Center for Strategic and International Studies

TRANSCRIPT

Event

Space Strategic Dialogue: Space and the Future of Warfare with Gen. Stephen Whiting, Commander of U.S. Space Command

Outside Perspectives on Space and the Future of Warfare

DATE

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FEATURING

Tony Frazier
Chief Executive Officer, LeoLabs

Even Rogers
Chief Executive Officer and Co-Founder, True Anomaly

Mike Gancio
Director of Analysis, Senate Select Committee on Intelligence

CSIS EXPERTS

Chirag Parikh
President, Indutara Space LLC; Senior Adviser (Non-resident) Aerospace Security Project, CSIS

Brigadier General (Ret.) Scott Stapp
Chief Technology Officer and Chief Revenue Officer, DEFCON AI, and Senior Associate (Nonresident), Aerospace Security Project, CSIS

Transcript By
Superior Transcriptions LLC
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Brigadier General Scott Stapp (Ret.): OK. Welcome to the strategic panel on, essentially, space warfighting. So I'm Scott Stapp. I'm a senior advisor here for Kari at CSIS. And we're going to do a continuation of, essentially – General Whiting did a great job of laying out not only how fast space is moving, but how complex space is becoming. So we're going to have the panel here dive a little bit deeper into those questions.

We're going to really break space into two pieces. One is – when you talk about space warfighting, one is: How do you support the warfight from space, so for the ground forces? And then the second one is: How do you actually conduct the warfight in space?

So, before we get into the questions, I want to introduce the panel. And I'm going to let them kind of go a little bit two to three minutes apiece, introduce their backgrounds, and a little bit about how they're thinking about this problem.

So, to my left, I have Tony Frazier, CEO of LeoLabs. And then Even Rogers, CEO of True Anomaly. Actually, I'm going to go to Mike Gancio, who's next; he's the professional staff member of the Senate Select Committee on Intelligence. And then Chirag Parikh. So I don't know – and again, I think most folks know Chirag, although it says – it says here he is the – Indutara Space LLC. I think most folks know him as the secretary for the – when he was at the White House for the National Space Council.

So, with that, I'm going to turn it over, Tony. And tell us your background and a little bit about what you think about space warfighting, and anything you want to talk about General Whiting stuck.

Tony Frazier: Yeah. Thanks. So Tony Frazier, CEO, LeoLabs. LeoLabs, our vision is to be the leading source of persistent orbital intelligence for space domain awareness, space traffic management, and missile defense.

I think – we do that through a global sensor network that is based on the ground, so we have 11 active radars across seven locations around the world. And we built that system to really maintain custody of what we saw as the emerging trends, you know, in space. And so building on General Whiting's comments, in low Earth orbit, you know, we saw this massive investment in commercial capabilities that led to a growth in the total number of objects being tracked from about 900 in 2016 to over 14,000 satellites today, and over 27,000 objects, you know, that we're tracking, you know, today.

And I think, you know, in terms of, you know, some of the themes that were covered earlier, you know, we've seen the environment become much more congested, contested, but also competitive, which is driving a change in requirements. And so when General Whiting referenced the integrated priority list and this need to have enhanced battlespace awareness for space

operations, you know, we need to move from an environment where we're getting, you know, a handful of measurements a day, you know, for those objects in low Earth orbit to being able to maintain persistent custody, you know, of those objects. And so that's really what's driving, you know, a lot of our evolution at LeoLabs, you know, where, you know, instead of being able to get a measurement a day to predict an orbit we want to be able to maintain constant custody, you know, of those – of those objects, increasingly from adversarial nations.

And so a lot of the investments we're making to proliferate our next-generation sensors, which then allow us to be able to get constant measurement, you know, to detect, track, and characterize, you know, those threats we think is really important. You know, and when you think about the threat going from very low Earth orbit, you know, out, you know, to cislunar, I think we as an industrial base need to come together, you know, to be able to, you know, provide that constant surveillance, which then can be applied, you know, in a much more, you know, tactical mission.

Brig. Gen. Stapp: Thank you.

Even?

Even Rogers: I'm Even Rogers. I'm the CEO and cofounder of True Anomaly. I'll start with my background.

I started True Anomaly four years ago after a 10-year career in the Air Force. And I was one of those young officers that General Whiting was talking about that lived through the weaponization and the militarization of the space domain in the modern era, and I had a front-row seat to that transformation. I was in the Air Force, and then I went into the Space Force and served the last couple of my – couple years of my career in the United States Space Force. As an Air Force officer I was an Air Force weapons officer, so my responsibility was to be a tactical expert and a tactical leader for joint fires in the space domain. And these were concepts and ideas in space that you had to say in very sort of hushed corners in public settings, but largely only in classified settings. And so it's been gratifying and incredible to watch this rhetorical transformation and conceptual transformation happen in front of our eyes, and that we can have these open strategic dialogues.

The core observation that led to True Anomaly was that space warfighting technologies are downstream of operational concepts, and the operational concepts that are starting to emerge necessitate that we build dedicated warfighting platforms for space. You'll hear me maybe talk about the death of dual use for space superiority; that's going to be one of my controversial and hopefully interesting takes today. But True Anomaly is all about building warfighting capability for the United States and its allies. So we spend all of

our capital and all of our talent and all of our time thinking about how to build and building the most lethal and combat-effective space systems and the training capabilities that are necessary for the United States to protect and defend itself in space, but more importantly to deny our adversaries the use of space for, as General Whiting said, targeting of terrestrial forces and the denial of the U.S.' abilities to use space.

The only thing I'll emphasize, maybe, from General Whiting's speech is that maneuver warfare isn't necessarily about maneuver. Maneuver warfare as a concept, it relies on the movement of objects in space and time to a position of advantage. And he – I'm not stating that he's conflating these two things at all – he's, obviously, an expert in joint warfighting – but the fundamental concepts that the space domain or space warfighters are starting to bring into the conversation are not new. We're starting from first principles of what it means to do warfighting. And now, with an abundance mindset, with a growth mindset, we're unleashed to have really interesting conversations and develop critical technologies that will defend the United States and its allies. And quite literally what we're talking about is defending and protecting hundreds of thousands of soldiers and sailors and airmen from space-enabled attack, and that's a righteous mission.

