

Spacepower Security Forum 2023 | Closing Keynote: Dr. Lisa A. Costa, SES, Chief Technology and Innovation Officer (CTIO), USSF

[00:00:00] **Maj Gen Larry Stutzriem, USAF (Ret.):** Well, ladies and gentleman, the faith will remain and it's my privilege to introduce our closing speaker for the forum today. Please join me in welcoming Dr. Lisa Costa she's the Chief Technology and Innovation Officer of the Space Force. Dr. Costa is charged with finding and harnessing linchpin technologies that will provide guardians with the speed and capability advantages they need to win. Given the rapidly evolving state of hardware and software, Dr. Costa has the expertise necessary to meet the task of getting this into the hands of the Space Force.

Prior to serving as the CTIO, Dr. Costa worked extensively on information access, risk management technology adoption and she worked in the inner Agency in the private sector. Her experiences range from advising the HASC and SASC to working for US Special Operations Command. She worked at PlanetRisk, big data analytics, and at MITRE.

So after the keynote, she is going to take questions. When that time comes please identify yourself and where you're from. And with that, Dr. Costa you have the stage.

[00:01:26] **Dr. Lisa Costa:** There we go. I'm very short.

First of all, thank you very much to the- the Mitchell Institute for hosting this incredible event. And I just want to take an opportunity, because I know I'm the last speaker, to have a round of applause for the folks who actually did all of the hard work in putting this together.

A wise man, Charles Galbreth, once told me that you cannot call yourself a space professional unless you have actually spoken at the Mitchell Institute. [laughing] And here I am. However, I would like to perform some expectation management in that I did not grow up in the space environment. And so we just had a panel of incredible experts, and my- my focus has been on operationalizing science and technology and getting it into the field for operations. So that's my background, I just wanted to set expectations because

space is, just another domain that- that I will have worked in. But I honestly believe that space is absolutely critical to ensuring the peace, the security, and the support to our joint forces.

So I'm going to talk a little bit today about the CSO's theory of victory. I'm not sure if this was covered earlier, because I was in meetings earlier. But the CSO's theory of victory, and then the CSO's level of effort. And then I'm going to talk about how this office of the CTIO blends into those theories and those levels of effort. And I'll try to be quick, and then we'll get into some Q&A.

Recently General Saltzman talked about his theory of success, the linchpin of that is competitive endurance. And there are three parts of competitive endurance. The first is, avoid operational surprise. So what do we need for that? And we heard it here. We need exquisite space domain awareness, but that's an interesting dichotomy when we're talking about putting assets into space that are not exquisite any longer. And we're trying to have this exquisite look, but we're putting non-exquisite assets into orbit. And that's okay, but we have to understand that's the environment in which we're working. And then we also have to have a really good understanding about the limitations or the constraints of the environment in which we're operating, which is, at minimum, inhospitable.

The second part of the competitive endurance theory is to negate first-mover advantage. That's a really hard thing to do. We want to do that through resiliency, and we want to make sure that the first mover in either competition or conflict, does not necessarily have the advantage. And, again, that is a hard thing to do, but I think that what you've heard today, especially from Dr. Tournear from the panel just before me, that is exactly what we are getting after in Space Force. And we're focusing on this resiliency of a hybrid nature, right? We have the old model of everything is exquisite very expensive, we have the new new model of "let's just get stuff up there." And it's really a combination of these models that's so important for us to sustain resiliency in the environment.

And then third is, avoid the unsustainable environment and, as General Saltzman said, we have to avoid a pyrrhic victory. In other words, if we have physical destruction in space, that makes it even more inhospitable, and we want to avoid that at all cost. What I really like about this theory that he presented is he presented it as a theory. He did not present it as laws. In other words, the whole idea behind presenting this theory of victory is to instill debate, discussion, deliberation about what are we missing out of this theory? And I think you are the people, right? That we expect to be having these discussions along with our guardians, both military and civilian, to really help

us understand what's missing out of that theory for victory and what we need to do to go forward. For as many great ideas as we have as a service, we are new, we are limited somewhat in capacity, right? When I go to some universities and visit, I think they're very surprised when I say, "Well, your freshman class coming in is larger than our entire Space Force. Both civilian and military." And that catches them by surprise. Right now we're very capacity limited, but not idea limited.

