Aerospace Advantage – Ep.194 – Battlespace Connectivity: Key to 21st Century Warfighting – Transcript

Heather "Lucky" Penney: [00:00:00] Welcome to the Aerospace Advantage Podcast, brought to you by PenFed. I'm Heather, Lucky" Penney, your host and a senior fellow at the Mitchell Institute. And 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, today we're going to be talking about data links. Because normally when we think about airpower, we visualize airplanes, bombers, fighters, airlifters, tankers, combat helicopters, uninhabited aircraft, and more. And these capabilities are obviously crucial to the equation, but they don't tell the whole story.

The Air Force operates as a team. Working together to close kill chains to achieve mission effects. And today we're looking to share information, not only across air and space platforms, think an aircraft harnessing space data to navigate and secure the precision coordinates to strike a target, to sharing data with other combat aircraft to manage threats in the strike region.[00:01:00]

And also sharing data across the services. So, this is the multi domain concept. Just consider how powerful it could be to share information across air, space, land, and sea. Like a satellite providing threat warning to a ship. And that then can cue an aircraft to target and destroy that threat, but all of this relies upon robust and resilient connectivity.

Data links. That's what we're talking about today. So look, while the data links that enable this collaboration are new, this isn't really a new mission or new goal. We can look all the way back to the closing days of World War One, when balloon observers would carry wires aloft, to coordinate fires with forces on the ground.

This was obviously expanded in World War II, and we are always big fans about talking about the Royal Air Force's command and control enterprise during the Battle of Britain. Which was mainly based on radio communication and telephone communication. And by the 1950s, believe it or not, electronic data links entered the picture in a big [00:02:00] way. It's how we manage the homeland air defense enterprise. Literally, we could have controllers from Sage

computers, manually and remotely, flying F 102s and F 106s to intercept bombers. Things have accelerated big time from there. So while the connectivity that knits together the modern battle space may be invisible to the naked eye, it's one of the most important components that will make the difference between success and failure in tomorrow's combat operations.

So, today joining me is JV Venable, one of the newest members of our Mitchell team. He's got decades of experience in the cockpit. Beginning his career in the OB 10, which by the way, JV is totally a bucket list plane for me and spending the majority of his time though, in the F 16. JV, welcome aboard.

John "JV" Venable: It's great to be back with you.

Heather "Lucky" Penney: And we've also got John Kohut, CEO of Galt Aerospace, a defense firm with significant experience in airborne networking, plus advanced waveform and data link communications and integration. John, thanks for being here.

John Kohut: Hi Heather, JV, it's a delight to be here with [00:03:00] you to discuss tactical connectivity. I love your introduction here.

Having completed a career flying F 14 Tomcats in the Navy, I too share your views on the view, on the value of the right information at the right time for the warfighter. We've come a long way since my flying days, but there is still much to do. So, I look forward to this conversation.

Heather "Lucky" Penney: Okay. So as a Tomcat driver, Got to give us your call sign.

John Kohut: I, my call sign was Kokonut shortened to Koko, KO, not a very good one, but during my time there were a lot worse.

Heather "Lucky" Penney: I think JV and I can probably relate to that. But so JV, let's get started with you. You entered the Air Force at the end of the Cold War and obviously you had the good old radio.

Did you have any data links? How did you share situational awareness and targeting data?

John "JV" Venable: Well, that's a great question. I'm going to go back to John just for a second and that just say your call sign violated several premises here.

It had three syllables, and it didn't pass the break left, you're dead. You know, you don't get through the [00:04:00] whole litany of the call sign.

Yeah, it's a great question, Heather. When I started flying, I was in the OV 10 and it was an airplane designed in the 1960s for Vietnam, exceptional in that way of utility. And when we got into the 1980s, really in my community, in the air to ground community, things had not changed that much.

And so throughout the Air Land Battle Concept in Europe, we were pretty much part of the COG that got air into and engaging the front lines, in front of our our ground forces. The aspects of that were based on four radios. We had a UHF, a VHF, an FM, and an HF radio. And the, opportunity for you to reach who you were trying to talk to was ever present, as long as you had a line of sight, and that you were not blocked from talking through the exceptional jammers that the [00:05:00] Russians had.

Things have come a long way since then, but if you go back to the premise of what and how we had to execute our mission, things may not have changed that much. I want to touch on one more thing while we're talking about the OV 10. We did green flags back then that were extraordinary and their punishment of aviators.

Green flags would have live jammers and some days we would be able to go out and communicate with the other fighter aspects, not the air to ground aspects, but the fighters using HAVE QUICK. And when you did that, it was clear comm. The jammers couldn't keep up with the hopping synchronization of the radio.

But when they turned off HAVE QUICK, it was a nightmare. And I remember being on the Nellis range in an airplane by myself, literally holding my hands over the top of my helmet as if it would block out the noise. And that psychotic moment stayed with me for a long time. The only way we burned through that was to get behind [00:06:00] terrain, but, put terrain between us and the jammer.

