Virtual CRT Space Based Interceptors

[Mr. Riki Ellison]
Good afternoon, ladies and gentlemen, from a beautiful August day here in Virginia. We're in Alexandria. I'm Riki Ellison.

I'm the founder and chairman of the Missile Defense Advocacy Alliance. We were founded 20-some years ago, and our sole mission is to make our nation and our world a safer place with the deployment, evolution, and development of missile defenses. It has been a remarkable year for missile defense, probably one of the greatest ever in the history of our country, with the Golden Dome Initiative by the President Executive Order, and the progression of that to where we are today.

We are just real fortunate to have our guests here today that were with us, Dr. Mike Griffin and Dr. Lisa Porter. Five months ago, they were with us before there was a DRPM, before there was any movement, and they were with us here in helping move the narrative a little bit on scoping space, and we spent some time on boost phase missile defense last time we spoke here. We are now at a phase where we're still developing our leadership, and also getting everything in place.

There is, as you know, a gag order with the Department of Defense on the Golden Dome aspect of it, but this discussion is bigger than that from my perspective, and we can start off with three weeks ago today. I just got home yesterday, but three weeks ago today, I was in Huntsville, Alabama, at the world's biggest missile defense conference, SMDC, and three weeks ago this morning, we had Mike, Brian Gibson, we had a group and a Breakfast of Champions that we've done for 23 years.

The next day was the industry day of Golden Dome. The first time that was announced and led by Lieutenant General Heath Collins and MDA, and put forward was the architecture that was laid out for the Golden Dome to the industry, and that was really three major levels. It was three, space, upper layer, and the under layer, and probably the most exciting was a young Lieutenant Colonel, I believe, that was talking about space and the engineering of creating platforms. He didn't specifically say what those were, but platforms to be able to have a space-based intercept capability and sensing capability, but certainly intercepting capability. And that really, I think, has invoked a lot of excitement with young engineers and movement on doing that because we have the policy to move forward on that. That is a critical part of our movement for this architecture. I think the biggest part is the command and control. The C2, I think, will get integrated. We're going to integrate everything, but how do we get it to the right people, the right service, the right time for the right aspect of that?

After that, I had the opportunity to go to NORTHCOM in Colorado Springs and just sort of reflect what happened in Huntsville. And the NORTHCOM commander will be probably the number one client, him and the SPACECOM commander, for the Golden Dome. It is his responsibility, and I think they're working that out on whose responsibility is that going to be up in space, but because it's such a U.S. Homeland Defense capability, I think that's going to end up with the NORTHCOM commander to be the warfighter for this right now as it

stays in it. As it grows into a more global position and getting collective data from other allied nations and so forth, I think you'll see some movement back over to the SPACECOM Commander, Stephen Whiting, on that. But it's clearly a priority, the space part of this is very clear on how powerful that is. We had the opportunity to go to the border down in Arizona and also look at those aspects of how important that data sharing is. And this is, we'll bring it back down to land a little bit, but the data share amongst our own agencies is the same problem we're having at the top end of it. And then we had a chance to go to INDOPACOM, which I just returned from, and they're facing China. They're the ones in front of our biggest threat.

And it's very crystal clear that if we don't win in space, we do not win. That was clearly put forward. It's not about buying more aircraft carriers or buy more planes or buy more major weapon systems. We have to win in space. We have to do this and so they are aligned, everybody's aligned to move in that direction. So it's gonna be a great discussion because we have one of the expert in the world. I think the oldest—

[Dr. Lisa Porter]
The oldest.

[Mr. Riki Ellison]
Because he's been around since SDIO, the 70s. There's not many people left on that. It's been, Dr. Griffin has been the prominent, he's been at the Clementine experiment, the first intercept. So he's seen it all. He's been the former undersecretary for research and development. And he's had, not the money that Mike's got, but he's had 10 billion over those years and been able to invest it. And he's gone through these cycles of policies that didn't allow him to do what's being allowed today. So we have just a phenomenal expert here to be able to give us his perspectives on it.

And we have Lisa here, Dr. Porter, who is a deputy undersecretary. But what she brings is the left-of-launch component to this. And what else is—because it is a data share. It is, I don't think you can distinguish the fires anymore. I think defense and offensive fires are non-distinguishable. We've seen that in Ukraine and we're seeing that here. So it's a great discussion. We look forward to understanding what this mission is. When we say space-based interceptors, are we talking about space orbit to terrestrial? Or we're talking about orbit-to-orbit? Or we're talking about orbit above, in space?

And I think people just forget how massive space is. Even think about it. Sensory, right? We're on a small planet and then the ability to think this big and to go big, but we've got to scope this thing down. We can't do everything. We don't have the money to do everything. And this is an exciting part of it. Everybody else is all excited about the legacy systems that we have for the terminal part of it. But this is the most important part of it. We want to get this as far away from the country as we can to do the interception, get this away from our country so we don't have to rely on the terminal defenses. So that's where we're at. I'm very excited to have you back, Lisa. So I'm going to start off with you to go forward.

[Dr. Lisa Porter]

Okay, I'll kick it off. So I actually want to build on what you just said because you're hitting on a key point from the EO. I looked it up. It was actually January 27 and today is August 27. So seven months—

[Mr. Riki Ellison]
I think there's a thousand days now. It's a thousand days—

[Dr. Lisa Porter]
A thousand days? Perfect.

[Mr. Riki Ellison]
—Before they have to produce something when it's over with. So we're at a thousand days.

[Dr. Lisa Porter]
So where are we going to be? All right. So, but if we look at that EO, it gets to exactly the point you were touching on, which it's specifically called out in there. The point is to further the goal of peace through strength, right? Which means deterrence to your point. We don't ever want to see this to a point where we have to use a Golden Dome. So when we think about deterrence, there's actually two parts of an effective deterrence strategy. And the first is, of course, how do we demonstrate that we can defend our homeland against anything a peer adversary could throw at us?

And this has been the focus of, I think of almost all of the energy to date is how do we defend against what an adversary can do? But there's a second part of deterrence that can be very effective and it doesn't get enough attention in my opinion. And that is that you can think about how you sow doubt in the adversary's belief that his system is going to work, so that when he decides to go, the missiles behave the way he thinks they're gonna behave. There is no way a peer adversary is going to attack us if they are not confident that their attack is going to land because they know our counterpunch will destroy them. So how do we think about that? How do we think about sowing doubt in their mind that, even if we didn't have purely accurate, perfect defense, they aren't gonna launch because they're afraid that it's not gonna work.

And that's a very important element of deterrence that hasn't been talked about enough. And there's some things we can do in space there as well. But I wanna start off by talking about C2 because you and Mike, you guys could sit here for hours and kibitz on interceptors and kinetic kills. And it is cool. It is the sexy part for sure. But none of that's gonna matter if you don't have the underlying command-and-control. And so we were thrilled, Mike and I were both thrilled when Guetlein came out and said that was his number one priority. I mean, we did a little rah, rah, you know.

[Mr. Riki Ellison]
Everybody thinks that's how we fight with our services. Why don't we fight like this today? This is 2025. Why are we—

[Dr. Lisa Porter]

Well, there's a lot of challenges, right? And so, we could spend an hour talking about how we got to this point. But I think what we need to do is say, wherever we are right now, what do we need to do? And that's why I like what Guetlein did. He put it right out there. He said, look, and I actually have the quote here because I think it's so important and I didn't wanna misquote him.

So he said, “we have to bring to bear an integrated network of sensors able to close the fire control loop with an integrated network of interceptors,” okay? Why is that so important? Because to date, when we've talked about engage on remote, we've talked about having a sensor in one area, queuing and then guiding an interceptor in a second area to hit a target or a couple of targets in a third defended area. And that's not easy to do. We've demonstrated that.

[Mr. Riki Ellison]
With the Navy-

[Dr. Lisa Porter]
But that's right. We have demonstrated that. That's what we call “engage-on-remote." What he's talking about, and he's absolutely right, is engage-on-remote on steroids, many on many. Why? Because when we focus, when we shift as a country, and the EO was very clear about this shift from rogue nation threat, to pure adversary threat, we're talking about a widely dispersed rate. We're talking about what a physicist or mathematician would call many-on- many, what an operator might call engage-on-remote on steroids.