Brig. Gen. Stapp: Even, thanks.

Mike.

Mike Gancio: Mike Gancio. I'm currently the director of analysis at the Senate Select Committee on Intelligence. I'll be brief.

I don't nearly have the expertise these gentlemen do, but I've been looking at space now over the course of my career mostly from a threat perspective. And what we've seen, the general laid out. I think he said it better than any of us will. The threat has almost gone parabolic over the last few decades, and now we're at a crucial juncture. So that's – whether it's on the committee here where I currently sit, or my job previous to this was in the intelligence community as an analyst looking at space and counterspace threats, it's very evident.

And it's – a forum like this is a privilege to participate in because we're now able to discuss a lot of the threats that previously, to Even's point, were not well-discussed publicly, and there just wasn't a lot of material that we could talk about. And now we've got fancy videos and plenty of evidence that we can point to in official government publications, or think tanks like CSIS put out great annual threat reports.

So that's been my – you know, my focus here is really on the threat, and I'll leave it to the much smarter folks of what we do about it. I just – I like to point out the problems. I'll leave it to Chirag to tell us how to solve it.

Brig. Gen. Stapp: All right. Thanks, Mike.

Chirag?

Chirag Parikh: Yeah. I think – I've had a front-row seat on this topic now for almost 30 years. Similar, you know, to a lot of people here, I started in the government. I started – you know, I think many of you know me, as Scott was saying, as the White House guy – Space Council, now Security Council. But my career actually began doing scientific and technical intelligence of foreign space and counterspace systems, similar to Mike – different organization, but similar concepts along the way.

I had the opportunity to help shape and inform national policies because of these threats in 2010. A lot of this begins in about not just the Chinese ASAT test, but also in 2010 policy discussions along the way. I had the opportunity after the Security Council and we – huge classified investments in budget in the '16 through '20 budget bill that has sustained now through three administrations, and hopefully will continue forward along the way. And what you see is the threat is outpacing the capability right now.

And so when I went over back into the intelligence community to run collection operations for the National Geospatial Intelligence Agency, it showed just how dynamic and complex this environment now is. Then, out of just sheer morbid curiosity, I decided let's see what it feels like to be in the private sector and work with the government. And, boy, that's hard. (Laughter.) Yeah, you guys are right; I have to admit that. The government does not make it easy to work with them on particularly novel topics now, like space control with the commercial sector or the international sector. I hope to talk about that.

But then I think the last job really shaped, you know, holistically, as the executive secretary of the National Space Council, because this is no longer just a military-for-military thing. This is no longer just national security – Title 10, Title 50. This is really the Venn diagram of civil, commercial, national security space capabilities overlaid on allied civil, commercial, and national security capabilities. And to be able to weave that those elements together is really essential for us to be able to operate in this new environment that we've heard General Whiting talk about recently.

Brig. Gen. Stapp: No, thank you.

So, as I said, as I start these questions, we're going to break this into two pieces. One is, how do you support the how do you support the warfight from space? And then, how do you, basically, conduct the warfight in space? And some of the questions will be generic. You can answer them both. We can talk a little bit and cross the boundaries.

But what I am going to do is key off a little bit of what General Whiting talked about when he talked about the U-2 getting shot down because, again, it's interesting that history tends to repeat itself as you – as we switch domains from air to space. When the U-2 got shot down, it was actually an intelligence platform, right? It was run by the intelligence community. When the – when the department, with all of its money, decided, well, in ISR there's intelligence, surveillance, and reconnaissance, and the department does a lot of surveillance and reconnaissance; rather than having three U-2s like the intelligence community had, they decided to buy a hundred, right? A lot of money. They made it surveillance and reconnaissance, and they pushed it that way.

I think everybody here knows that they've started other platforms have become at risk in the fight. We are moving – we are we are sunsetting JSTARS, and it is moving to space in a GMTI world, right? They're starting to look at AWACS. So a lot of other airplanes are struggling and they're moving into this space domain.

The ISR world has typically over the last 40 years been dominated by the intelligence community. The department is now looking into that, and is finding they need it to do strategic warfighting and the missions of these other assets.

So, with that said, how do we look at the integration of Title 10, Title 50, really DOD in – or, DOW and IC? And then, you know, how do we look at adjusting the policies – you know, operations, acquisitions – to make that more seamless? What are those barriers that you guys see to making that more effective? I know in the end if you guys don't talk, Chirag's going to talk.

Mr. Parikh: I'm giving you guys a chance. (Laughter.) OK, I'll start.

Look, having lived in both communities and having helped support now commercial entities along the way as well, the cultural element is a very interesting one. And I think it's a solvable one, to be quite honest, and I think it comes down to timelines. The intelligence community has often worked on longer timelines. The intelligence community has worked at higher classification levels and protected their secrets because of sources and methods. That's obvious. Department of Defense often lives at the unclassified level in SIPRNet, particularly at joint operations around the

world, participating with allies and partners. And so being able to change the culture of how quickly you need speed is one thing.

Then another thing, on the policy side of things, I think it's classification policy, and in two different areas.

One is on the threat side. So Mike talked about the fact that now more and more information is publicly available about just broadly communicating the threats out there. For a lot of the different international dialogues that I've led, we have talked about it in classified channels, about the threats along the way, with our allies and partners. Now being able to have reports like CSIS and these types of panels talk about these threats I think is important.

But similarly, while often – I'm sorry; I'm going to put my IC hat on – while often the complaint is about we can't talk about the threats, the DOD hasn't done much self-service as well. There are a number of capabilities within the Department of Defense that sit at varying classification levels that have been brick-and-mortared into security classification guidance – SDGs – along the way. Scott ran all of these along the way, so I think it's your fault. (Laughter.) So we'll begin the firing now.

But I think this is the challenge, which is in order for us to be able to get these types of capabilities out to the joint force, out to allies and partners, out to partnerships with commercial, the classification guidance policy – which initiated, you know, four or five years ago now, and is being continued – needs to continue to evolve along the way.

Brig. Gen. Stapp: No, that's great. And you brought up another one, which is I think commercial and international are, obviously, going to be critical as we go forward, but there's question marks about how do you integrate commercial and international when you look at varying classification levels, when you're talking about ensuring trusted data. How do you look at commercial and international integrating in with these national capabilities?