Heather "Lucky" Penney: To block the jammer physically.

John "JV" Venable: And have the asset, the other fighter that we were going to talk to close enough to where we could burn through that. And so as we go down this track on the exclusive and exquisite data links that we have today, we got to remember that the opportunity for folks to put up blocking mechanisms, to those data links, is always going to be there.

Heather "Lucky" Penney: And we have to plan on that. I mean, as we look towards China, even as you look at what's happening in Europe today, electronic attack, electronic warfare, jamming, is a key component of all of that.

And one thing you didn't mention JV about the good old fashioned radio is you had to know what frequency you were going to be on. So, it really required more pre mission planning as well as, you know, live fly direction and coordination, to make sure that you ended up on the right frequency. And HAVE QUICK, got to make sure you got the right, right hack, [00:07:00] right?

So, we're talking about the high end data links, previously that were connected to the air defense mission from the 1950s and 60s and so forth, but not the broader Air Force community. Whether that was fighters, or bombers, or heavies. So, what did the tech guys think about that? Did you have any awareness that, that there was this exquisite data link that existed in the air defense community?

John "JV" Venable: Now the development of that was almost innocuous to us. We didn't know it had happened in my community. The Eagle guys were talking with AWACS. They were the first ones I believe to get that integration between the two with a very early.

What's that?

Heather "Lucky" Penney: Was it fiddles? Is that what you are talking about?

John "JV" Venable: It was a very light component of what we've got now with Link 16. John will probably know the precursors to that and the development and the timeline, but it may have been tattle, I'm not sure because we didn't touch it. We were basically part of a COG when we deployed to Europe.

I was either on the ground as a ground FAC, trying to talk directly with my [00:08:00] Army counterparts and then transmit up to an Air FAC, an AFAC. Who would then relay the demands and the requirements of fighter support to either the ABCCC or the TOC, or a combination of the two. And then when we got fighters coming back in, that relay had to be there.

And so proximity, line of sight, exposure to the threat, all of that were live components of the day. And so all the way through my time as a fighter guy in the F 16, going into Iraq, I was over the top of that for almost a solid year and

we ran into the same thing, but surprisingly, we had dropped HAVE QUICK from our cross check.

The time of day either was too hard to get or we just didn't want to do it. And so there were times there, where I would go up to a troops in contact, literally be tasked to go down 200 or 300 miles away from [00:09:00] Baghdad to hit a TIC and support it and not have the radio frequencies with which to engage the enemy.

You want to talk about frustration, being over the top of a situation where you know things are bad and not being able to help them because you couldn't talk to them was devastating. One more aspect of this is the Army was doing counter IED operations there and JIDO had come up with concepts that involved jamming frequencies and some of those were across our spectrum.

And so if you were tasked to actually do support in and around the city of Baghdad, you would go through the same nightmare that I was in, in Green Flag, where I wanted to put my hands over the top of my helmet and make the noise go away.

Yeah, because they were trying to jam the activation signal that would blow up the IED.

But that jammed all their blue forces as well.

It sure did.

Heather "Lucky" Penney: Yeah, [00:10:00] I, you know, so when I first got in and was a baby Viper pilot, we didn't have data links either. And so I was flying the pre blocks, block 30, and just as we were getting ready to go off to the desert, we finally got SADL. Which was an airborne version of an Army radio, Army data link. And that was really cool, because then we finally started to see the potential of what data links and the shared information awareness could provide to us. So, when we went over to the desert in 03 to kick down the door in Iraq, we were hunting Scuds and we were working with special ops forces and so forth.

And we could free text with them. That's what the data link could do for us. We knew where they were, they could place a target, you know, onto our data link. We could get those coordinates. And so it really accelerated the pace of our operations to make us much more lethal. It was shocking what data links could

do in terms of making us faster and more effective because we could share that information and pass that data, machine to machine.

John "JV" Venable: Yeah, that's a [00:11:00] fascinating component of my time in the Air Force. The active duty Air Force did not have SADL, but while I was at Al Udeid, as the OG, I flew with some 16 different Guard units. Their aircraft were equipped with SADL when my F 16s, the ones that I had flown throughout my career, never were. Having that and the gateway that allowed us to communicate was really powerful.

Heather "Lucky" Penney: Yeah, the gateway was huge. We had the, we called it the BUG-E for the battle space gateway expeditionary, and that was supposed to connect the SADL to the Link 16. Now that was not always perfect.

And so it just goes to show how knitting together different type of data links can be so important.

So, all of this happened on the back of the theory of their constant strike complex. Basically, we thought that the ability to network together ISR assets with command and control and then shooters could dramatically outpace operations.