Okay, we have got a humongously difficult problem now. And it's even harder than what he was saying, because that problem by itself is hard, but now you have to remember we're going to be in a contested environment, right? We know that, we're learning hopefully that lesson from the Russia-Ukraine war. So not only is our GPS not going to work, but our comms links cannot be relied upon. So while we have to structure an architecture that hopefully can take advantage of as much connectivity as possible, we can't rely on that. It has to be resilient to whole pieces of it not working at any given time. That's really hard. Add to that, you've got all this noise. Now your sensors that he talks about, bringing all these sensors together, it's going to be noisy data and it's likely going to be spoofed data.

So how are you going to trust what you're fusing? How are you going to do your weapons target pairing when you've got lots of decoys everywhere and you can't just expend your magazine on lots of decoys? But the most important thing I want to highlight, this is the part that people are not talking about enough and it's really hard. If you look at the timelines and you're objective and independent, you look at those timelines, there is no way that we're going to have a man in the loop. We're not going to have a man on the loop. We're not going to have a man under the loop, over the loop, through the loop. There's not going to be a man. Okay? This is an uncomfortable truth, but the timelines do not support anything other than distributed, *decentralized* and fully autonomous command and control. And now—

[Mr. Riki Ellison]
It can be done in three years.

[Dr. Lisa Porter]
—We are going to have to get after it. We are going to have to get after it—

[Mr. Riki Ellison]
—Can we get this done in a thousand days?

[Dr. Lisa Porter]
Can we?

[Mr. Riki Ellison]
We are, i mean he’s got the authorities—

[Dr. Lisa Porter]
I think with this country, if we do it right, we can do just about anything we put our mind to. Is there a physics reason why we can't do that? No. And so whenever the answer is, I don't see a physics reason we can't do that. I say, put our best engineers on figuring out how to do it. But see, you can't just focus and you guys are going to talk a lot about interceptors. I'm not going to take that away from you. But if you're somebody who's more of like C2 and comms and you think more about data, this is sexy and exciting. Because if we can do this, holy mackerel. I mean, honestly, that's a weird quote, but—

[Mr. Riki Ellison]
The cloud, and It's—

[Dr. Lisa Porter]
It's not- It's not the cloud. It's decentralized. This is—

[Mr. Riki Ellison]
It still has to move that kind of information with computer power—

[Dr. Lisa Porter]
Yes—

[Mr. Riki Ellison]
—That you've got to have. The military's got to have their own clouds or whatever they have—

[Dr. Lisa Porter]
So you're touching on a point that's really important. And so this is where it's got another uncomfortable point I'm going to make. That's obvious when you really internalize what I just said. That means there's no common operating picture. There is no longer going to be a command center where somebody has visual picture of everything going on in real time. Because everything's going to be decentralized. Everything's going to be disaggregated. What's going on? You are not going to have the timeline capability to get everything done, right? So, you've been pulling on the data construct, a really important point. There's all the culture and the policy, yes. But technologically, for those people who might be listening who

are really into data and how you structure it and how you pass it, you've got to structure that data so that it's amenable to machine-to-machine, to your point. Not machine-to-human.

[Mr. Riki Ellison]
It's got to be tagged—

[Dr. Lisa Porter]
It's got to be- But it's got to be done in a way that I don't care what the ontology is for a human perspective. I don't care that a human understands it. Human's not in the loop. It has to be optimized from machine-to-machine, right? And I just want to point out for those who think that I'm exaggerating on the autonomy. Mike and I, before Golden Dome was a thing, when we were only focused, and we should still be focused on INDOPACOM Theater, to your point there at the pointy end of the spear here, we were looking at the hypersonics quite seriously. As you know, that's been a passion of ours for a long time. And we asked ourselves, let's do the kinematics math. And it's not that hard, honestly, to say I've got one interceptor, a glide phase interceptor going after a hypersonic target.

Okay, how do we think about this? Well, it's going to have in-flight target updates, but the time between the last time it gets its last in-flight target update and the time it actually acquires the target to go after it, if it's going to hit that target, that time window is less than about seven seconds. Even if I give you 10 seconds, now we're talking about seconds for one interceptor on one hypersonic missile. So what I've just said about autonomy, also applies to Pacific Theater. That should be a very daunting and call-to-action fact that people need to absorb. There is no man in the middle in the Pacific Theater against the hypersonic threat that the Chinese already have. So we got to get after autonomous, full autonomy. And there are, to your question, can we do this? There are lots of smart people out there who understand autonomy. They understand networks. We have very complex networks today that are designed to be resilient. We've got to start bringing in those smart people.

We can't just think about the traditional way of thinking about things. But one thing I will tell you is that current system for defense against rogue threats, the guy sitting in the chair, the man in the middle in a centralized control room, that is gone. And we can't bandaid our way there starting from that.

[Mr. Riki Ellison]
Are you familiar with SALT I and SALT II? Of course. So that's where that was going, right? That's evolved to JFN—

[Dr. Lisa Porter]
So JFN was a first cut, but there was still, I will just say from our familiarity of it, there are still assumptions in there that make it a little easier than the problem we actually have to deal with, in particular, the timeline. And the many-on-many, the Guetlein is emphasizing, the many-on-many. We can't start by going, well, we'll just wish away that part. We'll just assume they're gonna launch one or two. No. We're just gonna assume that we have all the time in the world. We have 20 minutes per missile. That's plenty of time for man in the middle. No.

[Mr. Riki Ellison]
Those days are over.

[Dr. Lisa Porter]
Those days are over. And if I could just, before you guys get to have your fun kinetic talk, I just wanna make one more point. On the second part that I mentioned, the deterrence and thinking about how to sow doubt in the adversary's mind, that's actually an easier problem. Okay, it always is. Think about cyber. The offense is always easier than the defense. So how do you think about sowing doubt in his mind? He has to deal with the same physics we do. He has to deal with the same C2 challenges we do. He's going to have to assume a contested environment, which means he's going to need, IFTU, in-flight target updates for his missiles, even against fixed targets, okay? So how is he gonna be doing IFTU? Well, if he's only doing it from terrain or maritime, he's vulnerable. He's going to need IFTU in space. China's not gonna attack us without IFTU in space. How are we gonna exploit that guys?

Second, he's gonna want fire control in space. He's gonna want tracking in space. He's gonna want all the things that we need. Let's start thinking about how we disrupt that capability and how we message to them that we have any time disruption capability against their C2. So we basically tell them, you don't control T-Zero—

[Mr. Riki Ellison]
You think that was part of Golden Dome, the ship—

[Dr. Lisa Porter]
Right now, it doesn't seem to be, but the EO says, left-of-launch, and everybody has laser focus on, oh, that's boost phase. No, read the actual items in there.

[Mr. Riki Ellison]
Wait that’s the warfighter. Wouldn't that be more SPACECOM? That would be—

[Dr. Lisa Porter]
That would be—

[Mr. Riki Ellison]
That would be a much bigger problem.

[Dr. Lisa Porter]
It's a big—

[Mr. Riki Ellison]
Bigger than the U.S., correct?

[Dr. Lisa Porter]
We would want, of course, in all of this, it would be nice to have our allies involved, hands down. But what it really is, is you also want people who think more like the intelligence community, who like to say, if we do our job, there will be no war. And what they really

mean by that is we're gonna try to set up a situation where the bad guys are not sure. That's what sowing doubt is. And if they're not sure, they're not. I mean, they've read Sun Tzu too. They are not gonna attack the moat if they're not 100% sure, or at least 95, that they're gonna kill us. Because they know we will destroy them if they don't succeed on the first punch. So that's the mindset we've got to adopt, Riki. And I don't think we've done enough there. But it's just as sexy if you guys want to start attacking it.

[Mr. Riki Ellison]
For sure. Definitely.

[Dr. Lisa Porter]
It is. So I'm gonna turn it over to Mike. But I just, I wanted to get that on the table. Because there's elements of those problems that are fun, even if it's not the interceptors.

[Mr. Riki Ellison]
But I agree with you, I agree with Mike, that the number one thing is command-and-control. And if you get a win on that, you start getting wins starting soon, every year, and you build that up. That's the most important. Everything else is just—I mean, they're appliances. That is critical.

