Aerospace Advantage – Winning Tomorrow's Fight: Airpower Must Maximize Electronic Attack – Transcript

Heather "Lucky" Penney: [00:00:00] Welcome to the Aerospace Advantage Podcast, brought to you by PenFed. I'm your host, Heather "Lucky" Penney. Here on the Aerospace Advantage, we speak with leaders in the DoD, industry, and other subject matter experts to explore the intersection of strategy, operational concepts, technology, and policy when it comes to air and space power.

So, if you like learning about aerospace power, you're in the right place. For our regular listeners, welcome back. And if it's your first time here, thank you so much for joining us. As a reminder, if you like what you're hearing today, do us a favor and follow our show. Please give us a "like" and leave a comment, so that we can keep charting the trajectories that matter the most to you.

So, for our listeners today, I'm on travel, I'm on the road. And so we're reporting this virtually, but we thought it was such an important topic, we didn't want to let it go. A few weeks ago, I was in Oshkosh, Wisconsin at the Experimental Aircraft Association's Air Venture Airshow. As anyone who loves aviation knows, it's the largest airshow in the world.

It's like Brigadoon for airplanes. It is the [00:01:00] place you want to be each summer. And they had everything. The world's only two airworthy B 29s flying in formation, an Avro Lancaster, over a dozen P 51s, five B 25s, the F 22 demo team, the A 10 demo team, a B 1, a B 52, and acres upon acres of general aviation airplanes parked as far as you could see, and pilots camping out there, too.

They also had several F 35s on static display and flying each day's part of the air show. And seeing that fifth gen fighter light the afterburner and roar to the sky is about as cool as it gets. There's a sound of freedom. And we talk about jets all the time here in D. C., but actually see them fly? It brings it all home.

But it's really hard to explain to people as they see the jet fly, they're only seeing a fraction of the F 35's capabilities. Some of the most impressive elements of the F 35 are invisible to almost everyone, because they happen in the electromagnetic spectrum. [00:02:00] See, combat isn't just about shooting missiles, firing the gun, and dropping bombs anymore.

Some of the most powerful capabilities are derived from the electromagnetic spectrum operations, EMSO for short. And thanks to this aircraft's amazing

sensor processing and data fusion capabilities, it isn't just a passive function. The F 35 can reach out and touch you. Through electromagnetic effects.

So, that's what we're here to discuss today to better understand the F 35 through the EMSO lens by talking to people who make it all possible. And that begins with industry, who innovates and produces the technology. So, we have Josh Niedzwiecki, Vice President and General Manager of Electronic Combat Solutions at BAE.

Josh, thanks for joining us.

Josh Niedzwiecki: Heather, thank you for having me.

Heather "Lucky" Penney: And next, we've got Colonel Larry Fenner Jr., the new commander of the 350th Spectrum Warfare Wing. And as anyone who listens to this podcast knows, we are huge fans of the 350th's work.

General Larry Fenner Jr.: Heather, thanks for having me. I'm looking forward to our discussion.[00:03:00]

Heather "Lucky" Penney: Last, but not least, we've got Colonel J. "Evil" Spohn, a longtime F 35 pilot and commander with the 188th Wing, Arkansas Air National Guard Base in Fort Smith. The 188th is one of the unit's TASA training allied and partner F 35 pilots, and this brings a whole other dimension to the F 35 EMSO discussion.

Evil, thanks for joining us.

Colonel J. "Evil" Spohn: Hey, my pleasure. Lucky. Thanks for having me.

Heather "Lucky" Penney: And thanks again to everyone for their time today. Evil, I'd like to kick off the conversation with you because frankly, you're the guy that's got a strap into the jet and go execute the mission. So, you began your career in the A 10 and not much exemplifies kinetic air power better than the Hog, right?

But now... (laughter) it's pretty awesome.

As an F 35 pilot, the tools available to you now are far broader, including electronic attack effects. So, could you talk to our audience about a macro discussion of what it means to operate a 5th generation aircraft, especially in the EMSO dominance [00:04:00] realm?

Colonel J. "Evil" Spohn: Yeah, I think the biggest thing is just that, things like EMSO or EA are an integral part of employing the F35, where just coming from my previous airplane was the F16 Block 30.

It just wasn't something that you spent much time on. The airplane wasn't capable of it. It wasn't part of your bag of tricks if you will. And so that, that's kind of the biggest thing. It's just getting your arms around the fact that electronic attack is a primary mission set of your airplane and you're not flying specialty airplane like a dedicated EA, electronic attack airplane. You're flying a multi role fighter just like the F 16, is just like the Strike Eagle is, but even that being said, in the F 35, that is a primary mission of your platform. And so that's kind of the mental mindset shift of going to that as a primary mission set.

In addition to all the other things that the [00:05:00] other multi role fighters still do, you know, OCA, DCA, strike, things like that, but adopting EA into the bag of tricks. That's the biggest difference I think is just making that mental shift and getting yourself familiar with the things you need to do that mission well.

Heather "Lucky" Penney: Yeah, so, Evil, it's got to be something way more complex and effective than just simply turning on the jamming pod and expecting your electronic warfare suite to jam and do self protection, because you're actually using EMSO operations, not just in support of your survivability and in support of your kinetic mission, but you're also doing other EMSO stuff, right?

Colonel J. "Evil" Spohn: Yeah. The F 35, one of the greatest aspects, I think of the F 35 and one of the biggest differences with it compared to other airplanes is that it, it's a giant sponge. Especially when it comes to RF energy. And so it has the ability to pretty much see everything that's [00:06:00] radiating out there.

The other airplanes, quite frankly, just don't, and that makes you as the F 35 pilot, a lot more integral to the entire strike package in that, you're not waiting for the rivet joint or something like that to let, you know, that threat X or threat Y is online and where it's located. You have that information.

