

## AA Ep. 187 – Spectrum Warfare: Freedom to Attack, Maneuver, and Defend – 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. To 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.

Electromagnetic Spectrum Operations, EMSO for short. It might sound arcane to some, but bottom line, this is one of the most important and dynamic components of modern warfare. That's because it all comes down to securing an information advantage while denying the same to the adversary. Look, this isn't new.

It's been a make or break factor in some of the most important [00:01:00] conflicts in history. I mean, remember the Battle of Britain? We might think a lot about the fighters, like the Spitfire, the Hurricane, or Germany's ME 109, but the electromagnetic spectrum operations were just as important. The British radars and their corresponding command and control enterprise are what provided the RAF fighter pilots the necessary information they needed to know when to launch and where to go to intercept enemy formations.

And this was crucial because they had so few fighters relative to the threat. Radar, radios, and command and control is what empowered the RAF to scramble fighters only when needed, to pair squadrons to specific threats, and manage their limited force to maximize their effectiveness. EMSO was a key reason why the RAF was able to prevail in the Battle of Britain, and the second people began using sensors, data processing, networks, data links to help gain a battle space advantage, their opponents began working on EMSO counters.

It's a cat and mouse game. Things like deception [00:02:00] and jamming. That's how we saw Spectrum Warfare develop. It's been a move counter move type world ever since. And all the while, the importance of the electromagnetic spectrum continues to grow. Just look at today's combat aircraft. They're just as

much flying sensors and data processors as they are old fashioned kinetic attack machines.

That's the entire thinking behind 5th generation technology and a lot of what we've seen advancements with earlier types like the F 15, the F 16, the B 52, or the E 7. And now we see it in space as well, with satellites and their supporting ground infrastructure engaged in similar spectrum warfare competition.

Bottom line, EMSO is crucial for closing modern killchains. It empowers concepts like Joint All Domain Command and Control, JADC2 for short, and the Advanced Battle Management System, which we call ABMS. A lot of the spectrum warfare tools are well known. Things like sensors and apertures, data links, radios, jammers, and cyber tools.

But it gets far more complex and more granular you get. And we're going to try and help break that down today. You [00:03:00] can't understand modern combat operations if you don't get spectrum operations. And we talked about this last year in several episodes.

It's so important. And we'll put a link to those episodes in the show notes, but that's why we're going to revisit this topic throughout the year to better explore what's happening and why. And if you want to know what's happening in the realm from an Air Force perspective, there's one go to source, the 350th Spectrum Wing, and it's located at Eglin Air Force Base.

So this week, we are honored to welcome back Colonel Joshua Koslov, commander of the 350th Spectrum Wing, and he's one of the Air Force's top leaders and visionaries in this mission area. Colonel Koslov, thanks so much for being here.

**Colonel Joshua Koslov:** It's my pleasure. Thank you so much for having me back.

**Heather 'Lucky' Penney:** Yeah, it's fabulous to have you back.

When we hosted you last year, and that's episode 145 from last September if folks want to go look that up. We tried to help our audience define electromagnetic spectrum operations at kind of a 101, 201 level. Yeah. So today we'd like to build on that, but first and foremost, let's refresh our definitions.

I [00:04:00] did my best to explain and define electromagnetic spectrum operations and spectrum warfare in the opening, but you're really the expert. So how would you think about it in your mind? How do you explain it to people?

**Colonel Joshua Koslov:** Yeah, that's a super awesome question. It's also super broad. I'll do my best. So the way I think about it it's often been said, and it's a 100 percent true. That if we lose in the spectrum, we're going to lose fast. There's no overcoming that. With the internet, interconnected world that we live in today and the interoperability between our platforms. We really have to posture ourselves to dominate the spectrum and win. And so what I think about that is the ability to meet joint force commander objectives.

Using the spectrum to either be supportive in nature of kinetic operations, or achieve the objectives on their own by either disabling, dismantling, or denying the adversary a capability in the spectrum. This has been most evident recently in our Red Flag exercises and the warfare centers, Bamboo Eagle exercise.

And the piece I also like to point out is [00:05:00] that the spectrum is inherently coalition and inherently joint. And so nothing the Air Force does in the spectrum, particularly is something we can do alone. We have to work with our joint partners and our coalition partners to make sure we're integrated in attacking, denying, degrading, and collecting the things we need to in order to win.

I think finally, the final point I would make is that in the past, spectrum operations have been channelized based off of platforms. And now because of the unique platforms that we have today, what we're finding is that due to the adversary's ability to and our ability to move quickly through the spectrum, we have to have platforms that are capable of receiving and transmitting new electronic warfare capability at the speed of need.

And that's really where the Spectrum Warfare Wing focuses. And I'm really excited about the prospects for the future.