And so, you go bomb the target, you come home, [00:12:00] you task another asset to go do BDA and you hope to get some kind of feedback loop and it could be painful how long it took. So, how did the rise of fifth generation RPAs like MQ9 plus information platforms like AWACS and JSTARS shape this notion of information flows?

I mean, we kind of take that evolution for granted, or at least I think a lot of the warfighters today in the American public takes this information for granted, but it was kind of a slow boil as these data links got passed to us.

John "JV" Venable: Yeah, it was and it is still in much of the fighter community, they have Link 16 going and you have exquisite assets like the F 35 that is a virtual data vacuum cleaner that actually pulls really important data into the system that the pilot can see and then send it on to other assets. The MADL system that is in that jet gives line of sight communications that allows those pilots to share [00:13:00] information across formations that are in the tens of miles wide. Which is a significant difference than when you and I were flying F 16s and you were at a mile and a half, because all we had to visually cross check each other was our eyeballs and checking six.

Heather "Lucky" Penney: Yeah, I mean, if we had to go EMCON and we weren't going to talk on the radio at all, because transmitting over the radio frequency was a big, "here I am," and it could stimulate that kind of jamming, so we had to use visual signals.

And now they have detached mutual support. They're able to cover much larger areas. The scope of their lane is much bigger than what we were able to do today.

John "JV" Venable: Really important point that they are able to actually get out and use the triangulation of their systems much more effectively, by getting space between the formations. That ability to transmit data in between those F 35s is really good, but then you have to actually move it down into Link 16, which is a grade and [00:14:00] a capability that's markedly less than what the F 35 has.

Heather "Lucky" Penney: And if you've been listening to JDAM, Mike Dahm, who's our China expert here at the Mitchell Institute, China has a cottage industry of how to collapse Link 16.

John "JV" Venable: Which is crazy, because our dependency in the JADC2 network that is being built right now and put together. The air airborne battle management system that the air force has spent so much time and money towards is volatile.

And that's something that we're going to need to tackle.

Okay Heather, and let me toss you a question. You've done a ton of work with concepts like Mosaic, AI's role in the battle space, the future fighter force and the likes. Paint a picture, if you would, what you think and how you think the journey goes from here.

Heather "Lucky" Penney: Well, we talked about the reconnaissance strike complex, about how we can use command and control and share information to target shooters and move them [00:15:00] towards areas where they can strike and to share a battle space awareness, but really what this future holds for us is the notion of how do we create greater resilience within the battle space and accelerate the speed of identification to the target, and we do that through machine to machine data links, right?

So, if you want to make it super simple, we can think about what the kill chain is. It's a linear progression from find, fix, track, target, engage, and assess, right?

And typically what we've done this in the past is we've had that kill chain organic within a single weapon system, right? So the F 16, the F 15, the F 22, the F 35, they all have the ability to do that by themselves. But when we network them together, we create greater resilience and we begin to network those functions outside of your major weapon systems, we now create a kill web, that becomes very difficult to defeat and can accelerate and be far more creative and [00:16:00] agnostic and agile regarding how we create those kill webs and complete the kill chains.

So, it's really an interesting place where we can go towards the future. But again, it all depends upon data links. The speed of the data links, the kind of information those data links can share, the latency of the data links, the richness of the data links. So really, we're becoming much more dependent upon data links for our future operational concepts.

So, they're really becoming the foundation. Which is why we've asked John to join us. So, Kokonut, you and your team at Galt Aerospace, you've been working on these technologies. They'll help manifest this kind of future that we've described. JV and I did our best to present situation from our view, but you're the technical expert.

Can you describe and help our audience better understand the tactical communication architecture? So, what are the tools in play and what are they trying to achieve?

John Kohut: Yeah, Heather. Yes, I'd love to do that. I do want to just say that just listening to you and JV, you covered so much ground [00:17:00] so eloquently and you brought some very fond and some not so fond memories back to me.

I remember those days being in the cockpit of an F 14 and you're only getting information through your own sensors and what you hear on the radio. And well, sometimes we didn't have any actual enemy jamming. I think we had lots of comm jamming from each other. So, you know, everything was in voice and and proper calls and all that kind of stuff.

Link 16 and actually the F 106, I got to fly that when I was in test pilot school.

Heather "Lucky" Penney: No way!

John Kohut: Had a remarkable data link back in the 50s for for defense of our nation and it was really way, way ahead of its time. But it was very structured

and very rigid and not really able to be expanded during that timeframe, coming from that technology and from technologies like the Navy had on Link 11 between ships. [00:18:00] And we had Link 4 between tactical aircraft. They were very rudimentary, but that's where Link 16 all came about in the midst of the Cold War. So, it was a really interesting system.

And so I've been around it from my test pilot days way back in the, way back when, and when we were creating the F 14D .All the way to running the tactical data links programs for the joint services in the international community, and finally getting it out to all the platforms, including the F 16 on a program called MIDS.