[Dr. Lisa Porter]
But trying to get a win by saying, I'm just gonna do more of the same, and I'm gonna add three interceptors. And no, the more of the same will break.

[Mr. Riki Ellison]
And that's AI. We're gonna have to evolve.

[Dr. Lisa Porter]
We're gonna be autonomous. And you're right, it's gonna be AI tools that allow us to bring all that data together and figure out what it's telling. And by the way, we're not figuring it out. The decision-making is at the machine level.

[Mr. Riki Ellison]
And it might be bigger than the Pentagon, right? It might be.

[Dr. Lisa Porter]
It might be bigger than the Pentagon.

[Mr. Riki Ellison]
There's innovation civilians out there that are doing some stuff.

[Dr. Lisa Porter]
There definitely are. They're doing things that are relevant.

[Mr. Riki Ellison]
That we need to be able to bring.

[Dr. Lisa Porter]
And we need to bring them in. You're absolutely right.

[Mr. Riki Ellison]
To bring this team together.

[Dr. Lisa Porter]
Absolutely.

[Mr. Riki Ellison]
Okay, good. Okay, Mike. All right, Mike. We get to get, now get into the –

[Dr. Lisa Porter]
Now you guys get to do your, your kill—

[Mr. Riki Ellison]
How do you wanna define, how do you—

[Dr. Michael Griffin]
You're making it sound as if I don't agree with what you were saying, whereas I do.

[Dr. Lisa Porter]
No, no, I know you do. I know you do. I know you do.

[Mr. Riki Ellison]
How do you wanna define space intercepts for this discussion? Do you wanna? Well, just define it the way you wanna define it.

[Dr. Michael Griffin]
So let me start by saying that you probably are gonna have great difficulty finding anyone who is a bigger advocate of space control by the U.S. and its allies against our adversaries than I am. Okay, as I've said in so many speeches, my model is that the United States would have the capability, not necessarily the intent, but the capability like until recently we had with the Navy, where anywhere on the world ocean, if you're a big enough problem for us, we can make you go away. And for us, the consequences are political, but you're not involved in the discussion because you're gone. That's a capability that until recently when we allowed the rise of China that we had. It's also similar to when the U.S. declares a no-fly zone over somewhere in the world. If we said that there's a no-fly zone, you're not flying. And not that I want the United States, ever, to be overtly hostile to others, that gains us nothing. But those who think that they can challenge us in space should know that we have the capability to make them go away. And again, there are political consequences to that and I get it, but the capability is what is significant.

[Mr. Riki Ellison]
And we don't have that.

[Dr. Michael Griffin]

And we don't have it.

[Mr. Riki Ellison]
So let's make clear, we don't have that ability.

[Dr. Michael Griffin]
So I'm an advocate of the U.S. having space control in a world where we have adversaries who seek it, clearly.

[Mr. Riki Ellison]
And they are demonstrating some of the—trying to do additional things, correct?

[Dr. Michael Griffin]
Now that said, I've been clear, frankly, for decades, that specifically going after ICBMs, boosters of one type and another, is basically a fool's errand. You have a very low probability of any given interceptor being, space-based interceptor being close enough to a booster to get it before it burns out and becomes a mid-course object. I know the timelines of our own ICBMs and I know the timelines of adversary ICBMs. I won't say them here, but this is not a profitable task. And I'll get to them.

[Mr. Riki Ellison]
When is that cross line? Is it, I mean, upper boost? Or is that when it gets into mid-course it becomes?

[Dr. Michael Griffin]
Well, mid-course objects are quite different. And I'll talk about that in just a second. I just, I just want to create the frame here.

[Mr. Riki Ellison]
Oh, I'll let you go.

[Dr. Michael Griffin]
No, it's okay. So you can certainly tune orbits to make sure your interceptors pass over given sites. But then that means that you're leaving other places empty. Not a good idea from my perspective. With a reasonable size fleet, the odds are just very low. As I said, when we talked in March, sub 1%, that you're going to get a shot at a given booster. So then that has design consequences. If you say, I want the United States to demonstrably have the ability to control space, again, in conjunction with our allies. All right. Then, well, to control it means if you're talking about kinetically, and I do want to pay respect to Lisa's points about not everything needs to be kinetic. There are other—there are mission kills as well as kinetic kills. Leaving that aside, if I'm going to go after a target with an actual interceptor, you know, the grown up analogs of SM6s and SM3s that live in space, then I have to know what I'm shooting at.

A booster in powered flight offers a signature, I'll just say 3000 Kelvin plus or minus. You look for that object, you can hardly miss it. You look for it in a one-micron band, IR band. You need certain control algorithms on the interceptor that can basically lead the duck in

flight. You can't get into a tail chase, so you have to be able to go after an accelerating target, which means that you have to have time to go. So, from an intercept guidance point of view, which is a subject I used to teach actually, you need certain kinds of sensors and certain kinds of algorithms to pursue a successful intercept. If that target happens to be within your range while it's still boosting, it's a pretty easy kill.

If you think you're going after mid-course objects because that's where, following the Willie Sutton rule, that's where the money is, right? Speaking about robbing banks. The mid-course gives you much more time. You have 10 or 20 minutes. Even for relatively shorter-range missiles, you'll have many minutes. So, you have a chance for your interceptor to get into the fight. But a mid-course object is going to be something like room temperature, maybe a little bit more, maybe a little bit less, but you're going to be looking for that object in long-wave infrared. Totally different sensor suite. Totally different intercept problem. You're not going after an accelerating target. In that environment, augmented proportional navigation will do just fine for you. Completely different set of math.

All this is to say, if you say, I want a space-based interceptor fleet, and I haven't even gotten into cost trades yet, but if you say, I want a space-based interceptor fleet, you have to decide in advance what you want it to intercept. And the decision about intercepting boosters leads to a vastly different design conclusion than one that goes after space objects. Now then, if you're going to go after space objects that are missiles, you have to assume that the adversary knows you've got this. He's going to deploy his re-entry vehicles as quickly as possible, along with all the decoys he can do. So, your interceptor design should feature a multi-kill vehicle approach. You see a threat cloud out there, you have some limited ability to discriminate a real thing from a piece of trash, okay? But you're never really sure. So you're not looking for a 30-06 to take out one target with one shot. You want something more equivalent. I'm just using a gross analogy here. You want something more equivalent to buckshot, where anything in the threat cloud you're going to go after.

Our defense industrial base can build either kind of interceptor. The government, we the government need to tell them what kind of interceptor we want them to build based on what's a realistic problem. Because discrimination is as yet—

[Mr. Riki Ellison]
The one thing you missed was the hypersonic, because that's got—

[Dr. Michael Griffin]
I haven't touched that yet. So I'm done with space intercept.

[Mr. Riki Ellison]
Can space intercept do hypersonic?

[Dr. Lisa Porter]
Great question.

[Dr. Michael Griffin]

Awesome question. Again, everything's a probability, but probably not. Because to do a space intercept against a hypersonic target, let me summarize some of the challenges. You have to have yourself, your interceptor has to be a reentry vehicle. It's not going to be able to see the target while it's undergoing reentry. If you use a relatively shallow angle entry, something you might get with a Delta V on board your interceptor of a few hundred meters per second, then you're going to be using a timeline that's something like a half an hour from where you see it to the object. The object, the hypersonic has round, has hit its target before you get down to it.

If you're going to use a lot of Delta V on your hypersonic interceptor, say two or three kilometers per second, that can give you a much steeper angle of entry, which is an incredibly challenging task, okay? Your interceptor is going to be hot. It's going to be pulling very high Gs. It's not going to be able to see what it goes on until it gets past the reentry pulse. It's an extraordinary challenge, even if you are positioned to be able to get it at all.

So if we're going to intercept-

[Mr. Riki Ellison]
That's a great explanation. I mean, this is education.

[Dr. Michael Griffin]
The best technical opinion that I can give you, and I'm nothing but an old engineer. That's all I ever claim to be. The best technical opinion I can give you is if you want to get hypersonic targets, you need to have interceptors positioned on the ground or on the ocean.

[Dr. Lisa Porter]
And on the ocean, please.

[Dr. Michael Griffin]
Pardon?

[Dr. Lisa Porter]
And. I'd like both.

[Dr. Michael Griffin]
Yeah, yeah.

[Dr. Lisa Porter]
On the ground and on the ocean.