So where I want to go with this is that we have to choose wisely in terms of what we're going to prioritize to get out into the field. There are many things that we could do, but we have to determine what's off the plate and what's on the plate in the next few years, and get to it. Will there be longer-term investments, And we just heard about alternative power capabilities? Absolutely. And we are all over that. But, again, I can't emphasize it enough that I am very hyper-focused on operationalizing science and technology for operations sake.

With that the CTIO. Is actually organized around this theory of victory. The Science Technology and Research directorate that we have conducts space futures. And we conduct space futures, it's a different cohorts every quarter that we convene, and we focus on what will the future of space look like, and what does the future of space need to look like over time? Because if we were to sit and be watching over a conference table 50 years ago, the things that we experience every day as normal in space would have been identified as impossible or, at minimum, improbable 50 years ago. We do not want to be in that same boat going forward. We want to be very active in shaping the future that we want to see. So I'm going to get into that when we get to partnerships.

But under negating first-mover advantage through resiliency, the CTIO has two directorates that are focused on digital innovation and modern infrastructure. And I will definitely be talking about the infrastructure part, because we have inherited some infrastructure that is quite old and the last thing that most folks want to take on is infrastructure because it's, it's the non-exciting part of any innovation strategy, but is absolutely critical for us to be able to adopt a lot of the capabilities and technologies that many of you are representing in this room today. And then third under extending deterrents, the CTIO has the S9. And that is the analytic and modeling support for the entire service in terms of... And we have them focused on deterrents and the Space Force of the future. That's how the CTIO office organization is linked to the theory of victory.

Now let me talk about the levels of effort. The levels of effort are not separate and apart from the theory of victory, right? They're actually staples of the theory

of victory, and some people see these as completely different activities, but they are not. The first level of effort that was identified by General Saltzman was fielding combat credible forces, and General Sejba talked about this earlier. It is absolutely necessary for us to be able to train, equip, and present forces that are combat credible and that can speak a joint language because, let me tell you, having spent a lot of my time at combat and commands, if you are not speaking the joint language, you are discounted out of the plans process, right? You are discounted out of the options available to the commander. So you have to speak a joint language, and we don't need to be teaching marines orbital mechanics, we need to be teaching our folks how to talk about space effects in a joint environment. And that's what I think about when I think about fielding combat-ready forces.

The second LOE is amplifying the guardian spirit, and that is really about our culture. Everything that is positive about the Space Force and the guardians that are in the Space Force, that make it up, and supporting them. The key to our services success are it's people, and I think anyone who has been around Space Force knows that there's been an incredible effort to make sure that we are reaching out to our entire society for the best and the brightest. And I will tell you, where perhaps some services are having very difficult times with recruiting numbers, we do not have that problem in Space Force. In fact, I would say we-we have an embarrassing dearth of incredible talent, and yet there are only so many that we can take. And I encourage people look, if you're- if you're not wearing a uniform, that's okay. If you're wearing civilian attire, you're still a guardian. And that's really an important, again, part of our culture.

And then, third is partnering to win. And Space Force was inherently built by Congress so that we must partner. We don't have a lot of the key services that other standalone services have. We must partner, and we rely heavily on the FFRDC's, academia, industry, The Mitchel Institute and the like, to ensure that we are able to take advantage of talent wherever talent resides. Which is again, very critical. Part of those partnerships too, though, is ally nations. And a number of our allies are fledgling in the space environment. We are working with our allies to help them develop space programs, and that includes education as well, right? There's no place you go to school to get a degree in space sciences. But we're working through our university consortium program to see how we can help train our allied partners so that as they start to develop and stand up their space programs that they're doing it in that professional way with the rules of law that- that we are encouraging, and that we are the partner of choice for these nations.

A lot of people think of the CTIO office as really being focused on one thing and one thing only, and that is digital transformation. My life would be a whole lot easier if that was the only thing that we were focused on but that is not the case. And I want to read you our mission statement. The mission of the CTIO is to provide decision superiority and advantage through asymmetric effects to craft a lethal war-fighting force, while building partnerships and taking care of our number one resource, our people. Along those lines, let me talk about what we are doing project-wise because, for those of you who are in industry and are very interested in how you might be able to tie in to some of our active projects, I think this is where you might be particularly interested. So under, LOE 1, right? Which is fielding combat-ready forces, I want to talk about Ion, which is our new mission network that we're standing up. Enhanced UDL, the Unified Data Library, and SpaceVerse.

