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TRANSCRIPT

ONLINE EVENT

Emerging Technologies & Long-Range Strike: A Conversation with LTG Neil Thurgood

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FEATURING

Lieutenant General L. Neil Thurgood

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CSIS EXPERTS

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Dr. Tom Karako: Well, good afternoon and welcome, everyone. I'm Dr. Karako from the International Security Program. I direct the Missile Defense Project here at CSIS. Today, we're talking about the Army's Rapid Capabilities and Critical Technologies Office, or RCCTO, what it does for emerging technologies and its portfolio of air defense and long-range strike prototypes, but also its plans and authorities in support of the Army Modernization Strategy and the National Defense Strategy.

We've got a healthy online audience today and I want to encourage folks that are watching to please submit questions, and those will come from the event page to my tablet here for our speaker. We're very glad to welcome Lieutenant General Neil Thurgood, who has, since March of 2019, served as the head of RCCTO. But his formal title established by Congress is the director for hypersonics, direct energy space, and rapid acquisition.

We're going to walk through several pieces of that title here in a bit. But he previously served as well as the director for test for the Missile Defense Agency and was most recently deployed from 2017-2018 in Afghanistan.

So, General Thurgood, welcome to CSIS. I think I last saw you at a baseball game in Huntsville, as everyone gathers there. We've got a lot to cover today, but I thought perhaps you might kick us off with just an overview of your portfolio and some of your priorities.

Lieutenant General L. Neil Thurgood: Great. Well, thanks, Tom.

First of all, thanks for having us today, allow us to talk a little bit about the Army and the Army Modernization Strategy. It's a super great time to be in the Army. We're super proud of our soldiers who are deployed worldwide, over 130,000 of them in multiple countries doing the things that our nation has asked us to do. So we're super proud of them and I would ask everybody to keep them in your thoughts.

It's a great day in our Army as we think about how to modernize, coming out of 20 years of the global war on terror into great power competition, as it's described in the National Defense Strategy. In order to do that, we have to change how we fight and think and how we organize ourselves to accomplish that task, and to be successful at that the Army historically has stood up unique organizations to help them behave differently, to help us do things differently, and there's multiple examples of that from World War II through Vietnam, through the global war on terror, and now today.

The RCCTO is designed to be one of those unique organizations designed to change the behavior of how we approach the modernization material part of our Army. And so, if you think back a few years ago as we were coming out of the global war on terror, the Army stood up the Army Futures Command under General Murray, and the Army Futures Command was really important and unique in that it established the future warfighter thinkers along with the S&T community – the science and technology community. So the people that think about how we should fight the next war, with the S&T community, who should be inventing and demonstrating ideas that can help fight that next war.

What we needed was an organization that could take that invention and demonstration from the science and technology world and make it prototypes, and prototypes is a word that a lot of people use, and I want to describe how we see that from our battle position.

The S&T community, they spend early 6.1s and 6.2 dollars, some 6.3 and 6.4, and they try an idea, right. Does it – does the idea even have legs? It might be a subscale model. It might be a piece. It might be a component or something like that, and we call that invention and demonstration, and they're really good at it. Our labs across the U.S. and our labs and our industry partners are really good at that idea.

What happens is sometimes we lose the sauce – secret sauce – of getting it from the labs to our soldiers. Sometimes that's called the "Valley of Death," if you've heard that term before. So our organization is designed to overcome that. Take the good ideas wherever they are – it doesn't matter if they're in the labs, if they're in industry partners – and prototype them.

Prototyping is defined as a combat piece of equipment at the unit of action level. It's not one of a thing. It's a pick the combat unit you want, whether it's a platoon, a company, a battalion, a brigade, and make a set of it, and give it to soldiers and let them see if it does two things.

Number one, is it safe, and number two, can it accomplish the mission we asked it to do. So in long-range hypersonic weapons, for example, we have an offensive weapon to kill targets. Will that weapon system kill that target in a prototype state?

And the reason we do that is we've learned a lot from business. We can do things at pace very quickly before we spend a bunch of infrastructure, a bunch of money, in a formal requirements document process – we call that the JCIDS process – before you spend a bunch of money in DOD 5000 going through milestone A, B, C, that takes you multiple years.

If we want to keep pace with our adversary, then we need to behave a little bit differently and this organization was designed to do that. And so it's really important to recognize that this idea, this construct, will allow us to demonstrate outcomes to see if they're successful before we invest years and money into some product and then kill it because, at the end of the day, it was old technology, it took too long, or it didn't do the thing that we wanted it to do.

Our team is organized very small. Very small. I'm a small teams person. We have a very flat organization, and I'm super proud of everything they've been doing. If you come to my organization, people are working extremely hard. They look tired for a reason. Super proud of them and all that they're doing, and so we're really glad to be part of the modernization construct of our Army.

Dr. Karako: Great. Can you talk a little bit about – staying there at the – kind of the fundament of – as you shepherd through the valley of death, your charter, who you report to? You know, where do you get your missions from?

LTG Thurgood: Right. So if you want to behave differently then you have to align an organization and the authorities to behave differently. If you try to behave differently with the old set of rules, you don't really get the outcomes that you desire. And so when the secretary asked me to stand up this organization, we talked a lot about the authorities and how we report and who we report to, that we need to do that.

So let me walk you through a little bit of that, if that's helpful. So our organization is chartered by the Secretary of the Army and reports through the Secretary of the Army, and in that we have what we call the board of directors and that board of directors consists of both sides of the headquarters of the Department of the Army staff – the secretariat side and the Army staff side.

So on the secretariat side, we have the Secretary of the Army, the Undersecretary of the Army, and the Army acquisition executive, and that's where I get my Title 10 authorities to spend dollars – the resources of our nation – for material outcomes.

On the right-hand side of that is the – our chief of staff of the Army, General McConville, General Martin, our Vice, and the AFC commander, which right now is Lieutenant General Richardson. That's the mission and requirements and the priorities that we execute to. So those six – we call that the RCCTO board of directors – assigns us our missions.

I do not have the authority to make up my own missions. Anything that I do, I must go to the board of directors and get their approval, and that's really important. And, in fact, they asked me if I wanted those authorities. I said, absolutely not. I only want to do the things that that group of six people say are the priorities for us to execute. Nothing else. And so to do that, you need a relatively small decision cycle. So between me and the secretary it's just the board of directors, and then I duplicated a very similar structure below me. And so it's organized very much like what business would call a venture capitalist construct.

I don't have a standing Army waiting for a mission set. That's not how we organize. It's not how we spend the resources of our nation correctly. The board of directors, the Secretary, assigns me a mission. I aggregate a team that I think is the right team for this mission set, we execute the mission, and then we disaggregate the team.

So I have a very small core. Imagine, it's just 78 people. The rest come and go as we get mission sets. And so that allows us to move fast. A very flat organization, and that's how we make our decisions quickly. We live on a few fundamental constructs in our organization that, I think, are the hallmark of the success.

So when we get our mission set – and I'll just use hypersonics as an example – I don't have a team. So I immediately establish the construct of – I bring all the S&T people from whatever the organization they came from, the people who invented the technology, into my organization.

So now I have custody of the knowledge of the invention and how the fundamental technology works. But S&T community doesn't know how to build more than one of a thing. That's what they do.