Mr. Gancio: I mean, I think the general's example with Operation Olympic Defender. And if you've been to a combatant command, watch for it; it's very helpful. That's where the Title 10 culture can help a Title 50 IC who's traditionally very U.S.-only-centric, no foreign classification, right? When you have a joint military element with our allies and partners operating together day to day, by default then you're sort of forced to operate at a level that's more releasable.

And that's – it's mostly culture. It is – there's IT networks. That's always going to be – you know, sort of the long pole in the tent is how do you make the computers talk to each other at the right classification. But when the default, and it's – that's the sort of top-down guidance, is you need to

produce information that we can share with so and so at a certain level, and that's the marching orders, the bureaucracy will adapt.

So I agree it is – it's mostly a cultural. And it's – you need a forcing function. And I think having, you know, integrated allies with us helps force that. The IT will follow behind in some time that – I can attest personally it is frustrating when you have information that, you know, you just can't get it onto another computer, right? I mean, that's happened. That's a solvable problem.

Mr. Rogers: Security is a big challenge, but defendability is also going to emerge as a serious challenge. And I think Tony's probably in one of the best positions to speak to, like, the operational integration of SDA data with traditional military and intelligence sensors, and how that's used.

But for our part, I think there's a question mark as to whether SPACECOM is going to defend commercial assets. Now, they've said it – from a rhetorical standpoint that it is on the table as a thing to go do, but unless an asset is on the CAL or on the DAL – the Defended Asset List or Critical Asset List – it's not going to be defended. And we've seen – we've seen this in the Iranian conflict play out a couple of times. You're talking about civilian infrastructure being targeted, but some of that infrastructure actually is on the DAL in the Middle East. So the United States is responsible for, along with its allies in the states there, to protect oil, to protect civilian infrastructure, in Qatar in particular.

Translate that to space, that becomes incredibly complex in a low-munitions, low-density defendability environment where almost certainly the first shots against space sats or assets are actually going to be against commercial partners. And commercial partners also need to come along. And this is like – space warfare, and I think John Klein said this, like, is sort of the obvious domain, especially in a contemporary conflict or a contemporary environment for irregular warfare, warfare below armed conflict – the shooting fight, if you will. But cyber and electronic warfare and directed energy always are sort of where – and those are the systems that our adversaries are using against our commercial partners, and by the way they're using them today against commercial partners.

There's a question about whether they need to defend themselves, and there's a question as to whether there's sufficient integration at the planning and the – and the OPORD level to say: OK, I need a Maxar spacecraft, I need a such-and-such spacecraft to be on the no-kidding DAL because it's providing – it's providing critical warfighting functions. By the way, as soon as you do that you signal to your adversary that it's an – it's an important asset and it becomes – it sort of goes up their list from a – from a joint integrated priority targeting standpoint.

Mr. Frazier: Yeah. I think those are all really good points.

I mean, what I would just add is that it's important in this relationship to build trust, and that only happens through kind of deep shoulder-to-shoulder engagement. And so I definitely think that the initiatives like the Commercial Integration Cell, you know, which has been incubated, you know, out of Space Force's space, you know, provides a forum for commercial providers to be in the right classification levels and environments to be able to share threat intelligence. You know, that was a great place to start. Things that we're doing now to extend that into active engagement and exercises and wargames, you know, I think shows, you know, kind of what would be the CONOPS, you know, for – you know, if commercial was targeted, you know, how we then would respond to that.

But I think kind of a broader topic, which, you know, taking a page out of my days focused on the geospatial intelligence mission, is, you know, when you're working to build a sustained relationship with the U.S. government, it's not just about kind of collecting, you know, what you believe is exquisite data; it's having the functional manager do the validation and verification of it to show that it's really fit for use, you know, for different missions. And so, you know, work we did at the time to be able to, you know, not just, you know, verify the resolution, but the location – the accuracy, you know, of the data, both in an enhanced form, as well as in a processed form, you know, that was really critical to be able to say that commercial imagery could be leveraged as part of a targeting operation versus just, you know, supporting a foundational mapping mission. I think there's a lot of parallels with what we're going to need in space.

So just like, you know, there is a – you know, a lot of the things that we did with NGA at the time that then fed into, you know, what, what was MIDB and is now MARS in terms of, you know, providing a foundational intelligence or order-of-battle capability I think is going to extend to space. You know, we need to be able to, you know, understand that, you know, the – not only kind of where something is, but what it is, the attributes of it, the locational accuracy, you know, so that it can be leveraged in more of an offensive capacity. And so having the relationships with, you know, who plays that role, you know, as a functional manager to be able to assess commercial imagery during times of peace, so that as we move to crisis and conflict it can be trusted at the time, I think that's super important.

You know, to Even's point, you know, we need to be integrated into the operational systems. You know, it can't be something that's just off to the side. You know, it needs to be deeply integrated into the same environment

that all of the national, you know, sensors are also, you know, feeding so that it can be delivered, you know, into the hands of the warfighter.

Brig. Gen. Stapp: That's good.

Do you have anything short?

Mr. Parikh: I'm just going to ask a question, more than anything.

But you know, you brought – or, you brought up the – Tony, you brought up the Commercial Integration Cell. Right now it seems to be mostly commercial – purely commercial, almost a sandbox type of environment. Where do you see that next step about maybe integrating? And there's so much good stuff going in there, and it's such a great construct, but it seems to be now its own isolated ecosystem separate from the integrated joint warfighting system that you guys have been talking about. So what do you think is that next step to be able to have – you know, bring that commercial layer in there?

Mr. Frazier: Yeah. I think the – one of the initiatives – you know, the conversations we've been having with the Space Force around their CASR effort, I think, has been instructive about where they want to go.

And in terms of deeper integration, you know, this is where you need to look at where the architecture is leading. So if you look at, you know, the way that the BMC3I – so the battle management, command, control, communications, and space intelligence – that PAE, you know, that kind of falls within the Space Force, you know, they're looking at, you know, how do we ingest commercial directly into the architecture. So if ATLAS is going to be the system, you know, for maintaining, you know, that space order of battle, you know, it needs to be not just kind of fueled by government sensors and then disseminated out, you know, to the community; like, we need to integrate commercial, you know, as far upstream as possible. So I think that's one example.