The F 35, you know, sniffs that out for you kind of automatically and you have that information that really is a game changer when compared to other multi role fighter aircraft out there.

Heather "Lucky" Penney: So, Colonel Fenner help us understand the 350th's role in this equation.

I mean, first, let's just do some basics about what's going on. I mean, after all, electronic warfare can evolve much more rapidly than hardware. We've got the right apertures, the antennas, the library, or the mission data files, and the processors. But you've got to match the signal you're receiving to the file in the library, and then decide how you want to counter that signal, and then transmit that to the counter.

So Col [00:07:00] Fenner, help us understand the 350th's role in this whole equation. First, let's just do some basics about what's going on to help our listeners understand the entire process. I mean, after all, electronic warfare can evolve much more rapidly than hardware.

We've got the right aperture is the antennas. That's a hardware piece. The library, which are the mission data files, that's a software piece and the processors, which is a combination of hardware and software. So, to really do this, we've got to match the signal that we're receiving in a jet to a file that's in the library and then decide how we want to counter that signal. And then transmit that counter signal, right? If we know who's out there and we've got a plan for how we want to transmit the attack, that's kind of how this whole system works. Right? I know I've simplified this a ton, but if you could go into a little bit more detail, so that we can understand really the role that you play here and how important it is.

General Larry Fenner Jr.: So, Heather, what I'll tell you is you're absolutely correct. Mission data files is [00:08:00] absolutely critical to making sure that we fully understand the EMSO environment. So, I'll back that up and say this.

So, the 350th Spectrum Warfare Wing is a critical node on the network of EW capability, specifically when it comes to mission data files. We regularly and continuously work with industry, our joint force partners, as well as our coalition partners, to continue to develop those mission data file.

So, the criticality of that is data is the weapon, is specifically EW data, because the more we can get that data in any anomalies that occur within electromagnetic operating environment, we can bring that data back, adjust those libraries, or like you said, the mission data file, to make sure that the warfighter is equipped with the most latest signal environment out there. So, that they have the ability to detect and recognize any threats that exist out there.

Heather "Lucky" Penney: Okay, so [00:09:00] let's put those basics into the jet. What are the macro capabilities and functions that you manage for an aircraft like the F 35? So, you mentioned the mission data files, and that's probably one of the key tools. And if we're talking about those, where do you begin, and how does this information make its way into Evil's F 35?

Colonel J. "Evil" Spohn: So, that starts out at the forward edge, that starts with the warfighter. This is where you hear the concept of "crowd source flight data." So, like an aircraft, which is a phenomenal aircraft with the F 35, but it's not just the F 35. There are other platforms out there that have receivers, and they can sense the environment.

So, the key is to get that data from the forward edge so that we can bring it into our data architecture and transport it to the teams that will analyze and exploit that data to make sure, are there any anomalies that are occurring within the electromagnetic operating environment? And if they are, we can then in turn update those [00:10:00] libraries that are within those existing platforms. So, that they have the latest information. So, that they have the ability to recognize what that threat is and then they can adjust appropriately.

Because the whole reason behind that is you don't want the warfighter to be surprised. You want them to have the latest information out there and how the spectrum has evolved. And then that enhances their lethality as well as their survivability, they're not being surprised they're ahead of the curve.

Heather "Lucky" Penney: So, basically, when we talk about aircraft in the battle space being vacuums, they're sucking up all these trons, right? They have to have some way to then be able to record all of those signals and bring them back to you so that you can then decide which ones are known signals, which ones are unknown signals, and of those unknown signals, are they threats? Are they, adaptations of existing threats? And then you create that for the mission data file. Is that right, Col Fenner?

General Larry Fenner Jr.: That's correct, because data is the key and data is what's going to [00:11:00] ensure the warfighter survivability. So, if there's no changes, then they should have the mission data files that have the latest information.

But if there are changes, we rapidly adapt to that, that change and make sure that is being pushed to the warfighters so that their mission data files are updated to see the environment.

Heather "Lucky" Penney: Awesome.

So Josh, let's bring you into the equation. You lead a team that makes all of this possible. Folks have had various theories in mind regarding what next generation EMSO capabilities might be, but the theories aren't much good unless we can manifest them through real technology. And the F 35 is a really big game changer because EMSO effects were part of the design from day one.

Electromagnetic spectrum operations, the functions for the F 16, which I flew, were way more federated and kind of bolt on in an ad hoc fashion. But the F 35 is different. How does that impact how you approach the jet and its various systems?

Josh Niedzwiecki: Yeah, Heather, if we, um, step back first, [00:12:00] we have a very unique perspective at BAE Systems.

We're not a platform prime. We're an electronic warfare provider. And we have EW kit on 80 percent of the Air Force's fixed wing fleet. So that's the lens, the lens of the electromagnetic spectrum that we look at when we approach capability and EW on platforms like the F35. When we look at that problem space, everything we do is driven by the threat and at the earliest stages of development, we focus a tremendous amount of energy on the threat.

Today, that threat is more advanced than ever. Our near peer threat environment consists of highly integrated air defense networks. Those networks have the ability to see, I. D., track and geo locate aircraft in the airspace. From an E. W. standpoint, our job is to mitigate and prevent those air defense systems from tracking our [00:13:00] aircraft and engaging. All of that is enabled by advanced electronics.

So, one of the things we focus on is highly advanced military electronics. We were actually the first company in the nation to get the CHIPS Act and that was all around advancing EW capability and the radio frequency electronics that enable us to address those, those advanced (inaudible).

The second piece of the puzzle is making sure all of these systems are software defined and open architecture. And the reason that's important is because the threats today, those radar systems that are trying to find our aircraft in the airspace. Are very agile and adaptive. That means that our EW systems have to be by design, agile and adaptive.

