Heather Penny:

Good morning ladies and gentlemen, and welcome to this Mitchell Institute panel on Winning the Kill Chain competition. I'm Heather Penny, a Senior Resident Fellow at the Mitchell Institute for Aerospace Studies. So for decades, the US military has relied upon relatively inflexible and predictable kill chains to rapidly detect, target, engage, and close kill chains with precision. This approach has been highly effective and efficient in the past, but in a past where adversaries could not target our operational architectures. However, China is changing that. They have studied and developed strategies and capabilities to deliberately obstruct, disrupt, and destroy our kill chains. China's system destruction warfare directly targets our nodes, those are our weapon systems, our platforms, networks, the relationships, how we fight together, and the tempo of our kill chains to neutralize our asymmetric advantage. To counter this threat, the Air Force must transition to more distributed kill webs and connect sensors, shooters, and weapons across domains into a resilient mesh architecture.

Kill webs with multiple pathways can continue mission execution even if some nodes or links are degraded. In our report earlier this year, we argued that speed, scale, so it's the number of kill chains, scope, the area of coverage and the range of those kill chains and survivability of the kill chains are important attributes that the Air Force should consider as it seeks to build kill chains that can prevail and appear conflict. These attributes have implications not only for the networks and battle management, but for the force design, size, and for our operational concepts. So to discuss how the US can win the kill chain competition, we're pleased to have four expert panelists. We're very excited to welcome Major General Scott Jobe as Director of the Headquarters Air Force Future Force Design, Capability, Development, and Integration and war gaming. He's responsible for providing the chief a design blueprint for the future that incorporates current, emerging and developing technologies, concepts of operations, and capability.

Next, we're joined by Mr. John Clark, Vice President and General Manager, Lockheed Martin Skunk Works. Skunk Works has of course, been a bleeding edge leader in designing advanced aircraft from its early work on the U2 to today's work on the SR72. We're also happy to have Nick Bucci, Vice President of General Atomics Electromagnetics. There, he leads strategy and technology roadmaps for critical systems both domestically and internationally. And finally, we welcome Colonel Adam Shelton. Colonel Shelton serves as the Commander 461st Air Control Wing and has a background in C2 operational tests and has led the advanced battle management system capability requirements. So with that, we are going to dive into the conversation. So setting the stage, gentlemen, after the first Gulf War, China began developing the system destruction strategy to target how the US operates as a system, specifically the PLA will seek to dismantle our kill chains. And this is fundamentally different than how we first understood anti-access and area denial. Can you explain or describe this war fighting approach and why it poses such a threat? General Jobe, can we start with you?

Maj. Gen. Scott Jobe:

Sure. Good morning. Thanks. So when you think about the complexity of PRC kill webs, it extends into multi-domain and multi-spectrum. So that requires us then to field capabilities that have counterpoint each of those different areas. So for the United States, that presents a large challenge in both how do you do a systems of systems approach designed to war fighting as the changing character of war migrates to that more complex environment that's multi-domain, multi-spectrum and more and more interconnected through a kill web. And so that's the approach that we've been after for quite some time in the United States Air Force. And so we're on a really good path to produce a force that is a systems of systems approach as opposed to a single platform against a single point threat as we had done in the times past.

John Clark:

Yeah, where I'll build on that is that, so in that historical context, the kill chains that were put together were very linear in nature. And when you have that linearity, if you have an adversary that's paying attention, they can understand exactly where in that linearity to go break the kill chain. And so they can find ways to interrupt any point of the F2T2EA process and create challenges for us. And so I think that as we migrate forward, finding ways to have that kill web construct and have diversity within our kill chain, in particular at the front end of the kill chain. And if you have that diversity where you can have multiple sources contributing to the track and then that track be able to be maintained through a variety of sources, that's going to help enable that resilience that will allow ultimately that end game effect or action to be taken and have it come out with a positive outcome.

One of the things that we collectively struggle with as we navigate these situations is understanding what those quality attributes of those tracks are as we go forward. And that's something that as we look at this resilience in a kill web construct is ensuring that the data sources at the front end are providing sufficient information to actually close the kill chain and not just provide situational awareness data that we can't take action on.

Nicholas Bucci:

I think the Chinese approach to A2AD was kind of the first shot across the bow when it comes to kill chain disruption. And what they saw was that we have a very good fighting integer approach. All of our platforms, we have trained personnel, we have very capable sensors, weapons, communications, and C2. And so they figured, as John said, if they can disrupt that kill chain, then they can essentially disrupt how we would conduct operations. I think as we move forward, as the General said, we need to think about a new approach instead of a fighting integer. We need to, and I'm sorry I'm going to geek out a little bit here, but we need to do an approach that is more of a fighting integral, a way to pull all of those fighting integers together, not taking anything away from each one of those platforms and trained personnel and capable weapon sensors and communication systems, but making them each a little bit better by bringing them all together.