Mr. Parikh: I've heard that for the past decade. (Laughs.)

Mr. Frazier: I think we're making progress on it.

Mr. Parikh: Yeah, OK. OK.

Mr. Frazier: Yeah, absolutely.

Brig. Gen. Stapp: Well, and I – and I think this is going to kind of go to what Kari was talking to General Whiting about, is this is about space and dogfighting, and how does this work in space. I think the corollary between what they call the Civil Reserve Air Fleet, which is aircraft that we actually take from the commercial

world and we actually push them into the warfight for – whether it's – it's primarily for mobility; they can go anywhere. When you start talking about CASR, right, which is, you know, the Commercial Augmentation Space Reserve, can you – how do you – it becomes more difficult to do this.

And I think this is where Chirag's going, which is the architectures typically have to be designed and built in such a way because you can't burn a lot of fuel. So if you're not already built into the architecture to cover the pieces you need as they start to look at how they do pass-offs for targeting, how does commercial play into that over time? And if they do, can you fulfill your commercial mission at the same time you know you're going to have to fulfill, you know, a department or a military mission into the future? And I think – you know, I think it's more complex than the CRAF, but it's still a doable do.

I mean, Tony, I don't know if you've thought about that.

Mr. Frazier: Well, absolutely, yeah. I think – I think that, you know, where we've started is, you know, the legacy sensor network that supports this mission, at least from the space domain awareness standpoint, is the Space Surveillance Network. And this is kind of a network of ground-based sensors, both optical and radar, that have supported both the monitoring of the space domain but also, you know, much of our missile warning and tracking architecture. And so the approach we've taken is to look at, you know, where are there geographic gaps in coverage, you know, if you want to be able to maintain persistent custody, you know, of all those objects that are growing threats, you know, whether it's to be able to maintain custody of counterspace assets that China and Russia are flying or if you want to be able to, you know, be in a position to counter the ISR fleets, you know, that are rapidly expanding.

And so, you know, we've been working to build capability that can fill those geographic gaps to be able to maintain custody, but then, you know, we need to be able to open up the interfaces, you know, so that we can be able to apply those sensors in an operationally relevant timeline. And so a lot of the things we've been engaging with the CASR team on has been, you know, how that CONOP would work; you know, how you'd be able to kind of quickly pivot from, you know, a commercial, you know, tracking mission to be able to be leveraged as an extension of the architecture.

Mr. Rogers: CASR's a really important concept, and – but I think the Space Force is still in the early days of thinking through what its real limitations are. There are some important lessons learned from CRAF, particularly in the 1970s – excuse me if I get the decade wrong here.

TWA was one of the major participants in CRAF, and they modified about a half-dozen Boeing 747s to support – with kind of heavier-duty landing gears and a fuselage that allowed them to carry much, much larger – and these are

– these are modified passenger jets that then became freightliners – to support, basically, moving huge, really, really heavy equipment into theater. And those assets were underutilized by CRAF, and it ended up resulting in a pretty significant loss for TWA. Those assets were unusable for commercial – for commercial use cases because the amount of extra excess fuel and the reduced payload carrying capacity for moving passengers resulted in the economics being upside down on those systems. And there's a couple of other examples in the history of CRAF that are interesting that you can point to like that.

And I think we're going to start – the Space Force's challenge – strategic challenge for CASR is to figure out where it makes sense to leverage commercial and where it makes sense to leverage the larger, broader industrial base. And I think the Space Force has a – has a tendency to conflate those two. They think commercial is industry. Commercial is services and capabilities generally provided, commercially owned, commercially operated, and sold wholesale or data to the United States government for consumption. Industry – the defense industrial base is much, much broader than commercial. We're selling units of combat capability to the joint force – or, rather to the services. And I think what we're seeing now is the Space Force come to terms with the reality that there's a role for a commercial, but what they actually need is a scalable defense industrial base that can respond with warfighting capabilities, not just as an augmentation, but as really the development of new fleets of warfighting systems.

Mr. Parikh: Yeah, I think CRAF is still in its nascency along the way. And, you know, I know we have a lot of software and hardware people in this audience here, but I will argue maybe the most important people to help shape CRAF are going to be your contract managers and your lawyers. And I mean this because there's the constructs that Even is talking about, but there's also, like, who has command authority, and when? OK, you're now part of this CRAF construct. You are now a legitimate target in the eyes of an ally – or, sorry, to an adversary. What about liability? What about indemnification? When I was at Space Council there was a very large debate about indemnification along the way. And we had different departments and agencies have varying differing perspectives at this. So a lot of these foundational contractual legal elements need to be ironed out as they kind of set the baseline for all these different operational environments that these guys are talking about.

Mr. Rogers: And a major insurance provider just pulled wartime coverage from their space offering.

Mr. Parikh: Just like that.

Mr. Rogers: Yeah.

Mr. Parikh: Yeah.

Mr. Gancio: Maybe I'll just zoom us out. I'm not a lawyer, not a business background, but what I do know is the threat. And if you think about sort of what is the – so what's the problem that a Civil Space Reserve would look to solve. And I think Even hit on it, but it's more than just one problem. It's capacity on demand. And that sort of goes into requirements, because in a conflict scenario or even a crisis you could imagine the number of things that you'd want to image from space is going to increase dramatically. And so you're going to want a surge capability. On the other hand, we've heard about, and, you know, there's plenty of material out there, that the threat is rising. So you also want redundancy built into the system, and, I would say, extra capacity to backfill any attrition that you take to government or first line commercial systems.

So that's really the problem you want to get after, is just you need more kit at a time and place that you can't – you're never going to really predict it, because a lot of what we design and build and generate requirements is sort of – the analogy to logistics is like just-in-time delivery, right? So when you build a system that's perfectly tuned and optimized to a set of requirements, the adversary gets a vote. And you can't – you don't – you're never going to know when that curveball gets thrown. So having excess capacity available, whether it's through the Civil Space Reserve Fleet or just our commercial sector in general, really helps make that problem more solvable.

