Spacepower Security Forum 2023 | A Vision for Proliferated Orbits and Small Satellites

[00:00:00] **Gen Kevin Chilton, USAF (Ret.):** All right, thanks ladies and gentlemen. Welcome back. It's my pleasure to introduce our afternoon panel to discuss the vision for proliferated orbits and small satellites. Space Force leaders have repeatedly discussed the advantages they expect to secure from placing a large number of smaller, simpler satellites into orbit as part of integrated collaborative set of low Earth orbit constellations. Not only does this hope to eliminate single points of failure, but it also promises to deliver capability faster and cheaper, and we had a great discussion on that I think by our lunchtime speaker, Dr. Tournier.

At the same time, proliferating beyond LEO is a, is crucial to better enhanced resiliency and enable certain crucial mission areas. So one of the questions you wanna explore is this, "Is everything gone to LEO or is there a place for MEO and GEO in future architectures?"

With that, I'd like to introduce our panelists. First, we have with us Brigadier General Timothy Sejba, the Program Executive Officer for Space Domain Awareness and Combat Power and for Battle Management, Command, and Control, and Communications. And General Sejba comes to us from El Segundo, California where he's working at SSC.

[00:01:18] **Brig Gen Timothy Sejba:** Yes, sir.

[00:01:19] **Gen Kevin Chilton, USAF (Ret.):** Next we have conel, Colonel Eric Felt, the Director of Architecture and Integration in the Office of the Assistant Secretary of the Air Force for Space Acquisition and Integration. That's Mr. Calvelli's office. And so you're it entrenched in the Pentagon fighting the fights there. Thank you for joining us.

Next it's a pleasure to have Mr. Robert Atkin, the Vice President of the Asymmetric Systems Group at General Atomics Electromagnetic Systems. We had a chance to visit last night at dinner and discovered his early passion for shrinking satellites down to smaller sizes and increasing the utility at the same time, not sacrificing capability. So Robert, welcome.

And last I wanna introduce and welcome Charles Galbreath. Charles is our Senior Fellow for Space Study at Mitchell Space, I think our newest acquisition, if you will, and it's great to have you on the team, Charles, I appreciate you par-, participating as well.

So before we get into the discussion, I'd like to frame why it's important we explore the topic. General Saltzman recently highlighted in his congressional testimony that he's exceedingly worried about the possibility for an adversary anti-satellite system to destroy satellites in geosynchronous orbit.

As we all know, up to now the military has placed exquisite large satellites in geosynchronous orbit as linchpins of our space enterprise. That was back before the enterprise, or I should say the domain, was contested. They worked great when it was a benign environment that has given where our adversaries have chosen to go in contesting space. There's a reason why General Hyten famously said he, "Wasn't interested in any more big, fat juicy targets." And I think at the time, he was alluding to our capabilities in geosynchronous orbit.

So, one of the questions we'll explore is there still a role for GEO constellations and is there a possibility of changing big, fat, juicy targets into big capable and survivable targets where there might be a need for them? So it's not I ... The question is one of the exclusivity.

So I, I'd like to begin, though, with Colonel Felt and and Mr. Atkin. If we could start with the notion, with the comment Assistant Secretary Calvelli has laid out. He's laid out nine tenets for the space acquisition community. The first of which is build smaller satellites, smaller ground system, and minimize non-recurring engineering which, of course, is the major cost in just about any program startup.

Please walk us through, if you will, through the thinking behind this, these statements and what benefits do you see coming from this approach, particularly in the small SATA arena. And Colonel Felt, if we'll start with you please?

[00:04:04] **Col Eric Felt:** Thank you, sir, for the opportunity and that is a super important question. Secretary Kendall has laid out that in order to implement the national defense strategy, he is focused on China, China, China, right? And so from the space acquisition point of view the s- Honorable Calvelli has adopted three priorities that are gonna support those, the, that, that focus. And his priorities are speed, resilience, and integration. And his nine tenants come from those three priorities. But I like to use those three priorities to explain the benefits that we see from small satellites.

So let's start with speed. Small satellites are inherently faster to build than large satellites simply because they're smaller. But that's not the only thing. Small satellites often can use more commodity parks that are more readily available. Ideally they come off of an assembly line that, that's already producing a commercial products and that makes 'em faster to produce, and they often can have a lower mission assurance posture that's acceptable to the mission than a large satellite. All of those are reasons that you, with a small satellite, you can build and launch a satellite within the two to three years that he's laid out.

So that is speed. Speed is key to deterring China and that's why it is so fun- important that we inject that into our space acquisition. And that is, and the small satellite's just one element of how we're planning to do that. That's not the only thing now, they, we also see tremendous benefits from small satellites in the resilience area. The big juicy targets become a lot less juicy if you have a hybrid architecture.