**Heather 'Lucky' Penney:** I can't wait to talk more about that because the kill chain, that is, utterly dependent on the spectrum. And as you mentioned, electronic warfare, electronic attack and operations, that's going to be embedded in [00:06:00] every single kind of platform that the Air Force fields.

So catch us up. The news is filled with so many examples of spectrum warfare in action today. It's played a crucial role in Ukraine and Israel. And so would you mind bringing us up to speed on how you're seeing this mission evolve in

real time as you mentioned? For our listeners, it takes years, even up to a decade to adapt our hardware systems to adversary innovations, but EMSO can evolve so much faster than that.

Your combat OODA loop is much tighter than the hardware OODA loop.

**Colonel Joshua Koslov:** Absolutely. And so that's the number one lesson we've seen from the contingencies executed across the world today. And the trends that we've seen prior to those contingencies kicking off is that commanders reliance on the spectrum, um, the center of gravity in many cases of modern day battlefields.

The ability to either secure our kill chain. Or to prevent the enemy's kill chain, to break the enemy's kill chain, or to facilitate our kill chains is [00:07:00] absolutely critical to the current fights and the future fights that we may have. And that could be something as novel and low tech as the capabilities that we're seeing in the Ukraine or at the very high end, the types of capabilities and kill chains we have to build in order to fight our pacing challenges of today.

**Heather "Lucky" Penney:** So where does your wing fit into this equation? As spectrum warfare events play out in real time, how would you assess what's happening and then use that to advance our blue spectrum warfare advantage?

**Colonel Joshua Koslov:** Yeah, thank you for that. So, we are avid spectators in what's happening around the world to start off with as we shape the way we think we're going to fight in the future.

And so we keep a really strong eyeball on what's happening out in the universe today. But importance to the Air Force, we are executing our TTPs that I've talked about in the previous episode of rapid reprogramming, target development, and assessment in real time at our exercises across the Air Force.

So we have executed many of our [00:08:00] TTPs at Red Flag, I talked about that earlier, and more importantly at Bamboo Eagle. Which is a warfare center event that we execute in conjunction with our joint coalition partners. In order to develop the high end training we need for pacing challenge threats.

And so what we're doing is we're training to the most severe threat we can in order to be able to include the lesser threats so that we're prepared for other contingencies across the globe. the Spectrum Warfare Wing has continued to grow both in personnel and our scope of mission. And we're really excited to kind of keep pushing the envelope of what we're able to do.

I think it's really important that, for folks to know that the capabilities that we've developed are out there in the field today. We're not talking about science fiction. We're actually doing our job today. And we're going to get a lot better at it as we move forward in order to execute the types of kill chains that we have to in the future.

**Heather 'Lucky' Penney:** So you've talked a lot about some of the deployments and operations that you've done lately, and specifically Bamboo Eagle, which was focused [00:09:00] on Agile Combat Employment. What were you trying to achieve there?

**Colonel Joshua Koslov:** Yeah. So, there was a lot of focuses of Bamboo Eagle, and I think the Agile Combat Employment focus is really interesting because if you think about the joint forces spreading out in order to kill. In order to be able to transmit new capability to our weapon systems across the globe, we're gonna have to have the com pathways by which to get there, and have really well trained TTPs by which we're able to make sure fleets have all of the same data as they're spread out in various locations.

And so that's really been exciting and something we're working hard on achieving. The second piece of that is really, developing the TTPs and assessing the TTPs that we plan to use in high end conflict.

**Heather 'Lucky' Penney:** Colonel Koslov, I'm really excited to hear about the advancements in the exercises that you're doing because it is going to be so crucial.

I mean, our nation has taken way too much risk divesting and under investing in Spectrum Warfare operations after the Cold War. In people, equipment, [00:10:00] and training, so we're digging out trying to regain speed and altitude as fast as possible in EMSO. So I've got to imagine that the front page developments that have been going on across the globe have helped make the case for this imperative.

And I think we're seeing that in these kinds of operations and exercises.

**Colonel Joshua Koslov:** 100 percent. I can't agree with you enough. The, we definitely, there was amazing things that we did in the 25 years of conflict in the Global War on Terror in the spectrum. But those capabilities and TTPs were localized and specific to that engagement.

And the things that we need to be able to do against the peer are completely, in the spectrum, are completely different than what we have to be able to do there. And so as we are regaining the air, speed, altitude that you talked about, I spend a lot of time working directly with members of the acquisition community special program offices assigned to platforms and with the Department of Air Force as they work through the operation, the Secretary of the Air Force Operation Imperatives, [00:11:00] to ensure that everything we're doing is informed by the requirements of Spectrum Warfare, Electronic Warfare, and what we need to be able to do to win those future threats. And we've been as an enterprise, we've been really successful at raising the temperature and raising the level of capability across the board.