I then wrap around that team acquisition professionals who know how to make production lines, who know how to build log supply, who know how to build more than one of a thing, who know how to design in reliability and sustainability for our soldiers. I assign each of them a contracting officer so we can move quickly in our contract actions.

Unique to this, I also assign to that team a test officer from the Army Test Command. So it's matrixed into my organization from the Test Command so that we don't skip any steps in testing, and that's really important

because that's how we determine it's safe enough and will do the mission we want it to do.

And then anticipating success, at the same time I stand this team up I bring what we call the transition team from the gaining PEO, so the gaining program executive officer. For hypersonics, that happens to be PEO Missiles and Space. So we don't start the transition at the end. We start the transition on day one of the program.

So it's seamless now. We've built a seamless transition from the S&T community to the prototyping community to the program of record community, and that group works for me until we're done with our mission set. And then when I'm done, I transfer everything to the PEO. I don't keep the team. I don't keep the money. Everything goes, and then I'll get another mission set from the board of directors to that outcome.

That allows us to move at pace. It allows me to pick the right people, and then the key to this that I need to mention here up front is on that transition team is also our industry partner. So I require industry to sit with me – a decision-maker to sit with me, come to my staff calls. They see all my budget documents.

We are a hundred percent transparent, and what we found is transparency equals speed. You can imagine in a complex mission set like hypersonics where there's five or six key industrial partners, at first they were very uneasy with this. You know, they're competitors in some situations and teammates in others. And so I literally had to get the CEOs all in a room. Here's the rule set we're playing by.

If you need to sign NDAs, sign them. Do whatever you need to do. We're going to sit in a room and we're going to be transparent. A little storming and norming, as you can imagine, but it is a super model if you want to coalesce a team toward a specific outcome for a specific reason and build the trust in that team to move at pace.

Dr. Karako: So you mentioned the S&T. You mentioned the PEOs, the transition for that particular program. But can you say a little bit more about your relation to Futures Command and the CFTs therein?

LTG Thurgood: Yeah. So that's a great question, Tom.

The Futures Command, again, the big brain war – what's the future fight like? The CFTs – the cross functional teams – were stood up to help

execute the six major priorities of the Army Modernization Program. Those six priorities are seen through 31+4 signature programs. So the CFTs, the very first one is the long-range precision fires CFT. General Rafferty – John Rafferty – is that, and two of my programs, so those one and two priorities, and PrSM is the third priority in that program.

So we have a direct relationship with the CFTs and we invite them to all of our meetings. Everything we do we bring soldiers in early. For example, in our directed energy weapons systems we have built one vehicle. We have over a thousand hours of soldier touch points just to design the vehicle. In a traditional model you would never do that. You would bring them in much, much later in the process.

So the CFTs are critical to help the experimentation arm of the Army. That's why the S&T community belongs to AFC. It's why the big warfighting thoughts are there. The CFTs take those priorities and help manage the execution of those priorities and they write a document called an abbreviated CDD – capabilities development document. It's not a traditional DOD 5000 JCIDS document. It's a document that defines the characteristics.

So let me describe how powerful that is, and it seems like a simple thing but it has huge implications. Traditionally, we would write in the joint requirements process – the JCIDS process – a CDD – a capabilities design document – with thresholds and objectives, and that's written without really much input from the science and technology community, from the material community. And so the great warfighters that have been doing that in the past have made their best attempt to define it must do these things or we don't want it. We don't want it.

We actually don't know if it can be done but we know we want it to be done and we make those thresholds. And we have – the Army and the Navy, all the services, have many examples where a threshold critical capability was not met and we killed the program. Five years into it, a lot of resources later, we killed the program.

With the Army Futures Command, we've actually realized – it's just phenomenal – that we actually may not know the full answer. What we know are the characteristics we want it to be. That's a very powerful construct in that now we're not linked to it must do this. Here's what we want it to do. Now let's see if we can go find the technology to

make it do that. That's a very, very powerful concept and that's what we live with, right.

So everything I do I have characteristics. For example, for Hypersonics, the mid-range capability, you must be able to move this on a road. That's a characteristic we have to have. You must – the characteristic must be moved by C-17. And so now I can find the technologies that are available to meet the mission, and here's where the power really comes in.

I build the prototype unit. It is just prior to what we would call milestone C in a traditional program. So when I come out of this, we actually – the Army, if we decide to move forward, the requirements community now can write a threshold that we know can be built. We know the technology exists. And then we make the objectives of that document what we want it to become beyond the technology.

Now for the first time the Army with the Futures Command, our organization, and all the other elements that support that – the community, the enterprise – we realized that we can start this without knowing the perfect answer. It's OK. We can figure this out as we go and we can move the pace of technology, and it's a really powerful construct.

Dr. Karako: Great. Well, it's a construct in the discussion about rapid capability development that has been going on for a number of years now since this kind of realization that history's returned and such. But the other services are doing similar, right? And so could you talk a little bit – you've talked about your relationship to all these other entities within the Army. Talk a little bit about what you're doing with, say, Air Force and Navy rapid capability analogs.

LTG Thurgood: Yeah. So another great question, Tom. It's – another one of our constructs is never duplicate. If somebody else has it, plagiarize it. Never make a new contract if you don't have to, right. Traditionally, we like to own all that stuff ourselves. We don't have to have that behavior. If the Air Force has a contract, I'll use that contract. I don't need to own a contract just because I'm an Army guy. If they have the technology I'll take it, and we have several examples and I'll give you some examples.

At the OSD level, they have the Strategic Capabilities Office, right. They're an S&T kind of organization. They try things, and the MRC is a really good example – a mid-range capability – of overcoming the valley of death. So the SCO has invented the technology. They have built one of a thing, and

we've now taken that technology and matured it into a prototype battery. It's a really good example.

So I didn't have to go make that up. Somebody had something that met the requirement. Let's go use that thing and move quickly. That's a – it's a very nonparochial behavior. We have the DARPA Labs, the Sandia National Labs. They're doing great work. I don't need to reinvent that work.

I need to use that work to accelerate at pace. And sometimes, I think, traditionally, we have – we may have the not invented here syndrome, right. It can't be as good as we're going to do it. Take what people are doing and make it better, and that construct works really well in many of our programs.

Dr. Karako: So before we move off all the organizational stuff, I want to tell you a little bit about the hypersonics board that you chair. There's, again, multi-service kind of cooperation.

LTG Thurgood: Right. So in hypersonics the U.S. has been working in our labs on this technology for some time. It's, certainly, not a new technology. We have chosen to not operationalize it, make it an operational capability. OSD has been leading that for some time. Mr. Mike White under OSD, a dear friend and great American, he has been leading that group.

Because it's a joint effort, the Army and the Navy and the Air Force are – and the Missile Defense Agency are all joined at the hip on this technology. So we all signed a memorandum of agreement and there is a governance structure so that we don't duplicate and that we share technologies. And in the case of the Navy it's exactly the same technology, and we can talk about that some more if you'd like.

That MOA creates a three-star level governance process. So it includes the Army, the Air Force, the Navy, MDA, OSD R&E and OSD A&S, and I'm the chairman of that three-star level board and that's where we make sure that our science and technology isn't duplicating. It's making sure that we spend the money on our science and technology for the thing we want next.