[Dr. Michael Griffin]
Yeah, yeah, yeah. I see. Yes, it's not an or. I want them—

[Mr. Riki Ellison]
And in the air, if you could.

[Dr. Michael Griffin]

Yes. You're going to be engaging on remote. Because the hypersonic round has to be engaged in its own midcourse flight, its gliding flight phase, because if you wait until terminal phase, the adversary is going to be pulling, and we've measured this, 20 or 30 or more Gs. You're very unlikely to intercept that target, so you want to get it in its midcourse, all right? That means you're going to be engaging it at altitudes of 30 to 40 to 50 to 60 kilometers of altitude. So, to get into that battle space, you're going to have to launch well ahead of when he's in your target area in order to get there in time. And then, as Lisa pointed out, the adversary can be—

[Dr. Lisa Porter]
And will.

[Dr. Michael Griffin]
And will. And will. Your interceptor has to be able to go after him such that when you get into active, active range, he's within your basket.

[Mr. Riki Ellison]
Yeah. I think we sold that. I think you got that completely.

[Dr. Lisa Porter]
Yeah, but it's important, Riki. It's important.

[Dr. Michael Griffin]
Give me one more sentence. If you take something like an AMRAAM radar capability, and again, I don't cite the parameters, but I know them. If you take something like an AMRAAM radar capability, which is about the most effective air-to-air radar we have, and say, okay, I can probably put something like that on my glide phase interceptor, I'll even let you scale it up. The point she made that you're dealing with an IFTU latency of under 10 seconds, that's very challenging.

[Dr. Lisa Porter]
Really challenging.

[Dr. Michael Griffin]
So going after hypersonics is going to be—

[Dr. Lisa Porter]
And then you're going to have more than one.

[Dr. Michael Griffin]
Oh, by the way, yeah.

[Dr. Lisa Porter]
They're not going to just launch one.

[Dr. Michael Griffin]

The adversary is not going to launch one hypersonic round at Guam, okay. You're going ... Or at a carrier, you're going to be dealing with a raid of many, many.

So, I love these challenges, but it's important to me personally that people understand what you want to be your target and where you want to try to get it from as opposed to just making it up.

[Dr. Lisa Porter]
And one interceptor is not going to suit all targets. That's the key, right?

[Dr. Michael Griffin]
That's another point.

[Dr. Lisa Porter]
Well, that's what you just said. I'm just summarizing it.

[Mr. Riki Ellison]
Yeah. Yep. So going back to ... I mean, you've seen this development 40, 20, 10 years.

[Dr. Michael Griffin]
I've seen it for 40 years, more than 40.

[Dr. Lisa Porter]
As you said, he's the oldest expert on the planet.

[Dr. Michael Griffin]
And I wasn't young then.

[Mr. Riki Ellison]
Well, what ... Emerging this new technology, there's a lot of new stuff from 40 years ago.

What is, from your perspective, what is that space interceptor? What is that? Can you give us what you think it is or what it could be in terms of taking out the missiles going through space?

[Dr. Michael Griffin]
Well, we've got a lot of younger folks in the playing field now, and so I don't want to ... I don't want to get too far out in front of my own self, but I would want a space interceptor fleet if I were going to have one that had a couple, if not a lot, of missiles on a given platform because I want more dispersed platforms. The individual interceptors should carry, in my view, smaller, after the interceptor is sent after its target and you jettison the boost stage that gets it toward its target, the individual interceptors would be miniature kill vehicles that are looking for objects that are at midcourse temperatures. Okay, and everybody in the sensor world knows what I mean by that. You know, room temperature is plus or minus a little bit, so they're looking ... Their sensor is something like we have on our GBI fleet, but smaller, more modern.

[Mr. Riki Ellison]
These are like CubeSats or not that ...

[Dr. Michael Griffin]
I won't get into the size. It does, I mean, something like a basketball. Okay? It's a breadbasket. It's not, you know, the actual kill vehicle doesn't need to be that big.

[Mr. Riki Ellison]
And this is all in low-Earth orbit, so make sure everybody understands that.

[Dr. Michael Griffin]
Yeah. Your interceptor fleet needs to be based in low-Earth orbit or you'll never get to any target in time. Now, after that, you have to have, and this is a critical part of the command and control, you have to have an interceptor with these multi-kill vehicles that can coordinate among itself because you don't want all of your individual kill vehicles going after the same target.

[Mr. Riki Ellison]
That's the challenge.

[Dr. Lisa Porter]
That's right.

[Dr. Michael Griffin]
Yes. Back to what he was talking about. So you got two problems.

The first is an interceptor. A given interceptor is targeted for a given threat cloud, which contains real RVs and lots of ash and trash from separation events plus deliberately placed decoys. You do your best to sort that out, but basically, if it moves, you're going to try to kill it.

Then you have the point that one more time, as Lisa has mentioned, you have the point that this is a raid. You're not looking at one Chinese ICBM trying to take out San Francisco, all right? You're looking at a bunch of ICBMs, or they're not even going to start.

Right. Okay? So you have to have interceptors that can coordinate, again, among themselves so that we're not all aiming for the easy target.

[Mr. Riki Ellison]
What's the capacity of the number of low-Earth orbit satellites you're going to need for this?

[Dr. Michael Griffin]
Well, I'm not aware of any studies that have concluded that you can do what you need to do with less than a couple thousand interceptors in space. Now, at some point, we need to talk about the cost trade.

[Mr. Riki Ellison]

Before you get into that, just for the population, is the debris from this a problem? Does it fall onto earth? Just help everybody understand what happens on a collision at this point in low-Earth orbit, what the effects are for the satellites and for earth.

[Dr. Michael Griffin]
Collisions in low-Earth orbit or collisions at low altitudes from midcourse objects are going to generate debris which will last for months and weeks to months or very low numbers of years. In higher orbit ...

[Mr. Riki Ellison]
Will that affect the other satellites? You sure? Will that fall on the Earth?

[Dr. Michael Griffin]
When somebody starts a nuclear war, my first concern is not going to be debris. Okay? As Lisa said earlier, my personal fondest hope would be we never use this system. But if you use the system, it will create debris. Okay. Again, I don't know how to say this...

[Dr. Lisa Porter]
But to answer the other question you posed, which I thought was a good one, is where are we now from a technological perspective where we might bring some of our advanced technology that the most challenging problem for midcourse intercept is the actual discrimination challenge? People have known this for decades. We're not seeing anything Earth-shattering by saying that. And people have tried to solve it primarily with thinking about, for example, two-color or multicolor detection so I can do fancy discrimination. But I would like to see as part of the focus of let's take the really smart brains in the AIML community and ask them to think about how they might solve it using some very advanced techniques.

Now, it's going to be a hard problem. You don't have a lot of training data, so you got to be thoughtful about what that means. But how we put smarter software into the interceptors would be one area I think would be interesting. And by the way, that's going to apply whether your interceptor is launched from space or from somewhere else.

[Dr. Michael Griffin]
Yeah, absolutely.

[Dr. Lisa Porter]
So, the discrimination problem is something I think that is worthy of revisit from, okay, how do we get the smart brains that are out there today on this problem?

[Mr. Riki Ellison]
And we're also going to have to use sensors in space.

[Dr. Lisa Porter]
Yes, yes. That is a whole other issue.

[Mr. Riki Ellison]

And if there's solar power, they only get half the life. So, are we just push that envelope a little bit with mini nuclear power? Do we need that up there? Do we need to be able to enhance our sensing power?

[Dr. Michael Griffin]
I personally would continue to assume that we would use solar arrays to power our sensor fleet. I don't see a design need to have nukes.

[Dr. Lisa Porter]
But the fusing of that data is still largely unsolved. You know, the SDA has put a lot of effort into showing we need those tracking sensors, right? Okay, but how exactly do you combine all that data?

And assume the adversary is messing with you. And there are ways to mess with AI. You've heard the term poisoning, right? Other terms of art that have to do with how I sewed out into your ability to actually fuse the data and get a real picture. And again, we have to think about those tools and techniques that the Russians have taught us about Ukraine, for example, in spoofing data. It's a very effective technique. And it applies to that as well.

[Dr. Michael Griffin]
It does, but you will have to have a space-based sensor fleet.