Heather "Lucky" Penney: Yeah, no kidding. Software defined and open architecture, that is, that's key to being able to out adapt and out pace the adversary, because we cannot allow the [00:14:00] software and the EMSO adaptations drag us back. You know, we can't use the timelines we have used historically for the for the entire process.

So, on that note, when does new technology enter the jet? We've heard a lot about TR 3 Block 4 and I have to imagine that the increased processing from the TR 3 core will dramatically improve F 35 capabilities a lot.

Josh Niedzwiecki: Yes. So, the TR 3 core certainly drives a tremendous amount of processing enhancement to the jet. Um, the piece that we're very involved with directly as the EW provider is the Block 4 electronic warfare suite, which has its own processing core. And when we think about adding technology to the jet, I like to use the iPhone analogy. If you think of an iPhone, you have software that gets updated. Your iOS gets updated continuously, because capability and, tools and [00:15:00] apps are added constantly. Processors, you actually replace your iPhone every 2 years because the computer processor in those iPhones doubles every 18 months with Moore's Law. And the radio frequency electronics operate on a slower pace.

Think of 3G, 4G, 5G. Those timescales happen on 5 plus year increments. If we take that analogy and say, how do we apply our ability to keep pace like the cell phone industry does. We're certainly not going to replace an entire EW suite every 2 years. That would be unbearably costly. And so our focus has been all around how to drive modularity into all the EW systems we make. And modularity all the way down to where those core processes are.

So, on the F 35, we have a mezzanine architecture, which allows us to replace just those processor boards and not an entire card or an entire line [00:16:00] replaceable module. That drives sustainment costs way down. The software architecture of the EW suite also allows us to have much more rapid capability insertion of new advanced techniques.

And a big focus for us across all of our EW systems that we make is driving to an architecture the Air Force calls "Big Iron," which is a common software defined architecture. The ability to have a common software architecture across multiple platforms then allows us rapidly insert new EW techniques, whether we made them or some other 3rd party vendor made them and get them in the field as fast as possible. On Compass Call, the EA 37B, which we make the EW suite for, we have over 20 3rd party app providers, providing capability to that platform with a similar type of ecosystem.

Heather "Lucky" Penney: [00:17:00] That's amazing. And so I wasn't aware that you had your own processor for electronic warfare capabilities, but as you've described it, that makes a tremendous amount of sense. And then when you integrate that across the entire enterprise that you support, that's important because that means that you're not limiting your MSO operations to a single platform, you're sharing that capability across a much wider set of capabilities.

So Colonel Fenner, I'd like to pivot to you because I'd like you to discuss how MSO has evolved, from the 350th's perspective. Electronic capabilities are a lot different than industrial age hardware. And Josh has spoken to that a little bit, because we're not talking about structures riveted together. As he's presented, it's a lot more, it's the software defined. It can be modular and we're looking at lines of code that can rapidly morph. So, in many ways, and so can provide serious capability at a way faster pace, and we can adapt the [00:18:00] hardware.

Which is important, because as you've all heard me say, time is a 3rd offset. Speed of adaptation is our operational advantage. So, how does the 350th understand this operating environment, which the adversary is shaping and how do you respond to ensure that our folks are equipped to succeed? And that their capabilities are relevant?

General Larry Fenner Jr.: What I will tell you is the spectrum is changing and it's changing rapidly. It's becoming even more congested, more contested and constrained as newer capabilities, not only just from us. But as well as our adversaries are populated within electromagnetic operating environment. And we understand one critical thing to a lot of these changes is it's driving to more software enabled integration of capabilities.

And that's one of the things that we're focusing on within the, uh, 350th Spectrum Warfare Wing, because we realize that within the software, and we have a squadron design [00:19:00] towards going towards software integration. And how do we develop faster? Is that, that is going to be the key is that open architecture to get after those new capabilities and to develop those counters, to counter the threats that we're seeing.

So, what I will tell you, you have to also understand our adversaries and how they're operating in the spectrum. And finding where those vulnerabilities lie. So, within those, you can design and develop those capabilities quicker and faster with that data that we talked about earlier, being the weapon that we use to get after, whether it's a war reserve mode or a new capability that's being put out there to address that particular threat. But I will tell you, we are

continuously monitoring the spectrum in the 350th Spectrum Warfare Wing. We're analyzing the data continuously and identifying where those anomalies are current, where those patterns are current, where those new technologies are being put into the spectrum and designing ways to get after it and counter [00:20:00] it.

Heather "Lucky" Penney: So, Colonel Fenner, one of the F 35's biggest attributes is that it's operated by so many allies and partners, and that's a huge positive. But it also drives challenges from a security perspective. Ensuring that US forces, our allies, and our partners are all on the same page from an information vantage is notoriously difficult.

It's all about classification, right? Because it hits at the highest classification sensitivity issues. And while things might be possible technically, policy considerations can get in the way. At Mitchell, we're huge fans of breaking down barriers, not to compromise security, but a recognition that modern information age combat operations will see greater risks if we can't align from an EMSO vantage. Stove piping these functions just is not going to work in the battle space and nor can we try to fix things after the conflict has started. So, how do you work with allies and partners at the 350th?

General Larry Fenner Jr.: So, Heather, what I will tell you, we're already working with our allies and partners. [00:21:00] We conducted our own internal exercise where we were getting after going faster as we talked to where speed is the key to being relevant within the war fighting scenario.

So, we've worked with our allies and partners within Rapid Raven to make sure that we're going faster with our reprogramming and making sure that we can detect and get after those anomalies and update those mission data files quicker. But we understand that, you know, priority has to be given to leveraging those alliances with those teammates.

So, it comes back to, we have to work with them, not just in the reprogramming piece, but in any of our exercises, I just came back from a theater where we constantly work with our allies and partners. Making sure we understand and get that interoperability of working together as teammates, we can't sacrifice security for speed.

