interceptor kind of role for this stuff? But how do you think about that world? It's something that MDA, at least publicly, has not been doing a whole lot on lately – lasers at least kind of taken out and done at the R&E level. But how do you think about that suite right now?

Vice Admiral Hill: Yeah, I think about it from the standpoint of looking at any threat trajectory and where can we interrogate that threat, either effected through some high-powered continuous wave laser – maybe it's a pulse laser, maybe it's a high-powered microwave. They're all different. I kind of round them all under directed energy, right? Electronic attack could be a part of that, as well. And where is it – where is it best placed, right?

A lot of it will be geographic, right, if you're trying to do, say the boost-phase mission, right? We've got to do more experimentation in that area to see how well we could do if you only see it after it has emerged, right, and not worry about knowing the exact launch point. Where would you have to be? Do you need to be in an aircraft? Can you be on a ship? Do you have to be on a land-based site?

So we're working through where it would make sense across that whole battle space. What can we do if it's coming in on you, right – can we dazzle a seeker, as an example? Can we march it off of its target? So all of that work is part of that realm. I think it's a very promising part of the future, and I would love to live in a world to where we could, you know, first be complementary with that sort of capability with our live interceptors and, you know, I'm not convinced that, anytime soon, that would replace hard kill, but I think it has always been a complementary part – you know, back to my Navy heritage, right, we throw chaff up, right – that's one way to

deal with things, right – you know, try to fry something, you know, by using a high-powered beam on it; you know, that's part of the equation, too.

And we're getting demand signals for lots of things. Air Force has asked for help on, you know, how we can defend an air base, how we – you know, the Navy has asked us, hey, what could we put on the fantail of a destroyer, for example, to carry that stuff forward? So a lot of experimentation, investment in the technology.

We need to continue working at the R&E level to ensure that we're scaling up power for, you know, continuous-wave, high-energy lasers, for example, and then, you know, scale down their size and weight so we can have the flexibility of putting them where they need to be.

Dr. Karako: Gotcha. I feel like the, again, renewed interest in air and missile defense that the Ukraine conflict has kind of instigated – lots of conversations going on in Europe and lots of other places. And so I wonder if you might want to spend a couple of minutes just talking about your important relationships with so many allies – Europe, Middle East, Indo-Pacific – in terms of the missile defense mission.

Vice Admiral Hill: Yeah, those relationships are incredibly important because what it really means is offsetting U.S. forces if you do it right. So our relationship with Japan – if you look at the Aegis program and the Standard Missile programs that go into Japan, it's their national missile defense, right? So that's an important relationship to have. Having them be absolutely interoperable with U.S. ships is just a big lift in that theater, right – the work that we do with South Korea, the work that we're doing on Australia, the work in the Middle East, as you mentioned before. I'll tell you – the work, you know, helping Israel, right – you know, half a billion dollars of our budget goes to Israeli missile defenses every year, so they have a layered defense to protect their country.

It helps that the combatant command decide, you know, when do you need to augment that with U.S. forces, and if they can carry the load on their own, that is fantastic because we're very short on assets total, right, so we can move that asset, if it's a ship, someplace else, as an example. So that's really the power and the lift of it.

It's less about – I'm always asked, you know, is there a technology transfer? That's not the issue. The real issue is let's get the capability there. I don't care who builds it, right, let's integrate that stuff and

make sure that we can, you know, freely pass information back or use that, you know, for us. So it's – you know, they're very valuable partnerships, and it is growing every day. The demand signal is high.

Dr. Karako: And you announced a new partnership with Israel, what, last year I guess – the Arrow-4.

Vice Admiral Hill: Right.

Dr. Karako: What's that about?

Vice Admiral Hill: It's the next generation of the current Arrow-3 that's deployed today – gives them, you know, much more autonomy. It's very similar to what we're doing with the Next Generation Interceptor. The more autonomous you are in flight – and you can never be totally autonomous, right, because the threat is constantly moving and you don't want to have to put all the fire power in the front of an expendable missile. But if you can lessen your reliance on some sensors, then that's a good thing, and that's what Next Generation Interceptor does, and that's what Arrow-4 is going to do for the Israelis. It will allow them to have more flexibility in their forces.

Dr. Karako: Fantastic. So you've now served as director for a number of years – I guess since the summer of 2019.

Vice Admiral Hill: Right.

Dr. Karako: I was wondering if you wanted to close out by kind of reflecting on how things have changed in the past couple of years, but also, the previous panel, you know, talked about Reagan's vision for SDI. And, you know, Reagan was, look, I don't know if this is going to happen in my lifetime, but we have to get started.

Vice Admiral Hill: Right.

Dr. Karako: And it didn't, right?

Vice Admiral Hill: Right.

Dr. Karako: It took a little while for a lot of this stuff to be realized. And so, kind of looking back the last five years or change that you've been at the agency, but also, what's your vision for 10 years from now when we come to the 50th anniversary or whatever. What is your vision going forward?

Vice Admiral Hill: Yeah, I would say, you know, for me it goes back to – so I served as a commander in the Missile Defense Agency. I served as a captain in the Missile Defense Agency, and then I came over to be the deputy back in 2016 – served under Vice Admiral Syring, served under Lieutenant General Greaves – love them both, totally different leaders, totally different challenges, right? None of them are comparable, right? We all live in different times, but we learn a lot from each other, right, so I like to keep in touch with our prior directors because it's just interesting to trade notes.

And you can see the change. It's all driven by the threat. All of it is driven by the threat. It's why I start every brief with a threat discussion because it's so – the evolution is so fast.

So where I see things going in the future, if we come back in 10 years, we will start integrating more and more of that high-end technology that you mentioned before. That whole range of directed energy capability, I believe, will be deployed in some fashion or another, right, so that's one thing to look for.

The next thing to look for is how we clean up the environment, and what I mean by that is the electronic attack and the protection environment, right, so that we are resilient to jammers, right, because we know that they are going to jam everything they can when they are coming in, right, and, you know, I don't want to waste missiles, and I don't want lives to be lost because of that. So that's really sort of the technical view of where it goes.

You know, far term? You know, I don't know, Tom. It really does come down – I've been surprised, you know – if I look at where the threat space was back in 2016 versus what it is now, it is mind-boggling. And I think you've been over to our war room where we've actually tracked, you know, numbers of tests done, and it's literally a toilet paper roll. You can just let that thing go, and these are all the tests that have been done over the last three or four years, and it's stunning.

And so, you know, I don't like to compare numbers but, you know, we don't have a toilet paper roll.

Dr. Karako: (Laughs.) On that note, well, look, we really appreciate your taking the time to come over here and having this conversation, but also appreciate your leadership for the agency all these years. So thanks very much.

Vice Admiral Hill: Thanks, Tom – yeah, I appreciate that. All right, it's great being here.  
Thanks a lot. (Applause.)

(END)