[Dr. Lisa Porter]
You will, I'm just saying, you're gonna have to think about what they will do.

[Dr. Michael Griffin]
And it has to operate in the context of the threat you talked about.

[Dr. Lisa Porter]
Yes, you can't assume an ideal scenario.

[Mr. Riki Ellison]
So, Mike, in a thousand days, in three years, or a year, two and a half years, can we have some sort of, from your technical perspective, a demonstration? Or a case ability in space?

[Dr. Michael Griffin]
We can certainly have prototypes on orbit where we begin to solve these problems and the very existence of those prototypes and experiments and all that is itself deterring. The United States, let me remind everybody, we had COVID vaccines available for old people like me 10 months after President Trump said we have an emergency here. And all the knowledgeable authorities were saying it could take five years. All right. The United States-

[Dr. Lisa Porter]
Because we mobilized people who weren't in the traditional chains. We mobilized the industrialists.

[Mr. Riki Ellison]

So it's doable. That's what you're telling me, right?

[Dr. Michael Griffin]
We can do an awesome amount of what is necessary. I mean, you're not gonna have 2,000 interceptors in space.

[Dr. Lisa Porter]
In a thousand days.

[Mr. Riki Ellison]
No but it’s necessary to scare China or to deter China.

[Dr. Lisa Porter]
But if you show the ability to do it.

[Dr. Michael Griffin]
If you decide that the cost trade favors that, which, again, should be done-

[Dr. Lisa Porter]
You still have to do that.

[Mr. Riki Ellison]
Can you talk a little bit about the cost trade before I put John on? I know he's gonna come. Because I think everybody needs to understand this cost curve of how expensive that is.

[Dr. Michael Griffin]
What I'm getting at is not the absolute number, but the balance of what you do in space versus what you do on the ground. So, I'll say again, I'm an advocate of space control. It's not free.

All right. One of the advantages of the underlayer, call it SM-3 IIA and its derivatives or glide phase interceptor when it shows up, as well as THAAD and frankly Patriot, you don't have a discrimination challenge. You see your target. Anything that's not your target's been weeded out by the upper atmosphere. You gotta get to it in time. And yeah, nobody wants a salvage fusing over San Francisco. That's not gonna be pleasant even if you do kill other RVs. So, there are problems with the underlayer, but an advantage is you can see your target. I never wanna give that away. I'm a huge fan of the underlayer.

[Dr. Lisa Porter]
Me too.

[Dr. Michael Griffin]
But if you now talk about putting a quote, golden dome over America and its allies and its fleet in the Indo-Pacom, you're talking about a very large number of underlayer defenses. All the way up to the ground-based interceptor that we have today. You're talking about a very large number of those things. Those are not free. Aegis Ashore is not free. Silos are not free. None of that is free. So, a properly done system cost trade says, okay, well, that's not

free, but neither is putting stuff in space. And it doesn't last forever. I might have to refresh my fleet every, say, five to 10 years. Okay, so there's a running cost there. Everyone has joked about how old I am, and I am. But that just means I'm lucky, one of the lucky ones. I'm not aware of a truly careful system study comparing how I wanna balance my costs for stuff in space versus how I wanna balance my costs on ground if I'm actually trying to provide a comprehensive defense.

[Mr. Riki Ellison]
But give them credit because that just came in January.

[Dr. Michael Griffin]
No, no, no, I'm not criticizing anyone. Please, I don't wanna sound like I am. I'm not criticizing anyone at all. I'm delighted with the president's EO, and I'm delighted with the selection of Mike Guetlein, whom I've known forever as the director. I'm delighted with all of that. I'm saying I'm not aware that we've done careful cost trade, and there hasn't been a reason to do so. But before we start out actually building something, we need to understand what we wanna build and why we think we want to build it. And if space-based intercept turns out to be something we say we wanna do, I want it to be crystal clear to policymakers that this is a better alternative to solve the comprehensive problem than replicating 10,000 Aegis Ashore. And I honestly, of my own knowledge, don't know what the answer is, but I think we could figure it out.

I mean, not to be stupid about it, but 10,000 Aegis Ashores is something we can build. It'll cost a lot of money. It'll take a time, but we have many.

[Mr. Riki Ellison]
I think that what was put out there on entry day was a Guam-type, we know what that is, but putting 15, 13 of those in, and they only cover Rhode Island or something. So, the cost of this is ridiculous at that level and it would suck away so many other things.

[Dr. Michael Griffin]
So I tend to believe, I tend to believe, and belief is an opinion held without benefit of proof. I tend to believe that when you scale up to equivalent coverage of a very large area, United States, our allies, our fleet, okay, that the cost trade is going to tip in the direction of space, as opposed to my mythical 100,000 Aegis Ashore, all right? But-

[Mr. Riki Ellison]
And you're further away from the country.

[Dr. Michael Griffin]
But before I start down that path, I would want to know that I've carefully done the cost trade to say, this is why I want to do it. Do you see where I'm going right now?

[Mr. Riki Ellison]
Absolutely.

[Dr. Lisa Porter]
And either way, you have to solve the C2 problem. I'm just going to put that out there.

[Mr. Riki Ellison]
Is that a congressional force study or is it something that should come up nationally by DOD?

[Dr. Michael Griffin]
I certainly believe that General Guetlein is a smart enough guy to know that before determining an architecture, he needs to have careful non-advocate review to make sure we know why we want to build what we want to build. And I'll double down on Lisa's point. And if you don't design this, there is an enormous difference between what you do for C2 to defend against North Korea or Iran, the rogue nation threats, and what you're trying to do if you have a massive, I'll say, interceptor fleet coming from various places, designed to engage at various altitudes against different kinds of threats, ranging from intermediate range ballistic missiles to ICBMs to hypersonic rounds to tactical ballistic missiles. There's just an enormous difference in the C2 requirements for those two ends of the spectrum.

[Mr. Riki Ellison]
Okay, we're cutting down on time.

[Dr. Michael Griffin]
Riki, I've done my best. I'm sorry.

[Mr. Riki Ellison]
It was a great discussion. Okay, John, you got a couple of minutes, buddy, before we open this thing up.

[Dr. Michael Griffin]
I think you got 10.

[Mr. Riki Ellison]
You've enjoyed the discussion. I know you have. It's been a great one.

[Mr. John Rood]
Absolutely. Are you able to hear me, Riki? On the mic?

[Mr. Riki Ellison]
Yeah, we can hear you good.

[Mr. John Rood]
Okay, great. Well, thanks for having me on. It's great to be with Mike and Lisa, two of the nation's experts on these things that have been at it for so long. But just a couple of points I'll make, and then I'll turn to ask some questions of them, of course.

But I think one thing that needs to be emphasized is the importance of the initiative, because it tends to be at the end of these discussions, when you're in the Pentagon or

there's competing resources, people sort of throw up their hands and say, look, we've talked about so many of the challenges, and there's a framing bias that exists that you frame the problem as challenge one, two, three, four, five, and at the end, there is not a perfect solution that negates the threat perfectly. But back in the real world here, I mean, we have to have a few fundamental recognition points up front that the nature and the character of warfare, not the fundamental nature of warfare, but the character of warfare that we're seeing has emphasized this threat.

I mean, you look at the laboratory that is the Ukraine conflict, or you look at the conflicts in the Middle East, and you look at the rate of progression of innovation and importance, which is not unusual historically in a conflict, but we are not keeping pace with that. And the president, this is a very bold initiative, like what Ronald Reagan did, like what George W. Bush did to really kickstart the initiative. But we're gonna have to also now focus on when you have not done something for a long time, immediately thinking there is a recipe on the shelf, kind of like instant pancakes or something that I pour it in a bowl and I add water and out comes my product, my solution. That's not the way technology maturation or these systems work. We have not had an initiative like this for space-based interceptors at this level. And we've not had the investment in the precursor technologies.

And so I think it's wonderful. And I think the short answer in my view as a person that runs a small space company in Silicon Valley and swims in this pool of new space entrants that are doing new things and do have the ability to move fast at unheard of costs, you know, here at Momentus, for example, that's one of our products behind us that we put in space to do a demonstration to collect solar energy in space and beam the electricity wirelessly to Pasadena, California for Caltech. It was their activity on our satellite. But the ability to do those kinds of things very quickly does exist, but you're not gonna be able to do it in a perfect way that is optimized for the Golden Dome mission, simply by snapping your fingers, putting out an RFP, making a contract award in 12 months after a lengthy competition, and out comes the intended object, which fits all of your requirements that have slowed down through this lengthy process of joint requirements setting and other things. That traditional approach won't get you there because we've not been investing in that.

