

Dominating the Electromagnetic Spectrum

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Col. Nicole M. Petrucci:

Good morning everyone and welcome to the Dominating The Electromagnetic Spectrum panel. I'm Nicole Petrucci and I'm the Commander of Space Delta 3. And we also are the Electromagnetic Warfare Integrated Mission Delta. As Delta III, we are the only Delta focused on EW in the Space Force. Over the last 20 years, the electromagnetic warfare battle space has changed, beginning with the restricted pool of RF jammers, so radio frequency jammers, to a diversity of capabilities requiring a different approach to attempt to dominate the electromagnetic spectrum. The warfighter dependence on the electromagnetic spectrum has become even more so when we look at current conflicts going on all along the world and it's led some people to dub it the ultimate or the next high ground.

So really, the military risks losing its edge if we don't push the envelope in the electromagnetic spectrum. Today we have a panel of industry experts and they've been looking at this problem for quite some time, and we're going to discuss the challenges and opportunities for the future of the Air and Space Forces. Starting with, we have Joshua Niedzwiecki, he is the Vice President and General Manager of Electronic Combat Systems at BAE Systems. He's responsible for managing the development of advanced electronic warfare technologies that deliver superior next generation electronic support, electronic protection and electronic attack capabilities that defeat current and future threats. Mr. Niedzwiecki?

Joshua Niedzwiecki:

Thank you.

Col. Nicole M. Petrucci:

Next we have Jen Lewis, she's the President of Airborne Combat Systems for L3Harris Technologies. ACS provides systems that enable US and allied warfighters with technical overmatch and evolving complex threat environments, and that includes electronic warfare and spectrum operations. Ms. Lewis?

Jennifer Lewis:

Thank you very much.

Col. Nicole M. Petrucci:

And finally, but not last of all, we have Michael Willy Andersen, and he's the Vice President of the Multi-Domain Spectrum Programs and Capabilities for Phantom Works, the Boeing Defense Space and Security's Advanced Research and Development organization responsible for maintaining Boeing's core portfolio of special technologies, materials, developing innovative concepts and prototyping and transition.

Michael "Willy" Andersen:

Thank you. Pleasure to be here.

Col. Nicole M. Petrucci:

Thanks. So let's get into the panel now. Now that I've done a lot of reading, let's go ahead and start with our first question. So as I said in the introduction, we had that increased emphasis on, hey, we're really trying to dominate the electromagnetic spectrum. So with this renewed emphasis on competition and speed, which they've talked about, we talk about, hey, this return to great power competition, give the audience just one thing that the government can do and one thing that industry can do to get capabilities to the warfighter faster? Let's go ahead and start with Mr. Niedzwiecki.

Joshua Niedzwiecki:

Sure. So thanks for the question and thank you all for being here today. I think when we talk about speed, it's really about understanding the pace of the threat. China as the pacing threat has immense capability in their home turf territory. Their integrated air defense systems are increasingly dense. They're increasingly more capable. They're driving capability into broader frequency ranges, so lower in frequency and higher in frequency, which drives a real change in what we need to do in the electromagnetic spectrum.

When we think about the industry side of how do we move fast? For us at BAE Systems, one of the big focus areas as a leading EW provider is how do we help the Air Force leverage the kit that you already have on the platforms you're already operating? All of those systems today are software defined and open architecture. And so as industry, we have to continue to embrace that software defined open architecture mindset. For us, there's some areas where we're taking systems that are already fielded on platforms and technology that was in DARPA last year that will go operational next year, and it's all enabled because of that software-defined capability.

The other area that's making some of those technologies successful is the ability for the Air Force to continue to do rapid testing. We do a lot of investment in modeling and SIEM analysis, but you have to validate that model analysis in the field. And so where we see the most rapid technology deployments is where we can be at the range out west and doing constant fly, fix, fly, really understand the details and take that back and build capability in.

On the government side, I would suggest an area that I think actually under Secretary Kendall's leadership has been a real warm welcome from an industry standpoint, is re-engaging the DIB in helping to shape the solution space by helping us understand the gaps. We are much better at looking at the problem set with the Air Force and Space Force to help trade technology, maturity timelines together than to be just asked to solve a series of requirements that we all have to compete for. So I think that's another aspect that I'd like to certainly encourage us continuing and have very much appreciated over the past few years.