**Heather 'Lucky' Penney:** No, thank you. EMSO is going to be integrated onto every single platform we have, whether or not that's in space, whether it's a fighter, a bomber, a CCA, a tanker, airlift, we all are going to rely on some element of the spectrum.

So...

**Colonel Joshua Koslov:** Yeah, I'm going to jump in on that just very quickly. All of those pieces work together in the spectrum of what that you're, as you're discussing. And the really critical piece of that is going to be the information, the data, the electronic warfare data.

That's associated with those platforms that they're receiving and then be able to turn that capability or that data, excuse me, into new combat capability and not just for platforms at an individual level, but all of those platforms at the same time. So that we're able to provide the joint force commander, the most options [00:12:00] when they're deciding which kill chains to execute in a conflict.

**Heather 'Lucky' Penney:** No, that's really great. And so I'd like to actually take a break here and, do a little bit of geekology because I think it's important for listeners to understand some of the basic of spectrum science, because not all spectrum is equal. And it's not that some frequency bands are good while others are bad.

It's just that the physical properties of certain frequencies are better for certain uses than others. A very basic example of this is the difference between a long range search radar and a fire control radar. You know, the physical energy wave of a long range search radar, which is on the low end of the spectrum, can be measured in feet or yards or more. And these low frequencies are great for long

range search because the properties of these wavelengths in the atmosphere means they can travel far, but the wave size also requires large antennas.

These antennas can actually be several kilometers long in order to receive the energy, and the long size of that wave means that these lower frequencies don't have great accuracy. Like, their [00:13:00] resolution cell just is as ginormous as the wave size itself. And that's why fighter aircraft, for example, their fire control radars operate in the high X band frequency like they do.

First of all, the aperture is small enough to fit on a fighter aircraft and the short frequency lengths can provide precision information that's accurate enough to guide a missile against another fighter sized target. So this is just one example of how military operations have needs and use cases across the entire frequency spectrum and I think that ties into what you're talking about regarding data.

**Colonel Joshua Koslov:** All right. So first off, Penney, we're hiring. You can come work in the spectrum warfare wing whenever you want. We need you come on down. We're ready for you. You are your examples of 100 percent spot on and just a really good education for the folks that are listening out there.

What I would say in terms of tying that to electromagnetic spectrum operations is, being able to develop the people that can identify what the capabilities and limitations are within that, that, those resolution cells [00:14:00] and systems that you're talking about. In order to attack, take away, or deceive red systems in order to protect or sneak in our systems, our weapons that we're trying to use to destroy the adversary.

And so the cat and mouse game that I like, is the analogy that I use to describe, how do we match blue capabilities against red to create periods of advantage, so that we can achieve our objectives for whatever that strike purposes or the JFC's objective that day.

**Heather 'Lucky' Penney:** Yeah, absolutely. And so as we look at those kinds of cases and you're building out the Air Force's spectrum warfare capabilities today, a real factor that everyone needs to contend with is the notion of the spectrum congestion.

For example, at the end of the Cold War, a cell phone was really a novelty that was mainly seen in movies, but today everyone has one. They're ubiquitous. So in response, the Federal Communications Commission is selling off more and more frequency spectrum [00:15:00] to accommodate these commercial demands. And this means less buffer between commercial users and military

users. And we've seen this as certain GPS frequency bands have been sold off to commercial 5G users that could actually cause GPS signals to be degraded.

And so frequency competition isn't just about GPS. It's affected everything from radars to data links. How has the commercial demand for spectrum impacted, and I assume complicated, your mission objectives?

**Colonel Joshua Koslov:** Yeah, thanks for that. That's a, there's a lot to unpack there. And so I'll kind of start high level and then get to some brass tacks for the average Air Force warfighter that's listening to this podcast.

And so, the Department of Defense works very closely across the federal government to make sure that we have the things that we need in order to organize, train, and equip in order to meet our challenges across the globe. And so the, President Biden's administration released the National Spectrum Strategy last year, which was basically a first of its kind document on how the [00:16:00] government was going to work with industry to share more of the spectrum. And to generate more dual use technologies that allow us to be able to develop and train and execute the capabilities that we need to.

But also provide the commercial sector the opportunity to do the things that they need to modernize our infrastructure. DoD works closely with the National Telecommunications and Information Administration to ensure that we can try to develop the capabilities to do more spectrum sharing without negatively impacting our training or what various, you know, agreements that the government has made with commercial entities get impacted there. So, the critical piece here is, you know, developing that effective sharing capability. So that we can then train against the highest end threat that's out there and go forward from there. Um, what I would say is that is all very nascent work and is very important work. And we must continue to do that. And the real impact is on our ability to live fly and live train [00:17:00] against, you know, modern spectrum threats. Which, in the world today, the pervasive intelligence surveillance reconnaissance world that we live in today, is already minimized based off of our adversaries in the world's capabilities in terms of collecting on us.