And what I mean by that is the hybrid architecture that also has capability in LEO, for example, with proliferated small satellites, that makes taking out the GEO capability less attractive to the adversary. So you can make those same targets less juicy with small satellites and having a hybrid architecture. And just having hundreds of satellites instead of a few or dozens of satellites is inherently more resilient.

So the, there's tremendous resiliency benefits as the Space Warfighting Analysis Center does their architecting and their force design work they analyze this resiliency aspect as one of the most important criteria that they look at. And everything we've done so far comes up with an element of the architecture at LEO. And my prediction is for our Space Force missions, our current Space Force missions, we will have an element at LEO for every every mission area. Doesn't mean we are only at LEO, we wanna have a hybrid architecture, but I do think we will have an element of LEO in every area for resilience.

And then the last thing is integration. Small satellites, we see a tremendous benefit in being able to more easily integrate and integrate with commercial, integrate with partners integrate our ground systems with our spaces sys-, systems, integrate different kinds of space systems.

For example, if you're gonna build a constellation with a partner or an ally and it is much easier for them to build one small compatible sa-, satellite and put it into a constellation with other small compatible satellites, than to ask them, for example, to to build a large WGS or something like that. So, so those are the

three benefits that Honorable Calvelli sees from small satellites and why they're so important to our future [inaudible 00:07:14].

[00:06:58] **Gen Kevin Chilton, USAF (Ret.):** Great, thank you very much. Mr. Atkin, did you wanna add anything to that?

[00:07:02] **Robert Atkin:** Yeah, yeah- ... I do. I'd like to really piggyback on that actually because I think it's, ... So I've been building small satellites and operating them for 30 years. You know, General Atomics acquired my company a couple of years ago and before then, I spent a lo-, 25 years trying to build small components to really compress the size of the spacecraft as well as compressed the form factor of compute capability.

And everybody in this room has this nifty little supercomputer that they carry around in their pocket, or maybe two and so I think that the calculus has changed that we can integrate like at General Atomics. Now my job is really to integrate more of the capability that General Atomics at large has so I can bring lasers, I can ring- radiological power, I can bring production capability to bear on these small spacecraft. Still, you know, there's still more room to, to squeeze things down.

But I don't believe that we're limited now to just LEO for small spacecraft. The spacecraft themselves are so much more capable that they have a role in GEO and then they're significantly cheaper to launch, significantly cheaper to put large amounts of capability up there. And once they're small, they're much, much harder to see, much harder to target, and they're not big, fat, juicy targets, they're just little speck targets, right? And so just it makes the problem set on the other side much more difficult for, you know, for the adversary to manage.

[00:08:24] **Gen Kevin Chilton, USAF (Ret.):** And so, I think what I've heard from both of you is it's not gonna be an exclusively LEO architecture that we'll lean forward on c-, both complicates the adversary's targeting to have multiple orbits to operate from. But I could, if I could follow up 'cause you mentioned GA's work in propulsion. Do you see ... Right now are geostationary satellites, were designed with propulsion systems essentially to station keep, not to get out of the way of a threat. Do you see a potential opportunity there for geostationary satellites to actually maneuver in the future by design, or be able to maneuver by design to avoid an attack?

[00:09:01] **Robert Atkin:** I do. The thrusters that are allow that for that are much larger and so-

[00:09:05] **Gen Kevin Chilton, USAF (Ret.):** Mm-hmm.

[00:09:05] **Robert Atkin:** ... it's more complicated on a larger spacecraft. The benefit of a small spacecraft is the little small thrusters that you use for station keeping also provide enough thrust that you can rapidly maneuver and change your orbital position. So-

[00:09:17] **Gen Kevin Chilton, USAF (Ret.):** 'Cause of their lower mass, yeah.

[00:09:18] **Robert Atkin:** 'Cause of their lower mass, exactly. So it, it's sort of a two fold benefit that you get from trying to shrink the vehicle. It doesn't have to be the size of a school bus. If it's the size of a shoebox, you can imagine how much more difficult it is to see and how much easier it is for it to move around.

[00:09:32] **Gen Kevin Chilton, USAF (Ret.):** Okay.

[00:09:32] **Robert Atkin:** Of course, some things, physics still applies. You can't have, a giant optic and a little teeny, tiny spacecraft, but there are other ways to try to address that problem.

[00:09:39] **Gen Kevin Chilton, USAF (Ret.):** Yeah, well never to get the capabilities, I suspect we won't see really small sa-, satellites on the scale we're talking about at this conference at GEO for simple physics reasons. Maybe smaller-

[00:09:51] **Robert Atkin:** No but-

[00:09:51] **Gen Kevin Chilton, USAF (Ret.):** ... than what we see today, but, you know-

[00:09:52] **Robert Atkin:** [inaudible 00:10:21]

[00:09:53] **Gen Kevin Chilton, USAF (Ret.):** ... different scales, though right?