So it's a very powerful board and we're all good friends. Johnny Wolfe, my good battle buddy, and John Hill, my battle buddy, we all served together in MDA and other assignments so we have a great partnership. But when we don't agree or we need help or guidance, above us is what we call the

Executive Steering Committee and that is all the undersecretaries of our services.

And so we have a very deliberate decision-making process to make sure that we, collectively, as a joint service, aren't stepping on each other's toes, aren't wasting our resources, and are moving forward at pace. For the Army, we are particularly linked at the hip with Vice Admiral Johnny Wolfe and the Navy. We share in hypersonics the same glide body. We share the same missile stack. It's exactly the same.

We put ours in a canister that we shoot off of trailers. He puts his in a canister he can use off the Navy assets. It's a really good model, and when you have the transparency you can work at pace, and when we have industry involved in that it's very important.

The three-star BOD is a government organization. When Johnny Wolfe and I got together we actually duplicated that on the industry side. So there's an industry BOD that is the three-star levels and the six players in industry and hypersonics, as an example. And so that group meets every quarter. Every quarter we meet without fail, and if there's a wicked hard decision then that's where we make it.

Dr. Karako: Well, I think that's a very good point, especially in terms of the not duplication. A lot of folks kind of out there saying, oh, there's all these different hypersonic strike programs and, oh, my goodness, it must be duplicative. But from what you're describing it's just the opposite. Mike White was here six months ago or so, and if I'm not mistaken, described your partnership with Admiral Wolfe as the model of hypersonic strike development.

Before we get into the programs, let's stay kind of at the philosophy and the acquisition stuff.

LTG Thurgood: OK.

Dr. Karako: Another word that you use a lot is innovation. But, you know, these things are buzzwords. They're clichés. So in your universe, you know, between the S&T and as the shepherd through the valley of death, what does innovation mean? What are – what kinds of innovation are you encouraging and what do you do concretely to encourage it?

LTG Thurgood: OK. Innovation is another word like prototype. Everybody uses it for a different meaning.

Dr. Karako: We'll get to that. (Laughs.)

LTG Thurgood: So let me describe that to you how we see innovation. The first thing is that innovation is generally unscheduled, right. It's hard to schedule an invention or an innovation. People work at it and work at it and work at it, and sometimes it pops up and works and sometimes it just never does. It never comes to life. It never becomes a thing for anybody.

And so innovation is how we bring material solutions that are available to life for our soldiers, and it's really important that we recognize that that innovation is everywhere. And so one of the missions the board of director(s) gave us – the Secretary of the Army and the board of directors – was to go find innovative solutions.

Step away from the major big six defense companies and go out there and find out who has got good ideas that can help us move forward at pace. And so we have been given a very specific mission to look for ideas that have – that fill gaps that we have. So not every innovative idea has a military application. We have to have a gap and a need, and so we focus on that and we do that in a couple of ways.

The first is we started our first year, our first summer, what we called "Innovation Days." We sent a statement out to industry. If you have anything in this world that can solve this problem we want to know. And we got 185 responses the first time and we selected that through a white paper. Very, very transparent.

We down selected to about 45 companies and we brought them in a room much like this to give an oral presentation, very similar what you see with the "Shark Tank" on TV. Bring in experts. If it's an aviation problem we bring in aviators. If it's a missile problem we bring in missile people. Infantry problem we bring infantry people.

And they get 30 minutes to give their presentation. We have a question and answer period, and we tell them right there on the spot, we are interested in that technology. What's interesting is that most of these are very small companies. It's some Ph.D.s that were in a big company, they wanted to vector off and they did something else. The second time we did this 735 responses of white papers. Same process.

Here's the dilemma you have to get through. It's hard for Congress and hard for our departments to put money in a pile where there's no specified requirement, right. So how do we manage innovation with resourcing? The first year we did it we didn't have any money.

So I went back to the secretary – at the time, Secretary McCarthy – and I said, sir, we did it. Here's what we want to do. We want to award these six contracts, and we fought for about seven months and found money across the Army. The next year it was a little bit faster.

But in '21 – because I go to Congress every quarter and a hundred percent transparent with Congress – Congress set aside a pile of money in the '21 president's budget for our organization just for innovation. That is very powerful. Now we can have our innovation event, which we did 60 days later, all on contract and executing.

The thing with innovation you have to realize and we have to really understand is that not every innovation is going to work. Some things we try in the RCCTO aren't going to work. We are designed as an organization to prototype quickly, prove that a capability exists and can be built, or prove that it can't. That's what we're designed to do.

I tell my team all the time, don't worry if it doesn't work. You do the best we can do make. Get a decision point to our Army, to our senior leaders, and they can decide if it has the capability we want. So innovation is really hard.

The second way we do this is in my joint role in the Counter-sUAS. So, if you recall, about two years ago the secretary of defense at the time said, who's in charge of Counter-UAS, and – (laughter) – it wasn't a great outcome. But at the end of all that conversation the Army was designated. The executive agency for the Department of Defense, Major General Sean Gainey – a good friend – he is that guy. He's in charge of that for the Department of Defense.

The board of directors assigned our organization to be his material arm, and so that's a really good relationship for – so I coalesced another board – I'm a big transparent guy – all the senior leaders in all the services that had Counter-UAS in their title. And so we immediately started the down select of all the systems that are out there what works, what doesn't, focused on the 10 initial systems that worked, and now we're in the process of filling those gaps.

Again, what did we do? We reached out to industry. We need – I'll give you the first example. We call it a semi-annual demonstration. We need a low collateral interceptor. Who's got an idea? White papers came in. We did the down select. In this case, we actually go to a live-fire range. So we select them and we go, OK, show up at the range on this date. We give you the targets, we pay for the range, and we do live-fire events.

The first one was really, really successful. But the technology they were presenting wasn't as mature as they might have wanted it to be.

Dr. Karako: We're going to get into the programs here.

LTG Thurgood: OK.

Dr. Karako: But just let me stay on this innovation for one second, which is, I mean, if you've got a reputation, it's, you know, kind of a snap the chalk line. Don't be late. There's a point at which the good idea fairy needs to go away.

LTG Thurgood: Right!

Dr. Karako: So how do you manage that desire for constant innovation but also, OK, no more good ideas – stay on schedule? So what's that tension for you?

LTG Thurgood: Well, it's really easy. Quite frankly, it's easy when the secretary of the Army calls you in – (laughter) – and says, we want an offensive hypersonic weapon by FY 2030. What are your questions, Neil? I got it. I don't need any more guidance than that. But in the process of designing complex weapon systems or simple weapon systems, we can never stop learning, right.

As soon as you stop iterating and learning, you're done. You're automatically behind the power curve and behind the threat. But what you have to do is establish decision points, and so for every one of our programs, whether it's a small widget or a hypersonic weapon, at this point you stop adding good ideas. We don't stop collecting them. We stop adding them into the weapon system, and then we make that part of the Block II strategy or the Block III strategy.

And so sometimes what happens is we don't take that deliberate approach. We keep adding things and keep adding things and changing things and maybe adjusting the requirement. And perfect is the absolute opposite of good enough. What we need is a behavior that allows us to

give something to a soldier that is good enough to do the mission it was designed to do and safe enough for a soldier to use. And so I'm the person personally who signs that document and I hold that pretty close, having started as a young enlisted soldier. I don't let anybody influence me in that.