Col. Nicole M. Petrucci:

I definitely didn't understand that until a couple of years ago. I went to the Eisenhower School for National Strategy and Resource Security, and we talked a lot about the indents. I can't talk right now, sorry. Yes, I'm the moderator. We talked a lot about the industrial base and how it had really shrunk and COVID had really amplified that because we just couldn't get things and so we couldn't continue to build things. And so when we looked at, hey, our systems that we had and where we went in the future, what was that going to mean for us and what did we need to do? So we've done a lot of work over the last couple of years really saying, "Hey, how can we get that defense industrial base? How can we get it going? How can we get it moving? How can we get a full production for some of these systems?"

I know that that's something that in space, we are always at low rate production. We never really get to what's a full rate production when you talk about, "Hey, how many aircraft we're going to buy or how many weapons we need that have those capabilities to be able to compete in the electromagnetic

spectrum?"And so that's where it really... To put a finer point on what you said, that is very important because we have to have those tools. We have to have those capabilities. We have to have those raw materials to be able to build those systems or we're not going to be able to compete. And that's not just us, that's also allies and partners as well. I know we're also looking at how we can help with their defense industrial base and what we can share to put us closer together as well. So thanks for the question.

Joshua Niedzwiecki:

Yeah, thank you.

Col. Nicole M. Petrucci:

So Ms. Lewis, do you have anything you'd like to say?

Jennifer Lewis:

Sure. I do agree with Josh's comments that I'm going to build in a little different direction from them as to not repeat here. I think one of the things that industry can do to really get relevant electronic warfare capability out to the field quickly is to leverage commercial technologies where we can. This really drives acceleration in the development timeframe. It lowers cost, it mitigates risk and getting proven technology out to the field.

I would say one example of this that we can think of, something we use every day is cloud technology. All of our devices are very, very connected. When I think about electromagnetic spectrum operations and really trying to coordinate effects across the battle space, we're really going to need to leverage that kind of technology and we're investing in that way. As you look at, again, coordinating effects from next-gen, excuse me, exquisite platforms, legacy platforms, even attributable systems.

This is something at L3Harris that we've really leaned into, leveraging the COTS technology as well as really leaning into the open mission systems standards and strategy of the government. That is a way for us to rapidly innovate and deploy capability. What I think we really need or what we're really seeking as industry is consistency in how the open systems and scalable systems are valued across the acquisition cycle. And I'm going to talk here a minute about software. So again, as we lean into COTS hardware, we lean into COTS technology, open mission systems.

The secret sauce that enables all of the good EW effects to happen on the field is the software. Josh talked about software defined. You think about how that software is made possible, decades, decades of innovation by industry developing the software, decades of building systems engineering expertise about the threat environment, how it's rapidly changing and about the mission area itself and how to integrate these solutions into systems and platforms.

So as we think about procurement models for software as we need to do now, we need to think about how we really value that systems engineering knowledge that's been developed over decades of experience so that we can mitigate that risk in getting that capability out to the field. The DOD has to balance cost, risk, technical performance, as well as integration risk. Again, for speed to getting capability of the warfighter. I think what you really need to look at is a portfolio of software products that really range from things that are matured and proven and cutting-edge critical, maybe lower TRL software products.

So if you look at the software library, it really does require a very strong software industrial base and one that is really still motivated to go out and invest and innovate and rapidly create those solutions so that we can get them integrated for the warfighter. Without that innovation and industry leaning

forward and really competing to meet customer requirements, we won't be able to deliver the technical overmatch that our warfighters need.

Col. Nicole M. Petrucci:

Thank you. I do just want to pull on one thing you said. When we talk about dual technology, I think that's definitely something where there is a growth industry. We used to really build systems that were inherently military. That's it. We'd build them for the military. The military would use them. It was a valid target, and there you go, right? It went on the targeting list and we would do something with that. Where here, where you're talking about dual use, that's become a bigger and bigger part of warfare. And so that's when it gets harder where you're like, "Okay, is that a valid target? Is it not?" How do we determine that? How do we decide what we're going to go after next and then how are we going to deal with that? And so some of that is just on the industry side, being able to say, "Hey, we can use this for both." There's some on the military side because you are taking some risk when you use some potential commercial capabilities. There may be some risks that you have.

And then the other part of that is just the policy that goes with it at the higher level to be able to use it to use something that is commercial as something that is military. And for us in the US, we have a clear line about what we can do for military and commercial, but that is not the case in other countries as we have found out as we're looking at their targeting solutions. So just something to keep in mind, that is something that's on our mind as we're trying to move forward and we're trying to innovate our systems at Space Delta 3 with where we want to go with electromagnetic warfare, but that is also true for a lot of other systems as well.