[00:09:54] **Robert Atkin:** ... it's the main awareness and things like that. Those things you don't need to have-

[00:09:57] **Gen Kevin Chilton, USAF (Ret.):** Right.

[00:09:57] **Robert Atkin:** ... tracking and telescopes and if you have a lot of these things proliferated around, they can do that inspection mission much better-

[00:10:02] **Gen Kevin Chilton, USAF (Ret.):** Like GSAP today? Yeah,

[00:10:04] **Robert Atkin:** exactly.

[00:10:04] **Gen Kevin Chilton, USAF (Ret.):** Yeah.

[00:10:04] **Robert Atkin:** But everybody knows where GSAP is.

[00:10:06] **Gen Kevin Chilton, USAF (Ret.):** Yeah.

[00:10:07] **Robert Atkin:** So I can move my ... If I'm an adversary, I know where that is so I can stay away from it. If there's a little teeny, tiny one that I don't know where it is or there's a whole slew of 'em, it's much, much more difficult for me to try to avoid.

[00:10:19] **Gen Kevin Chilton, USAF (Ret.):** Very good, very good. Thanks. I wanna shift gears a little bit to launch, responsive launch. And General Sejba and Mr. Galbreath, I'd like to ask you. So the tack the concept, the topic of tackle responsive launch has been garnering a lot of interest lately. It's not a new concept. I remember the ORS program, Operationally Responsive Space when I was on active duty. I was wondering how do you define tactical responsive launch and how do small satellites support that particular mission? And General Sejba, let me start with you.

[00:10:52] **Brig Gen Timothy Sejba:** Sure. No, thanks for the question. It's certainly of keen interest right now within my team of, within Space Force. So, you know, what we've tried to really do is kind of broaden the discussion. Responsive launch has been kinda the point that we've discussed for a number of years. But responsive launch for what? And so we've really tried to re-redefine responsive space.

And that you only have responsive space capabilities if you have the end to end capabilities both with launch vehicles, ground systems that are ready to operate those, and launch capabilities that can put them on orbit when needed. So, you know, the way we're defining tactically responsive space is it's an operational capability that's meant to be able to meet needs on orbit in an operationally time relevant fashion. That is really where we're trying to drive to.

Sir I think I remember probably Major Sejba briefed you years ago on the idea of plug and play capabilities and the vision of where that would go. You know, 15 years ago we just didn't have, necessarily, the industry base to be able to do some of those things and we certainly did not think at the time had the launch capabilities, but we certainly see that now today.

So what we're trying to do is be very specific also about what aspects of a mission do we think tactically responsive space can really go after? It's not really replenishment like we've talked about maybe in the past with concepts like ORS, it's really going after two very specific areas.

One is to be to respond to a new threat or an emerging threat that we have to be able to categorize either through space domain awareness capabilities or space control capabilities. The second is really augment. How do we take ... And I think it's complimentary when we look at proliferated architectures and different orbits. How do we then, potentially, augment capabilities, whether it be in SATCOM for very specific mission cases, or maybe tactically tactical ISR? Those are two of the areas that we see that augmentation, whether it be from a government capability or especially commercial capabilities, that we could very easily then plug into and augment the current architecture in time of conflict or crisis.

So that's kinda where we're heading right now when we talk about tactically responsive space. There's really three different ways that you could do that. You know, the first if we kinda go with the exploit buy/build mantra that SSC has been pushing for the last year and a half we can look at commercial. There's certainly a lot of commercial capabilities today in what I just mentioned that would be able to provide either additional capability to respond to a potential crisis at LEO or even augment some of the capabilities that we have from a government perspective.

So I think that certainly is one of the key places. And that is fairly easy to do given the industry base that is continuing to grow in those areas and how we now have a commercial space office that's designed for us to be able to go out and buy those commercial services within hours or days. So I think that's the first piece that we have to always look at as the number one choice.

The second one then is do we actually build capability and do we have it in reserve on the ground? We're not necessarily talking about a fleet of GPS satellites that are sitting in the barn waiting to go, but we are talking about, you know, small SAC capabilities that can be launched in a moment's notice to be able to respond to some of those threats that we see on orbit is one of the

potential. So we see that as a real potential that we're starting to build out that concept.

And then the final one is in some cases, maybe storing capability on orbit is the best way for us to actually be able to respond to a new capability. We're already seeing that with a lot of the proliferated architectures across LEO where, inherently, they already have spares that are on orbit waiting for one of the operational capabilities to fail so they can turn on one of the spares that they have on orbit. So we're already seeing tactically responsive space play out in a proliferated architecture. We're looking at how do we then enhance that and give the combatant commander additional capability?

The way we're gonna do that this year is [inaudible] is our operational demo that's scheduled for early summer. That really is an operationally responsive capability for the combatant commander into LEO with a space domain awareness mission.