So when I sign that document, I know two things – that a soldier can use it safely in combat and it will kill the thing we need it to kill or do the thing that we need it to do. Does it do it perfectly? The answer is no.

I'm not trying to get to perfect. I'm trying to get to a solution that kills the target we want it to kill and we'll make it better as we go, because the moment we stop making it better we're going to be behind the adversary.

Dr. Karako: So two other words, if you could just sort of dwell on them. Prototyping – you've used it – and then rapid. I mean, these are used all the time, but what does that concretely mean to your organization?

LTG Thurgood: So for our organization, prototyping – it's acceptance that we're not perfect. It's acceptance that we don't know all of the answers, but we know enough to create a weapon system that will kill the target, and we do that at the unit of action level. We don't build things to go to a lab. We don't build things to go to a test center. Everything we build goes to a combat unit at some size and fashion.

And so every one of our engineers, every one of our contracts people, every one of our logisticians, every one of our budget people, they know that this weapon system they're working on is going to be delivered to a unit on a timeline. That timeline is not arbitrary. That timeline is based on mission analysis, what our threat is doing, when do we need to be ready to fight the warfight of the future.

According to the Army Modernization Strategy, that 31+4. I'm the +4 guy of that 31. And so that – the word prototyping is intentionally used for that cultural difference that creates the behavior difference, which is matched to our organizational difference.

And then the second part of that, Tom, is that you have to be focused on a very specific outcome, right. You have to start – and you heard that term before – you got to begin with the end in mind. Rapid doesn't mean you don't – doesn't mean you cut corners. That's not an acceptable decision space or behavior space.

Rapid means you focus on the things that produce a weapon that's safe enough to give to a soldier and will kill the target, and you capture the things you're not going to do for your future improvements.

And I would say that rapid means don't accept delay. Don't accept things being pushed to the right because somebody doesn't like the thing that you're doing. Look, our system is designed as a system of checks and balances. It's why we have the greatest Army in the world. It's why we have the great equipment in the world. Sometimes that slows us down. Sometimes it's important to go in that pace, and sometimes when you have wicked hard problems you need an organization that can perform to standard at pace.

Dr. Karako: Now, you've said that you report directly to the Secretary of the Army. You've got this board and your priorities are right there at the top of the list for the Army modernization overall. But talk to me about your acquisition authorities, so the tools at your disposal. Yes, you've got OTAs and middle tier things like this. But how would you characterize the acquisition authorities of RCCTO and do you see that becoming a bit more widespread within the Army or the joint force, for that matter?

LTG Thurgood: So, as I mentioned earlier, the board of directors consists of the secretariat side and the Army side, which make up the headquarters of Department of the Army. My Title 10 authorities to spend money come through the secretariat side, from the secretariat to the Army Acquisition Executive to me.

When we stood up this organization, we realized that we needed to control as much as we can our own destiny, and so we asked for, and they assigned to us, a senior contracting official who acts as our head of contracting agency for our organization. Pretty unique. We haven't done that for years. It's not new. We just haven't done it for years.

And so once the secretariat gives me the mission and I get my strategy approved and the money assigned, I go to my senior contracting official and I execute that contract. Whether it's a broad area announcement, as you mentioned, other transaction authority, there are lots of ways to execute contracts. What we have is the authority to do that through our senior contracting official.

The second thing that we have is milestone decision authority, similar to a PEO but a little bit different, and I get that from the Army Acquisition

Executive, right. So those authorities, unlike in a normal PEO, it might be in multiple organizations, we have them in one organization, and so it's really important that you can control the priority of your workforce to match the priorities of the Army without having to go outside to get help from other people.

Now, we – as I mentioned, we're very transparent. You know, I work really well with all the three-stars in the Pentagon and they know exactly what we're doing. We're all good friends, grew up together. But I never confused one thing in that my decision body is the board of directors. (Laughter.) It's not somebody else.

And so keeping that focus with that alignment authorities under the secretariat side with the priorities from the Army side and the correct requirement document – the ACDD we talked about – those two things are very powerful and this organization was designed to pair them together to execute.

Dr. Karako: All right. Well, let's start at the top of the – I think it was then Chief of Staff General Milley laid out the modernization priorities several years ago and right at the top of the list was long-range fires.

So let's start with the field of hypersonic strike. It's in your title. Before we get into LRHW particularly, talk to me how you see the hypersonic strike capability, this high-speed maneuverable capability. Why is the Army doing that? Why is it important? What's LRHW and things like it going to do? Give me that mission.

LTG Thurgood: OK. And I think it's – let me draw a picture in your mind. Across the world we have combatant commanders, and combatant commanders have a warfighting plan, and in that warfighting plan there are targets apportioned to the services. And so the Army did. They built the modernization strategy, what they called their Strategic Fires Study.

They took all the targets that were apportioned across the combatant commands and said, OK, what weapon system do we have that can kill the target we know we're going to be assigned to kill. And that created a gap. We needed a capability we didn't have at the time. And so that's how the long-range precision fire, the number-one modernization priority for the Army, three subsets of that – hypersonics, mid-range capability, PrSM.

And so it's very deliberate. It's based on our warfighting needs in the National Defense Strategy. And so it's not just that we need a hypersonic weapon, we needed a weapon that can do this. In order to meet that characteristic that I described yesterday, I need hypersonic technologies.

So it's not arbitrary and it's not happenstance. It's very deliberate process. The department, and I'll say the labs – DARPA, Sandia National Lab – have been working on hypersonic technologies for a while. Let me describe that to you, which helps fill the picture in.

Hypersonic, if you're an engineer, simply means it goes five times faster than the speed of sound. We have lots of weapons that go that fast. Colloquially, when we use the word today. we use it to describe and mean a weapon that can not only go really fast but can maneuver both vertically and horizontally in the plane. That's a much different problem set to solve.

When we say hypersonics today that's what we refer to, a weapon system that can maneuver vertically and horizontally in the plane of reference and go really fast. In order to win on the future battlefields in our National Defense Strategy you have to have multiple ways to influence the battle.

You have to do it from land. You have to do it from sea. You have to do it from air. And so people – you asked the question earlier, well, are they duplicative skills? They're actually not. We have to build a fight on all of the domains, including space, and we have to have weapon systems that can fight from each of the domains.

Dr. Karako: Including basing from different domains. That gets you a different characteristic, right?

LTG Thurgood: That's exactly right. So how I move things through the air and where I can shoot from, how I move things on the sea, under the sea or on land, all those things play into why you have some capabilities that are similar in all the services. It takes the joint force to fight and win. One service isn't going to do it alone. We know that. We need our allies and partner nations. We have years and years of history with that.
And so the hypersonic weapon that the Army is developing – an offensive strike weapon – fills the gap in their National Defense Strategies from the combatant commands to the apportioned targets that we know we have for the Army in a certain warfighting plan. And so that's why we have the

hypersonics capability. It's why we have PrSM. It's why we have the mid-range capability. It's why we're working on the other five priorities inside the Army.

Dr. Karako: You quoted the Army's Strategic Fires Study from several years ago. But, of course, it wasn't just the Army that decided to go out and do this on its own, if I'm not mistaken – well, this goes back to probably the late Obama administration – in terms of multi-domain basing for fires. Is that correct?