The Space Force introduced Integrated Mission Deltas in October of last year. We were one of the first ones, so we were for the electromagnetic warfare. IMD, the other one is for PNT, and that is a provisional Delta right now. What that really did is that they brought together operations, intelligence, cyber and acquisitions, which was new. We were split up and we were focused before. So bringing that together, we were trying to have that unity of effort so that we were always moving forward in the same direction toward where we needed to go for us, especially EW, as we're talking about that in the panel.

So yesterday, in the room next door, not in this room, we discussed that from what an IMD meant from a military perspective. Today, I want to look at that from an industry perspective. So how do you see that role of industry changing as we bring on new capabilities and we sustain that and it's all done through this Integrated Mission Delta instead of through, hey, you have SPOC, which maybe do some sustainment. You have some space systems command or other commands that do program offices, that do that development and sustainment. How do you see the role of industry changing, Ms. Lewis, we'll start with you.

Jennifer Lewis:

Sure. I think the new structure to the Integrated Mission Deltas is a good move. Really combining the operations and the sustainment together and really creating a team that's aligned around mission rather than function. It's a critical shift for the Space Force to optimize the space team around the near peer contested environment and the next great power competition that we are in. For industry, we find the same benefit when we take subject matter experts and put them into integrated teams to really work around a mission space.

These Mission Deltas have really already started to allow L3 Harris, and we're seeing it collaborate with operators early in the life cycle, and I think that's very important. Again, I think one of the things we're talking about here is speed. We look forward to that collaboration going forward and really getting that

early feedback. We do need feedback, not just collaboration. Don't be afraid to tell us what we need to hear because our resources among us are critical and scarce. We need to know where to invest.

As the Space Force is prioritizing acquisition of defense and military applications at the speed of commercial technology, we're looking at things we used to take decades to get into space now taking years and five years, right? Or less. So that has really challenged industry, I would say at L3Harris, it's really challenged our thinking around the entire life-cycle development. And we have been investing in a very robust modeling and simulation capability because that is really what unlocks you to be able to go through those design and validation cycles very quickly. I think integrating with the Mission Deltas will give us that early and often feedback that we need.

I think that with our investment and modeling and SIEM, I look at development cycles that used to take L3Harris years to do now being crunched down to months, and we're not done. We need to continue to go faster. And so I think that's one thing that we in industry are focused on. And I would say, because you poked on it a little bit at the end of the last question, then another thing for just all of us within security boundaries, of course everybody, we're going to do the right thing here, but we do need to continue to overcome the barriers by compartmentalizing everything and make sure that we really are creating these cross-functional teams so that we can create those multi-function and multi-spectral solutions and get those out to the warfighter quickly.

Col. Nicole M. Petrucci:

Yeah, it's definitely really important, right? Because you're saying, "Hey, we want operator feedback." And I've been doing this a long time. I've been doing space a long time, and they always said, "Oh yeah, we want operator feedback." And they didn't always want operator feedback pretty early in the process because it was like, "No, I want to get it to a certain point, then you can look at it, then you can tell me what's going on." What we've seen with this Integrated Mission Delta is it's really... We've been able to bring people on earlier and earlier in the process, but it's also a teamwork. Whereas before, it was split between acquisitions was one way and ops was another way. By bringing us together, we're all in those same meetings, and so that's where we're really figuring out where want to go together. And so we've been able to get a lot of great feedback already on it.

So for EW IMD, it's been a little bit different. We only have sustainment of one of our systems, so that's our counter-communication systems 10.2. But we've already had some great things where we've led the sustainment team. We've led those issues where we said, "Oh, we had a problem. So we were able to fix it pretty early." And then we've also had our operators sit in on our upgrade to the system as well, which has been great. PNT is a little bit different for them. They have development and sustainment under their IMD. So theirs, they've been able to bring systems online sooner because they're still in that space. It's a little bit different how they're working out. We're trying both ways to see which way might be better as we go in the future as they introduce more IMDs.

So you haven't got to speak yet, but we'll let Mr. Andersen speak here. So how do you think that this is going? What do you think we can do?