So, there's things that we can do, but there's things that we can't do due to security concerns, but we must continue to work with our partners and find the logical solutions to our classification challenges as we [00:22:00] continue to

work for it. But I can tell you, our allies and partners have been great teammates to work with.

And we learn a lot from them, just as they learn from us. And I look forward to working with them in, when it comes to EMSO, and finding the right ways to get after our challenges in the spectrum. That's what the 350th Spectrum Warfare Wing was set up for, is to get after those difficult challenges that we face in the spectrum, and working with our allies and partners to get after those difficult challenges.

Heather "Lucky" Penney: Oh, thank you for that. Because we do need our allies and partners and what they bring to the battle space, what they bring to the partnership as well as their capacity. So it's, it's their innovation, their and their collaboration that will be crucial. So, that that's those are good words. Josh. I'd really like to hear your thoughts on allied EMSO integration from an industry perspective. So, you clearly can't control or influence government policy, but you've been charged with developing an interoperable, highly collaborative system.

Josh Niedzwiecki: Yes. So, Heather, you know, the way we think [00:23:00] about this problem is, as you said, we're not responsible for policy, but what we do have control over is the hardware and making sure what we design and deliver is interoperable and effective. And so when you take EW suites that are on the F 35 going to many international partners, and even EW suites like EPAWSS that's going on the Japanese super interceptor, all of those have to be designed to support that interoperability.

One thing we do is make sure all those systems are designed so they can be export approved. And that is absolutely the case now. The other is driving tools inside the EW suite to enable rapid reprogramming and let the policy decision makers decide what you can do when, but let the EW suite be enabled to do it.

So, we have data recording capability in our EW systems that allow you to take data off the jet after a [00:24:00] sortie. And then rapidly update a mission data file. For example, in Northern Edge in 2023, we were flying EPAWSS on an F 15 and the team was flying a mission and during that mission, there was an unknown radar threat in the environment that the EPAWSS system was able to characterize, but have some, but not optimal performance against.

The team took that data off the jet, had the mission data reprogramming tools to update that mission data file overnight and the next day, fly another sortie and

crush that same radar threat. And so, from our standpoint, it's about creating the tools that allow that rapid integration of data and to allow that interoperability.

And then let the policy makers decide and how they interoperate with US forces.

General Larry Fenner Jr.: And Heather, if I may, I just [00:25:00] want to do a follow up here because, you know, with the allies and partners question, I just want to just highlight the fact that yes, we are working hand in hand with the teammates that we already have here because we already have the UK, Australia, Canada, and we also have Norway and Italy that are working at Eglin this very day, to get after the reprogramming piece as well as the F 35 partner support complex to get after that reprogramming rapidly of the data. So, when I talk about us working with our partners, we're figuring out those challenges and how to work through some of those classifications security issues.

To make sure that we're all working together in concert to make sure we dominate the spectrum of win.

Heather "Lucky" Penney: So Evil, you're part of this equation in Arkansas, the 188th. So with allied and partner training, what are your thoughts on this?

Colonel J. "Evil" Spohn: I think buying the F 35 is a monumental decision for any nation if you will, right?

It's a total overhaul of, you know, whatever airplane you're flying right now, whether it's [00:26:00] the, F 4, the Tornado, the Gripen and whatever you're flying right now, just deciding to buy the F 35 your air force or your navy, is a huge decision.

And the fact that given that, so many nations are deciding to go that route, really shows the value that these air forces and these ministries of defense are placing in the F 35s capability. So you know, it really shows that they think the same thing that we do, that this is going to be a game changer for your national defense to bring the F 35 online.

And that allows them these foreign partners in Europe, in Asia to adopt our tactics, techniques, and procedures and to really to train with us side by side doing the same tactics in the same airplane. Using the same technology. And that really is a force multiplier just like we saw back in the 80s and into the 90s with our previous airplanes. [00:27:00] We're gonna see that again with the F 35. The largest operator of the F 35 in Europe, it's not going to be us. It's going

to be the collective of all of those NATO and partner nations that are operating the F 35 and we're a piece of that. But really it's a force multiplier.

Heather "Lucky" Penney: Yeah, our partners and allies are crucial. We're not going to go it alone.

Colonel J. "Evil" Spohn: Absolutely.

Heather "Lucky" Penney: So Colonel Fenner, what about our adversaries? I mean, I assume they're doubling down with EMSO too. And we talk a lot about Russian and Chinese capabilities. Is it fair to say that we're in an EMSO race?

General Larry Fenner Jr.: No, I wouldn't say we're in an EMSO race. So, what I will tell you is the 350th Spectrum Warfare Wing is focused. And we are focused as an Air Force on going faster and developing the EMSO capabilities that we need and how we're going to fight within the spectrum. So, that doesn't change the fact that our adversaries, yes, they are going to [00:28:00] develop capabilities. We're going to make sure that we are have the ability to recognize what those capabilities are within the spectrum and what impacts they're going to have against us. But I wouldn't say we're in race. We're just going to go faster. We're going to develop our war fighting capabilities for tomorrow, and we're going to dominate the spectrum and win.

Heather "Lucky" Penney: Okay, I'm all about that domination and winning for sure.

So Evil, how do we train for em? So operations and electronic attack? I know this is highly classified stuff and we can't just light up and unintentionally impact civilian infrastructure, like 5G and all of the electromagnetic capabilities that our everyday lives and civilians rely upon. So, I'd like to start with you about how your F35 training is different than how you execute in the A 10 or the F16 from an EMSO vantage. I mean, I imagine you have to really rely upon simulation primarily to play with all of your high end [00:29:00] threats.

Colonel J. "Evil" Spohn: Yeah, absolutely. I think we were definitely coming to a place where the ability to replicate the front line or night 1 type of scenario, if you will, is getting pretty limited in a live fly environment for a lot of reasons. Modern airplanes are capable of operating at a lot greater distances. So, their detection ranges, their ability to employ weapons is much further away than it used to be which requires more airspace.