The challenge that we have been given is that from the time we are given the go we are supposed to have that capability on orbit within 24 hours. So that is really gonna to test the entire part of the system. That's gonna test responsive launch, it's gonna test our ability to encapsulate, stack, launch and then have it in operations with an operational crew on the receiving end of that. So that really is the goal of what Vickfixknox is trying to accomplish. That plays into the larger tech RS mission, sir.

[00:15:21] **Gen Kevin Chilton, USAF (Ret.):** So you've kind of defined responsive, at least in one scenario there, as 24 hours?

[00:15:26] **Brig Gen Timothy Sejba:** Mm-hmm.

[00:15:26] **Gen Kevin Chilton, USAF (Ret.):** But is there, there is a range of responsiveness that you're looking for as you look at these different, three different scenarios you describe where we want, wanna, might wanna have this capability?

[00:15:36] **Brig Gen Timothy Sejba:** You know, I'll ... If I go back to the commercial side, again with commercial capabilities today that we're testing out and improving in many cases through things like the JCO out in Colorado Springs. Some of those capabilities, again with a credit card, you can turn on data within hours. So that certainly is responsive in my perspective. And that's just is, again, a responsiveness that 15 years ago when we talked about this, these concepts, we just didn't have that broad industry base necessarily to do it.

The scenarios I played out of having a small reserve on the ground, again, the challenge is how do we respond with threat im-, immediately? So the challenge is 24 hours and how do we drive that to that point? That is certainly gonna be a challenge given, you know, where what we've demonstrated to date.

On orbit I think gives us a lotta flexibility also. But then, you know, as we look at what the production lines look like today, there are already production lines across parts of my portfolio and across industry that if we needed to be able to take a satellite bus and plug it into an existing ground system that already controls that, and there's plug and play capabilities for payloads, a number of different payloads that are already near production line quality, I think within months, you could also have other capabilities that you could put together based off of maybe a new emerging threat that maybe you hadn't planned for.

So I certainly see a range there the challenge is gonna be how do you work through all the processes required to launch and then operate to make sure that you're deriving all of the latency out of those processes to get to those timelines I just talked about?

[00:17:09] **Gen Kevin Chilton, USAF (Ret.):** Great, thanks. Mr. Galbreath. Did you have some comment?

[00:17:11] **Charles Galbreath:** Yes sir. So, thank you. And I, so I agree with General Sejba of course that the augmentation is really one of the key factors for being able to responsibly deliver capabilities. I think it is a, potentially, a show of force even that we're gonna augment our capabilities prior to a conflict so that we stay in crisis mode as General Saltzman was talking about.

I think I will push back a little bit, though, and say that the ability to reconstitute, to, to replenish a lost capability is still important. Because when you look at an overall mission assurance architecture, it's not just the resilience of the system but also the ability to rebound. And so I think that reconstitution does have a key part to play because it does decrease the value of attacking assets in the first place. General Sejba is absolutely right, though, that there are multiple ways to get to that reconstitution: launching new capabilities, activating spares, leveraging commercial or allied capabilities absolutely.

But, it, but it's in-, interesting back to the original question on tactically responsive launch, a few years ago, that would've been a, the launch on schedule versus launch on demand question,

[00:18:11] **Gen Kevin Chilton, USAF (Ret.):** Mm-hmm.

[00:18:11] **Charles Galbreath:** ... but we've evolved so much beyond that. And we used to talk about having barns of satellites ready to go and but boy, isn't that a waste? We've built these satellites and now we're not utilizing them. The dynamic now with the advent of proliferated geoconstellations has really changed that. We have assembly lines of satellites and if a capability is required for a crisis, we can take one satellite off of that assembly line and one satellite off of this assembly line and launch it where and when we need it.

Whether that's a dedicated launch of a tactical nature or whether it's a rideshare for one of the, you know, rapid launches that we have on a recurring basis, you know, that, that's somewhat irrelevant. But I think that the game has definitely changed-

[00:18:53] **Gen Kevin Chilton, USAF (Ret.):** Mm-hmm.

[00:18:53] **Charles Galbreath:** ... as a result of PLEO. I'm glad to see small satellites gaining the attention that they deserve. For so long it was, "We've gotta develop all this capability of, with exquisite capacity and multiple redundancy." but there's a lot of benefits to be had from small satellites and it's great to see that coming again.

[00:19:08] **Gen Kevin Chilton, USAF (Ret.):** It's great. You know, I actually opposed the ORS concept when I was Space Command, Commander because there was no ConOps. And you know, there was no ... you didn't ... You couldn't answer those questions, "So how many rockets can I have standing by? How many satellites are you gonna have sitting in the barn? Are you gonna have a hard production line? Or what's your refresh rate?"