Mr. Frazier: Yeah, I mean, I think what I would just add, though, is that the – having it – the CONOP of it just being a surge capability, where industry is going to build a capability and just wait for potential activation, like, that business case won't close, right? (Laughs.) So I think – I think that what part of what we're all working to do is, you know, how do we take what we know is this parabolic growth of the threat, and identify, you know, how does that align to enduring COCOM requirements? You know, what John Whiting said, his AOR is 100 kilometers and up, right? And then, how does that also, you know, map to, you know, what we see as kind of enduring Space Force requirements? And so, what – you know, what General Saltzman shared, you know, kind of the trend lines in the future operating environment as well as the objective force design, you know, is showing that, you know, this is – this threat is not going away, right?

You know, today we have in the, what, 12-14,000 active payloads in low Earth orbit. There's going to be north of, you know, 40,000, we estimate it will be up to 70,000 in the next five years. And if all those active payloads can do maneuver without regret, you know, if that's a trend, that means we're going to need a more robust set of capabilities. And so I think part of, you

know, the way we're approaching it, CASR, as a contractual mechanism. You know, to be able to, you know, go from a, you know, a base service level to an augmented, you know, service level.

It's not an optional way to just potentially activate, you know, the industrial base a few at a time. It's a break glass during a time of conflict. And I think getting aligned on, you know, what that kind of sustained warfighter requirement, you know, means in terms of sustained funding, you know, to address that requirement, and how the mix of spend needs to go from the kind of traditional industrial base to new providers that are able to move quickly, you know, to address these gaps, I think that's a lot of where we're going as a community.

Brig. Gen. Stapp: All right. So I'm going to now transition us back into, you know, the warfight in space. And ideally the warfight in space doesn't happen, right? But as you have conflicts with near peers and they realize how much you rely on space, there is a high likelihood that that will escalate to space. When you look at how much money we've put into terrestrial fighting to do surveillance and reconnaissance and understanding, whether it's airborne or space, it is – over the decades, it's in the trillions, to understand our adversary, understand their capabilities, understand where they're at.

When you now flip that upside down and you start talking about a warfight in space, and space domain awareness becomes an absolutely essential part of that fight. I don't think we've spent anywhere near that kind of capability to do that. When you look at just terrestrially, air is tough to surveil, maritime – we still don't have maritime dominant surveillance. So when you start looking at space, which is significantly more vast, how do we start looking at closing that gap on space domain awareness so you can identify and track those threats? And then, how do you do attribution for those threats? How do you – how do you start understanding deterrence and attribution in that environment?

Mr. Parikh: Tony, you start. You're the –

Mr. Frazier: OK. Happy to kickoff. So, yeah, I think one of the ways we've worked to get after this is to look at how do we invert the cost curve, you know, on this? And so, you know, we – again, traditionally this mission has been addressed through large sensors. You know, these are billion-dollar to multi-hundred-billion-dollar systems, where, you know, they're, you know, extremely proficient, but they're expensive to build and maintain. And so we've been very focused on if you need to proliferate coverage to be able to maintain custody, you have all these threats, where you can for any launch be able to detect – you know, track those launches, both in terms of the launch, plus all the payloads that are deployed from those systems, as well as be able to maintain custody to be able to see the types of activities – so things like

rendezvous, proximity operations, secondary deployments, you know, things that nature – you need to be able to get your cost per sensor down, you know, so you can proliferate coverage.

So similar patterns we've seen in low Earth orbit, you know, looking down, we need to be able to do the same thing from the ground. And so, as an example, the investment we made in our Scout class system, which is a(n) initial prototype we built on a truck. We've now kind of moved to a 20-foot ISO shipping container. That system, you know, we're able to, for the cost of one of these large exquisite systems, we could build dozens, you know, of these systems that could be proliferated around the world, to be able to maintain custody of, you know, those types of ISR assets, you know, that were being highlighted. So I think, you know, we play in that, the tech track and early phase of characterization. I think a lot of what you're doing, you know, which would, you know, allow you to be able to get, you know, higher fidelity view understanding of the threat and action on it, you know, it's how we would contribute.

Mr. Rogers: It's really in the – in the function of intelligence. Intelligence, surveillance, and reconnaissance. And one of the things that Tony's really pulling out is you have to do all of those things. You have to surveil. You have to understand what's there. You have to perform reconnaissance. You need to understand its capabilities, vulnerabilities, limitations, tactics, techniques, and procedures, and intent. And that means that you need a(n) architecture that is multi-phenomenology. You need passive optical systems in multiple wavelengths. You need active systems like radar, ground-based radar. You need space-based radar. And you also need cameras on engines. So you need systems that can maneuver around in space and go where the adversary is. And you need to be able to do that responsibly.

So right now if an adversary launches something into space, particularly into deep space, it's likely going to be months until we can get a good image of that. Then that image is going to be low quality, particularly in ex-GEO. And that's going to – we're going to get surveillance, but we're not going to get reconnaissance. And so, as Tony pointed out, the trick here is to invert the cost curve. You need to get cost per meter per second down, and you need to – and that's at the platform level. Which means you need to be able to get where the adversary is with a lot of thrust and a lot of acceleration. And you need a ton of capability on orbit or responsively to be able to get, again, wherever the adversary goes, from LEO to MEO, to GEO, to cislunar. There's not any one uber system, just uber surveillance and reconnaissance system. There's not any – just like there's not any one offensive uber weapon. It is a combined arms problem. It's a multi-phenomenology problem.

And just to put it in perspective, the United States Air Force, since its founding, has spent $10 trillion on air superiority platforms – $10 trillion.

The United States Space Force is going to have to make the same level of investment. That sounds maybe a little odd, sitting from where we are today. But if space is really a warfighting domain, and you start to expand your imagination about what's possible, then surveillance is the foundation of combat capability. And you're going to need hundreds of billions over the next several decades, if not trillions, in a broad surveillance capability that's from – by the way, from VLEO as well, into low Earth orbit, MEO, GEO, cislunar, and beyond.

Mr. Parikh: I can even go lower. I think the stratospheric operations also is a unique domain to think about too. But let me – let me flip the flipping for a second here. Last I checked, the space surveillance network, all the terrestrial space domain awareness sensors, are not going to tell me where and when I'm going to get jammed; are not going to tell me when a high-energy laser or low-power laser is going to lase my optics; is not going to give me indications and warning of a direct-descent ASAT preparing to launch on orbit. Now, all these capabilities that these gentlemen are talking about are absolutely essential for the war in space. But the war doesn't just come from space to space. It also comes from the ground.