Michael "Willy" Andersen:

Thank you very much. Well, first off, the move to bring all that under your seat, single unity of command, all focused on mission effect is a bold move. We've seen some of the benefits with the operational imperatives all focused on mission effect, and that's how you can break some of these barriers down that my colleague was talking about. Just lessons learned from being involved in the operational imperatives, the three big stumbling blocks. One is the requirements process is... Long legacy is not made to do that. So there's growing pains, but we're seeing a lot of benefit and movement

in that particular area. But we get ourselves into squishy requirements, meaning we want to do this. We don't exactly know how we want to do this. We can't necessarily communicate to industry what this is in traditional ways. So partnering with industry along the requirement side to collectively help figure out what it is so that we're not wasting a valuable investment and government money.

So that's one. Acquisition process. I was a 27-year Air Force retiree. Acquisition side, even though I had a lot of operational experience. And I can tell you with personal experience, the acquisition process is archaic. It is just brutal, but we're making all sorts of headways, whether it be agile contracting, breaking down store pipes within program offices and so forth. There's just growing pains that are still going to continue.

And I think the third one, my colleague mentioned this, is breaking down roadblocks like SAPRA security form. Made a lot of headway, it's still out there. From a Boeing side, I oversee well over 100 SAP programs. Well, just imagine how our teams are trying to collaborate internal to a company and still, "Well, are you cleared? No, you're not cleared." And then across collaborating with my peers here, that's complicated. That's difficult. We made a tremendous amount of progress in that area. Please don't let up. We absolutely need to keep pushing through here because that's how you're going to go fast. And you've organized for speed and agility, partnering with industry in things like consortiums and partnerships that enable cross-partnerships within the industry. That's how we're going to have rapid insertion of technology take advantage of open architecture. In the EW spectrum, that life-cycle between being able to act, sense and then react, very, very short. We need all those barriers knocked down so that we can work with you to get the next best effect when something happens that is unforeseen.

Col. Nicole M. Petrucci:

Thank you. That sounds great, but it's really that acquisition process rate. We talk a lot about that. I think as operators we're like, "Oh, that process just takes so long." And that's true, but it really does come down to requirements. Knowing really what you're trying to shape those systems to do and do in the future, and then have enough flexibility to be able to change when the threat changes, because that's really the issue that we've seen is just, "Hey, we have these systems, how can we change faster to meet that new threat?" And I think that's everywhere.

So one of the things though that I like to talk about is I like to say that the science of space should be automated because I need the warfighters to do the art of space. I don't need them to do that. I need them. That's what their master's at, that's what they're moving forward. And so how can I do that? So the biggest thing for me that I've seen, how do you see that role of artificial intelligence, machine learning, and what I'm most excited about, quantum computing in the development of future EMS capabilities? We'll start with you, Mr. Niedzwiecki.

Joshua Niedzwiecki:

Sure. So I guess I'll take the question first from an air-breathing domain and then talk about extending it to space. BAE Systems, we're certainly a major player in the airborne EW space. And I think when you talk about AI and ML, it's really about what's the problem you're trying to solve? And it's the fact that the pace of the threat is changing so dynamically. In the past, our intelligence cycles, you had threats that were mostly analog radar, integrated air defense systems that were deployed. We could collect intelligence on them for years, build countermeasures, test them at the ranges, and then validate them and deploy them, and they would have longevity over a period of years. Now the threats are all software-defined, reprogrammable, all digital thanks to the telecom boom, and that technology being

pervasive around the globe. And so the threats are changing pulse to pulse to pulse, and so that's driving the need to have higher amounts of speed in reaction to those dynamics.

I think the other thing before we get into AIML is how we buy EW today, especially in the air domain. We fight today and we think of every problem as a one versus many fight. If I'm an F-35, I have to defeat every possible threat I may encounter in the battle space. If I'm an F-15, my E-pause system has to defeat every possible threat in the battle space. When you look at the density and complexity of the threat environment, you realize we have to stop just playing self-protection and defense, and we have to really go offensive in the spectrum, and that requires coordinated effects, coordinated kinetic and non-kinetic effects.

So if you take that now back to the AIML piece, I think there's really three areas where we as an industry and the Air Force can continue to accelerate. One is drive the low-hanging fruit first. So in our world, that's rapid reprogramming. Every EW system has a mission data file. It takes six to nine months to get those validated and deployed. There's a major focus in being able to take data right off the flight line with organizations like the 350th Spectrum Warfare Wing, and be able to use the latest information about what you saw in the battle space and take some level of calculated risk to modify that MDF and get the new capability out there to the fleet the next sortie.