And we, we just hadn't thought through the ConOps. And, in fact, you know, technology hadn't gotten to where we are today. The availability of launch today with all the different folks trying to compete in that area has evolved. And certainly the technology of what we can package in a satellite. And now the demand function that we heard from Dr. Tournier for large numbers of constellations gonna motivate industry hopefully to have those productions line, production lines stay warm. Of course that, it requires consistent funding from the Congress.

Mr. Adkin, I was wondering if you could share some of your thoughts on what can government do to further cultivate the growing sector of small satellites and make sure that it ... You know, at the end of the day and I've had industry partners say to me, "Remember, [laughs] we gotta make a profit. We're not in this as a charity operation." And so, how you contract for them, how you

incentivize people to stay in the game even when they're not picked this round, I think is an important question. I was wondering if you could share your thoughts from an industry perspective?

[00:20:25] **Robert Atkin:** Absolutely. I think the first thing we need to do is stop talking about things being stored in a barn, they should be stored in Pelican cases, right, and not [laughs].

[00:20:33] **Gen Kevin Chilton, USAF (Ret.):** [laughs]

[00:20:34] **Robert Atkin:** I think risk is, it's actually two things: risk, and security. So from the risk perspective, every everyone here General Saltzman, Dr. Tournear every panel that's been here has said, "We need to move fast, the adversary's moving too quickly. We need, we just need more capability more quickly."

And I think part of the problem is we need to be not afraid of failure. And it's not so much that ... You know, I don't plan for failure and General Atomics certainly doesn't plan for fail, plan to fail but it, you have to plan for failure and understand that failure, in a development sense, means that you're accepting enough risk that you're being able to move as fast as possible without ... You know, you have to balance that, at the hairy edge.

If I can pack five payloads into one spacecraft, and I'm accepting a bunch of risks because I'm jamming all of them in there, but I can do that with one launch, one spacecraft, and say I'm 80% successful, versus having five individual programs that then stretch out over time I've still beaten the odds even if those are 100% successful. And we need to stop looking at that as a bad thing.

And I think maybe at the leadership, people say we need, you know, to accept risk but once you get down to the program offices, it doesn't really seem to be the case. They tell us in industry, "Well yeah, we understand you want risk, but why are you," I had this happened last week, "why are you offering me four things when I've only asked for one?" And it's, "Well because the four things are better than one and you know that and." "Well, yes, but it's too risky." Well, that's the exact point, right?

And then on the security side you know, we have everything is all stovepiped and everybody understands that we have to try to address that. But part of the problem is computer systems, you know, security clearances for people, those get tied to contracts. And so if you haven't, don't have an active contract, then

you can't, you don't have those systems. You may have good ideas and let's say you get them in front of the relevant people and they say, "Oh, good. We're gonna award you a contract." Now it takes six to 12 months to get the IT systems turned around. And the government needs to figure out ways to make it easier for no cost contracts to relevant players so that one can keep those IT systems up and operating continuously and be able to provide those ideas on the timescales to keep the clearances for the people when you're in between contracts as opposed to only from currently hopping from contract to contract.

[00:23:01] **Gen Kevin Chilton, USAF (Ret.):** Pretty good. I've seen where we've depopulated expertise because of a lost contract and then it's really hard to reconstitute, so it's a great point.

[00:23:09] **Robert Atkin:** Yeah.

[00:23:09] **Gen Kevin Chilton, USAF (Ret.):** The risk aversion's also a great point that I think General Burke talked about that in an earlier panel. It's in our nature and the nature of the Department of Defense to be risk averse but these times call for new approaches that I'm hearing from you gentlemen on stage.

Mr. Galbreath and this is for for Colonel Felt as well. You know, we've talked about how small satellites can support missile warning, missile tracking in low Earth orbit communications, relay of data, as well as providing relay nodes for tactical forces and delivering operating, common operating pictures at the operational level of war. But, but there are certainly other national security uses for small satellites that the Space Force could use to fulfill their missions and Mr. Adkin, you talked about one domain surveillance at GEO.

But I'm thinking more along the lines of capabilities that could hold adversary's assets at risk, for example, or small satellites that could provide ISR support to Title 10 forces that are commanded and controlled, tasked by Title 10 forces in support of operations in theater. Do you see any opportunities in these areas or others that I haven't mentioned? And Mr. Galbreath first and then Colonel.

[00:24:24] **Charles Galbreath:** Thank you. Ab-, absolutely. Small satellites have been around since the beginning of satellites, right? So there, there's obviously capability and military utility to be gained from them. Your comment about ISR makes me think about the dub satellite which is a 3U CubeSat operated by Planet Company out of Silicon Valley. So that's providing through a proliferated constellation of small satellites a wide area surveillance via imagery.

I also think about, as you said, the ability to hold an adversary's target at risk potentially. You know, we can launch small satellites into GEO as well. I think the TETRA program is a great example of how we're using that. Not to hold an adversary's asset at risk but to demonstrate what they might do to us and help us develop our TTPs on how to respond to a threat.