We see normalization of jamming happening in the Middle East as we speak right now. And it's not just because of the Iranian conflict. It's been happening before that as well. And so to me, space domain awareness is as much looking down as it is looking up. And where you're going to get those investments are going to be often from this guy's coffers now, from the budget on the intelligence community side. And while we often put a gigantic, generalistic term for intelligence, there's actually three different phases – I might – there might be four, but I'm just going to go with three right now. There's the world that we grew up in, which is the scientific and technical intelligence community, to be able to provide the attribution, the capability, the knowledge to our acquisition community, years, maybe even a decade in advance – how high, how far, how fast, how lethal, how vulnerable along the way.

Then when I was at the National Geospatial Intelligence Agency, as well as our sister agency NSA, that's more about the indications and warning. And you see this up, this over here, and this over here. That's likely this is going to happen, but if this thing isn't here then it won't happen. And then you have the tactical and operational intelligence community, the twos at the combatant command. To say, now that I know the capability that I've been talking – we've been talking about for a decade. I know where all these pieces parts are now in play, and what they do, and those actions. Now that I see that, now I can provide, you know, capabilities for offensive and defensive space control to be able to take action along the way. And to me, there is this great, huge investment that's going into the military space of things. My only concern is not to replicate the capabilities and needs that are

already being developed in a different domain that has that expertise along the way, that needs to have better Title 10-Title 50 integration along the way.

Mr. Gancio: At the risk of stating the obvious, I mean, it's a tough problem, right? And I think what you've heard a lot focuses on the technology. But I would just bring it back, it also takes people, training, and we talked about culture earlier, because a lot of this – whether it's fusing together sensors, commercial sensors, with government or, to Chirag's point, fusing together the very strategic, long-term intelligence of I've been looking at this weapon system for five years with the watch floor of, well, when's it going to attack us? We need to know the tactics and procedures that are going to be diagnostic of an attack versus testing. A lot of it comes down to people. And that's not something that's easily developed overnight. A lot of this technology we can make investments and surge, and in certainly, this year's budget does that in the right places, but people take a long time to grow in the expertise, both on the IC side and the military side.

So I would just, you know, frame that as an important thing to consider here as you think about doing this. And AI will help. Certainly, you know, that will help us get there. But you're going to need a person who's skilled, you know, whether it's in the technology for deep, you know, what I'd call foundational intelligence, but also what's new, and much harder I'd argue, is the operational and campaign level intelligence of just how all these threat systems are going to work together. Because whether it's on orbit, ground based, there are a lot of different threats. And it's not apparent how they're all going to work together.

I mean, I think you could make cases of, why are they developing this threat system? It's not – doesn't seem that effective. It's hard to know until they use it in anger how it's going to work, and how it's going to work together. So technology will get us there, but it really is going to take a skilled workforce of analysts, military professionals, commercial, to think about how all this, you know, melds together into a space warfighting picture. Hopefully we never find the right answer to that, right? Deterrence, hopefully, works. But you have to – you have to keep thinking about this.

Brig. Gen. Stapp: OK, like you just brought up, so since we were talking – whether it's space dominion awareness, whether it's supporting the warfight from space, fighting it in space, for the whole group, what are the critical technologies we need to look at? You already mentioned one, which is AI. But how does that work? And what are the other critical technologies that enable us to actually maintain some level of superiority in space?

Mr. Parikh: I'll start. I think what you heard General Whiting talk about. I think there is a desire to grow capabilities in the traditional domains within Space Force. It's an intuitively obvious thing that we have to do. From proliferated SATCOM to

proliferated ISR to missile warning support of Golden Dome, as well as conventional conflict along the way, you know, I think a more resilient PNT. And those are the higher-level things. But there has been an historic under investment in, however you wanted to call it, space mobility and logistics, in-space servicing, assembly, and manufacturing along the way. And just as you would not send a B-2 from Missouri and say, oh, sorry, you can only get as far as the Atlantic and then you got to come back because you don't have refueling, we've kind of focused on the refueling thing. And I think that's fantastic. And I think that's the most urgent need along the way.

But I'm hoping that where Space Force now creates, I think, S-9, the Futures Command capacity – I hope you have people who are thinking about all these new technologies about, you know, nuclear propulsion, and about going between different orbits. We talked about cislunar, so different areas for domain awareness. We think about in-space manufacturing, where I don't need to worry about the size of the fairing of the launch vehicle anymore, I just need to get raw material – whether from Earth or from other sources – and I can just make that in space. Where I can do in-space repair and assembly, where I don't have to just gut something because one small actuator failed. There is a whole area, a mission set that exists in every domain – whether we're talking army for tanks, we're talking ship repairs, we're talking air mobility and logistics, all of those domains have those capabilities. And they should be replicated in space.

Mr. Rogers: I'm a knuckle dragger, so I like to work from the target backwards. The purpose of the Space Force is space superiority. That means they require weapons, and they require countermeasures, and they require self-protection – other self-protection technologies. Weapons come in a lot of forms. There are kinetic weapons, non-kinetic weapons. The Space Force is going to need a wide variety of them, including cyberweapons. They're going to need low-debris generating or non-debris generating systems. That seems to be the area of priority. And those weapon systems are going to be across really three engagement phenomenology.

So they're going to need surface-to-space weapons. They're going to need space-to-space weapons, because our adversaries will put capabilities beyond the reach of warfighting systems. And they will eventually need space-to-ground weapons. Space is increasing – is the high ground. It is the ultimate high ground. And it provides you with over match from a momentum and a kinematic standpoint that is incredibly valuable for striking targets, either electronic – from an electronic warfare standpoint or kinetically in the upper atmosphere or down to the surface of the Earth.

As the air domain becomes increasingly contested, long-range munitions, particularly those built by Russia and China, hypersonic weapons, we're not going to be able to get surveillance assets and strike assets anywhere close to

the South China Sea, in particular, and especially in a Russia conflict as well. We will increasingly see the development of weapons placed in space, conventional weapons placed in space, for strikes, in my view, this is just my view, in the terrestrial domain. You need to look no further, by the way, than the 2040 vision that General Saltzman has laid out. He has specifically called out the United States Space Force. I know this can feel a little uncomfortable to folks, because you grew up in a world of 1967 Outer Space Treaty. Doesn't govern the use – deployment of conventional weapons, by the way, in the space domain.