In Northern Edge 23, we were flying our EPOS system and we were asked to look at this as an example. So there was a radar threat that wasn't in our MDF that the Marines were out there with, and another agile radar that weren't programmed in the MDF, we were flying it, we detected it, but performance was marginal. Team came back, looked at the data, and within 24 hours had a new MDF updated that was able to now crush those threats. And so how do we create an environment where technologies like AI and ML can help automate that in the battle space in real time?

The next phase of that is actually putting that on board. So what else can you do on ship, in the platform in real time? And the challenge there is you have limited compute resource and you also have limited data. So when you think of machine learning and all of the Googles of the world and Facebook's, they're operating off of loads and loads and loads of data and massive cloud farms. ChatGPT is another great example. When you're in a tactical aircraft or a spacecraft, you have limited hardware and you have limited data. So there's really nuanced ways to use AI and ML to help you learn how effective you're being and then take that data back.

I think the third thread on AIML, and this applies to both air and space, is given that we have to be better at doing coordinated effects across domain and across multiple platforms, AIML can be a huge tool to enable that orchestration, that orchestration between EW battle management, air battle management, kinetic versus non-kinetic effects and mission planning, and I think that's the third area that deserves a lot of focus moving forward.

Col. Nicole M. Petrucci:

Yeah, I definitely think that as we at Delta 3, we have some systems that used to be SAP. Now they're at lower levels, so we can talk about what they do. What didn't move with that is really the C2, right? And when people say C2, and they talk about command and control, they're just like, "It's command and control and it's all the same." It's not all the same, right? There's different requirements you need for a tactical C2 versus operational C2, and then to be able to do that mission planning. And so, well, that's very important because we have to be able to collaborate and move together so that we can have that domination of the electromagnetic spectrum.

That's a really good point because the other part of that is you have to be able to mission plan together to be able to execute together, and that's really something that we are very interested in as well. You did talk a little bit about classification. I know there is a lot going on with that so that we can collaborate

more. Within the Deltas, we're starting to have more collaboration with not only in our Delta with being able to have exercises to train together, but also intra-Delta. So between Deltas that are different mission-focused. But to be able to do that, we have to be able to mission plan together. We have to be able to have that TAC C2. You have to be able to see what that schema maneuver is so that you make sure that you employ your systems at the right time. So that's a very good point. Mr. Andersen, do you have something to say about that?

Michael "Willy" Andersen:

Well, first off, I'm going to pull the thread a little bit on your BMC2 conversation. So Boeing's had quite a long history in that particular area, and in the area of EW and multi-domain, you've added a whole nother level of complexity to just simple battle management of air vehicles doing a strike package. So we started thinking through how do you synchronize for maximal effect across domains? How do you be able to tie the EW aspects of it to our air operations so that you're enabling their success? Not a trivial problem by any stretch. The AIML pieces of it, there is absolutely opportunity to be able to accelerate decision time in the BMC2, focusing in... Well, first off, when we go against a peer threat with home field advantage, they've been preparing for a while, they're going to throw everything at us and we're going to see stuff we've never seen before. We know that's going to happen.

So AIML being able to process through the sheer vast amount of data, to be able to flag those new signals that we haven't seen before, be able to quickly analyze as best we can, what is that? And then allow our BM folks to be able to make those kind of decisions. So across the life-cycle of that piece, sure, there's a ton of opportunity in AIML to be able to do the processing and shorten the time period, and we need to take advantage of that.

A couple of other threads along those lines is we can actually do a lot more in the digital thread space related to how best to apply AIML so that we get maximum effect. How best can we do that so that has the best overall opportunity and effect for our battle management control forces as well as the systems that are coming online, whether it be E7X or space type aspects? So along the whole digital thread piece, we're making tremendous amounts of progress related to systems digital twins, linking from concept to design, to manufacture and ultimately sustainment. But that's at the system level. So now let's start taking a look at that at the warfighting CONOP level and start to see how the different pieces plug in, what new requirements need to be made and how best we can start to really optimize that side of things.

Joshua Niedzwiecki:

If I could just to pull your digital thread, I think an area we haven't talked about here today which really is more on the mission planning and digital thread side, especially in the EW space, is the need across industry to do better with the government at leveraging operational analysis. A lot of the OA today doesn't take into account the nuanced EW capability that exists out there. And so we think of it as J to S and reducing your signature fuzzball, but there's a lot of techniques and capability that have much more advanced mission effects. We as a country have to do better at integrating that capability into our ops analysis so we can understand, "Jeez, with this fourth-gen platform or even fifth-gen platform and these techniques, I can reduce the WES by this much, and now I'm willing to take more risk and operationally plan with those assets because the fight is scary, the fight is real. We're going to have to bring every platform we have to the fight."