So, I think I have a pretty interesting perspective that I can help share with you. You know, really, if you take a step back over the last three decades, all of our military systems aircraft, ships, fighting vehicles, and sensors have become digitized. They are capable of both generating and processing massive amounts of digital information, and they are able to share that, much of that data with with other warfighters when they are [00:19:00] connected.

For good reasons, we, and if you don't mind, I'll use the "royal" we are here representing the Department of Defense and our past lives, and now our industry partners in our current lives. But we have created and fielded specialty networks to exchange information for various applications and missions across the services.

Despite the progress we face, what I see is three fundamental challenges. One is these networks, and therefore the systems they support, too often do not connect with other specialized networks. Thereby eliminating their usefulness. You gave a few examples earlier, JV, the great things in the F 35 and its MADL system, and dumbing it down into the Link 16 system is a great example of that limitation.

Second problem, we're slow in developing the common innovative applications that can readily use all these data. And third is, [00:20:00] as you mentioned, our enemies have been studying how we use information. They are aggressively attacking the command and control and communications architecture. These are all areas that we're going to explore today.

Heather "Lucky" Penney: Yeah, but in all fairness, this architecture proved really capable for a long time because we were ahead of the adversary. You know, we've never had such a powerful sensor shooter construct and it's what's

allowed us to even begin to think about what a kill web or some kind of mosaic, disaggregated, JADC2, ABMS architecture might look like.

Because sharing real time information, it is a game changer. But how do we need to evolve this enterprise? I mean, we all know that China wants to collapse Link 16. How do we, where do we need to go?

John Kohut: Yeah, yes, you're so right that capabilities such as rapidly preparing target information from a wide variety of sensors and digitally passing them to shooters have revolutionized airborne strike as an [00:21:00] example.

Sensor to shooter that you mentioned includes the decision making process to select the effect and to authorize execution. So, that's a longer cycle time than the actual digital connections. So, it is able to flexibly use the right network path to achieve those, to accelerate those kill chains, as he described. Over the past three decades, the joint services have demonstrated incredible global reach and force coordination through centralized command, decentralized execution.

That relied upon unparalleled connectivity. As mentioned, the emerging peer level adversaries are focused on disrupting these communications through electromagnetic effects, cyber attacks, and even kinetic destruction of critical nodes.

Heather "Lucky" Penney: So, I think one thing that we need to at least say or put some ground rules is understanding that different data links, they might be highly specialized, but they're specialized for a reason, right?

Like, I'm not going to send full motion video [00:22:00] over Link 16 and the different frequencies and having these different message sets, it is a both a problem because as you transition between one to the other, you might truncate a little bit of data. You might lose some of that data because of the truncation.

But at the same time, it provides us an operational resilience that we wouldn't necessarily otherwise have. Again, one of the reasons why China is so focused on Link 16 is because that's the dominant data link that connects not just the US services, but all of our coalition and joint forces. So, it's kind of like having HAVE QUICK by jumping around between different frequencies, allowed us to be able to avoid the jamming, if we're able to have multiple data links out there and then connect to them more seamlessly.

That can also provide us some more resilience, even as some of those data links might be targeted by our adversaries. What are your thoughts on that?

John Kohut: Yeah, so, that's a great question. You know, unlike commercial telecom, that we rely upon on their day to day [00:23:00] lives. That are pretty well standardized. You know, everybody's cell phone is pretty close to the same thing. Everybody's computers are pretty close to the same. And we have a series of applications.

In the military, these type of data links were rapidly developed through purpose driven reasons. So, let me kind of step through a little bit what these links are, just to give a little background.

Heather "Lucky" Penney: Sure.

John Kohut: We talked about Link 16 earlier, and by the way, earlier it was mentioned the F 15s. At first, there was two squadrons that got JTIDS, Joint Tactical Information Distribution System.

Heather "Lucky" Penney: Yeah.

John Kohut: Big boxes and they were up in Mountain Home and two squadrons of F 14Ds got JTIDS. And they ended up operating in the CENTCOM AOR together.

And it was pretty amazing. Those were the first ones that really had Link 16 capability in operational settings. Link 16 is our premier situational awareness network that connects aircraft, ships, ground [00:24:00] defense units, and various command and control nodes across the services for over 20 nations.

And it was originally developed in the height of the Cold War to improve upon Link 16 that I mentioned. The central purpose was to exchange both structured data about each participant. Fuel state, weapons load, you know, things like that, location and to share target information. So, that was a real improvement.

It's kind of interesting. Once we fielded MIDS, and that was really during the first deployments were in Iraqi Freedom. And these data links were meant to, like I said, just pass, air to air target information, things like that. But quickly, as you mentioned, the SADL warriors innovated and started passing information from, a good example was an F 18 that was a Winchester, out of weapons.