But you think that space is a is a peaceful domain, a peacetime domain. It's not, as we know now. And it was born in conflict. So the development of weapons technologies are absolutely critical. And that includes conventional terrestrial strike capabilities. That is only way to really solve those problems at scale. You move to the left from that, and its advanced targeting systems in every domain – on the surface of the earth, in space, and, of course, space to terrestrial. And then you need the surveillance infrastructure, the training infrastructure, the test infrastructure that supports the service in learning how to operate in a contested environment. The space – again, space Force is a warfighting service. Their job is to deliver combat effects in every domain in which contemporary forces and terrestrial forces in the Joint Force operates. And they're going to need those capabilities.

Mr. Gancio: I think – yeah, I'll offer just the one answer on this. It's a classic intel answer. It depends. To what's the most critical technology going to be, it depends. And I think we're naive if we expect to anticipate or guess – expect to guess that perfectly. And that the historical parallel I think about when I think about how the space domain's evolving today and will look like five, 10, 15 years from now is the interwar period between World War I and World War II, where you had a lot of new technology in the air domain, on the land domain, with armored vehicles, and at sea with aircraft carriers supplanting traditional battleships, right? You had all this evolving over the period of 20 years. And every military at the time was just sort of throwing ideas at the wall.

And if you took sort of the concepts that militaries were thinking about in the early 1930s, radically different by the time you get to World War II and you're in the '40s, right? The Japanese built all these massive battleships, expecting that to be a mainstay. And, well, it's a good thing they built aircraft carriers for them, but for us we invested heavily and that ended up being the primary naval weapon platform by the end of the war. So if you think about applying that to space, and we have all these ideas and novel technologies – whether it's refueling systems or on orbit, you know, weapons of bearing degrees we could talk about, ground based, I really hesitate to try and,, you know, pin a point on one and say, this is it, right? This is the thing we need to put our money in.

So it really is a hybrid approach. And I think maintaining flexibility is really how we get after this and kind of buy insurance. And I would say, fortunately for the U.S., we have a very robust commercial space sector that can innovate with a lot of these technologies quicker than the government can, and can experiment and find out what might work so we have options available in the event something does – you know, a crisis does escalate.

Mr. Rogers: This is one of the reasons that campaigning with commercial is so important, because the dynamic between operational concept development and technology development has been the driver of defense industrial innovation for decades. And really, we saw that in the aviation domain in the 1930s. I mean, there are systems that have no other application outside of warfighting, like the P-51, the F-22, the F-35. Lockheed Martin doesn't sell F-35 to United Airlines. So this collaboration and operational concept development and tactics with the defense industrial base is, I think, really the only way we're going to get to scale with precise warfighting technologies, and not sort of just guess.

Mr. Frazier: Yeah, one point, just to add. I think the – you know, you made a point earlier about we're human resource constrained, right? I mean, if we're willing to ask our Guardians, you know, to be able to take one more warfighting functions, they shouldn't be spending time tracking SpaceX transporter launches and cataloging blue objects – (laughs) – as part of the catalog that supports space safety. And so I think part of this is a cultural shift in – you know, in looking at ways to, you know, through these, again, shoulder-to-shoulder partnerships with commercial, you know, identifying areas where they can stand down on, you know, on certain missions that, you know, are inherently commercial or dual use, you know, so that they can focus their scarce resource on areas that are much more –

Mr. Parikh: Tony, that's already been articulated by Space Force in 2024. They released the commercial integration strategy that said, here are the things that will be inherently governmental. Here are the things that are dual use. And then here are the things that will be purely pushed off towards commercial at this point. To me, I think Space Force has already identified it. I think we are kind of in that, you know, playground, monkey bar world, which is unable to release one hand to go to the next rung along the way. So whether we're talking about World War I-World War II gaps, or we're talking about, hey, we still have to – we still have to operate. We still have to provide capabilities to the joint force. At the same time, we're trying to re-architecture because of the threat. I mean, we're in this strange, nebulous period right now. And I credit Space Force for finally putting out this vision out there. My only gripe with it is, I think the title is wrong. I think the Title should be 2035 not 2040.

Brig. Gen. Stapp: OK. So last question, because we can't do this, so, you know, Even, you talked about, again, some of the capabilities you're going to need to do warfighting in space. Mike, I agree, there's technologies all over the place. One thing we've learned from history is from the Peloponnesian Wars on, is that conflict is going to be primarily kinetic. And as much as we talk about non-kinetics, our adversaries talk about the kinetic space. And there have been a lot of conflicts since the Peloponnesians to now. And every one of the targets that have been hit are somewhere lying on the Earth or at the bottom of the ocean. So when you start talking about a kinetic conflict in space, whether it's us or our adversaries are going to be looking at the same thing, how do you start looking at debris? How do you start looking at debris mitigation? Because there are long-lasting effects. And is a conflict in space a one and done event?

Mr. Parikh: No, it's not, because a conflict is happening in space as we speak, right?

Brig. Gen. Stapp: Kinetic. So if this escalates to a kinetic conflict in space, are you essentially – how do you mitigate the long-lasting effects that will occur?

Mr. Parikh: Well, I think – well, first, I think you got to do this from a normative-setting perspective, right? You know, I know that there is somewhere like 40 or 50 nations have, you know, put out the policy following the United States about not doing kinetic debris-forming ASAT tests. Because, as General Whiting talked about, it's just indiscriminate, like a nuclear weapon, in a way, right, and going along the way. So I think one is just getting the knowledge out there about, like, this is really bad. Remember what happened after the Chinese ASAT test in 2007. International condemnation about littering this domain. We've had to move the International Space Station countless times because of the Chinese ASAT debris that was out there. So, one, I think, is there is a – we've been talking about DOD. We've been talking about the intelligence community. But also part of our national security enterprise is our Department of State being able to make sure that our allies, partners, and potential adversaries understand the consequences of that.

And to the other question, and then I'll turn it over to these guys, is, look, I think – I don't know if it's a one and done. If you destroy one satellite, is that messaging? Or are we talking about destroying everything all at once, right? And to me, I think that's still a question about the war planners and the scenario designers, about how does this all – how does this all work.