So, a really critical part of, electronic warfare capability in the future, is going to be our ability. To train and fight in modeled and sim worlds in order to more accurately represent the congestion that we're going to face in the spectrum. And then the second, piece of that is an understanding that we're not going to be able to own the spectrum all of the time.



There's not going to be spectrum supremacy. And so we need offensive capabilities that give us the ability to achieve localized dominance when we need to in order to affect our kill chains. And the way we're going to train to that, I think is going to be a combination of live fly and modeling and sim environments.

**Heather 'Lucky' Penney:** So I'm really interested to peel the onion back on what you mentioned regarding spectrum superiority, right? I assume that's a [00:18:00] similar to air superiority where you're creating this, Time and space of dominance, were you able to really control and maneuver within the spectrum. So how would you do that in a contested environment?

**Colonel Joshua Koslov:** Well, I think it always starts with what does the JFC need to accomplish that day? What is our task, right? And if we take our pacing challenge threat, which is China, and we take the fact that we have to break into a very dense IADs in order to kill targets that are very well protected and have very strong offensive capability.

How do you peel that onion back? And I think it goes back to basic you know, mission planning and understanding Red's capabilities and then applying our offensive capabilities in a layered way with our joint coalition partners in order to attack the critical nodes we need to attack in order to close the kill chain that we're working on at that time.

And the way we're going to do that is kind of, I think, twofold. One is, you have to have an operational commanding planning cell, that is able to integrate capabilities that [00:19:00] are space based, that are medium altitude air based, that are ship based or even land based. And you have to then be able to synchronize those capabilities in time, space, and tempo in order to affect the offensive capability that you're bringing to bear.

We talk about that in, in some respects as electromagnetic battle management. But I really think we need is the transport layer that provides the capability to synchronize our capabilities, our offensive capabilities, in order to affect nodes at the right time and place in order to achieve the objective of the day.

**Heather 'Lucky' Penney:** Let's sort of swing over a little bit to the traditional battle management and JADC2 element because all of that also rides on EMSO, right? I mean, these constructs demand that spectrum access and that also means spectrum superiority, which you had just described.

So in other words, you know, ABMS, JADC2, none of that's going to work if we don't have access to or control the spectrum. And again, even how we plan to fight kinetic [00:20:00] operations, as I mentioned earlier, the entire kill chain rides upon this spectrum. In this disaggregated future force design, it all relies on connectivity.

Again, Spectrum is foundation to the modern kill chain.

**Colonel Joshua Koslov:** 100%. So I think the first piece is, one of the things I spend a lot of time working on with my acquisition counterparts is ensuring that our platforms that the Air Force is building are interoperable with each other from the beginning. That they can share information data at the right classifications at the right data speeds in order to make sure that we're able to be interoperable and fully communicate with each other.

That has not been the case in our forces history, and that's one of our biggest challenges today. So, one of the things that I look forward to is being able to work with an acquisition counterpart on who's able to ensure that our requirements across the board from an Air Force perspective are interoperable with each other.

And so that's the Air Force solution. We have to have the same architecture for the joint solution. Specific to JADC2 and [00:21:00] ABMS, I 100 percent agree with you. The network we need in order to warfight is the same network that we need in order to take electronic warfare information from the edge, bring that back to our capability developers, and then we transmit that capability.

It's the same network. And so at Eglin, we talk about being a node on the Air Force's battle network and we're fighting in real time with the joint force commander and the joint force as we execute combat operations.

**Heather 'Lucky' Penney:** So when we talk about electromagnetic effects, you know, the main categories I tend to think about include detection, exploitation, deception, and that all includes the manipulation and simulated activity and imitative actions, plus straight out denial. There we're talking disruption, degradation, destruction, and jamming, but we can't just forget protecting our own assets.

Do you mind talking. More about these types of functions in EMSO. Am I missing any?

**Colonel Joshua Koslov:** Yeah, so the [00:22:00] analogy that I use often, and I think I use it in the last episode is, you have a fighter force that's going to be providing offensive counter air in order to bring capability close enough from a kinetic perspective to get bombs on target. Right? Just in a normal scenario.

That capability, needs to be protected as much as it can with electronic warfare, both their onboard systems, but also external systems. In order to properly affect that kill chain. There's a command and control layer, whether that's digital or man in the loop, that needs to make sure people are at the right time, space and place in order to affect their mission.

And so for us, offensive electronic attack has two forms. One is what you're doing to the adversary, and then what you're doing to protect yourself as you execute your mission. My wing, the 350th Spectrum Warfare Wing, is responsible for providing combat capability for both of those eventualities.