Col. Adam Shelton:

No, I appreciate it. And I would say that as a, I guess you would call it a tactician, from a standpoint, I've always look at the threat and work backwards. And if you take China for at its words and the way that they've even written in white papers that are public source knowledge, the way that they're describing to attack us now is completely different than the attrition warfare of the past, and focusing first and foremost on the information domain, then looking at how our C2ISR construct actually operates, then flowing into the way our networks connect and pass information, and then finally looking at how do they affect our way of conducting kill chains and kill webs.

That approach has really been the nexus for what the services have tried to tackle within their different opportunities and approaches that we've called ABMS project convergence, project overmatch, and I'm sure we'll get into some of those niches here in just a bit, but ultimately, the way that the services have tackled those type of specific opportunities lends itself to being, no kidding, a systems on systems type approach and the way that we've got to be able to deconstruct their approach compared to the way that we plan to operate in ours.

Heather Penny:

So Colonel Shelton, I'd like to follow on with that. Can you speak to the training and the mindset that our Airmen will need to be able to prevail within this kind of environment?

Col. Adam Shelton:

Yeah, thank you. So from a training perspective, it gets really interesting. There's been a lot of different talking points and discussions where you can get really anchored on the technology side of this and really get focused on the kit that we're trying to provide and the speed at which we're trying to do both the acquisitions and the fielding, all absolutely necessary. We can't lose a perspective on the human capital that has to be able to integrate said capability and also figure out the operating concepts that are going to make them effective. I'd say there's two areas that we've got to look at. First and foremost, when we look at the ways that we're tackling the mindset is the ways that we're not only being joint interoperable, but coalition integrated, and the ways that we're trying to pull in your standard partners that we normally talk about, whether it be Australia, UK, Canada, or even some of the other Pacific Theater partners such as Japan and others.

We've got to be able to look at our opportunities to train with them, the ways that they see the problem set, and figure out not necessarily what to drive them towards from a training or kit standpoint, but how we pull the best of breeds across the different perspectives into a single system that's effective. And then the second I'd say goes back to the Mitchell paper and we talk about the scope of the problem. When we really break it down from a training aspect, you can look at recent examples like Operation Glowing Symphony, and some of the declassified information of just how that operation took place in AFCENT and CENTCOM, to attack the cyber connections within the ISIS construct.

That ability to see to across different combatant command lines, and the ways that our personnel have to be able to think beyond the typical domain approach of our systems are currently built to integrate a training portfolio that bridges what we do in WSINT, what we do in some of the PACAF Mobile Guardian type exercises, to really stretch beyond the typical domain weapon systems specifics and figure out how to address those in new and complex ways that you can't necessarily get across in our limited airspace issues or just training portfolios we have. So those are the two lenses I would look at it right now.

Heather Penny:

No, thank you very much. And it's crucial that we have the trained personnel to close and manage those kill chains and manage those battle networks because I think that human cognition will be utterly crucial for us to be able to obtain that combat advantage against China. General Jobe, I'd like to pivot to you because we have talked about the human side of this, but we do rely upon our technologies, our networks, and so forth. Can you speak a little bit to how you're thinking about the force design of this future?

Maj. Gen. Scott Jobe:

Yeah, thanks for that. So I think Mr. Clark hit on it and he touched on data. So we're deep into the information age and bringing decision advantage to battlefield commanders is the one thing that really brings an advantage to whoever can do that the quickest and at scale. So throughout this particular conference, I've been talking to a lot of folks about data, and one of the attributes for force design that we are characterizing is the data structure of future and emerging capabilities and assets or weapon systems. And as much as we can, bring that backwards into the force that we have today, because taking data and sharing it across multi-domain operations is how you're going to be able to instantiate both not only your own kill web, but then counter the opponent's kill web as well because they're using the same data. And then we're no longer in that linear battle space that Nick talked about, which is I had an SA-2 Fan Song radar targeting my fighter aircraft, and I knew exactly who was targeting me and I had an RWR and I knew exactly the characteristics and parametrics of that system.

Now I've got someone that is in a completely different spectrum that I cannot sense that is getting data from a third or fourth party that's on the adversary side or from an open source or other side, fusing that data into a track and then targeting and engaging with specific weaponry or capabilities, both kinetic and non-kinetic effectors. So that's the environment that is characterizing a large part of the force design is data attributes, data structure, data curation and enrichment. And how we do that from the beginning of capability development so I could do things like model-based system engineering, I can ingest into a joint synthetic environment and do live virtual tests and training concurrent with what's going on with hardware in the field. And so data is one of those things as we look at the future force design as a huge characteristic of the changing character war.

Heather Penny:

Thank you. When we talk about data, it's very easy to be general about it. And so I am always concerned that we regress into platitudes regarding data and connecting everything to everything else. And that's a challenge because as war fighters, we know that the data, the kind of data matters. A missile, an air-to-air missile will require very specific data in order to be able to close that kill chain and complete that intercept. So John, would you please speak a little bit to the diversity of data sources and their contribution to kill chain dominance?