[00:25:11] **Gen Kevin Chilton, USAF (Ret.):** Mm-hmm.

[00:25:11] **Charles Galbreath:** Small satellites aren't just in, in LEO and GEO there's a small satellite orbiting the moon right now, Capstone Project, right? It's a 12U CubeSat, 25 kilograms. To there's potential utility for small SATs in every mission area that Space Force is involved in and then some.

[00:25:29] **Gen Kevin Chilton, USAF (Ret.):** Great.

[00:25:30] **Col Eric Felt:** Yes-

[00:25:31] **Gen Kevin Chilton, USAF (Ret.):** Okay.

[00:25:31] **Col Eric Felt:** ... both for the current missions and for some of these emerging missions that you've mentioned we the architecture that we envisioned and stra-, and build towards is a hybrid architecture including hybrid in different orbits, hybrid in large satellite, small satellites, hybrid in terms of commercial, government owned. All of those things give us good attributes for resilience.

And in the in the ISR area for example if you talk about what we'd really like to have on the battlefield it's you know, everything of interest, everywhere, all the time, and in real time. And each one of those parameters drives an architectural element that small satellites, especially small satellites and proliferated LEO are turn out to be very useful to fulfilling that vision.

And so you'll se-, you se-, in the '24 budget, we did invest in some moving target indicator options to help get after those, that, those emerging mission areas that we want to be able to support from space missions that may have traditionally been done in the air. It's one of the most important operational imperatives the Secretary Kendall's operational imperatives that we're working on. It's operational imperative number three.

So, it's very intentional that we move some of those missions to space because the technology and the cost structure that we see now for these launch and constellations is very attractive for performing those missions in a highly contested area.

[00:26:45] **Gen Kevin Chilton, USAF (Ret.):** Great, great.

[00:26:45] **Col Eric Felt:** That is an emerging area.

[00:26:47] **Gen Kevin Chilton, USAF (Ret.):** Well and, you know, we'll, we've talked about moving GMTI and AMTI to space but this is kind of a policy and an acquisition question. Reconnaissance from space has become ubiquitous with the advent of commercial ISR and yet, I hear frustrations from some of those commercial ISR providers is that the only one that, only people that will buy their data is the NGA. And warfighters need this data, not national reconnaissance collectors because the different requirements, different priorities, different speed of delivery requirements.

And so, I believe even in this budget, a bunch of MIT money was invested to, that went over to the intelligence agencies to acquire these satellites. But the end of the day, who's gonna task them? Are they gonna have to compete against national requirements or is a theater Commander gonna be able to turn to his Space Force component in INCOPACOM, for example, and say, "I need a picture of this now." And in minutes get that photograph delivered directly to his headquarters, not sent to an agency that has to rack and stack it against other priorities?

So you talk about buying what you can that's out there today, but I'm not hearing that the Space Force is buying it. I'm hearing the NGA is buying it. And then other, the policy fight is looming, I think, on who's gonna control these assets that are gonna be essential for victory in in the various combatant command's arena. So over to you gentlemen please.

[00:28:23] **Brig Gen Timothy Sejba:** I'll start with just a couple of thoughts and turn it over to Eric. Certainly, you know, as we look at the growing capabilities from a commercial standpoint, I'm obviously most familiar with space domain awareness commercial capabilities which we're leveraging pretty heavily, and I know that's gonna continue to grow but certainly we're seeing that on the tech ISR side as well.

I know that our commercial space office has a strong partnership right now with the IC on how we are purchasing and leveraging commercial data from an ISR standpoint. I also know organizations like AFRL are looking at how do you actually then tie a lot of those commercial capabilities together and have some means of actually task going after and tasking them in a time relevant fashion? So there's work looking at how you leverage all those capabilities. Again you've got more capability on orbit at LEO between national capabilities and really the

commercial companies that have come into this market than we've ever seen before. So how do we take advantage of that?

I can tell you that, you know, during a visit last fall all the PEOs out of SSC made a trip to INDOPACOM and we went out to South Korea as well to really understand what those service components are going to need as we go forward. And especially as we start to retire air aircraft in the future because they may not be survivable for the for the future missions, that was one of the key things that we certainly heard is, "How are we gonna be able to task future space capabilities to provide the same type of persistence that we've been able to depend upon from an air assets?" So certainly something that I know that Colonel Denaro, who's the PEO overseeing the ISR piece out at SSC is looking into right now, and a few efforts that I'm at least aware of that he's trying to look at how do we take advantage of commercial.

[00:30:00] **Gen Kevin Chilton, USAF (Ret.):** Thanks, General.

[00:30:02] **Col Eric Felt:** And,

[00:30:02] **Gen Kevin Chilton, USAF (Ret.):** Eric.