One of the really cool things about the Spectrum Warfare Wing is that in the past, [00:23:00] we've developed combat capability that was specific to a platform, and that platform may have had the best waveform against a particular threat, and it resided in that one platform. Now, as you liberate the electronic warfare data, you're able to take that core of that waveform and use it across many different apertures in order to ,you know, promulgate at a much greater level, high end capability.

**Heather 'Lucky' Penney:** I'm really excited about that because that the ability to. Proliferate that particular waveform and understand it and identify it and then respond to it allows you to do maybe coordinated maneuver across the spectrum and maybe across even different platforms in different areas in different regions.

**Colonel Joshua Koslov:** 100 percent. That's what makes the transport layer so important to what we're trying to do in the future. Because in order to affect those changes, we have to be a node on the net and we have to be able to communicate with our our partners in order to make sure that [00:24:00] we have the right game plan going forward and that the right capability is available airborne or shipboard in order to affect the mission that's being executed that day.

**Heather 'Lucky' Penney:** So let's talk a little bit more about that multi domain type of operation, because you mentioned it before, you mentioned the EW planning cell, and you've got to be able to not only integrate and then coordinate

this kind of EMSO maneuver across different entities and different domains. You also have to be able to achieve specific objectives.

So how do you develop that competency within the 350th? And how do you manifest that at the combatant command level?

**Colonel Joshua Koslov:** Wow, that's a great question. Thank you so much for that. One of the things that I've spent a lot of time, the team here spent a lot of time working with external commands and agencies on, is getting our arms around the EW profession.

So first off the way we've developed our EW professionals in the past has also been sort of platform centric. My background is I'm a EC 130H Compass Call guy. So I have focused my career on electronic attack.

Other folks have been in the [00:25:00] B52 or the B1 or in the back of a Strike Eagle or their ECOs from the Viper world, etc. And we don't have a commonality of the EW profession writ large. And so we have to get our arms around that in order to provide and build the people that are capable of developing operational plans that then can be executed at the tactical level.

And so what we're doing about that in the spectrum warfare wing is I just authorized the beginnings of planning a squadron to be named later. That is going to basically be the operational planning cell, for a joint force air component commanders in the future. They could get pulled up to the JFC if that's how the JFC is going to organize.

But basically, people that are focused geographically on the priority O plans, that understand what the O plan is and are able to build the operational plans in order to achieve the JFC's objectives, and they would be deployable to whoever the JFC is going to be executing or the JFAC is going to be executing that planning.[00:26:00]

And so the second part of that, of your question was, how do we get this to the combatant command level? Without that core of professionals, the manning of EMSO inspired and knowledgeable folks across our MAJCOMS in the Air Force and in the COCOMS is actually relatively low. And part of that is because we haven't developed this cadre of people that understand how to integrate and plan operational effects very well.

And so that's one of the missions that the Spectrum Warfare Wing is attacking. And we look forward to our success there. In the meantime, what we're trying to

do is through our assessment capability is to be a partner with the various exercises that we operate in order to build a more robust EMSO environment and also EMSO training.

So we develop more of our force to understand how important it is to be able to fight and win in the spectrum. And to, you know, operationalize it for your average listener, you know, (inaudible) has kind of always been there in the background. [00:27:00] And it's now more important than ever. So making sure folks understand that when they get a new MDF file from, the mission data file, from the 350th Spectrum Warfare Wing, that it has the most recent data and they need to get it uploaded in their jets as quickly as possible. So that they're ready for the next wave of strikes and their capabilities, the computers that they use to upload those systems need to be exercised just as much and just as often as their BFM tactics.

**Heather 'Lucky' Penney:** No, absolutely. I mean, it sounds like you're really becoming an evangelist for EMSO because we need to be able to transition the warfighter in the squadrons away from just simply the notion of, "I'm just going to turn my pod on and leave it alone." Or "I just hit this button and I don't really care what happens," to really understanding how integral electromagnetic spectrum operations are to everything they do.

And it's actually just as important as the kind of weapon that they're going to hang on their aircraft. So how are you reaching out to the squadrons? Are you imagining taking different warfighters from different MDSs and bringing them into your ops planning cell and, this new flags [00:28:00] to be named later?

**Colonel Joshua Koslov:** Yeah, so a couple of ways. One is I think that you'll see down the road that the Spectrum Warfare Wing and that squadron has a larger training role for the United States Air Force in terms of the academic classes that we offer to the air and joint forces. We've already worked very closely with multiple wings to increase the level of training that they're receiving in their organization. We participated in the first Spider Wings, local exercise, in order to test their rapid reprogramming receive capabilities. And we've had our own internal exercise where we've exercised many of the TTPs that I've talked to you with you about today.