LTG Thurgood: Well, multi-domain basing is, certainly, not a new construct. The Fires Study I'm referring to was just done in the last two years. So it's probably an update to that.

Dr. Karako: Right. Right.

LTG Thurgood: So and that describes, again, the apportionment of targets and what we need to be able to kill and our part in the battle plan – in the battle sequence. And so that capability drives you to certain material outcomes. If I need to go at this speed at this distance, then I need this kind of technology, and it happened to be that in the case of the Army and the Navy we share exactly the same technology on hypersonics. Same glide body. Same missile stack. We launch it differently from different platforms, depending on what we believe the battle space is going to permit.

Dr. Karako: Now, you've got this, what Mike White called the model again. You know, some folks say, oh, well, all these different services pursuing this capability. You know, what if the Army were to go away on the long-range hypersonic strike? I mean, at the very least, wouldn't that be a big bill for the Navy that they'd have to eat, given the cooperation that's going on there?

LTG Thurgood: Well, I think when people ask that question, Tom, they're making some assumptions, right. So the assumption is that we have freedom of the seas. The assumption is that we have freedom of the air. I'm not sure those are always good assumptions. We have the world's greatest Air Force, the greatest Navy. But in the anti-access aerial denial times of today – just study our adversaries – we know that we're going to be challenged to get into those domains.

We got to create penetration and lanes of penetration to move forward follow-on forces and exploit that so that we can fight and win our nation's wars that we're assigned. And so I think people might be a little bit parochial when they go, you don't need an air component. You can live

with the land component. If it goes that far that fast, you don't need an air component. You don't need a sea component.

I think you have to realize that the domain is contested everywhere, and we have a lot of history that says that's absolutely true in combat, and that allows us to focus on that. The advantages – to your point, Tom, I think – is that I don't need to duplicate. I can share that with the Navy. I don't need an Army-unique hypersonic weapon. I can share that with the Navy.

Now, how I get it off an aircraft if the Air Force decides to do that is a different problem set. But how I launch them, we can share technologies. We don't need to be parochial anymore.

Dr. Karako: So you've got the launcher. The pictures of the LRHW launch are out there. It's a beast. What's going to happen in FY '23? You're going to hand it off, presumably, to the PEO. Is there going to be a delay for EMD? How do you envision that?

LTG Thurgood: So the way we constructed this, as I mentioned earlier, Tom, is to be seamless. The reason the transition team is assigned to me now is they're writing the POM documents so there is no delay. There is no gap. You can't build a prototype weapon system, spin up industry to do that, and then say to industry, no, sorry, we're going to wait two more years for the next POM cycle. That's a strategy that doesn't work. The valley of death is a perfect example of that.

When we got the mission on the 13th of March in 2019 to – the approval to execute the hypersonic mission, that team I described earlier was in place on the 14th, and we began to design the trailers, launchers, trucks. We took the S&T work from Sandia, and there's a really good story there. We teamed with the Navy to do it, and we delivered all of the ground support equipment, every piece of equipment they need to go to combat, minus live rounds, in September of '21.

So think about that design at pace to standard. The unit right now is in new equipment training. They will go with us to our flight test. Now, think about that what I just said. Traditionally, a bunch of engineers would do flight tests and then sometime down the road we'd give it to our unit and let them go do a flight test. We're doing it all together. We can be transparent.

And I promise you, one thing I've learned in this job is that you get soldiers involved early they will give you good ideas. They are not shy. I'll give you an example – before we even built the first trailer we had soldiers from Fort Sill – long-range shooting soldiers – in a virtual environment walking through the equipment, and here's what we did.

They were all their combat gear. We had a generator on one of our trailers, and we said do this maintenance action on the trailer in a virtual environment – 3D and virtual environment. The soldier didn't have enough room with all his combat gear on to get the leverage on the tool he needed. And so that is huge.

Now, think about had we not done that, four years later we're out at unit. The soldier can't repair the piece of equipment. So we actually changed through the virtual design before we even began building metal with our soldiers.

Dr. Karako: So this is virtual modeling in SIM and the digital engineering for this?

LTG Thurgood: Yes. Yes. Something we traditionally would never bring a soldier that early on in. We have over 800 soldier touch points hours in Hypersonics before we even fielded the first unit. So the unit now has their equipment and their training. We'll take them into our flight tests.

We have a series of flight tests between now and '23, and the soldiers will execute those. So truth in lending – the first time there will be an engineer standing right next to each one of them. (Laughter.) OK. Do this. Say this. Touch this button. And then the last flight test in '23 will be their certification flight test. They're ready to go to combat. At the same time we're doing that we're finishing the design of the – (inaudible) – not in sequence; in parallel.

Dr. Karako: And is the glide body, a key part of it, is that going to be transitioned to PEO Missiles and Space as well in the near term?

LTG Thurgood: Yes. So that's a great story. Let me just take a second to tell you the story.

Dr. Karako: OK.

LTG Thurgood: It's really, really great. The great folks at Sandia National Labs invented the glide body technology that we're using. When I got the mission, the first place I went to was Sandia. The second place I went to was DARPA,

and we chose to pair with the Navy, and the Navy was already working this at Sandia National Labs.

In the MOA that I mentioned earlier with our common hypersonic glide body board of directors, the Army is responsible to produce the glide body. The Navy is responsible to produce the missile stack. And then we make those at a facility in Courtland, Alabama. It's just being made right now. We're making the building as we're making the weapon.

So when I got the industry BOD together, I said, OK, you're going to go out for a year and a half and you're going to learn how to make these at Sandia. We call that a leader-follower strategy. Very different. Normally, we'd give a contractor or a company, go figure out how to do it. No. No. We don't have time for you to reinvent what the labs already know how to do.

So we took – for a year and a half we took our key players in glide body – Raytheon, Lockheed, Dynetics, General Atomics. We put a team together under Dynetics, who won a competitive competition to build the glide body, and they learned how to make them from the Ph.D.s at Sandia.

So the next flight test we built that glide body at Sandia, what we call Joint Flight Test II. Industry built that at Sandia. And now, right now, as we're sitting here today, industries back in Huntsville, Alabama, at the factory, Sandia is now there watching over their shoulder. So we changed the roles. It seems intuitively, obviously, to do it that way until you go, when's the last time we did something like that? (Laughs.)

Dr. Karako: Well, you know, you listed a handful of companies there. But could you talk a little bit to the industrial base for this? I mean, this is something that's kind of been a science project for a long time and, lo and behold, we're now super interested in it. How do you see the industrial base for thermal protection systems, for the ability to scale up and build these things more than the onesie, twosie, or twenties kind of things? How do you see that now?

LTG Thurgood: I would say – I would characterize our industrial base as aggressive and immature in hypersonics, right. There is no – two years ago, there was no industrial base for hypersonics. We were building a glide body once every three years in the labs. You don't need an industrial base to do that.

And so in hypersonics, the glide body technologies – not the missile technology but the glide body technologies – you have to build the industrial base. I can't go from zero to – you know, I'll just make up a number – say, 50 a year. That is unrealistic, right. I have to teach industry how to do it. They have to – I mean, we are literally, Tom, building factories as we're finishing the design. And so I would say under hypersonics it's an emerging industrial base.