[00:30:02] **Col Eric Felt:** ... the what, the goal of the Space Force is, of course, to work as closely as we can with the intelligence committee to make sure our needs get met. And if the best way to meet our needs is to partner with them to build a shared constellation that may be allocated in new ways or in previous ways then those are all on the table and being discussed by our senior leaders to make sure that these new capabilities that we put in space for the DOD are gonna meet the DOD's needs.

And the... it would ... Well, the concern is that there would, be it would be duplicative and not cost effective to build a separate constellation from what the intelligence community might need. And if we can get a combined constellation that meets everybody's needs.

And so whether that is the ... All those discussions are underway, there's a wide trade space that is being discussed. But I can assure you that our senior leaders are very committed to making sure that these DOD capabilities are used for, are usable for Title 10 missions for our needs and our capabilities regardless of who builds 'em.

[00:30:59] **Gen Kevin Chilton, USAF (Ret.):** And right and so that would be the number one priority. So they would be ... Doesn't matter who builds 'em,

building the most efficiently is what I'm hearing. But at the end of the day the ISR from space capabilities that the INCOPACOM Commander may be, for example, will be satellites that he or she can task directly without going through a process in the national intelligence process which, frankly, you know, the Presidential's daily decision briefing trumps every other satellite collection in that national process.

And so I, that's what I'm hearing you say is if you're gonna do a right, just put the acquisition part aside and let's just do that as quickly and efficiently as possible?

[00:31:42] **Col Eric Felt:** Yes, sir. And one of the things that will help is that sensors in space are becoming a commodity. They're becoming so proliferated-

[00:31:47] **Gen Kevin Chilton, USAF (Ret.):** Right.

[00:31:47] **Col Eric Felt:** ... that you don't, they don't have to be carefully rationed like a mainframe in 1970. And so I think that there is going, there are gonna be enough sensors in space to support everybody's needs, it's just a matter of how we organize them most efficiently and apply them most efficiently and that's what we're aiming to [inaudible 00:34:11]-

[00:32:01] **Gen Kevin Chilton, USAF (Ret.):** Great. All right, I'd like to turn to the audience and see what questions they might have for the panel. We've got a few minutes left. And we, first quest- ... Hand up over here I saw and then, and one in the back of the room here in the middle.

[00:32:17] **Eric Weiss:** General thanks. Eric Weiss from Blue Origin. I'm actually I'm fascinated, General Sejba, by the second half of your title Combat Power. And this is a question really for the panel. How much can you share about how Space Force, Space Systems Command Colonel Felt, you know, head-, headquarters about Space Combat Power? Because two years ago, we weren't talking about space domain awareness, now we're very much working towards space domain awareness, common operating picture. But Space Combat Power, can you share your thoughts or?

Yeah, I'll certainly start. You know, we've said for a long time, and certainly the CSO has made it very clear that the key to space superiority is space domain awareness. That's a key piece of my portfolio and it's something that from a both a ground and from a space based perspective, we understand that today's systems are very capable. We've got new capabilities that are coming online. They're all based off of force design that had been done through either the

SLAC or SSDP over the last several years. That really is forming the basis for what capabilities we need as we go forward and that really is then met as we field those capabilities but we also look at a lot of the legacy capabilities.

One of the challenges that we've had is we have a lot of exquisite capability on the ground but we haven't necessarily kept up with things as simple as data transport to take advantage of all the data that's coming off of some of these sensors. Sensor data that could give operators in the future the id-, the understanding of whether or not visual magnitude or radar cross section, whether or not a vehicle is tumbling or not, that could give very clear indications of whether or not a satellite has been damaged on either side in the future.

So that's something that we're really going after is how do we modernize the legacy capability that we have today, and then how do we use force design to really look at a lot of the space deploying awareness capabilities we need for the future threats that we see and fill those as quickly as possible?

A lot of that then comes back to how do that, does that inform, you know, potential kill chains? You know, I talked about this about a week and a half go out at NDIA Los Angeles. And we have to start talking about, you know, the threats that we face and how we're going to counter those. We can do that at an unclassified level in many cases but we've also gotta bring it down from a SAP level.

We don't have to talk specific capabilities, you know, necessarily today but we do need to talk about, you know, the overall process and what that might look like so that we can bring a broader audience, maybe at the SDI level, into the discussion and bring it so that we can really have an informed discussion about what that looks like and what it doesn't. That then starts to lay in some of the the other aspects of portfolios that I have and certainly others are looking at as well. So I don't know if that answers your fu-, your question fully but I think that's kinda where I look at right now.

The other piece I'll say is you know, that's one of my portfolios. The other portfolio is Battle Management, Command Control Communications. I've had a lot of folks say, "Wow, two portfolios. Boy, it's time for another PEO." Probably is but-

[00:35:10] **Gen Kevin Chilton, USAF (Ret.):** [laughs]

... I'll also tell you that as a PEO overseeing those two portfolios, everything I just described is so tightly coupled be- between one or the other. You've got sensors, you've got potential effectors and the only way that they are successful is that they have data transport, they have command and control, they have a data library that is able to take that data and then inform decisions machine to machine.