We called that exercise Rapid Raven and it was wildly successful.

**Heather 'Lucky' Penney:** Excellent. Very good. I, as geeky as it is, it's so important that, that warfighters really become familiar with all the language, all the lingo, and frankly, the science behind electromagnetic spectrum operations.

Because it is going to be key to how we operate in the future and how we prosecute warfare in the future.

But I'd like to pivot the conversation now to a concept that we've [00:29:00] heard regarding cognitive EW. Where artificial intelligence and machine learning would be used to develop and enhance these electronic warfare techniques. I understand that the specifics can get classified very fast, but would you mind explaining how you see this cognitive EW shaping the spectrum operations?

And how does the 350 intend to manage the artificial intelligence elements and agents that can make cognitive EW so powerful?

**Colonel Joshua Koslov:** Yeah, absolutely. So I get in a little bit of trouble sometimes with some folks in the world about cognitive EW. And here's why. Is that there's a, there's folks out there that believe that in the future that we're going to have boxes on the edge.

That are the combat edge, excuse me, that are real time making decisions about what to counter, what to attack and to have all of all the capability that they need by which to do that. We support that future, but the technology at the scale that we need it to be successful is not there yet. And [00:30:00] so in the Spectrum Warfare Wing, because the spectrum is often misunderstood, we try not to speak in science fiction.

And we try to be honest brokers about where something might be at the edge of our capability. It's not quite there. And so that vision of cognitive EW is not quite there, but we think we have a decent road map by which we can bring that future faster. And so we call that crowdsource flight data. And so, in order to develop these cognitive EW or AI machine learning enabled capabilities, you require large data sets. And that's one thing that the Spectrum Warfare Wing has, are large data sets. And so what our challenge is today is developing the algorithms and the tools by which we can carve through these vast quantities of data in order to find the new or novel war reserve mode or capability that Red is putting on us in order to identify capability that we need to deliver.

And so that's really where we're focused today is working [00:31:00] with and finding the folks that can develop the capabilities by which we carve through large data sets. Now, if we're able to be successful with crowdsource flight data, what we now have is the ability to, you know, for lack of a better term, democratize that data and give that data to our industry partners who we work closely with, give it to academia.

For them to continue to work and develop combat capability for our forces as well. And so we don't think the Spectrum Warfare Wing will be the only people developing combat capability. We just think that we are the brokers of identifying the targets and capabilities we need in order to drive change.

And so, kind of tying it back to AIML, we use AIML today. And there are cognitive EW systems at a very low scale that are fielded in my wing and also across the United States Air Force. And so it's a real thing. It just requires much more investment and data sets in order to train and build the capabilities that we desire in the future.

**Heather 'Lucky' Penney:** No, it's really interesting. I heard two things from you [00:32:00] regarding cognitive EW. And one is, it really gets to the EMSO maneuver and electronic warfare battle management. And the other pieces is signal identification and counter, right? And so where do you stand on both of those? Am I hearing you correctly?

**Colonel Joshua Koslov:** I think you are. So I think, for countering, I think what you have to be able to do is definitively, as you said, identify that it's Red, right? We can't accidentally be stepping on ourselves. And so that requires an ability to command and control the spectrum and know what's Blue and what's Red.

And that programming is very difficult to do, and we have to continue to work on doing that. A huge part of my job is actually, involves Blue and Grey data because the spectrum is also in many ways, as you alluded to earlier, when you're talking about specific apertures on, you know, like fighter aircraft. It's very Finite in where certain types of weapon systems are able to operate and so the ability to be unambiguous when you're being [00:33:00] offensive in the spectrum is really important.

And so we spend a lot of time understanding Blue's data so that we can also, so we can definitively identify something as Red. And so when you extrapolate that to a machine making the decision. The ability to train that machine on real data is hugely important and a difficult challenge.

**Heather 'Lucky' Penney:** No, absolutely.

Especially as we see, you know, AI today having hallucinations, right? In large language models and optical tools. And for our listeners, you can think about this as, you know, visual recognition or other examples where AI simply gets it wrong. And so it's important when we need to protect a Blue spectrum that we don't get it wrong there and fall a victim to hallucination.

Especially in an environment where we have to expect that our adversaries will release those war reserve modes, or you know, do something that is novel and is adaptive to our operations or potentially could even just be a sloppy signal.

**Colonel Joshua Koslov:** [00:34:00] 1000%. I think we, you know, the, we live in a world of perpetual novelty.

I stole that term from somewhere, but we have to, in the spectrum, expect that Red is going to attack us and that we have to be, and we have to be able to respond to that. And so, that's why, I kind of profess we need more offensive capability in the spectrum because we have to be able to take spectrum when we need it in order to affect our maneuver, our strikes, and the JFC, in order to achieve the JFC's objectives.