There's also the, MCON or the security implications of using frontline electronic attack techniques or things like that out in open airspace where that could maybe be collected by foreign entities and used against us. There's that aspect of it. And then quite frankly, in the EA discussion, it's just pretty difficult, if not impossible, even at a large range, like the Jay Park up in Alaska or the NTTR are in Nevada to replicate a full frontline [00:30:00] integrated air defense system, like, you'd see in a peer adversary country. So, all of that is driving us towards doing a lot of these high end things in simulators.

We can park (inaudible) out in the airspace and we do that and we'll continue to do that. But it's driving a lot of the ability into the simulator and a lot of these tactics require multiples of airplanes, you know, 4, 6, 8, 10, 12 airplanes, depending on what you're training to and you just can't do that as effectively in a live flight airspace and all that's driving you into the simulator.

Which drives a need to increase the fidelity of those simulators in a way that we haven't had a need to do before. And so it's driving the, not just the simulator capacity, but also the simulator capability need up for us. And that's an issue we're working through right now.

Heather "Lucky" Penney: I'm glad you brought up the notion of ranges and the [00:31:00] limitations we have on range because it isn't just about not wanting adversaries to know what we know about them and know what our capabilities are. But there are other inherent limitations to our ranges and our airspace today. They continue to pressure our ability to train the way we need to fight. But when it comes to the best simulation, it's clearly very different from, like, way back in the day when I was in the F 16, because we had no, idea really what it would feel like what it would look like to fight with war reserve modes.

We didn't really do it a whole lot of training with jamming and we didn't have the advanced simulation that would allow us to do that. So, you touched on this briefly, do we have enough high fidelity simulation, both in the capability? So, is it up to speed and up to date? And do we have enough capacity to meet the throughput necessary to get everyone trained up?

Like, do we have enough JSE simulators and DMOs and are they updated frequently enough? And what about LVC, live virtual constructive? [00:32:00] What's kind of the state of play here you are saying out there on the ground?

Colonel J. "Evil" Spohn: Well, I mean, I would say, you know, it's kind of like money in your bank account or whatever. You're never, if you ask your, average fighter pilot out there, there's never enough simulation capacity. To answer

succinctly, I would say no on both counts. We don't have the capacity. We don't have the fidelity that we need, but I would caveat that. That is a high emphasis item for the Air Force and we're improving in leaps and bounds every year. So, compared to 5 years ago, 10 years ago, the state of affairs for our simulators is greatly improved, not just in the 5th gen airplanes, but also in the legacy platforms as well. And that's continuing to grow. So, no, we don't have enough JSE facilities, but we are opening up additional ones. Just like you saw back in the day when we were lieutenants in the, in the A 10 and the F 16 respectively is you got go to the range. You got to go to the airspace. [00:33:00] A couple times a week, and then you start getting good at it.

That's what the young folks are dealing with now in the F 35 is you got to get in that simulator, that advanced simulator, a couple times a week to get good at it. And we're just not there yet, but we're making, we're making big strides.

Heather "Lucky" Penney: So, Colonel Fenner, how about how you and your team enter the equation at the 350th? How do you work to ensure that the capabilities will execute as advertised when used in real life? I mean, I'm assuming things like live virtual and constructive training are crucial, but what does an EMSO range look like for you and your team?

General Larry Fenner Jr.: So Heather, that is one reason why we stood up the 950th Spectrum Warfare Group. Their sole focus is to make sure that our ranges, whether they be live, virtual, or in the modeling and sim constructs, are mirroring the pace of challenge. And so they're ever changing. So, our teams are working with those range coordinators and those directors and the teams to make sure that our ranges [00:34:00] emulate the environment we're going to fight in. Because it does you no good to go against environment that, going back to the train like we fight, the range has to mirror that. Whether it's in a live construct or virtual.

So, that is what we're getting after with the 950th Spectrum Warfare Group and that is what I've given them to charge. They just got activated on the 1st of August, and they will have their assumption of command on the 29th of October. But that is the charge I've given to them. Get after this difficult EMSO environment. I get it. We have security challenges that we have to face.

But we need to make sure that the warfighter is going into an environment that is emulating what they will expect to see. That way we're making sure that our capabilities are dialed in to defeat that particular threat. That our tactics, techniques, and procedures are truthful and they're based on actual factual data of operating within that environment as opposed to what our best guess is.

So, I think as we develop, and assess the current [00:35:00] capabilities that we have, and we develop newer capabilities, you will see our ranges, whether they be live or virtual, they will transform to make sure that we're mirroring that pacing threat. So, we do truly train like we fight.

Heather "Lucky" Penney: Congratulations on standing up the 950th. That's going to be amazing. And we definitely need to have those capabilities, both for what you do. broadly within your team to develop those MSO operations, but also for what our warfighters do and how they train and how they employ their MSO capabilities. So, Josh, I'd like to hear your thoughts on how do you approach this from an industry perspective when it comes to ensuring that your folks can train and develop as well?

Josh Niedzwiecki: Yeah, so I think we hit this from a couple of different angles. So, the first one is before you talk about training, it's really about how do you test and validate EW techniques against representative threats? And so we've invested a tremendous amount of [00:36:00] energy in pulling what we call the digital thread. Having modeling and simulation that is validated by hardware in the loop laboratory testing and then further validated by continuous flight testing. And we operate on a design cycle that allows us to fly, fix, fly.

Develop, test, fix, because everything is so dynamic these days. So with that underpinning, the other major investment we're making is in operational analysis. This is something that the primes, the platform primes, Lockheed, Boeing, and Northrop do very well because they have to. That's all about how do you characterize the performance of your aircraft or a strike package in a representative threat scenario.