And I draw a parallel when I was in the White House during the George W. Bush administration and we withdrew from the ABM Treaty. Partly why we structured the initiative to begin with a spiral development, to field incremental capability upgrades, was a recognition we have not as a nation been investing in a missile defense architecture because it was illegal. It was prohibited by the ABM Treaty. And so there needed to be a time period to mature that. So thing one I would say is don't let the perfect be the enemy of the good, as the old saying says.

Begin with plateau accomplishments to build certain capabilities. And there's a balance in my view in investing in the legacy systems because if you spend all your money there, it's not just the acquisition cost. Manning and operating a ship, manning and operating an airplane, the sustainment and the personnel costs are very substantial.

And if you only spend money on today's technologies to exaggerate for emphasis, you will not ever develop the needed technology. So there needs to be a balance between

improving and building some more, a lot thicker shield, if you will, of what we have now, but quickly also investing in the enabling technologies to get you where you want to go. I'd say some of the things I really wanted to underscore that Lisa made some excellent points, and Mike as well, about it's the speed at which you have to take information, understand it, translate it, move it. And that's not going to be human speed, as she mentioned. And I don't think that we have, working now in Silicon Valley and interacting with so many of the AI entrants and the early tech maturation, I personally think we're at the early stage of the next industrial revolution to see the enablement from that. I don't really like the term, frankly, artificial intelligence, because it's really compilations in an automated way of human intelligence so far.

The ability to translate things that humans have developed quickly into either solution space, to separate signal from noise and things of that nature. But I do think we've got to be able to deter, degrade and defeat in space, as Mike was emphasizing for space control. And I'd really say we're at a phase like the early days of naval warfare or the early days of air-to-air warfare, where we're going to look back in a few years and say that was very rudimentary what we were doing. And I think you have to start with one-on-one engagements in a simulated way, but as mentioned, you have to very rapidly transition to non-stovepipe systems that can deal with many-on-many as General Guetlein's emphasizing.

I don't think it's invalid. It reminds me of when I took my early physics or engineering classes, the professor would always say, let's assume a frictionless surface, and then you begin to solve. Well, you have to do that because you're learning, but there's no place on earth or in the real world that there's a frictionless surface, but this is part of the building blocks of learning. And so in some ways we have to be able to do stovepipe and simulated assessments, but very quickly transition into the real world. I do think space-based intercept has translated to become much more cost-effective and feasible and desirable as part of a system of systems.

I think if you're looking at it to be a hermetically sealed dome that perfectly operates from space, that's unattainium. However, being part of an integrated architecture, I think makes sense. And what Mike emphasized about the challenges to boost phase intercept, I resonate with because the simulations I've seen, the period of time in which the booster is boosting, it's quite slight. And I also measured in a handful of minutes. And I also question a little bit about what the utility of that, the cost to do that, to detect it, translate it, understand it, and move an interceptor over vast distances to get there. You're dealing with, as Lisa said, seconds to do that. But at the end, having an intercept very late in the boost phase, I'm not sure what is so militarily more effective about that than later in mid-course, say near the apogee or late ascent phase. And the reason I say that is there's some false impression that when a booster is rising, if you target it, it will simply fall straight back down to earth. But if it has enough momentum, really what the simulation shows, it falls short. It may not make it all the way to its intended target, but it'll fall short somewhere else. That occurs whether you're in boost phase or late boost phase or early mid-course, ascent phase where you're gliding, or those kinds of things. So personally, I think doing some things in space is very feasible.

And what I would say we need to do as well is, the cost of launch has come down dramatically. The cost of small, miniaturized satellites has come down dramatically. I mean, 95% on the order of that amount in the last 20 years. And the enabling technologies like optical communications, meaning I can transmit vast amounts of data very rapidly at high throughput. So one of the things that Mike and Lisa should be very proud in their legacy, while they were in the Undersecretary's Office for Research and Engineering, we started Proliferated LEO. And you're starting to see that be populated.

Now it takes time for those tranches, but missile tracking satellites in the dozens are soon to be in space above us as a result of that. So having the ability to invest in these high compute, automatic target recognition, autonomous algorithms, the enabling communication technology to transmit vast quantities of data, not small amounts like we've done in the past through Ka band transmission, or something of that nature, that needs to occur. But also companion technologies with directed energy, the means to degrade other activities through other forms of directed energy can be part of that architecture. And I think I resonate a lot with the hypersonic challenge comments that Lisa and Mike made. But part of what you have to do in hypersonics is, you don't necessarily have to kinetically defeat the reentry vehicle. If you degrade it or you disrupt it, it is in such a challenging environment that it can be, through its own dynamics, torn apart or experience instability.

As long as it misses the target, we're good here. You just need to be able to do that. But last thing I'd say is there are, the governing pace for speed is typically regulation or the acquisition environment. It's not the pace that technology can be developed. We shouldn't exaggerate that crash programs produce things right away. There's a famous Wernher von Braun comment where he said, look, the problem with saying there's a crash program, it assumes if you get nine women pregnant at the same time, you'll have one baby in a month. It doesn't work that way. And there needs to be a certain tech maturation period. But typically that's governed by our acquisition system, our requirement setting system, or in Mike's case, in the COVID example, the vaccine actually existed much earlier.

We spent most of the 10 months going through the regulatory process to assure ourselves it was safe. And there are very valid and good reasons why requirement setting processes exist, acquisition processes exist, but they're typically for mature technologies, meaning before you take an M16 rifle out of a soldier's hand, you wanna make sure the replacement works. In mature technologies, that system has a strong value, and that is in most areas. But in areas where the technology doesn't exist, or you're experimenting, or you're developing, you're doing true research, that system doesn't work very well. And I still remember the debates, and this is why the creation of the direct report and the authorities General Guetlein has are so important. People like Mike and Lisa and I arguing within bodies in the Pentagon for resource setting, things like we need to invest in directed energy, we need to invest in counter hypersonics. But the countervailing voices are, those are not yet very mature. We should limit our investment there. Well, they never become mature if you don't invest sufficiently. So that's where the ability to see a little further horizon, to have the ability to make bets and make decisions about technology areas, that's one of the areas I think General Guetlein can do that.

And then the last thing I'd close with is don't let the perfect be the enemy of the good. Begin doing some demonstrations, some experimentation, some learning on orbit, because I think it will really be illuminating about what truly can be done and see the clouds. But with that, I've prattled on here a bit. Why don't I turn over to you, Riki?

[Riki Ellison]
Yeah, thanks, Jeff. We're gonna go over a little, just a little bit over, but I do wanna just, if you got a couple of questions, not all of them, just pick a couple.

[Mr. John Rood]
Yeah, you bet.

[Riki Ellison]
To Mike and Lisa.

[Mr. John Rood]
Well, one of the questions, and there were several good ones that we got from the audience, was Mike and Lisa's space-based intercept in very low Earth orbit operating areas. The question was, China is showing a lot of interest in very low Earth orbit. Other people are. Do you think it's viable or not for us to do space-based intercept or support the intercept mission from very low Earth orbit?

[Dr. Michael Griffin]
Well, certainly it's viable. The question is, is that the best solution? I mean, what problem are you trying to solve? And then is, you know, I don't start with the perspective as a system engineer that I wanna do very low Earth orbit. Now, what's your next question? I'd start with, what's the goal of the space interceptor fleet? What are the goals of it? And what role does VLEO have in that? Because it has challenges. You need to be constantly boosting. You're going to have, you know, it's basically an aerodynamic object. Long, long ago, I worked on, that's for scientific mission, a VLEO object, and it's challenging. So, okay, if that turns out to be the best answer, great, but I don't start with the assumption that it is, and certainly not just because that's where China's going.

[Dr. Lisa Porter]
Absolutely.

[Mr. Riki Ellison]
John, next one.