So with that, we're delivering digital services to combat-ready forces, and this new mission network that I'm talking about starts out at the SAP level. Is it limited to the SAP level? No, it is not. It is a mission network that has to be operational, really, at every classification level. But again, I want to emphasize, this is not enterprise IT, this is a mission network and very different from enterprise IT. The sorts of things that industry is sending to us, right? Cannot operate on the networks that we have today. We just had a great discussion, a wholesome discussion, about commercial data. Our networks cannot support the amount and the AI processing required to determine what data is important to a guardian, because not all data has to be presented to an individual for decision support. It is the important data that needs to be identified the them. ION will be a dynamic cloud-based software defined mission network that integrates the Space Force across all of it's verticals. What do I mean by that? It's not just the physical verticals, but the functional verticals.

We have three field commands, and those are the equivalency of MAJCOMs, right? In the Air Force. And then we have a number of direct reporting units. When we were standing up those field comms and those DRUs, the focus was on "we need to get them stood up", right? And so the- we created these verticals. But now we need to integrate across those enterprise, not only organizations, but the functions that they represent. And we had SSC, right? We need to help them connect in a high bandwidth, high IO, low latency way to, for example, the Space Warfighting Analysis Center, right? SWAC. We need to be able to link them up to Starcom so that they can provide model-base systems engineering models to Starcom so that training materials can be developed for guardians, and so that they can then take that training material and have guardians developing TTPs and doctrine off of it. And then that gets translated to SpOC and operations. We're not only doing the vertical physical piece, but also the functional integration piece with Ion.

Ion is moving fast. We stood up a OPT, I believe last November, and we have already done the fieldwork and engineering to determine what we need. And an RFP will be going out I believe this month. So that's a great endeavor and I am driving the team very hard and very fast to focus on agnostic data transport because, again, going back to what Dr. Tournear talked about, we are not interested in and it is not good for Space Force or industry to have vendor lock. And we are looking at a highly resilient agnostic data transport via Ion.

The second effort I want to talk about is enhanced UDL, so the Unified Data Library is a great initiative and actually this does fall under General Sejba's portfolio. It's a great initiative, many industry and academic partners use it, we use it within the Space Force. However, when we built it was never designed to take on the at scale data needed and being provided by commercial entities. And we have built a series of requirements for enhanced UDL, and that RFP I believe is coming out of General Sejba's shop early in '24. So the focus of that particular RFP will be on allowing us to have discoverability, accessibility, and at-scale processing and movement of data. So again, I can't emphasize enough. I could implement AI today I can tell you, I couldn't even run an MPEG-4 on my desktop that someone sent me last week. Exactly how are we going to be running, AI and deep learning algorithms without enabling the entire force to be able to do this, instead of just small enclaves being able to do it?

And then finally, SpaceVerse. Space Force is the smallest service with the largest area of responsibility, and I just talked about that whole dichotomy, right? About more assets going up, but we need more exquisite space domain awareness. So how are we going to get to that? Right now, we put a huge cognitive load on our guardians. They sit there for 12 hour shifts and they watch, 24 open screens and text messages. Text messages coming up. And all of the integration of that information in what where? It's happening in their brain. and imagine the exhaustion of walking out of that place after 12 hours. We have got to do this a different way, and one of those ways is meeting our guardians where they come to us from.

Our guardians have been training for their jobs for their entire lifetime, because they have been gamers, and we need to be implementing... And it's not just us saying this. We're actually looking at doing a collaborative project with NASA on this, because we're training on, the next generation of astronauts. And how do we immersively engage them in their environments instead of thinking about, the old ways of just presenting flat data and not being able to help them understand what they should emphasize and understand in decision making? We are very much focused on that, but let me say this. We could spend billions of dollars on the concept of SpaceVerse, and it wouldn't run. None of it would run

because, again, we don't have the infrastructure to run it on. And that's why Ion is so important.