Mr. Gancio: I mean, I'll just offer, it really depends. (Laughter.)

Brig. Gen. Stapp: That's always a good answer. You know, he is from the Hill.

Mr. Gancio: But, I mean, here's how I break it down. If you take an adversary like Russia, or you could also put North Korea in this bin, where there is a clear

asymmetric advantage. The U.S. has space superiority. Russia does – I mean, capable space actor, right? Rich legacy in the Soviet – they're capable. But they don't have nearly the capacity that the U.S. does. And they realize that. So for them, I think it's an easy trade off. If nobody can use space, whether it's because of debris or jamming, that's a net positive for them in a conflict, right? And I think that's why it's no surprise we saw two years ago when it came out they were – they were developing a nuclear counterspace weapon, right? That fits right in with their doctrine of imposing costs on the U.S. in an area where there's a clear imbalance of value.

On the flip side, and here's why I say it depends, China, I think the one silver lining of their rapid acceleration as a great space power now – they've launched over a thousand satellites in the last decade – is they now have skin in the game. They have designed their military similar to ours, watching the exquisite precision strikes we're able to do anywhere on Earth. And they know space is critical to that. We've seen them dump money and invest into a space program, which debris is indiscriminate. So in there – you know, I am less convinced that they would take the approach of just, you know, wrecking the sandbox, like Russia would, right? Because they have an inherent need to use space like we do.

So I think it's going to be much more of a, you know, tailored strikes by China, as opposed to Russia where they're happy to just cause indiscriminate damage. So how that plays out in a conflict. Again, I mean, trying to guess that is, I think, you know, a fool's errand. But just – I think there's two – it really does depend who you're talking about, whether it's a, you know, Russia, North Korea, or a China-type actor here, and how that factors into deterrence and their willingness to generate debris.

Mr. Rogers: I think I've been sitting here thinking about how to parse this, watching Mike Palski stare me, as I think about the physics of it. (Laughs.) I think I would add to the political and sort of like tactical and strategic, it depends is exactly right. The United States has no interest in generating debris because it's a Pyrrhic victory for the United States. We are dependent. China is dependent, as you said. I think you're right. It is totally threat dependent. However, their – kinetic weapons in space don't necessarily mean hypervelocity kinetic weapons, where you're talking about Mach 30 – well, I won't use – 15 kilometer per second, 20 kilometer per second closing velocities.

I think what you're going to see happen over the next decade is, as the United States really understands the convergence of operational concepts with key orbital terrain, which is a key concept from the United States military doctrine around space, which specifies what orbits we care about and what orbits we intend to conduct operations in, the physics of each one of those environments and that key orbital terrain really matters. A debris-generating event by China in GEO is very different, from an orbital mechanics

standpoint, than a debris-generating event in low Earth orbit or in VLEO, for example. So I think there's an opportunity that the Space Force may want to capitalize on, and maybe organizations like this can capitalize on, that gets into the nuance of debris. It's not kinetic weapons bad, non-kinetic weapons good. We have a – we have a physics problem, we have a threat problem, and we have a weapon-type problem. And we need to be thoughtful beyond sort of the headlines around this. And it is probably time to have a more productive conversation.

Mr. Frazier: Yeah, and it's both what are the types of kinetic weapons that the U.S. would employ, but also, you know, what do we need to defend against? And, you know, it may be that we need to get far left a launch your early in launch, if we know that, you know, a certain class of, you know, threat from an adversary, you know, could have, you know, catastrophic impacts.

Mr. Gancio: It really does depend on the weapon. I mean, just because we talked about, like, direct descent ASATs, bad. Well, not always, because, as we demonstrated in 2008 and the Indians demonstrated later, you can do an intercept in LEO and not generate a lot of long-lasting debris. It might cause a spike –

Mr. Parikh: It was not a direct descent ASAT. It was a safety mission. (Laughter.)

Mr. Gancio: Well, direct – yes. But a – let's just say that capability, right, to intercept. In our case, it was, you know, a satellite we needed to take offline in a safe manner so it didn't pollute the Earth. In India's case, it was demonstrating a capability. But all that to be said, it really does matter what type of weapon you're talking about because I think there's this notion that any kinetic event in space there's going to be thousands of pieces of debris. And that's not the case.

And I'd say for certain weapon systems, that might be the risk-reward, of if you're going to attack a very high-value asset, and you're – you know, a U.S. high-value asset, and you're an adversary, that risk-reward might be there. You might be willing to generate that debris to take a very high-value asset offline, whereas a proliferated constellation of many satellites it just doesn't make sense to use one-shot kinetic weapons to go after Starlink, for example, right? I mean thousands of satellites. That risk – it's just totally off balance. So I think it's – you have to – there is a lot of nuance to this. Again, like, it really depends, both on threat actor, threat system.

Mr. Parikh: But this goes – this goes – sorry, Scott. This goes to one thing that has only been talked about in a singular term. And it is a(n) extreme level of "it depends," and that's deterrence. And I think for a lot of the young professionals and military planners in this room, the permutations of deterrence is still not fully played out. Who are you trying to deter? If it's

Russia, if it's China, those are two different actors, two different political systems, in a way, from a military perspective. What are you trying to deter? Is it acquisition, deployment, testing operations? Is it against kinetic weapons utilization? Is it against electronic warfare capabilities? Is this against military conventional, nuclear command and control, national technical means, protecting allied and partner – you know, deterring against attacks on allied and partner or commercial capabilities? The permutations are so infinite. And then the response actions, having to go not just from space but in all the different domains along the way.

And then this is still an area that both, I think, governments need to think through, number one. Number two, I think organizations like CSIS and others, and military organizations. And to be quite honest, I think that there is an opportunity for track two level dialogues with other nations that we consider hostile to U.S. interests along the way. And I think this all goes back to the final two words, which – "it depends."

Brig. Gen. Stapp: It depends. All right. We are out of time, and like every meeting I've been in with Chirag, he gets the last word. (Laughter.) So I want to thank – I want to thank the panel. You guys are brilliant. This is a very good discussion. And I want to thank CSIS for hosting the event. So thank you all. (Applause.)

(END.)