Had a target on the ground. Link that target to an F 16 that was about 20 miles [00:25:00] back. And they bustered up and was able to see the target on their HUD from that Link 16 track that never been done before. And it was, really not contemplate in the original design. So, that's one of the things is pretty cool about it as a tremendous amount of flexibility, connects lots of different players together.

Beyond that, there's a common data link was originally developed to pass large amounts of information, particularly intelligence, surveillance, and reconnaissance information from unique platforms, such as U2, to ground processing elements. How do you get all this data that you're collecting down to somebody that can use it fairly quickly and just and disseminate it?

So, that was a very specialized link. Tactical Targeting Network Technology, TTNT, it's just emerging now, is a very low latency system, unlike Link 16, which takes a while to exchange the information. It can pass a lot of information in a very short period of time. And it was originally developed to [00:26:00] counter threats that required near instantaneous triangulation. So, that was a very unique network.

New networks that you mentioned since the 1990s the Interflight Datalink or IFDL for the F 22, the Multifunction Advanced Datalink or MADL for the F 35. That were compatible with those 5th generation fighters survivability features. Those, that was the big enhancement that those 2 data links came about for.

Heather "Lucky" Penney: Yeah. The LPI, LPD, low probability of intercept, low probability of detect.

John Kohut: Correct. And so if you have a, stealthy aircraft, again, as you mentioned, you don't want to transmit and target yourself. So, if you transmit in a mode that the enemy really can't see or detect LPD and LPI that supports those aircraft's missions.

But that's different than what other airplanes needed at the time. [00:27:00] Navy came up with a cooperative engagement capability, which between our Aegis ships and the Navy's E2 Hawkeye. And that was really to enhance its ability to target airborne platforms. It exchanges completely raw sensor radar data between those ships and enables them to all correlate that information at a level of fidelity that you can't get any other way.

That can't talk to anybody else. So, each of these networks have expanded their capabilities over the year, but none of them talk to each other. And while this

may seem strange to some, each has been optimized for a particular warfighting role, and they do amazing jobs at it. But as you mentioned, having spectral diversity and waveform anti jam complicates the enemy's problem in countering them.

So, this is really pretty cool. I'd also like to mention satellite communications and undersea cable networks that are key to the overall global connectivity architecture. For a long time, the [00:28:00] Department of Defense developed very impressive space capabilities in high geosynchronous orbits that covered a whole theater.

They were thought invulnerable at the time. However, over time, vulnerability started becoming realized in a classic case of measure than countermeasure. The emerging highly populated low Earth orbit or LEO constellations, both military and commercial, or again, changing the architectural landscape.

Heather "Lucky" Penney: And we're going to have to figure out how to data link those LEO and those GEO constellations down to aircraft ,tanks on the ground, subs and so forth, because as we knit this data link architecture, this JADC2 ABMS across all platforms, and we're looking, the Air Force specifically, at ground moving target indication and potentially air moving target indication to space. We're going to have to be able to figure out how do we get that data from a satellite directly into a cockpit. That's going to be a big challenge.

John "JV" Venable: Yeah. Can I just say, [00:29:00] can I just say that I'm completely impressed with Kokonut, who's a golden arm ability to disseminate information to two knuckle dragon fighter pilots like ourselves. You know, you've talked about a lot of things.

Heather brought up the LPI, LPD. Low probability of intercept, low probability of detection, but She didn't mention and I haven't heard this yet. And these these concepts of low probability of jamming. We've got a lot of seams. We've got a lot of systems that won't talk to each other. And those that do are basically going through a translator of source.

How do we deal, Kokonut, with these challenges? What is it the gateway that's going to be the solution? What's your thought?

John Kohut: Yeah that's a great question. By the way, my call sign got shortened to Coco for the very reason that you said, and I've lived with that ever since. But before I jump into how to improve, you know, connectivity between

the networks, it's worth mentioning that several new [00:30:00] networks, based upon new complex waveforms, are emerging.

And and really get to a little bit where you're talking about JV, with the low probability LPI, LPD, LPJ to further complicate the potential enemy's problems. To step back on Heather's question about the P- LEO the highly proliferated low earth orbit satellite constellations and connections to individual platforms. You know, I think in 20 years you're going to see everybody connected directly to either the military or maybe all of the, military or Starlink, or maybe all of the above. Anywhere in the world and connectivity will be just assumed for just about every place you are.

And they are also extremely hard to jam because you have so many satellites moving in so many different directions that you can access in different directions. It's just not like you can send a jamming beam down [00:31:00] a particular. Access and it's gonna blank out a specific satellite. And they also, you know, are highly redundant.

If you take out one, you know, there's 40,000 more waiting to take its place. So, but the challenge is gonna be over the next two decades is they we're not gonna be able to integrate that type of capability on every platform, on every F 16, on every F 35, on every tank for quite some time.