Because EMSO is becoming a more crucial part of the battlespace, what we've been investing in at BAE Systems is standing up our [00:37:00] own operational analysis capability. To make sure those EW effects are accurately represented. We actually just hired a retired Air Force red team chief to lead this organization and he'll be starting next week.

So, the team's very excited about it.

Heather "Lucky" Penney: Oh, that's huge! Having that kind of ops analysis that is specifically looking at EMSO is crucial. I mean, cause we don't have any, any way to be able to say, I believe and understand how EMSO is going to impact our operations. Make us more successful, or perhaps alternately how adversary operations could adversely impact our operations.

That's amazing.

Josh Niedzwiecki: Yeah, and Heather, I'd add to echo what you just said. Today, in our operational analysis, things like joint simulation environment, these platforms, the EW effects are modeled at a very high level. And what that means is we create a much more conservative posture about where the aircraft [00:38:00] can fly in a mission and how far back it can we take an F 15, for example, a 4th gen aircraft.

If you don't model the EW effects, you may design tactics that keep that platform much further from the fight than it could get if you understood the EW capability that the system like EPAWSS provides. So that's a big focus for us.

Heather "Lucky" Penney: Yeah, and that's crucial because we know that operating inside the threat environment will make us far more effective if we can also be survivable. And if we can't model those EMSO effects from our perspective, so how effective our EW is, that might push us back behind the threat rings where we can no longer successfully execute combat operations.

So I'd like to look at this then from the electronic attack side gentlemen, you've all talked a little bit about this as well, but like, for example, I know what a gun looks like [00:39:00] when it fires and when a missile launches.

But the EW technology, EMSO, I mean, that is, and we alluded to it a little bit earlier, really hitting the, I believe button, because you don't get to see a fireball or a radar contact disappear. And so, you know, it's 1 thing to do it in the laboratory, but it's another thing to do it in actual combat operations.

Like, how do we know when our electronic operations are working? How do we validate those effects in combat? Because this has a very real impact regarding what our follow on actions might be for a warfighter.

Colonel J. "Evil" Spohn: Yeah, absolutely and as some of the other guys alluded to, there's definitely an aspect of, hitting the, I believe, but, here that, you know, when you're coming from a legacy airplane, you just take for granted that you're going to get, you're going to get targeted in your A 10 or your F 15 or F 16 when you pass a certain point on the map. You just know that that's going to happen.

And certainly in the F 35, you got to kind of believe initially that, okay, that's not going to happen. [00:40:00] The smart people told me that F 35, if I do these

things, I'm going to be able to trespass this threat or get over here unmolested if you will.

So, initially that's what you're doing is you're just believing what the guys before you told you, and, and I'm just gonna, I'm going to lean forward. I'm going to do what they told me, but it doesn't take very long before you start to realize, you know, I'm really not getting targeted by that SAM, like what, what's going on with that?

Or does that airplane, that enemy airplane really not see me here? Because you're so used to that just being a given, like a way of life in the, in the legacy airplanes. That's when it sunk in for me. As I was learning those tactics and really doing what the instructors told me to do following the TTPs that we had and not being targeted.

It was working how they told me it was supposed to work. And, you know, that might be kind of a trite or a simple answer, but that's how, you know, it's working. Is that when you're in a part of the map or you're in a proximity to a threat that [00:41:00] you would have got shot down 10 minutes ago in your F 16, but you're still here and you're employing that GBU-39 on that threat or you're, shooting an AIM-120 at that enemy aircraft. That's how, you know, it's working because I never would have been here in those legacy airplanes, no matter what I did.

And so, you really see the payoff of the, not just the tactics, but also the equipment that you're bringing to bear in that fight.

General Larry Fenner Jr.: At the core of what you're discussing in that question is electromagnetic battle management. Being able to determine real time, what effects are occurring within the electromagnetic operating environment.

If we know what capabilities we're going to bring and we can overlay those within EMVM. But being able to see where our capabilities are having impact and what effects it's providing going towards our adversary is absolutely key. Because the way the 350th looks at [00:42:00] EMSO is it is a total force challenge and being able to accurately command and control those non kinetic effects within the spectrum is exactly where we're going with electromagnetic battle management.

And that is going to be key to making sure we prioritize our effects and we deconflict. So, you don't have a lot of electromagnetic interference or we're

(inaudible) at each other's effects within the spectrum. And we're making sure that it is home towards denying our adversary their ability to operate in the spectrum, while enhancing our ability to move and maneuver within the spectrum.

Heather "Lucky" Penney: That's huge. Oh, my gosh. Talking about electromagnetic battle management is a step above, because that allows you to be dynamic, agile, respond to blue operations as well as red operations and do that real time as opposed to having just rely on [00:43:00] position and timing de confliction. And I assume that because we're putting a lot of these EMSO capabilities into cockpits that we're going to have to have our warfighters, our fighter pilots, our bomber pilots and so forth. Really become more EMSO operators as well and have awareness. And so that EW battle management, that is something I think that is underappreciated and under talked about.

Josh, I'd like to get some of your perspective on this. How do we measure these effects as well?

Josh Niedzwiecki: Yeah, this Heather is a very challenging problem. And one that we've been working as well as other industry partners have been working for a while. And the other term I'd add is electromagnetic battle damage assessment. How do you know that those EW techniques are effective. As you know, flying F 16s in an end game when a missiles coming off the rail and you hear your radar warning receiver, you know, you've been painted. Your tactics are ingrained in your head about [00:44:00] maneuverability and deploying electronic countermeasures.

But as we look at the threat environment in an EMSO space, we look at disrupting the kill chain at all different levels of that kill chain, not just the missile end game, but the target tracking of the early warning. And disrupting their ability to transmit information from one node to another. And those are harder to measure.