I like to think of these projects, Ion, enhanced UDL, and SpaceVerse as really like a house. You're building a house, and Ion is the foundation, and all the plumbing that has to be done, and that's the dirty work and no one really wants to get involved in that, right? When we get to now we're putting up walls now we get into enhanced UDL. Because now we're figuring out the structure, and the wiring of the house, right? And where's that data need to be delivered to? And then finally if we think about SpaceVerse, it's really the appliances, and the layout of the rooms. Because that's what's going to allow individuals to really understand their environment and the environment they're going to have to navigate through. So that's how I like to talk about these three projects.

Finally in LOE 2, I'll talk about Digital University and Supra Coders. LOW 2 is about the guardian spirit, advancing the guardian spirit. is providing over 30,000 classes now almost double the number of classes than guardians that we have, but that's good thing. And, again, some folks think, "Oh, just in, the digital engineering part of what we're doing." No. It's optics, it's physics, it's base lining space language? So that when you talk to others you're speaking from a common playing field. So DU is the long term vision of where we will be meeting our guardians where they come to us from, this is all online learning they can get professional certifications and we can help them move a lot of those classes into professional degree-seeking programs as well. So DU is important to get people digitally fluent. And our workforce needs to be digitally fluent.

Someone asked me if that is what I really meant. Does everyone in Space Force need to be digitally fluent? Absolutely. We have roughly 16,000 people. Every single one of them has to be cross trained, and they have to be able to, when they move from operations and they go to acquisition, they need to know what they're buying, right? When they move from acquisitions and they move to training, they need to understand completely how they're going to maximize those training platforms to get the most out of a guardians understanding and comprehension.

DU is absolutely critical, as well as the software development immersive, or what produces Supra Coders right? And we have 106 Supra Coders today, and this is what I say about Supra Coders. I- couple weeks ago I got an email, "Hey, I heard about Supra Coders. How do I get me some of that?" You cannot build Supra Coders overnight? You have to sign it, bill it, and there's a little bit of pain involved. You have to send an individual to a highly immersive class,

right? Away from your environment, where they're focused on learning different computer languages, data science user interfaces. And then they go to a three month internship. Then when they come back to you, they have a Z-prefix and, when it's time for them to move on, we track those Z-prefixes so that their next potential commander knows how they can use them.

Now, this is what I'll say about Supra Coders. If it was only about coding, well, we could hire coders all day long. I mean, many of you provide coders to the government. The difference is that these coders are certified on the systems that they are working on. They are space professionals, unlike me, and they are working in their team to identify pain points to their Deltas. So they are able to put a solution into place within hours or days, as opposed to going through the big "R" requirements process. Think of this more as the little "r" piece. And an example of that was a recent Delta Supra Coder got a bunch of Supra Coders together and said, "Hey, we have a problem. We have some ISR data on a classified system that we, every time we try to look at this stuff, it's corrupted, it's got all kinds of problems with it. Let's figure out, how we can make this more usable to the Delta." So they got together, they figured out what data streams they needed to capture. they captured them, they normalized the data, they created a new dataset altogether. And now they are able to shave off weeks of time going through massive amounts of data, and it's directly feeding into operations.

So again, 106 Supra Coders trained and in place. We continue to fight for an increase in the pipeline because, again, you don't create these people overnight, and we have to think about ways that we are going to ensure that we have enough of these assets. Especially in terms of surge capacity. Cannot emphasize that enough. We need to ensure that, yep, okay, if 100 is right, maybe you need 300 in order to have surge capacity if something truly happens.

And then, LOE 3, how partnerships can help. So Partnering to Win. We have a number of efforts in partnering, and so much that I can't really go into it. We have Hack-A-Sat, we have immersion challenges, we have Spacewerx, AFWERX, we have our University Consortium research opportunities that are going on right now. We have a hypersonics challenge going on now. We're getting ready to start a power challenge. But with that, let me just focus on, let me just focus on the fact that in partnerships, I want to go back to what I said earlier, we don't need perfect. And I think you've heard this message today. We don't need perfect, The 60 or 70% solution is okay. Except in Nuclear Command and Control and Communications. Let's- let's not take that. Let's not take a 60% solution there.