And in that interim, I look at it as much like the commercial telecom world described many years ago when they put cable out on all our streets. But then the hard part was the last mile problem of getting, you know, the Internet to individual homes. That last mile problem, I used that analogy for this, if you can connect anywhere in the world through P-LEO and then you have gateways that are in various places around the theater, you now have a pathway to get to all of the platforms.

[00:32:00] So, I think that's you know, kind of an approach that you were getting at JV.

John "JV" Venable: Grateful for that thought process, you know, we and the Air Force are now trying to do a bunch of things with limited assets and the high threat in the Pacific. We're starting to talk about this ACE concept of playing a shell game with aircraft, moving them rapidly from one location and to another, to where they can't be hit.

That's going to put a huge strain on logistics in every way, shape, and fashion. And recently we've had the opportunity here at Mitchell to talk to General

Minihan about the AMC's lack of ability to communicate lack of ability to gain situational awareness. At times, they can't even get threat warning to their aircraft in time to save themselves.

And as you know, that's everything for a heavy aircraft that doesn't move very fast or move in airspace very quickly. So, [00:33:00] what do you foresee as a possible solution for this? Do you see us being able to integrate this across all platforms, even non shooting and non collecting platforms? What does the increased demand mean to you?

John Kohut: Yeah, so that's a great question. A little complex. Let me jump into, you know, the mobility Air Force's tactical connectivity to improve their mission capabilities and to enhance their own situational awareness for survivability more recently, the AMC has recognized that much of the mobility fleet is going to be within the engagement zone and able to provide a unique level of connectivity across the tactical air forces.

So, there's been a lots of discussion on integrating airborne gateway functions into those type of platforms to benefit the entire theater. So, let me take a step back and just talk a little bit about what gateways are. [00:34:00] You know, to enable various networks to talk together, gateways, particularly airborne gateways, are an important solution.

Every node that needs to communicate with every other node, ideally, every F 16, every F 35, would have the ability to communicate with every other node on whatever means is being communicated, whatever networks are in operation. And this is way too difficult and expensive with current technology.

So, gateways are an important capability that's just really emerging. It's a node that operates on each of the networks of interest and can move information in the right form to any of the other networks. There are some gateways that are referred to as bent pipes, which merely take a signal in, retransmit it on the same network, and that basically increases the range of whatever it is. There are other gateway capabilities that are a little bit more flexible, such as the joint range extension known as [00:35:00] JRE that takes Link 16 messages and recommit retransmits the messages themselves.

On other links, such as satellite communication channels, and that allows a network to be seen globally. You can see a Western Pacific Link 16 network in the Pentagon as an example. But true airborne gateways contain the processing power, to take information from one network and translate it into the language of another network.

Tactical data links use one of two fundamental structures. The first highly defined message structures, such as the J series messages for Link 16, very defined. Each bit has a specific meaning. And there's a whole bunch of messages within the J series message structure. And then there's very flexible structures that are based on internet protocol.

So, that's much more like what we use you know, in our home [00:36:00] computers or on our phones. So, for the former, the highly structured, each node must be able to code and decode these messages to use that data. For the latter, each node must have the right application to employ the data. An airborne gateway and our company is building one for the Marine Corps called Sky Tower 2 is a pod that performs all these translation and routing functions. So, any information can move in 1 network and go out in a different network. That's what an airborne gateway is.

John "JV" Venable: That's a fabulous answer. The opportunity to interrupt those, how volatile is the signal between them? And we talk about the being able to approach China and being able to attack targets in those proximities. Highly reliant on all of these the ability to communicate between platforms using these data [00:37:00] links. How volatile is that? And are we at risk of losing it?

John Kohut: Yeah, that's a difficult question to answer at this level, but in essence, you're right. Each of them, they use some advanced techniques. And that's 1 of the reasons why things are unique. Spread spectrum techniques that blend the signal into the noise floor.

That's useful for LPI LPD. It's also the basis of Link 16. They also, LINK16 has a pretty three levels of security, if you will, on how it sends out signals and things. So they're difficult to get into, but as was mentioned, there's a lot of people working hard to to break them. The other thing, though, is you know, this whole thing about highly populated LEO, is enables a level of reduced vulnerability, not eliminate it, but reduce vulnerability just because of [00:38:00] the geometry and things like that.

Heather "Lucky" Penney: So Coco, what about cyber security? I mean, we haven't really brought that into the conversation. We've been treating this a lot like jamming is the only threat that our data links would face. But cyber to me seems to be something we need to be worried about across the board.

John Kohut: Yeah, and that's, you know, amongst the things we've talked about, cyber attacks are probably the gravest threat to just about everything. PLEO in particular, along with any of the tactical data links.

Now, each has been hardened, as I mentioned, through encryption and the complex waveforms that we use. And so they're difficult to penetrate, but real cyber hardness comes from the emerging technologies to achieve zero trust authentication.