Dr. Karako: So on this right before we move on – we've got a couple other big buckets to deal with – there's been the suggestion that, you know, some of the testing failures across the joint force for the hypersonic strike – everybody's talking about going fast – the suggestion has been made that, you know, maybe the reason there's been some of these failures is because we're going too fast. What do you think about that? Unpack that for us.

LTG Thurgood: A lot of people confuse speed with cutting corners, and that's just a behavior, as I mentioned earlier, of our fundamental constructs. You don't get any relief from the standard. Speed does not equal relief from the standard and you have to build that into the culture of the organization.

You also have to accept that you're going to have failures. There are no perfect programs. There are no perfect solutions. And when I first got this mission I went to Congress and I laid out the test strategy and how much money we needed, and I said, I promise you all this will not go like that piece of paper says. I promise you it won't.

We're going to have some failure that's going to happen. You're going to call me over and you're going to chew me out, and I'll explain to you what happened and we'll keep pressing forward.

If you want to go at pace there is some risk associated with it. Risk is not something to be shied away from in my world or anybody's world. My opinion is it's something to be managed and controlled. Uncontrolled risk is chaos. That's process failure. If you want to move at pace you must accept that you don't get relief from the standard, period.

If you do that, if you have that sense and people are sensing that, you have to squish it. You have to squish it immediately. I promise you Neil Thurgood will not sign a piece of paper and give a piece of equipment to a soldier that is not safe. I will not do it. I don't care if it takes a hundred years. That is not what Thurgood is going to do.

And so we've had some failures, right. We've had missile body failures. We've had glide body parts that didn't work like they're supposed to. The supply chain while we're in COVID has been wicked hard to solve. But we get paid to solve hard problems and that's why we have great leaders in our organizations and great engineers to help us solve those wicked hard problems. And when they know the clarity of the mission and why the mission is important, not just that it's important but why, I tell you, that motivation and passion across industry and across the workforce is amazing

Dr. Karako: So let's move – we could spend the rest of the day on this field, but we got to move to the mid-range capability, kind of a VLS canister on a truck, a beautiful concept. Tons of applications there one can imagine. Talk to us a little bit about that. It's the Typhon launcher, if I'm not mistaken, that you rolled out in August. Why does the Army need that in addition to LRHW and PrSM?

LTG Thurgood: So the Typhon program, and the reason we call it the Typhon program, by the way, is that mythical creature has multiple heads, right. So the Typhon program can shoot multiple missiles.

Dr. Karako: Well done.

LTG Thurgood: It really is. The engineers came up with that. They did really well. I talked earlier about the Strategic Fires Study. I talked about the apportionment of targets. Not every target is way out there and not every target is close. So the Army has in the long-range precision fires modernization priority long shooters at pace called hypersonic weapons. We call that Dark Eagle. Mid-range capability, Typhon. In short-range, PrSM.

You can't afford to shoot everything at every target. You just put yourself on the wrong side of the cost curve. Each of those missiles are a different cost breakpoint. And so when you have that – when you know the things you need to kill in layers, then you need a set of missiles that puts you on the right side of the cost curve in combat so you can win and not shoot a really high-end missile at a really close target that doesn't really need that kind of technology or that kind of kill capability.

Dr. Karako: You touted the cooperation with the Navy on LRHW. Could you talk about the cooperation with the Navy with two things off of their – that they developed, SM-6 and Tomahawk, for MRC?

LTG Thurgood: It really started with the SCO, as I mentioned earlier, right. So the SCO inventors, scientists, said, hey, I wonder if we can take a Tomahawk and

shoot it off a trailer. And it was a good idea – (laughs) – and they tried it and it worked.

Dr. Karako: They waited until we were out of the treaty. (Laughter.)

LTG Thurgood: True. And it worked. It wasn't a solution that you could give to a soldier but they proved the invention, the demonstration, could work. And then the Army made the decision to pursue that technology. And so think about the idea that I talked about earlier about not being parochial.

We literally took a Mark 41, a Mark 71 launch mechanism, cut it in half, put it in a trailer. That launcher works. I don't need to make my own. I don't need to come up with an Army-unique solution to launch a Tomahawk or an SM-6. I can use the Navy solution. I can put it on a truck.

We actually made the contract to do that with the prime that the SCO was using, which was Lockheed. And then I buy my missiles on the Navy contract. I don't need my own contract. I MIPR money to the Navy. I need this many missiles. Here's the dollar value for that. Here's the money. Deliver the missiles. And that partnership works really well.

Dr. Karako: Is that going to transition to PEO Missiles and Space?

LTG Thurgood: It will. Yeah. So PO Missiles and Space has the mission for long-range fires when they become programs of record. And so to that point, I probably should mention this. When we do the transition what we own is all the way up to the prototyping, delivery to the unit of action, and one year.

That one-year period is the transition year. In that one-year period we start moving people and money and all of that to PO Missiles and Space. And that's a deliberate, right, because this system isn't in the Army – some of it's not in the Army logistics system. We have to maintain it with contractor logistics support.

The transition team is also my fielding team. So think about the power of this. The S&T community invented it. We bring them to us. We bring the PEO team here. They're the fielding team. They do the net training under our authorities and our responsibilities, and then when it transitions the unit already knows the people.

The Army already knows the team. The budget's already in place. Very different way of behavior, and that construct is going to pay us big dividends.

Dr. Karako: Now, the salience of long-range fires, everybody knows that for the Army. But, again, big Army looking at Army IAMD, not just for the defensive stuff but the offensive stuff as well. So you bring up Tomahawk and SM-6 where you've got for the first time a single launcher that is doing right now offensive fires, but that's also a multi-mission effect where they could do defensive.

Do you see it becoming that multi-mission – the Typhon program becoming that kind of multi-mission thing with the right networks and fire control and such?

LTG Thurgood: I'll link a couple of ideas together that, I think, solidify that very idea, Tom.

The Army for years has a field artillery system command and control and an air defense system command and control. When I was a PEO – PO Missiles and Space – years ago, we work in a program called the Integrated Battle Command System, initially focused on the air defense piece but there's a plan in place to make that the command and control system for both offensive and defensive fires.

That's a wicked hard transition, and General Rob Rasch is working really hard on that. Our weapon systems up until this point have been designed to do defense or have been designed to do offense, and as you just mentioned, for the first time on the rails the SM-6 can do an offensive or a defensive mission on the rails. You just have to tell it which one you want it to do.

That's probably a path that's going to grow in the future. The Mark 41, the Mark 71 launcher, can hold many more missiles than a Tomahawk and an SM-6, many, many more, hence, the name Typhon. (Laughs.) And so I think the MRC program will be very much proliferated across our service, probably with our allied and partner nations, because it can shoot so many weapons. When the Navy made the construct of the Mark 71 launcher and made all the missiles compatible with it, that was – they stumbled onto, or intentionally, a powerful construct.

Dr. Karako: It's beautiful. It's beautiful. Many, many wonderful things.

LTG Thurgood: Yeah. So we took advantage of that and so, you know, you can see a time in the future when a mid-range capability battery could be assigned an air defense mission, shoot SM-6 only, or it could be assigned only offense to shoot Tomahawks and SM-6s. So the Army really made a pretty

good choice for that mid-range capability at a relatively low cost to kill the targets that we've been apportioned.