But the vision of the University Consortium is not just to throw money out and to create more 61 and 62. Because, let me tell you, when I compare the money that we have with the money that others have to fund 61 and 62 it's very small and I would rather spend that money on taking what others have funded in 61 and 62 and figure out how we can operationalize it, and get it into the field as soon as possible. And again, we have to have this kind of near term, mid term, and short- and long term view, but I am a near and mid term view sort of person and want to get things out into the field. And we have five science and technology institutes that we're standing up. The first one, the RFP went on March 27th, and let me tell you why industry should be really caring about this. Because it's not just about academia. Our SSTIs require that there be more than one university, and require that industry be involved. Why? Because we would rather buy something than to have to take something at the 62 level, 63 level, hand it off to maybe AFRL or DARPA, then wait another few years, et cetera. We want industry to be involved in the research so that they could take IP, put it into products, and we can buy it.

The five SSTIs are, beyond geostationary orbit, XGEO, Operations in Space Domain Awareness. I think- I think you probably saw that one coming. Two is In-space Operations. Three is in Advanced Space Power and Propulsion. So someone asked me earlier, do we care about propulsion?. Absolutely. And hybrid propulsion particularly. Four, Advanced Remote Sensing Technologies and Operational Changes and Concepts. And then Cyber Mission Assurance and Data Trust for Space-based Military Missions.

Let me give you an example of something I saw earlier this month. Well, it's pretty hard to say, but it was literally last week. And that is where a university had taken AI and deep learning to look at imagery, different phenomenology imagery, put it all together, and then look for particular artifacts, and doing feature extraction, automated feature extraction, right? Across the globe to picture certain attributes, right? Water, oil, et cetera. Imagine being able to use deep learning feature extraction, automated feature extraction, in space, right? Again, lots of platforms, but we need to be able to understand where they are and where they're moving, especially if they're going to be able to be moving more often. Especially if we enable on-orbit servicing, right? And add it to the manufacturing. We need to be able to have that understanding. So it's a great example of where we can take things that have been developed for others and then apply them in space.

So with that I know that I stated at the beginning the Space Force was designed so that we have to partner, we absolutely do. We have evolving architectures. I think you heard a lot about that today. I'm a huge fan of what SDA is doing,

what SSC is doing really amazing work by many people and we're looking to have these capabilities put into operations with agility, with resiliency, and in operationally relevant timelines. I can't emphasize that enough. With industry, let me just emphasize that Space Force will continue to partner, but even look for closer ties to industry, so that we are able to exploit what we have, to buy what we can, and only build what we have to.

And with that, thank you for your time and thank you to The Mitchell Institute. And if there are any questions, please raise your hand. Yes, ma'am?

[00:35:21] **Theresa Hitchens:** Hi, I'm Teresa Hitchens with Breaking Defense. Thank you for that speech, it was really interesting. General Miller from Space Command talked about his concerns about lack of capability to keep custody of satellites on orbit but particularly those that are moving, and that this is a need that the command has. And it sounds to me like that's a need you're trying to fill with the enhanced data library, unified data library. Is that correct, and if so, can you elaborate on how the enhancements will help that problem?

[00:36:07] **Dr. Lisa Costa:** No, absolutely. And, yes enhanced UDL will be able to help with that particular challenge, but it is only a component of the technologies that will be needed, right? So if you're talking about managing custody, well, okay, we might need something like Blockchain, or we might need other sorts of capabilities that allow us to understand movement in space and ensure that an asset is exactly the asset that we have been tracking, And be able to understand movement around that asset. Absolutely and enhanced UDL will also be able to help in terms of being able to understand more about the environment, because it will be bringing in that vital commercial data at speed and- and at scale. And that's another way. Thank you.

Anyone else? Now I know what Derek meant by the light's right in your eyes so you can't see. Yes? Yes, sir? Oh. Yes. [laughs]

[00:37:24] **John Kohut:** Thank you. I'm John Kohut from GALT Aerospace. The Earth-Moon Lagrange points offer some particularly unique capabilities of being able to enter, essentially, any orbit at very low energy states. Is there any thought or interest in establishing a base at a Lagrange point, and conversely what would be our reaction if China decided to do that?