And in many cases, the ability to develop novel electromagnetic capability is way cheaper than it is to build new weapon systems that are able to carve through the spectrum. And so the cost curve there is on our side. If we're able to develop the processes and capabilities and infrastructure, by which we can rapidly continue to develop new capability and outperpetually novel Red.

**Heather 'Lucky' Penney:** Absolutely. So you'd mentioned, previously the mission data files that you're working [00:35:00] with. And we know, for example, with F 35 and we see E 7 Wedgetail come on board that, and we know that working with our partners and allies is going to be absolutely crucial. But how do we ensure effective teaming, especially in the EMSO operations? Which is, often gets classified fairly quickly. If we're not aligned that's going to be a problem. We're not gonna be able to fight effectively. So what reforms do you see that we need to execute from a policy side to break down these barriers, given modern demands?

**Colonel Joshua Koslov:** Yeah, this is a big challenge for us. I enjoy the fact that our wing is both a joint wing and a coalition wing.

And I'm tied to lot of different international partners. We have a large FMS squadron, we have actually two foreign military sales squadrons in the Spectrum Warfare Wing that focus exclusively on our allies and our partners. And it is a very big challenge, particularly when it comes to classification.

What I will say is that the first part is, the fix is integrated by design, as the Department of Air Force has talked about. And we have to continue [00:36:00] to work towards that future. Now the secondary part of that is there's things that nations want to protect and we have to be able to protect those things, but we



also have to make sure that as we're protecting those things, we develop interoperable systems.

And so in the Spectrum Warfare Wing, you mentioned the F 35. We have a hand in reprogramming every single F 35 in the world. And we have to continue to work with our allies and partners in order to develop the most effective way to ensure all of those weapon systems can work together, at the right time and place.

And so, policies that continue to allow us in a prioritized and specific way to share information are highly critical to our ultimate success in a high end conflict.

**Heather 'Lucky' Penney:** So it sounds like senior leaders within the Department of the Air Force are really on board with recognizing the importance of spectrum operations.

When you engage with them what are your key messages? How do you communicate not only down to the warfighter level, but also up to the senior leader level regarding [00:37:00] the essential elements of spectrum warfare?

**Colonel Joshua Koslov:** The Air Force senior leadership is massively supportive of the spectrum and the strides that the spectrum has made within the United States Air Force over the past three years are just outstanding and awesome.

And so, we really have to continue that advocacy within the Air Force structure to continue inform our senior leaders so they can make the best prioritized decisions for the force. We've had nothing but outstanding support. I think a key message that I carry from the wing level is that we are part of the enterprise, and we work really closely with, across the Air Force enterprise, within the Space Force enterprise. With all of the stakeholders in order to ensure that we're moving the same way in the same day. So that's kind of the first pieces. We have to be working towards the same objectives.

We take part as a wing, which is unusual in many DAF level working groups that are developing our future forces, and our future capabilities, and those types of things. The next way we do this is we work really [00:38:00] closely with the test and acquisition world, and that's unusual for a combat wing and Air Combat Command. But it's part of our job because as new capabilities come online, our wing actually gets involved at the developmental test level.

And we are, as most folks know, we are born of the 53rd Wing, which is the Air Force's operational test wing. And so we have that DNA in our culture and we have to continue to foster that, because we can't be successful in combat without a really tight alignment with our acquisition partners and and bros and brolettes.

And so we just got to, we have to keep that going. The last thing that I message to senior leaders is that we have to continue to ratchet up our capability to integrate these capabilities in our warfighting exercises and our training events. And lot of times there's, you know, whether that's the ability to obtain a jam clearance or develop threats that are representative. We have to continue to fund and resource those capabilities and often you know, data infrastructure requirements are not the thing that gets [00:39:00] the programmer super excited in the building. And so we have to continue to do a really good job of defining and explaining our requirements, be very specific about how these requirements for networks drive combat capability and combat effects.

**Heather 'Lucky' Penney:** No, absolutely. I remember the first time that I flew against a jammer and that was just utterly eye watering and soul crushing to finally operate in an environment where I was in a contested spectrum. And so the ability to be able to do that is so crucial, especially because EMSO isn't just simply about radars and jamming and deception techniques, but it's everything that we do from radios to data links to data transfer.

I just can't even begin to imagine, um, the level of complexity that's required there. And you've done a lot to transform your organization to build and rebuild the 350th, not just from a organizational line chart standpoint, but from the human capital side as well. What would you like to share with us about what you see the future [00:40:00] requiring out of the war fighter and out of folks that are doing the EMSO job?