Dr. Karako: So let's move, in the time we've got left, to kind of our last big bucket, which is directed energy. I wonder if you could, before you get into the programs and the specific air defense missions that you've got here, talk about kind of your vision for directed energy within the big Army. Yes, it's kind of been an S&T effort for DOD wide. But when you think about direction energy for the Army – I don't just mean lasers – what does that mean to you and how do you see that moving out?

LTG Thurgood: So directed energy, Tom, as you said, is one of those things that's always five years away. It's always five years. The next five years it'll be ready. And about 10 years ago, I actually was given a mission to work on high-energy lasers, and industry had convinced the department they were ready and we had a – I brought them all out to the range – I'm a big demonstrate it to me kind of guy – and nobody could shoot.

So we kind of walked away from it for about 10 years. The technology now has increased. So directed energy doesn't – as you said, doesn't mean just high-energy lasers. It also means other forms of high-electronic stuff. We often refer to that as high-power microwaves.

A directed energy weapon called a high-energy laser is designed to see a target and kill a target and move to the next target. See a target, kill a target, move to the next, very much like our kinetic interceptors. If I'm going to shoot a Stinger at an aircraft, I'm going to shoot the Stinger. I'm going to go find the next target and shoot another Stinger. Lasers work in that same fundamental kill chain construct.

High-power microwaves are different. They work in a construct of kill anything in the cone. Whatever has electronic components in that cone it's going to kill, whether it's one or 10 or whatever it might be. And so if you look at the future of directed energy, you have to begin with the basic construct that you've heard me say already today, which is there is no perfect weapon system that works everywhere all the time in every environment. I have never found that weapon system.

You have to have multiple ways to kill targets. Some of them are – think about how many ways we can kill a tank today, right. Some we do with shoulder-fired weapons. Some we would do with vehicle-mounted weapons. Some of it we'd do it with other armored vehicles. You have to

have the same thing in air defense or any defensive position that you're moving forward.

We need to be able to kill things kinetically. We call that the M-SHORAD program. KE, kinetic energy, M-SHORAD. It's paired with DE, directed energy high-energy lasers, 50 kilowatts on a Stryker, and that's with the maneuver force protecting the people that are on the move in combat vehicles.

All of the Army is not all the time in those situations. Some are in fixed-base defense or semi-fixed. Then you can pair high-energy lasers with high-power microwaves, right, to kill things in layers – layered defense. Kill things as far as you want, as far as you can, and then, you know, what we would call in the Army, final protective fires. When things are – where things about to be really bad go to final protective fires.

And so directed energy is one of the tools. I would be an advocate to say that it's not THE tool. It's not the placebo of life. It's not going to solve all the problems we have. It's just another arrow in the quiver to allow our soldiers to engage the enemy on the battlefield and hopes in doing that they have the opportunity to return back to their families.

Dr. Karako: So you – in the voiceover there you had kind of a blurring of these, I guess, called units or levels. I mean, you talk about DE and SHORAD. I think you were alluding to kind of the Counter-UAS thing as well. There's also IFPC.

Can you walk us through that? When the CFTs talk about this they talk about the mixing and matching of the kinetic and the non-kinetic, but also the blurring of effectors between those three different levels. So mixing and matching with Patriot and IFPC, and IFPC and DE SHORAD.

What do these several effectors – how's that all going to work together in terms of the HPMs and the lasers and the kinetics? How do you see that for air defense artillery and other things?

LTG Thurgood: Yeah. So I'll describe it this way, Tom. The effector is simply the mechanism that kills the target. What you're describing is the command and control systems that integrate those, right. So FAAD C2 it does that. That's what it's designed to do. (Inaudible) – is in FAAD C2 currently.

In the future, as I mentioned, that will become IBCS. But, currently, as we design these weapon systems on the material side, we must be in that system because the systems must be able to communicate. Anytime you're going to engage a target there's a geometry associated with it. A head-on shot when you're trying to kill an artillery mortar coming toward – an artillery round coming towards you is much, much harder than a side shot. And so you have to have a command and control system that not only sees and recognizes a threat but can select the best effector to kill it.

If you're going to kill, say, a large helicopter, between a Stinger and a high-energy laser you probably want to shoot it with a Stinger. If you want to kill a group one, two, or three UAS, you probably want to kill that with high-energy lasers. It's much cheaper to do it that way. Kinetic energy is not going to kill a rocket artillery and mortar. That's what high-energy lasers do. Giving multiple ways for soldiers to be successful on the battlefield is really the heart of the issue. It's not so much that one is better than the other. It's a set of tools that a soldier can use.

In our formations with M-SHORAD, and I'll say in our maneuver formations, you have two platoons that are Strykers with Stingers. That's the M-SHORAD program, and General Rasch or General Rafferty probably talked about that. It's in the AMD priority on the six priorities.

The third platoon of that company is a directed energy high-energy laser platoon, right. We pair them together intentionally to kill targets – different targets at different times in the battle space. And so it's really important that we recognize killing in layers, multiple ways to kill things, and always finding the best way to kill the target is what we're trying to give to our soldiers.

Dr. Karako: So can you give us some updates on the progress of, let's just start with C-UAS and M-SHORAD. You had a shoot-off last year, for instance. You're working, as you said, with Major General Sean Gainey. What's the status of those efforts, Valkyrie, Thor, et cetera?

LTG Thurgood: Yes. Super. So we call our DE M-SHORAD program Guardian, right. It's a great name to protect our soldiers. We did a – we had a competitive prototyping program and, as you mentioned earlier, I'm pretty, "You're on track. You're not." (Laughs.) One of the contractors fell off and so we stopped, right. You can't do it? That's fine. No harm, no foul. Thanks for trying.

We went to a combat shoot-off. In about 60 days, we shot 450 engagements with high-energy lasers. Think about that. Four hundred and fifty sets and reps for our soldiers to practice killing things. And so we focused on group one, two, and three UASes and some rockets, artillery, and mortar.

We go back to White Sands this month to finish with the mortar – rockets, artillery, and mortars. Compare that to the cost of a KE system.

How much would it cost to shoot 450 Stingers, right? Now, the cost of the base vehicle is different but how we use them is differently – is different. So a very successful combat shoot-off. We learned a lot from our soldiers.

We've gone back since and designed – made some designs changes. Those design changes will be at White Sands Missile Range January and early part of February, and then we deliver the first directed energy Stryker vehicles on 30 September this year. We received that mission on the 23rd of May in '19.

Dr. Karako: So these are the 50 KWs?

LTG Thurgood: Fifty KWs on a Stryker. They're going to be given to the first unit, which will be at Fort Sill, Oklahoma, and we'll learn a lot. We're going to learn – I hope we learn a lot.

Dr. Karako: And, presumably, once you hand it over to the soldiers and they start playing with it, they're going to come up with things that maybe the engineers and the designers hadn't thought of.

LTG Thurgood: Oh, I promise you they will. I hope they do. I really do. If you just go back – so when I was a young lieutenant and I'd get a piece of equipment, and I'm, like, hey, why did they put that bolt there? If you just moved it a half inch it'd be a lot easier. I hope we learn that kind of stuff and that's why you prototype. You don't prototype for protection, perfection. You prototype for combat activity that's safe.