[Mr. John Rood]
So next question would be, in terms of space-based intercept integrated tests, the question was, we need to do some testing. We need to begin to experiment. What would you recommend in terms of the right way to start doing that? For example, the questioner asks, should we try to tackle non-ballistic threats like hypersonic missiles or FOBSs, you know, operating in orbit? Should the future focus be just ground-based things, such as more advanced ground-based interceptors? Where would you begin your experimentation first to get to the goal for demonstrations, what the questioner is asking?

[Dr. Michael Griffin]
Well, again, I have no objection to proceeding in parallel, but the extent to which we want a space interceptor fleet does depend on the outcome of a cost trade for an overall system designed to maximize our defense efficacy. But if I wanted to do those experiments, you first have to decide that you are going after mid-course objects, which, as I said earlier, is a different kind of intercept problem than going after a booster, and is, again, a different kind of an intercept problem from going after hypersonic rounds. So those are just two completely different things.

[Mr. John Rood]
But wouldn't you, Mike, begin with some demonstration efforts?

[Dr. Michael Griffin]
Yes, of course, of course. And I was about to say that everything you want to demonstrate about intercepting mid-course objects can pretty much be done with suborbital shots or a low-orbiting interceptor and a suborbital target. You don't need to make a big mess with debris. For those of us who like orbit dynamics, there are obvious approaches to being able to do that kind of testing without making a mess.

And yeah, those are the demonstrations with which you'd start. Going after a hypersonic round is a whole different task, but yes, I would want to start with demonstrations of how we can get our glide phase interceptor out into the battle space, which is, you know, Mach 6 or 7 and above, in time to get the incoming hypersonic round when it is maneuvering. And I'll emphasize one more time that going after a maneuvering target is a different class of guidance problem than going after an object in ballistic flight.

[Dr. Lisa Porter]
Right, and then I would add that the sooner we can break our dependency on human-in-the-loop, the better. So I'd start designing manageable experiments, John, to really push us to explore what we can do autonomously. Even if we didn't, “have to do it autonomously,” i.e. you had like five coming in and you had a couple of things you're connecting, we've got to break that dependency on the human-in-the-loop. And the only way we're really going to do that is to convince ourselves that we can do it, obviously. So I would not push that out till later. I would start getting after the autonomy problem.

[Dr. Michael Griffin]
Couldn't agree more.

[Dr. Lisa Porter]
And you can design experiments that are manageable that allow you to, as you correctly pointed out, you don't try to take on seven miracles at once. You take on one at a time, and you can do that. A good program manager can design a set of experiments that allows you to climb that, but you're never going to climb it if you don't start.

[Dr. Michael Griffin]
Right.

[Mr. Riki Ellison]
John, one more question, please. Last question.

[Mr. John Rood]
Well, just following up on that, there's one question that's a good one for Lisa to follow up on, where a questioner asked: how will space-based, ground-based, and sea-based engagements be de-conflicted to avoid interceptor wastage, given the time periods involved?

[Dr. Lisa Porter]
Yep. No, that's an open question. And that's part of how you set up your series of experiments, because you're also going to have to demonstrate that, the weapons target assignment part, especially when you are decentralized, meaning you don't have access to everything you'd like to, you only have some amount of information, how do you do that exact problem? These are exciting times, honestly, but again, you design experiments, John, to your point, to say that's a specific challenge.

We know how to design experiments to try to push ourselves to solve that problem. My concern is that we'll just keep doing, you said the same thing, we'll just keep doing the same thing because it's what we know how to do. And we've got to get after some of these harder problems, but there is definitely a very appropriate, as Mike says, system engineering approach to solving these things. And you do it with a set of experiments that allow you to climb and grow. And I think, John, you were alluding to also, not every experiment is going to succeed. That's fine. That's what an experiment is about.

[Mr. John Rood]
Absolutely. Did you want me to stop there, Riki?

[Mr. Riki Ellison]
We good?

[Dr. Michael Griffin]
We're fine. Whatever—

[Mr. Riki Ellison]
You want more?

[Dr. Lisa Porter]
Did you want to say anything else on that?

[Mr. Riki Ellison]
Do you want to answer more questions?

[Dr. Lisa Porter]
Whatever you want.

[Dr. Michael Griffin]
Whatever you want. I wasn't going to say, I had nothing to add to what Lisa said—

[Mr. Riki Ellison]
John, are there any other real good ones that need to be asked?

[Mr. John Rood]
Well, I mean, there's one that is deliberately provocative about: is it really a good goal to aim to do a demonstration in three years given the cost and previous studies? You know, they're playing the role of doubting Thomas. Can we really do this from space in the time period required?

[Dr. Michael Griffin]
What do you mean by this?

[Dr. Lisa Porter]
Right. Yeah, it is the question of what do you want to demonstrate, obviously, John. Yeah, yeah.

[Mr. John Rood]
Okay, well, and then another one was: do you have any views on the organization structure here and how, you know, one of the questions asked, where should we put this joint program office? How should it be structured? Kind of the questions Riki was raising, which are difficult ones about command and control.

[Dr. Lisa Porter]
They are. They are, John. And I think the command-and-control point, again, Guetlein was extraordinarily on point with just making that the center focus of his number one priority because it also guides answers to those questions. But if I could offer just as an addition, Mike and I are both really, really pleased to see, you know, the authorities and the independence and the ability for Guetlein to do what he has to do. But we do hope that he will include and be able to get others outside of DOD to participate as well, and particularly the intelligence community. How they think about that other part of deterrence I talked about could be extremely valuable and also would allow for some, I think, bone chilling demonstrations as far as the adversary goes.

And if you just think about the FOBs and how they have some doubt in our abilities in the INDOPACOM theater, right? They didn't demonstrate thousands of FOBs. They just demonstrated a couple and that was enough to put us back in our heels and go, oh boy, well, we need to be able to do that. And what does that look like? And how do we think about that from deterrence? I hope that Guetlein has the authorities to reach out to his IC in particular colleagues and say, let's think about that part of deterrence and make sure we really sow doubt in China's mind and Russia's mind about what they could or couldn't do.

[Mr. Riki Ellison]
Lisa, I think Mike's on the page with just that, with those agencies. I know our SHIELD program that he developed with us.

[Dr. Lisa Porter]
Yes, I'm just kind of giving him a shout out.

[Mr. Riki Ellison]
We're bringing those guys in. We have to play with them.

[Dr. Lisa Porter]
I'm just giving him a shout out, yeah.

[Mr. Riki Ellison]
I think we got it. It's been so great. Five months ago, we projected and it happened. So I'm gonna ask the same question five months from now. Five months from now, what is the best projection that we can expect or be really hopeful, really happy about? And I'll leave you last, Mike, but I'll start with John. It'll go Lisa. John, five months from now.

[Mr. John Rood]
I think significant progress is possible in five months in the following ways, that the Golden Dome initiative led by Guetlein, they're still forming up and focused on authority, structure, people, division of labor, roles and responsibilities, and beginning to solicit input from industry. Good so far. But I think what's possible in the next five months is to use, exercise some of those rapid authorities to accelerate the movement towards some of these demonstrations and procurements. Because I really think the only way you're gonna get some of that new thinking and new tech, that enabling technology. I don't think we should think of three years as a cliff. Three years is a waypoint, a milestone, on the way to greater capability. So I think that is possible, some early demonstrations of the GO FAST authorities.

The other thing is, don't forget, there are solicitations that the Space Development Agency has been doing to build out the missile tracking layer. Those can be accelerated very rapidly by making acquisition decisions, expanding the size of the pool, the number of satellites, if you will, that you buy, so that you build out the enabling structure to both sense, detect, pass the data, and then begin to communicate at the speed of light much more rapidly, so that you create some of the plateau, if you will, the foundation of capability that you need more rapidly. And I think all those things are possible in the next five months.

[Riki Ellison]
Thank you, John.

[Dr. Lisa Porter]
So, you know, Guetlein has a task. I think he has to deliver an architecture pretty soon. So I can't remember if it's 60 days.

[Mr. Riki Ellison]
We're well beyond that.

[Dr. Lisa Porter]

Yeah, but no, no, but he's supposed to do another more detailed as I understand it. But the point is, that's going to need to address Mike's points about some of these high-level trades. We need to start thinking about what is it that we want to focus on? And because, you know, there's a lot of different ways you can go and you can't build everything. So you've got to do that. And then to John's point-

[Mr. Riki Ellison]
Do you want those studies, the one that Mike's talking about, happen in five months?