So, for us, it's about two things. Thing one is when we develop our EW systems and test and validate them, we are no longer in the mode of testing and validating against a known threat characteristic. We instead take that threat characteristic, test against it, and then forward project what are all the capabilities that threat in this case, a radar, could do or evolve to and try to expand the envelope of of our testing. So, that [00:45:00] we're more confident going in, in the value of an effect. So that's one thing.

The other is there's a whole series of research and development going on right now. All around advanced battle damage assessment algorithm development. What are the tells that the signal environment is showing that if you could listen to and record can give the pilot some indication that the EW technique is having an effect and that's where we're doing now as well.

General Larry Fenner Jr.: So, there's also another piece of this Heather, that I just wanted to add. Is the education piece. Because at the forward edge is the war fighter, making sure they understand the point outs that they need to be able to provide. And being able to funnel a lot of that information when it comes to, as was discussed, you know, electromagnetic battle damage assessments.

Well, the people on the forward edge and warfighter on the forward edge is going to be the key to that as well. And so educating the force on what things to [00:46:00] look for, what things are you seeing out there in the spectrum so that we have those point outs to basically bring that back into that battle management network.

So, we better understand are we having the impacts that we are expecting? Or maybe it's not impacting the adversary as we expected. So, I feel like educating the force is going to be key to that as well. And that is something we're doing right now within our exercises. Understand, making the warfighter understand the importance of bringing that data back so that we can update those mission data files or what things they are seeing out there alone with their equipment so that we can better understand how the spectrum is evolving.

Heather "Lucky" Penney: That's amazing thinking about what those tells might be the electronic, the EMSO battle damage assessment and being able to do that real time so that you can then go through the decision tree of what you'll end up doing tactically or technologically is huge.

So Colonel Fenner, how do you [00:47:00] work to integrate an asset like the F 35 from an EMSO perspective with other capabilities? Whether it be an F, 22 or an F, 16, or one of our allies or partners. And when I say integrate, I'm not necessarily just talking about the technical perspective. I'm really talking about that operational integration. How are you approaching that? We've just talked about EMSO battle management. Can you give us some more detail there?

General Larry Fenner Jr.: Yes. So Heather, what I would tell you is it starts with a lot of the exercises. That's how we're going to train like, we fight. And so it goes into our weapons school integration exercises. It goes into our red flag exercises, whether it's Bamboo Eagle, even our own Rapid Raven internal

exercise within our wing. You're the biggest thing we have to remember is the customer is the warfighter. The warfighter is the one that is out at the forward edge taking the fight to the adversary. So we need to make sure, and this goes back to what I've learned a long time ago. It is [00:48:00] people that we are investing in to make sure that we hone our warfighting edge.

So, we are making sure that when they go out to a (inaudible) that they're getting those challenging environments. When they go out to a Red Flag, they're getting that challenging EMSO environment so they can get the reps and sets that they will expect to see in a comparable pacing challenge threat environment.

And in doing so, what we're doing is enhancing that lethality and survivability of the warfighter at the forward edge, because I believe wholeheartedly, that when you couple a really informed warfighter that knows the EMSO environment and knows how that environment is going to respond to their particular weapon system and their EMSO components. And you couple it all together, that is what makes a lethal warfighter and that is the warfighter that is going to be able to meet the challenge. Be successful and come home.

Heather "Lucky" Penney: I like it. Josh, you've been working on this too. [00:49:00]

Josh Niedzwiecki: Yes, Heather, and when we look at this problem set, you know, we think about the fundamental shift in the threat environment.

Today, our current platforms operate on what I would call a one versus many fight in the electromagnetic spectrum. Each aircraft has to be able to defeat every possible radar threat that it might face by itself. And as we look at the complexity of the red adversary's integrated air defense networks we really have to move to a many versus many fight. We have to be able to provide offensive electronic effects from all of the nodes or platforms in the battlespace. And so from our standpoint, one element of that is making sure that the electronic warfare architectures are as common as possible across those platforms so that those EW bullets can be delivered from as many platforms as possible. Just like a JDAM or a [00:50:00] Sidewinder can be delivered from multiple aircraft. The other piece of that is the battle management command and control piece. You have platforms like the E7 or the E3 that do air battle management across all these aircraft, we have to now think about how you integrate electronic warfare battle management into that space.

We think of platforms like the EA 37B Compass Call as being a great airborne node to be considered to execute that electromagnetic battle management and be able to communicate to those different aircraft in the theater and develop that common integrated EW effect across the battle space.

Heather "Lucky" Penney: We've heard Air Force senior leaders say that they need the EA 37B now and I'm assuming that a huge piece of this is that EMSO battle management. Which will be crucial to our operation success [00:51:00] and Colonel Fenner, as you mentioned, for our warfighters to be able to go inside the threat environment and get what they need to do done successfully, survivably, and then come home.

So, Josh. I'd like to talk a little bit about cognitive EW. How AI ML, so artificial intelligence and machine learning, how this might impact the future of EMSO operations and how you approach EW?

Josh Niedzwiecki: Yeah, so, as you, as you said, and, you know, artificial intelligence and machine learning is advancing at tremendous rates.

All of the large language model capability that's out there in the commercial industry. It's making huge leaps and bounds. We have to figure out how to pull that into the electronic warfare space. The difference is those systems have massive industrial server farms and back end compute processing in different towns that are doing all of that [00:52:00] computation.

When you think of the EW space, especially at the front end at the edge and the aircraft, you're operating with limited data sets, and you're operating with limited compute power. So, how you apply those machine learning and AI algorithms is fundamentally different, but equally as important, the threats are highly dynamic now. In the past, a radar signal would be fixed for many years to come because it was all analog electronics. And once it was in the field, it stayed that way. Now, all of those radar threats are digitally reprogrammable and software defined. And therefore, the waveforms and the radar techniques they can use and the war reserve modes they can program, they can change on the fly.