[00:37:51] **Dr. Lisa Costa:** So now you're asking me something that a space scientist would only know. But [laughs] however, what I will say is that we are working and partnering with NASA on some initiatives in terms of alternative orbits alternative communications, et cetera. And I would refer you, probably,

to my science tech and research branch that would be able to answer your question much more detailed than I would be able to.

Yes?

[00:38:36] **Patrick Binning:** Good afternoon. Patrick Binning Johns Hopkins Applied Physics Lab. Enjoyed hearing the talk about Ion and where you're going with that. low latency high bandwidth, very much necessary. But most government networks can only run Microsoft products. What do you see Ion giving the guardians, and high performance computing, and their ability, to actually do engineering and high performance analytics? Is Ion where that's going, or is there something else that the Space Force is thinking about? Thank you.

[00:38:58] **Dr. Lisa Costa:** That is where Ion is going. Although let me tell you, I would be happy to be able to run Microsoft products [laughs] but absolutely. High performance computing, having access to that. Not everyone has to have that from their desktop, so being able, though, to use Ion to access resources, again, where they reside, be able to run algorithms at that localized level, and then bring back the results is absolutely critical. I've emphasized this point of we- we collect a lot of data in space, right? We have to create, quote, "an Ion" in space as well. Because when we think about the amount of data needing to traverse space, that really almost begs the question of w- where are our data centers in space, right? Where is our agnostic transport? What are our space data layer transport?

It's absolutely critical for us to branch out from Ion. We're starting at that kind of classified networking WAN-based level, but it will expand from there.

Now, whether it is all under that title of Ion or not, I don't care really. I'm really about providing access to the individuals who need it. Not every guardian needs to have high performance computing, but what we do need is we need to be able to access that high performance computing, and then we need to be able to feed that, at speed, to individuals so that they're able to comprehend the results of that analysis. And that is exactly what we're focused on in Ion, and in enhanced UDL, and the construct of SpaceVerse. It's really all three of them put together.

When we think about networking, we really have to think about you know there are many layers of networking, right? And we have strategic, operational, and tactical levels of networking. We have different requirements for each one of those, I was really only talking about the strategic levels of networking with Ion. I was not talking about the operational and the tactical pieces, where, again,

the focus is really on software defined networks and re- with really software defined everything. If we're going to be able to communicate space effects at mission command levels, then we ultimately need new types of capabilities to be able to communicate to the joint forces who might be in A2/AD environments. And Ion is not that but it needs to feed that.

Any other questions?

[00:42:08] **Maj Gen Larry Stutzriem, USAF (Ret.):** We have time for one more. If not, I've got one.

[00:42:12] **Dr. Lisa Costa:** Okay.

[00:42:13] **Maj Gen Larry Stutzriem, USAF (Ret.):** I'm just curious, Dr. Costa you said recently it would take about seven years to fully digitize Space Force, make it a digitized service?

[00:42:21] **Dr. Lisa Costa:** [affirmative]

[00:42:21] **Maj Gen Larry Stutzriem, USAF (Ret.):** I'm just curious is the money in the budget to do that? Is there more needed? Where do you see that at right now, in terms of resources?

[00:42:30] **Dr. Lisa Costa:** That's a great question, and it really depends on how much of the enterprise IT, and I talked about enterprise IT, that we have to take and upgrade versus just greenfield, right? And at some point, yes, greenfielding is a very painful thing, but I dare say that if any industry CIO, CTIO, was looking at the infrastructure that we currently have, it would make monetary sense, return on investment sense, to greenfield. And, again, that's a challenging thing, right? DOD is not very good at taking things off the list. We're really good at adding things to the list. The list gets very long and no one is willing to rack and stack it one to end. So I fundamentally believe that we will get ahead much quicker if we don't try to dig ourselves out of tech debt, but we just leap over that and move to software defined everything and modern systems that, keep evolving over time. And again, I go back to Dr. Tournear, and it's exactly what he's doing is really a great initiative and I think that's the same thing that we need to do in terms of digital infrastructure.

All right, well thank you so much. I very much appreciate it and hopefully now, Charles, I can say that I am a space professional [laughs]

[00:44:18] **Maj Gen Larry Stutzriem, USAF (Ret.):** Thank you so much.

[00:44:19] **Dr. Lisa Costa:** Thank you.