And of course, in the whole cyber world, that is, I hate to say nirvana, but that really is the goal. To reduce the vulnerability to cyber attacks.

Heather "Lucky" Penney: Yeah. It's [00:39:00] going to be crucial if we want to maintain the resilience and rely upon the data links that really are connecting the force, especially as we see the Air Force move towards this more disaggregated vision of a family of systems that in order to function and do and complete any kind of kill chain, we'll have to have those data links.

So, how do we get there? I mean, we've all got this shared vision of having this kill web, having this family of systems, and networking across all the domains, but how do we get there?

John Kohut: Yeah.

So, you know, I think like many things, a crawl, walk, run approaches is a called for. And I say crawl, I think we're crawling pretty quick. I mean, the level of connectivity, the networks that we talked about earlier, the capabilities that we have are really impressive, but we really have to up our game.

So we got to crawl faster, at least in the start. And one point I'd like to make is you highlighted the [00:40:00] sensor to shooter and really the acceleration of the choke of the kill chain. And that really is a little bit different than another term sensor to affect the former collects and moves battle space information to see 2 nodes most likely, you know, the air and space operation center or are distributed around the world.

To be processed, validated, prioritized, and assigned to action. That is the, that is a big part of the kill chain. Then the last part is getting information, both pre mission planning, and in flight, directly to the shooters and employing weapons. In that formulation, the time, the timing of information flow is important, but not absolutely critical.

Probably most of that of the kill chain cycle is really wrapped around. [00:41:00] Decision making and validation of an assignment. So is the command and control aspects, but in sensor to affect sensor effect is really getting the absolute last 2nd targeting information into not only the shooter, but really in a weapon in flight as it's approaching the target.

Because targets move targets, you know, the whole targeting process changes and our ability to put sensors in various places, particularly close to the threat envision F35 or B21 with some amazing sensors and while they're incredible in and of themselves, they really are data nodes to provide for others.

So, if you can connect to those that really makes a difference. So, I think the, you know, as we're talking about the crawl, walk, run approaches really to get high bandwidth connectivity to and from the C2 nodes. And and that [00:42:00] is really enhanced through this proliferation of emerging gateway type capabilities.

The next phase is you really have to get some direct connectivity from sensors. Into weapons and weapons and autonomous vehicles, because those are becoming weapons in and of themselves. And there's been a search for what's the perfect waveform that everybody can use to feed information into weapons in flight.

And I think that's just as, I think that's a poor approach on how to achieve this capability. The use of multiple waveforms is given by the fact that different platforms have different needs. So, weapons need to have the ability to operate on multiple waveforms, not necessarily simultaneously, but during their time of flight. That is an emerging capability and technology that I think we're going to see in the fairly near future.[00:43:00]

And the last part of that is really to get to zero trust authentication, because if you're feeding information into weapons in flight, you need to make sure that information is coming from a trusted source and not from the enemy.

That's a fast walk at that point. And then scaling to be able to do this on a scale of thousands upon thousands of simultaneous engagements and really do it in an autonomous mode and using ad hoc connectivity is when we would be really running with this type of capability. That really is, I think, the vision coming from Mosaic Warfare.

John "JV" Venable: Coco, that's a lot and being able to put it all into perspective. You said we were crawling fast, but we needed to crawl faster. If

you look at all of the capabilities and the unfolding capabilities in front of us, how should we grade the services performance today?

John Kohut: Well, I think that's [00:44:00] an interesting question.

I find that there's a lot of vision, a lot of capabilities and new technologies that can be employed that will get us to the walk and to the run. But you got to take the first steps and that's one of the reasons I really enjoy working with the United States Marine Corps. They're very practical and they basically said, hey, we're not going to get an advanced radios. We're going to use the radios. We have in the networks that we have and put them in a pod and put them in an MQ 9 and start our connectivity to support our Marines that are forward deployed.

And I think that is a evolutionary approach it doesn't achieve all the objectives, but it's making really definite progress. Where I think the other services tend to look for much more capability and wrap it around a longer program that ends up taking longer and costing a lot more money.

Heather "Lucky" Penney: So, JV, I've got a last one for you. We began the episode talking about the good old [00:45:00] days. Or maybe they're just the old days when we could operate without having this kind of connectivity. So, as we look towards a future where we know that China is going to be targeting us, Russia is going to be jamming. I mean, they're going to seek to, to break our connectivity because they know that's an asymmetric advantage for us. Should we be preparing our airmen differently? Should we be teaching them visual signals? Should we be developing alternate tactics?

John "JV" Venable: That's a great question and one that I've spent a lot of time in my Air Force career of pursuing.

It's back to the future. These incredible capabilities come with the opportunity to process and engage an incredible number of targets. But if we get so reliant on those to where when they take away HAVE QUICK, we can't talk on the radio anymore. We don't know what the backups and how to get the messaging across to where we can engage targets effectively and have a great [00:46:00] effect on the enemy.