[Dr. Lisa Porter]
Oh, gosh, yeah. If there are enough experts, again, they have to be independent. You don't want people coming in saying, I know the answer. That's the challenge. So there are people in the community who could do that objectively. Oh yeah, you could do that very-

[Mr. Riki Ellison]
That's an achievable goal.

[Dr. Lisa Porter]
For goodness sake, yeah. Now, you're going to make assumptions. You're going to have to, you know, but I think you can do it to the extent that Mike was talking about. And then I would say, what I would want to see, you're asking me if I were queen for a day, I'd want to see General Guetlein stand up a couple of Tiger teams of folks to pose some of these technical challenges that are not impossible, but they will require focus. I'd want to bring in real non-traditionals. I think that term's overused and watered down now, but there are communities that solve these kinds of problems in different domains, and they normally don't engage with the Defense Department, and they need to be brought in and really start getting people to put some ideas on the table. To John's point, start getting after that.

Let them design demonstrations that just show what's possible. That in and of itself is a deterrence. If we start mustering together some of the best and brightest and just put them on these problems, and to John's point, I don't want to see any DOD 5000 crap. I don't want to see any of that stuff. Just have them go and show what they can do. And John's right. And Guetlein has the authority to do just that. He has all the authorities he needs. He can go and say, go do this. Show me what you can do. And just doing that, just showing the action is the next step. That's the concern issue. We don't want to be sitting here in paralysis around what do we do next. Mike, I'm sorry.

[Dr. Michael Griffin]
I think I agree with you. Five months. So what I have, yes, I believe that the kind of architectural trades I'm talking about can be done easily within five months. And I think they should be done. I'd raise a point that when you talk about what you want to put in space versus what you want to leave on the ground, the trade can come out either very obviously in one direction or another, okay, decision made, or it can be close. If a system engineering trade at the top level is close, then it doesn't matter what you do. Okay, think about that. If it's close, either answer's okay. All right, and if it's obvious one way or the other, then you should do what's obvious. It's just that the study needs the effort, the design effort, the

system engineering thinking at the top level needs to be done by people who don't have an ax to grind. Okay, so I-

[Dr. Lisa Porter]
Or have a lot to gain if you pick one over the other.

[Dr. Michael Griffin]
Yeah, exactly. It should be done by people who are going to profit from a certain answer.

[Dr. Lisa Porter]
Answer versus another, yeah.

[Dr. Michael Griffin]
Okay, this is why we have government and why we have contractors. Contractors exist to do what I tell them to do. Okay, so that's thing one. Thing two, the kind of experiment that I think we need to do for the distributed autonomous C2 that Lisa's talking about is actually a pretty simple thought experiment. Suppose we start with five sounding rocket class targets. Okay, and suppose we start with, you know, a couple of SM3s, a couple of SM6s, a couple of THAADs, a couple of Patriots, and say, show me the C2 architecture that allows me to do an experiment where I'm gonna go after those five targets with this suite of ground-based things that I already own, that don't presently talk to one another in any significant way beyond experiments we've done, and show me how you're going to do the autonomous distributed C2 to kill those things in such a way that the problems we've talked about, like everybody decides to go after the easy target, that doesn't happen. And, you know, the different interceptors aren't stepping on each other's toes.

[Dr. Lisa Porter]
And there's no GPS.

[Dr. Michael Griffin]
And, oh, by the way, thank you. There's no GPS, and they don't necessarily have comms with one another. Okay, one, you know, the THAAD battery doesn't have comms with the Patriot battery, doesn't have comms with the SM6. What do you, how do you, how do you, just show me you can do that.

[Dr. Lisa Porter]
So it's essentially what Guetlein called for, but we're saying, and no man in the middle. Like, if you can show that soon, that would be a huge step forward.

[Dr. Michael Griffin]
And once you show you can, see, that's an approach. You've started down a path, which is potentially scalable to bigger systems.

[Dr. Lisa Porter]
Yes.

[Dr. Michael Griffin]

As opposed to starting down a path where, you know, we are today with ballistic missile defense where you do have an overriding capability. And we say, we're going to scale that. Well, no, you're not.

[Dr. Lisa Porter]
Right. And everything's centralized.

[Dr. Michael Griffin]
Yeah.

[Mr. Riki Ellison]
I'm going to add my thoughts.

[Dr. Lisa Porter]
Yes, please.

[Mr. Riki Ellison]
For what's going to happen in five months from now.

[Dr. Lisa Porter]
Okay.

[Mr. Riki Ellison]
So I 100% agree with the cost position of space versus those. That's going to happen. I think on the bigger picture, we have to go public with Golden Dome to the American public. We have to do this. In five months, we'll make that choice. And that's just for our public confidence, but for the threat.

[Dr. Lisa Porter]
Yes.

[Mr. Riki Ellison]
For China.

[Dr. Lisa Porter]
Yes.

[Mr. Riki Ellison]
To make it real.

[Dr. Lisa Porter]
Right.

[Mr. Riki Ellison]
And be real. And yes, that first C2 can be demonstrated and will be demonstrated with exactly what you're talking about.

[Dr. Michael Griffin]
If we don't have the American people behind us, we're not going to be doing this because-

[Mr. Riki Ellison]
Absolutely, it's going to be gone.

[Dr. Michael Griffin]
Not only does it have cost implications, it has massive policy implications. It is a different policy stance by the United States than we have today. And if the American people don't buy it—

[Mr. Riki Ellison]
But that's the rollout that has to happen. I know the team's still forming, the architecture's not fully in place. So that's not, that's going to take some time. That's what I'm saying. Five months, we got five months here. When all that's ready, then yes, it's got to be pushed to the public on a big rollout. And I think I'm pushing, I believe it's Vandenberg. I believe it's the place to do this. And you can do the experiments of the C2 all over the place, but that would be the center point to go. And then I think, yes, you invite, you go up to Silicon Valley and you invite the best innovators in the world.

[Dr. Lisa Porter]
And not just Silicon Valley. Remember, they're not all here.

[Mr. Riki Ellison]
But you got to start somewhere.

[Dr. Lisa Porter]
But the point is there's a lot of innovation we're not tapping.

[Mr. Riki Ellison]
So those are big. I don't know if they're as big as what we did five months ago to get the authorities and the DARPA.

[Dr. Lisa Porter]
They're important, but this is the time. We don't have time to, yeah, exactly.

[Dr. Michael Griffin]
We have to- I want to double down on the policy point. This is a major policy shift for the United States to do this, hopefully again, with allies and partners to say that we're not tolerating the current vulnerability we have to adversary missile attack.

[Mr. Riki Ellison]
And that policy space, just because the biggest one is Space Intercept because we've never-
[Dr. Michael Griffin]
That's right. So if we decide that we want to invest in Space Intercept, that's a huge policy change. But frankly, replicating my, at the other end of the spectrum, replicating my, I wasn't quite joking, but it sounds as if I were, my 10,000 Aegis Ashores to provide a really

comprehensive defense. That's a huge policy implication. And if the American people don't buy into the concept of “we're going to remove some of the vulnerability we have toward missile attack,” if people don't buy into that, it won't happen.

[Mr. Riki Ellison]
Absolutely. And I think we also know that there's a lot of threats to the Golden Dome here, because of the money and the power it has. So that's got to be fought as well. But these are great five-month achievements. We'll have you back here five months to look at what happened. We all good? I want to thank you, John, certainly Lisa, Mike, for taking the time to help.

[Dr. Lisa Porter]
Absolutely. We're very passionate about this, as you are. So we're happy to be here.

[Mr. Riki Ellison]
Great discussion. This is educating. This is highlighting stuff that is not circulated, I don't think, to the general public.

[Dr. Lisa Porter]
Right, I agree.

[Dr. Michael Griffin]
I just hope we weren't boring.

[Mr. Riki Ellison]
I don't think you were boring. Thank you.

[Dr. Lisa Porter]
All right, guys.

[Mr. Riki Ellison]
Thanks, John.

[Dr. Lisa Porter]
Thanks, John. Good to see you again.

[Mr. John Rood]
Thanks for being with us. See you later.

[Dr. Lisa Porter]
See you later.