**Colonel Joshua Koslov:** Well, I think we have to continue to seize the initiative that we have today. I think we have to continue to build the profession so that we are, raising the level of Air Force electronic warfare knowledge across the force. We can't continue to be reliant on platform electronic warfare officers, which is what I am.

We have to include and develop a pathway for our other career fields that really focus on the spectrum. These are folks like, you know, in Air Force Parlance 62 Echoes, which are engineers. We have to we rely heavily on ops research analysis folks, ROR folks. We have to continue to develop them.

We have to continue to develop our Intel professionals, um, who are amazing, and, but develop them to continue to have an emphasis and a focus on how do we fight in the spectrum. We need Intel folks that understand the jamming of a SA-21 at the same way that they understand the radar timeline of an F22 versus J20.

And we have to [00:41:00] continue to build this capability from a professional aspect across the force. And so that's kind of step number one. Step number two is to continue to make sure that we are being very clear about what our requirements are and what the cost effectiveness of our requirements are in relation to combat capability.

So that we're able to be resourced at the level required in order to invest and build the things that we need to build in order to win.

**Heather "Lucky" Penney:** Absolutely. I think EMSO is having that proficiency within the electromagnetic spectrum is going to be utterly crucial across all of the various AFSCs that we have out there.

It's like the reading and writing and arithmetic and EMSO. Um, so thank you. It's not just about the folks within the 350th. We all need to understand that. So as we close this episode I'd like to hand the mic to you because you are getting ready to transition to your next assignment. And so I'd like to offer you some parting shots.

Your time with the 350th is going to go down as one of the most formative in history. [00:42:00] So what would you like to share with your team or the broader audience?

**Colonel Joshua Koslov:** Well, I appreciate that. And uh, I'm just really lucky to have an amazing team here. And the team has really bought into what we're trying to do and it's been an awesome ride.

And this has been a great command that I'm, really proud of, what we've done. And so, thank you for that, but it's a huge team. And, there's a real palpable sense down here at Eglin but, you know, it's, and this is not meant facetiously at all to anyone who's listening, but it's about time.

And I just, it's really cool to be here and to be part of it. And so, I'm grateful for all of that. The thing I would say is that, you know, our 3 core missions are rapid reprogramming, target waveform development, and assessment. And

those three missions are completely .Interoperable with each other and interdependent of each other in order to be successful.

And so, in our wing, we have to continue to develop our folks and our organizations to feed into each of those three missions. In order to at the end of the day, develop the combat capability and execute the combat missions required in order [00:43:00] to deter adversaries and, unfortunately, if deterrence fails, to whoop them.

And I think the Spectrum Warfare Wing, is among the most consequential wings in the United States Air Force and we have to honor that burden and continue to accept that burden and drive change across the enterprise. And the last thing I'll say on that note is that, we have to continue to be advocates of the spectrum writ large.

We have our three core missions, but there's lots of other things in the spectrum that we have to be the professionals and understanders of and communicators of why is this important. And so we have to make sure that we build ourselves to be able to understand the environment and the changes in order to continue to be relevant.

Otherwise, we run the risk of back sliding again. I'll close with just this fact is there was a time that there was an Air Force electronic warfare center at Eglin Air Force base. And it was a 2 star lead combat capability that both did acquisition and test and develop combat [00:44:00] capability and that center, went away.

And if you look at the timelines of that center going away, and our gradual degradation, the Air Force's gradual degradation in EMSO operations. I think you could draw a correlation there. So the fact that there's an organization, and commanders, and senior list of leaders that are focused every single day on improving the Air Force's uh, spectrum game is an awesome thing.

And uh, we look forward to continuing to push the bubble and being a factor in future wars.

**Heather 'Lucky' Penney:** Well, we can't thank you enough and not just for spending time with us on multiple episodes, but for what you've done to advance the Spectrum Warfare mission. So it's been a huge challenge and the is killing it.

And I'd say a lot of that is due to your leadership. So thank you so much.

**Colonel Joshua Koslov:** Thank you very much. It was great to talk to you again. And uh, you guys are doing amazing things for the Air Force. And I really appreciate it. Keep on keeping on. And if there's ever anything that the Crows down here can do for you, please let us know.

**Heather 'Lucky' Penney:** We'll be hollering. You take care.

**Colonel Joshua Koslov:** Bye bye.

**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 [00:45:00] you, our listeners, for your continued support and for tuning into today's show. If you like what you heard today, don't forget to hit that like button and follow or subscribe to the Aerospace Advantage.

You can also leave a comment to let us know what you think about our show or areas you would like us to explore further. As always, you can join in on the conversation by following the Mitchell Institute on Twitter, Instagram, Facebook, or LinkedIn. And you can always find us at Mitchell aerospace power.

org. Thanks again for joining us and have a great aerospace power kind of day. See you next time.