Technologies like AI and machine learning are ways to combat that threat in the jet. In addition to that, those techniques and and tools are also highly leverageable back at the [00:53:00] reprogramming center, like the 350th, where you're getting all of this threat data from multiple sources, data off multiple platforms from multiple sorties. And your ability to sift through that data and

automatically optimize and reprogram your mission data files more effectively, I think is another great application of AI and machine learning.

Heather "Lucky" Penney: I'm glad you brought that up, Josh, because I think a lot of people don't realize how power intensive, how the physical footprint that AI requires. And so it really makes it important to be able to prioritize where our processing is going to be. So, I think you're right. I mean, not only is there incredible potential there, but we need to understand where those vulnerabilities might be.

If we have to stay linked to a server farm that is, you know, well behind over the horizon or how we then prioritize that kind of processing in the battlespace and how to use that appropriately.

General Larry Fenner Jr.: Heather, so [00:54:00] I will offer up my info on AI and machine learning. What I will tell you is from the crowd source flight data and where we're going with the data architecture for machine learning and I will play an integral piece and making us go faster.

So, but as we do our analysis and determine, you know, how that data architecture and those transport layers are going to be developed, it will play a key role as we move toward the future of creating efficiencies and going faster. And where do we put those AI machine learning nodes within that data architecture to help us filter out data, move it faster and getting it to the appropriate folks that will do the exploitation to make sure that we push it back and push it back into the fleet so that we are moving at the speed of relevance for the warfighter.

Heather "Lucky" Penney: Absolutely. And it's important to know that the blocking and tackling [00:55:00] skills, the basics of doing M so well, which your folks there at the 350th are total professionals and experts at, that doesn't go away just because we sprinkled some, AI ML in there.

So, we're getting tight on time, so I'd like to wrap our conversation, which has been awesome and very rich, but I'd like to look towards the future.

So, I'd like to help our listeners better understand the direction that you're taking EMSO. What's our vector? So, what should capabilities look like in 5 years and how should we grade the homework? How will we know if we're making the right progress?

Colonel J. "Evil" Spohn: For my money, I think it's just agility. That's what I would like to see from the, not just the F 35, but every, every airplane in our arsenal, you know, the B 21, the F 22, the F 15EX. I would like to see them all be significantly more agile when it comes to aircraft changes, whether that's mission data file changes or hardware changes.

Right now we've need to be able to get [00:56:00] into a rapid evolution. To where as the threat changes and as peer adversaries make rapid unforeseen changes to their capabilities that we can make those same changes to counter those and to get, you know, one step beyond to where we keep the advantage.

Right now, I don't think we're there, and that's what I want to see is five years from now, ten years from now, we're able to make changes to how the airplane operates and its capabilities in weeks and months, not decades. And so that, that's my, you know, fingers crossed wish for Air Force capability with our, with our platforms.

General Larry Fenner Jr.: So for the 350th Spectrum Warfare Wing, we have the cutting edge professionals that are getting after the mission each and every day. So, where we are going to the future is highlighting where those gaps and seams are that the adversary is creating for us. And what type of capabilities we believe will [00:57:00] best counter those gaps and seams that the adversary is introducing into the spectrum.

We believe also that the rapid reprogramming piece can't be foot stomped enough on where we need to go as far as being faster at the speed relevant for the warfighter and the engagement that are going on out there to detect those anomalies and be able to adjust rapidly to those different introduction of spectrum capabilities so that we can best counter our adversary.

And also we need to have the ability to assess how effective our capabilities are. Are they really meeting the need or do we need to fine tune them and adjust them accordingly to make sure that it enhances our spectrum capabilities? And that's what the 350th Spectrum Warfare Wing was stood up to do.

It was to counter our adversaries, because they're developing organizations, they're developing their tactics, techniques, and procedures, and they're developing the capabilities to counter us each and every day. And [00:58:00] so, the 350th was stood up to get after that difficult problem set to make sure that we are developing the right capabilities.

We're doing the right assessments, and we're being faster than our adversaries, so we may dominate the spectrum and win.

Heather "Lucky" Penney: Well, I'm just glad that 350S is on our side. Josh?

Josh Niedzwiecki: Yeah, from an industry standpoint, I'm very excited about what the future looks like from an EMSO perspective. You have to remember, the EW kit that we're building now, integrating onto jets like the F 35 and Block 4 that will be fielded and operational in five years.

The EPAWSS system that's on the F 15 E and EX models that are starting to roll off the knot of the line will be in theater operational in five years. As well as the EA 37 B at scale. And so for us, the exciting part is we've invested, the DOD has invested in some of the most advanced electronic capability to [00:59:00] counter those threats.

And in 5 years, it's going to be all about that software upgrade ability and pacing of the threat. So, for me, success is, as we go into a fight somewhere, we get data off the platform and we're able to rapidly respond to agile unknown threats and counter the adversaries kill chain better than we could before because we're closing that decision cycle and closing that capability insertion timeline at a pace faster than we ever have.

Heather "Lucky" Penney: Excellent. This has been an amazing conversation. Super rich and very enlightening. Thank you all so much. Josh, Colonel Fenner, Evil, thanks again for joining us and we look forward to chatting with you again.

Colonel J. "Evil" Spohn: Hey, great job. This is awesome, Heather. Thank you.

General Larry Fenner Jr.: This is definitely allowing me a new opportunity for me, so thanks. I look forward to working with you in the future.

Josh Niedzwiecki: Yeah, thanks for having me, Lucky, and thanks to everybody else for being on here. [01:00:00] It's been a great discussion and I'm looking forward to the next one.

Heather "Lucky" Penney: With that, I'd like to extend a big thank you to our guests for joining in today's discussion. I'd also like to extend a big thank you to you, our listeners, for your continued support and for tuning into today's show.

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