There's a natural synergy between these tor- two portfolios that for the last two years, my teams have been driving pretty hard, both from an acquisition standpoint and an engineering standpoint, but also from an overall funding perspective. The days of just delivering a system and saying that it was good enough is no longer good enough for what our operators need.

We have to be able to look at a system and say, "I've got the C2 connected, I've gotta have the data transport. I know the data that's gonna flow from A, to B, to C. I've gotta have training so that it's actually a combat credible capability." And then that will play into those kill chains I kinda mentioned. So that's kind of the focus of where we've been trying to go the last two years and certainly a part of the larger space enterprise is we look at roles of the SSIO at SSC to integrate systems of systems across a lotta different space acquisition organizations.

[00:36:26] **Gen Kevin Chilton, USAF (Ret.):** Thanks. Colonel Felt, did you wanna add anything to that?

[00:36:28] **Col Eric Felt:** Okay. Just briefly. From an SQ perspective, we're very focused on partnering with the Space Warfighting Analysis Center who is doing force designs in the protect and defend mission are to figure out what we need to protect our own capabilities and make sure they are there when the warfighter and the joint force needs them the most, and to defend our joint forces against any adversary threats in any domain that sometimes affects the space domain.

So that partnership with the SWAC and their force designs tell us what are the, gonna be the most effective ways to perform, and protect, and defend mission. And then the Ops community tells us how they're gonna use that SWAC force design to actually protect and defend our assets. In SQ then, we go by what they tell us to buy and make sure we buy it in a way that may, it's gonna be usable by the operator in terms of how they want to use it.

So we, that is absolutely essential part of what we're doing is making sure that we can, that those capabilities are resilient and there when the warfighter needs

them. That includes a protect and defend mission and those are our key partners in implementing that as we move forward.

[00:37:28] **Gen Kevin Chilton, USAF (Ret.):** Thank you. I think we have time for one more question in the back.

[00:37:32] **Mark Stone:** Mark Stone, Independent Mathematical Defense Analysis Consultant. Could you please comment on the prospects for nuclear thermal propulsion both to facilitate maneuver of operational assets satellites as well as, perhaps, to enable software define maybe on orbit spares to quickly maneuver to different orbits to where they might be needed for new missions? Have a rapid response?

[00:37:59] **Charles Galbreath:** I'll take a swing at this-

[00:38:00] **Gen Kevin Chilton, USAF (Ret.):** Go ahead.

[00:38:01] **Charles Galbreath:** ... please, am I on? So, DARPA famously has a program right now to demonstrate propulsion ... Now holding closer, sorry about that. So, DARPA has a program to, to demonstrate this. I think the Space Force needs to look very seriously at the potential for nuclear propulsion because you're right it does offer the opportunity to maneuver without regret.

And a lot of people will go to, "Oh, we can maneuver out of the way of a threat." you're doing it too late if that's your strategy, right? You need to maneuver frequently so that the adversary can never target you in the first place, right? That's what we need to do. So I think that's absolutely critical.

When we look at the ability to create a resilient architecture, we talk a lot about proliferation. We've talked a little bit about disaggregation, a little bit about diversification. And I think what your point is using nuclear propulsion, you're able to use diverse orbits in a rapid fashion to, again, increase the overall resiliency of the architecture.

As a power source as well, not just for maneuver, but as a power source you can do some incredible payloads that, that have great military utility as well. There's another effort that maybe someone can kinda elaborate on further to, to beam power, solar power to two different users. But you do the same thing with nuclear power and, beam that energy to users terrestrially in orbit or even in the system inner space. So I think there's a lotta potential in that area that the Space Force needs to look at.

[00:39:25] **Gen Kevin Chilton, USAF (Ret.):** Great, thanks [inaudible 00:42:10]-

[00:39:26] **Col Eric Felt:** Agree. It's a potentially disruptive technology. The reason that Honorable Calvelli is so interested in speed is so that we can harness the power of these potentially disruptive technologies faster than our adversary. Then we get, we, if, when we wanna evaluate it and use it as quickly as possible for u-, for our missions.

[00:39:41] **Gen Kevin Chilton, USAF (Ret.):** Fantastic. And I think this area that you just asked about nuclear propulsion using that technology, and nuclear power in space for mission set along with directed energy, are areas that we need to, as a nation, increase our investments in. Because I don't wanna be five years from now watching the Chinese field something in both of these areas and us like in hypersonics saying, we thought of that back in the 1960s, we just didn't do anything about it." I think the time is ripe for both of those to accelerate both those technologies and get out in front of our adversaries. But with that little soliloquy, I'm gonna wrap up this great panel. Thank you, gentlemen. How about a round of applau-, applause for this great panel we had today? Thanks a lot.