If we get so far down that line that we can't operate after we've been attacked, after we have gone into survive to operate kind of mode, then we've lost. And we can't afford to lose that ground. And so we need to spend a little time working on backups to this extraordinary technology.

Heather "Lucky" Penney: And this isn't just at the tactical level where we're actually out there and flying.

It's also at the operational level, especially as we move into Agile Combat Employment and we're island hopping around. This is why mission command and contracts and sort of standing orders and commanders intent, I think matters so much. But Coco, as we look towards building this future enterprise, as I like to say, no bucks, no Buck Rogers.

And the air force hasn't had bucks for a really long time. So these battlespace connectivity initiatives, they're generally underfunded because they're not quite as sexy. What do we need to do? What are the risks here?

John Kohut: Well, I think there's a greater [00:47:00] recognition that connectivity and moving information is an entity in and of itself.

I mean, you look at the big initiative that you mentioned, JADC2. It really is doing what we've done for a long time, but in a way that would really accelerate all of that, you know, the kill web and then accelerate our capabilities. It would tie together that theater level logistics support that's required for ACE to really be effective to be that level of flexibility.

So, I think that there's a recognition that it like logistics in and of itself, are maybe the real professional part of of warfighting and that we're going to have to up our game there. I think it's possible. There's one other aspect in this, though, is I think that there are ways to drive cost out of some of these systems.

[00:48:00] And I think the technologies are just emerging in the communications world, to really open up radios and change the environment of proprietary systems and waveforms. Really turn them into software defined and make them commodities. Open software radio is a, is an emerging technology that really came out of Rome labs up in AFRL up in New York.

And now we're working on that for weapons capability and things. It really is going to change how communication nodes and networks are created, make them more commodity, and drive the cost out. And I think that's a key part of the other side of the equation when you say it's not just getting more money.

It's doing more with what you have.

Heather "Lucky" Penney: Well, gentlemen, thank you so much for being here today. It's been a fabulous conversation. And so I'd like to thank you and look forward to our next. JV?

John "JV" Venable: I'll tell you, [00:49:00] Heather. It's been a great session with you and Coco. Great to get to hear your voice, get the download and get to know you a bit looking forward to the next opportunity.

John Kohut: Absolutely, JV. Heather, it's always a pleasure to talk with you. I look forward seeing you again and meeting you in person, JV. I feel really at home with a couple of Viper drivers and a great airplane and great stories.

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. 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 [00:50:00] joining us and have a great aerospace power kind of day. See you next time. So you got to tell me about flying the F 106.

John Kohut: Yeah, it was a great airplane. Um, uh, it Had tremendous range. Um, you know, I, I evaluated it amongst other things, you know, you're supposed to evaluate it for a mission. So one of the missions I evaluated it for was uh, The cross country mission to get Coors beer, a great

John "JV" Venable: checklist and your evaluation process, it

John Kohut: was had all kinds of enhancing characteristics.

Like it, it cruised at Mach 9. 4. That was cruise speed. It went like, I think it was 1, 500 miles. And it had about a weapons bay, so you can put a lot of beer inside the weapon. So ideal platform

John "JV" Venable: in your meanderings inside the Navy. Did you ever run across a guy named frog Burgess?

John Kohut: I know the [00:51:00] name um, but I don't know him.

Well,

John "JV" Venable: he was the uh, Kelly Laurel, uh, 14 guy.

John Kohut: oh, really? Okay. Yeah. Yeah. East coast guy. Yeah, it was more West Coast. There

John "JV" Venable: you go. It's the separation of church and state East and West Coast of the Navy. And then,

John Kohut: yeah, no kidding. So, hey, I had a great event this past Saturday. My son, who's a, is a Navy um, 60, Romeo helicopter pilot just flew in.

He was a squadron commander on the Eisenhower in the Red Sea.

Heather "Lucky" Penney: Congratulations on getting him back.

John Kohut: Oh, man, it was, it felt so good to uh, to see him in person, but they did a fly in that even us jet people would like um, their, their, uh, tactical call sign is ambush their squadron name is the swamp foxes after Francis Marion.

So the ambush is a big deal to them. So they're doing a, they did the fly in 8 aircraft. And we're in the [00:52:00] hangar looking out over the river, everybody flies it look in, look in, they're not there and stuff. And all of a sudden you start hearing rotors, but you don't see anything. And they came in at 200 feet right over the hangar from behind it.

And, uh, it was just amazing the sneak pass. JV. I think you're familiar. Not with helicopters. That's a new one. No, no jets. It would have been, you wouldn't have heard them coming. That's right. That's right. Coco. Thanks so much. We're going to let you have the rest of your day back, but we will be sharing this with you so you can send us any, any comments that you have.

Heather "Lucky" Penney: Take care. Okay.