And if we don't really understand through that OA the operational impact of that EW capability, our default will be to be more conservative in our approach because we don't want to lose assets, and I think building that into our pipeline is a big area of interest for us. And I think an area of needed focus.

Michael "Willy" Andersen:

I think you're 100% correct. I've talked with General Cropsey a number of times about getting the operational use cases so that we can make sure that we're doing the level of ops analysis. We do a fair amount of that. It's just like yourselves and multiple other people in industry, and there's going to be an unintended consequence with all the trons that are going to be in the air on our systems. So we've been looking at this offensively. Well, it's going to have an effect when comms are starting to get impacted and just pull the thread a little bit on the CCA stuff. So with all the trons that are out there and you've got all of the CCA's, affordable mass out, how is our EW and theirs going to affect the control of those vehicles in doing the intended... What it is that we want them to do and the time we want them to do it? We don't know yet. And so the operational analysis that's there is crucial because we need to understand those specific requirements and how they build and integrate together. Good point.

Col. Nicole M. Petrucci:

That's a very good point because if you don't know what the outputs are, you don't know what the inputs are. So we don't know how to mission plan correctly for those if we don't have that, and we have that assessment to be able to re-roll those targets so that we know what's going on next. When I was at the Pentagon, I was actually an Operations Research Analyst. That was my title. I just played one at the Pentagon, but what I learned in that job was how important it was to do that kind of research, to have that information so that we could plug it back into the system.

With the last few minutes that we have left, I'd just like to give you another opportunity if there's anything else you'd like to say about the electromagnetic spectrum. Ms. Lewis, we'll go ahead and start with you.

Jennifer Lewis:

Look, I just want to thank you for letting me be on the panel today and on behalf of 50,000 employees at L3Harris and 4,900 that work for me in my sector, thank you very much for the conversation. I hope what you all take away today is, look, what we're dealing with is very complex. It's evolving very quickly. There are technologies and information out there that we can leverage to get at this thing together. We're all in. There are some barriers we need to overcome and I think that I'm optimistic about our future and our ability to provide this capability to the warfighter.

Col. Nicole M. Petrucci:

Thank you. Mr. Niedzwiecki, we'll start with you.

Joshua Niedzwiecki:

Sure. I'd just say now more than ever, the threat is real and it's very scary. I was out in Japan with Fifth Air Force a couple of weeks ago and meeting with the JMOD, and our coalition partners that are much closer to the fight also feel that reality. And so to me, everything is about speed. How do we as an industrial base go faster and how do we learn to take and be comfortable taking more calculated risks to take some of the sixth-gen capability, accelerate its fielding? Getting the budget passed would be nice to help with that, certainly. But you look at the space race and we put a man on the moon in a decade, and we just have to learn how to take more calculated risks collectively to drive that urgency.

Col. Nicole M. Petrucci:

Mr. Andersen?

Michael “Willy” Andersen:

When you think of the EW spectrum, very, very complicated and challenging problem, if you will. So on the phantom work side, we're the innovation hub for our Boeing defense. We're the ones that are supposed to be moving at the speed of relevance. And so we also are changing just like the Space Force and Air Forces to be able to meet the challenge. And you're seeing that across industry. This is not a Boeing-only kind of thing. All of the industry partners here on the stage as well as those that are not, are all working a lot more collaboratively together to be able to help you all with this unique threat and this unique problem set.

And so we're doing things that we traditionally and classically would never have thought to have done, but we're partnering up. We're doing that in many different ways. We're enabling third-party tech insertion into our systems. We're trying those out in our digital environment, and we're doing everything we can possibly do to drive mission effectiveness, mission effect, so that you guys can do your mission and be successful. And so I just want to say that all three of us and those that aren't here are all standing with you to help enable you to your success.

Col. Nicole M. Petrucci:

Thank you. So what I think you've seen today is that really, it's the nation that's going to be able to take that technology and cycle it into military advantage faster is the one that's going to win, but the military can't do that alone. We need industry, we need partners to be able to do that so that we can compete in this next great power competition.

I'd like to thank the panelists today for being here with me. Thank you very much for your insightful words, and thank you for the audience for being here today to learn how to dominate the electromagnetic spectrum. Thank you.

Michael “Willy” Andersen:

Thank you.

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