Dr. Karako: I'm deliberately trying to fuzz up the boxes here in talking about the other missions but, I mean, I'm talking especially in terms of the offensive capability. So yes, it's in that nice little DE M-SHORAD and IFPC bucket, but how do you see those evolving for the offensive applications as well, the things that you're putting out and handing off?

LTG Thurgood: Yeah. I think there definitely is a future for that. I'm not sure we have defined that very well, quite honestly, Tom. The DE M-SHORAD,

the 50 kilowatt on the Stryker, is designed to meet the maneuvers. The IFPC fixed-base 300 kilowatt class laser paired with high-power microwaves, shoot at distance and up close.

Look, we had a lot to learn and I'm not sure we know all the answers, and that's OK. We don't have to know them all right now. (Laughs.) What we have to do is learn and figure out even in a defensive start, just like we will in SM-6, how do we – how do and when should we, could we, should we? What's the policy going to be to take that to an offensive capability?

So I think that those discussions are way out there in front of us. Wicked smart folks up in the Pentagon will figure that out. My job is to figure out how to make one.

Dr. Karako: You alluded to the 300 KW for the IFPC fixed and semi-fixed positions as well. How's that program going? And awesome that the 50 KW is going to be out there fielded this year. Where do you see 300 KW come online?

LTG Thurgood: So the 300 kilowatt and the HPM are really good examples of I don't have to invent it. (Laughter.) SMDC is, basically, missile defense command and under General – a good friend of mine, Dan Karbler – they had an SMT program to build a 100-kilowatt laser, and when they started that 100 kilowatt was really good. It was state of the art. It's not anymore. Three hundred kilowatts is the state of the art. So we transitioned that to a 300 kilowatt program.

I immediately teamed with OSD, who has what they call the High Energy Laser Scaling Initiative. So they're actually paying contractors to develop this. I don't have to do that. I don't have to repeat that work. I need them to take that work, demonstrate it to me that it's viable, and then we'll put it in a combat vehicle – in a truck, not a maneuvering vehicle.

And so this August there are three companies who are in that teaming relationship with OSD, with us, and will – they'll demonstrate to us and we'll select one of those 300 kilowatt lasers. Then we'll put it in our vehicle. The same is true with high-power microwave. When we got that mission the same time on 23rd of May in '19, high-power microwave wasn't really talked about like it is now. The Air Force S&T program had a program called Thor, high-power microwave. That was the best thing we had. I don't need to make that. I'll use that one.

And so for the last year that system has been forward deployed in combat and we've been testing and watching it, and that might be a good solution

for the Army. We'll see. That assessment is not over yet. Under General Gainey in one of the gaps he identified in the joint requirement for Counter-sUAS, his requirements team said, we need to kill swarms of things.

That's the purpose – one of the purposes of high-power microwave. So our semi-annual demonstration I talked about in April, we just did our white papers. We've done the down select. The companies don't know yet so I'll be careful here. They'll come out to Yuma Proving Grounds, do a live fire. At the range we'll fly swarms. Show me you can kill something. And if that works then we'll have choices.

Industry, in this case, has responded very well with high-power microwaves. Two years ago, three years ago, it wasn't that important to industry. We've been out there talking about it. We know we need it. Now industry has responded and they've come up with some really good solutions.

Dr. Karako: On that exact topic, you said – you characterized the TPS and the hypersonic industrial base. How do you characterize the industrial base for directed energy right now?

LTG Thurgood: I would say that's – where hypersonics is an emerging industrial base, MRCs – mature industrial base – those production lines are run up. Directed energy is emerging industrial base. We're taking this technology from industry, who's using it for industrial output.

So it's relatively – I wouldn't say it's as mature as making a Blackhawk or making a jet, for sure. But it's growing. All the services are engaged in it, in the high-energy laser domain. We're tied together with all of those programs. We know what each other are doing. I would say it's a growing industrial base. There's a real opportunity there, given the technology works, for industries to really take advantage of that.

Dr. Karako: We've talked about the DE side of IFPC. But while we're there, before we close out here, you also touted, again, it's going to have to be a kinetic and non-kinetic mix because there's weather and everything else.

Do you see RCCTO as having a role on the kinetic side of IFPC? I'm talking about future increments or tech insertion. I guess it would be both IFPC and also LRHW future evolution.

LTG Thurgood: For the future things beyond the prototyping, in my particular case I have the responsibility for the S&T work, also for Hypersonics and for high-energy lasers. And so we're forecasting that now. Here's where we're spending our S&T dollars that eventually will become – hopefully, through the valley of death and become a capability.

Our organization is designed to do things that haven't been done. These aren't ECPs – engineering change proposals. These aren't small mods to a weapon system. PEOs do that kind of work, right. So there's going to be a small mod in the future. Then we're going to do an engineering change proposal and the PEOs will do that.

When the Army has what I often describe as the wicked hard problems they need to solve at pace, that's why we exist. We're not the ECP group. We're the go figure out how to get it out of the S&T world, out of industry's IRAD investments, and give it to a soldier. I hope that we never stop changing our equipment. We must always be improving it.

From my own background, you know, as a young officer in aviation, constant changing how we can fight, how we can fly, how we can maneuver. Missiles are no different. What I need today is not what I'm going to need in 2035. We've got to start that work today. And so I'm an advocate of just a base understanding that their work is never done.

Dr. Karako: Well, we've covered a lot. Thank you for your time. Is there anything we haven't hit that you want to close out with and leave us off with?

LTG Thurgood: Well, Tom, I'd say that the Army Modernization Strategy is very active. The Army is pursuing it aggressively. We've got a great Army leadership that has really got us focused as an army. All the six priorities, you know, from missiles to aviation to air defense to networks, all kinds of great programs out there.

CFTs are doing a great job. One of those things we do is called Project Convergence, and Project Convergence is, as you hear General Murray talk about, who just recently retired now, and Lieutenant General Richardson, it's a campaign of learning and experimentation. That's very powerful. It's the acknowledgement that, yeah, we're going to try it. It might not work.

And we don't beat people up. In my organization, we don't beat people up in AFC when it doesn't work. It's OK. It's OK that not everything is going to

work a hundred percent of the time. And when that experimentation happens and we want to prototype it, the Army now has an organization that can prototype.

This kind of work is high demand. It's not for everybody. Some people like to make a lot of a thing. Some people like to do invention and demonstration. This organization loves to prototype. We love to take an idea that we can give to a soldier and let them show that it has a capability or show that it doesn't. Either answer is perfectly acceptable. Very different behavior than we've had in the past.

So we're super proud of our team, Tom. We're super proud of our Army, and most importantly, super proud of our soldiers. There are just great Americans out there, our sailors, our Marines, our Space Force, the Coast Guard. They're out there – the Navy. They're just working wicked hard.

These young men and young women they're great – in my opinion, great heroes of America. They deserve our best effort. When I started this job, I had a full head of hair – (laughter) – and so – and I'm happy to lose every piece of it if it helps bring soldiers home.

Dr. Karako: Great.

LTG Thurgood Thanks for letting us come today.

Dr. Karako: Well, thank you for coming out. Really appreciate it. I think we'll be hearing more about Project Convergence in the future. And thanks for everybody online. Lots of – lots of great questions. So appreciate it, and we'll be back with more in the future.