John Clark:

Yeah, absolutely. And how I'll start this response is actually tying it back to what we see the adversary doing. And so if you look at the adversary today, and going back to the premise of that linear kill chain, historically, we optimized around the adversary's capabilities. And if we look specifically at the Russians, there was a lot of optimization centered around X-band capabilities. And the premise of that was that we were breaking their kill chain. We were breaking their kill chain by not giving them the information that they needed in end game to be able to shoot at our aircraft. So fast-forward and now the adversary has taken that same recipe that we have and they're applying it to us, and they understand where we have optimized and where we haven't optimized. And so they're putting a lot of energy into those places that we haven't optimized so that they can get the information that they need to help facilitate their kill chains.

And that's where systems like a KJ-600 become very threatening to our environment given that it's taking advantage of places that we haven't optimized with the entire force structure. And so I think that what that drives is that as we look at the diversity of data that we need to close our kill chains, it really can't be emanating from a single source. An air platform, it will have its limitations with respect to persistence. And while it has great geometry and you have varying degrees of proximity that you can get with these systems, you don't have that persistence, but you have the ability to be unalerted. Contrast that with the space domain, they have the ability to persist and that persistence affords them the opportunity to maintain elements of custody. However, also their location is known and we've seen lots of enemy tactics or adversarial tactics where their behavior changes with respect to how the satellites navigate.

And so I think that having the robustness of both the space domain and the aero domain and coupling them together and understanding how to blend those two sensor or data modalities into one common custody construct, is how we create an asymmetric advantage against an adversary that's been very sophisticated in understanding where we have our issues. And when we're able to go do that, I think that that's going to help us go find and drive the same historical construct that we've had with an asymmetric advantage of having more information available to close the kill chain. There's a way to scale that and still maintain that same type of advantage.

Maj. Gen. Scott Jobe:

So it is a really interesting bridge that Mr. Clark just painted for Colonel Shelton, right? Because now we're going to have to have Airmen, Guardians, and joint force allies and partners who understand the complexity of adversary kill web. Because now if I physically go out and take down a particular node, and your example was the KJ-600, that completely disrupts part of the adversary kill web. So you've got to understand that, that it's now a systems fight, not a platform fight because the platforms have only a finite amount of capability in a particular area. And this example could be spectrum, could be information data passage, could be speed altitudes, there's a whole plethora of those things, but you can only optimize for so many things. And so now as you're operating the battle management command and control of these kinds of things, and you're training Airmen and Guardians to do this activity, you've got to understand what those kill webs look like so that when you're then in battle, you can now take down specific parts of it for a very specific commander's intent.

Nicholas Bucci:

That's great. And I think what we're all talking about here is the classic electronic attack, electronic protect, cat and mouse game that we find ourselves in as our adversaries pursue ways to disrupt our kill webs and we pursue ways to disrupt their kill webs. We have to be cognizant that we have to be adaptable and have certain technology developments that feed the ability to be able to have that adaptability. Things like, I'm sorry for the buzzwords here, but open systems and software reconfigurations, right? We found in that EAP atmosphere when somebody would change a waveform, our best approach was to have essentially a software defined radio approach for how to change how we deal with that. Rather than having fixed equipment with very difficult linear software, we became very agile and adaptable. And I think that's important as we go forward in this competition, is to be able to be that resilient to the cat and mouse game.

Col. Adam Shelton:

And if I may just real quick on the data conversation, it lends itself to the natural tension that exists between your intelligence community and your comm community of how do you provide either a mill deck or an ability to influence environment to collect what you need to, but at the same time have the bandwidth and the pathways that don't open yourself up from the same type of effect that the adversary may try to lean against yourselves. And that's the area where I think we still have work to do on being able to refine exactly within this context of conflict or competition, where do we prioritize what data matters most between those two incredibly important functions of your intelligence versus your comm when it comes to signature management, EMS and everything else.

Heather Penny:

And ensuring that data gets to the war fighter in a operationally relevant timeframe. If we're relying on off-board sources to close the kill chain, how do we ensure you get the update rates? How do you ensure that you get that data piped directly into the weapon sufficiently when we have those considerations regarding intel and comm?

John Clark:

If I may, I'd like to just build on that just briefly. I think that that's one of the larger things that I have concerns about as I watch our collective community navigate through how we go close these kill webs and what does that end game requirement with respect to data and data integrity and the accuracy and timeliness of data. I think that what I would encourage all of you from the Airmen and Guardian

perspective is ask those hard questions with respect to what is the timeliness of this data, what's the accuracy of this data, what's the integrity of this data to make sure that the kill chain can actually be closed and not just, "Hey, I've got a track." But that track, when we contrast to the track quality to what is needed for a weapon, they're two different conversations, but if you don't ask the hard questions, assumptions can be made that kill chains can be closed with data that you have, when candidly they can't.

Heather Penny:

No, thank you. Those details matter. Nick?

Nicholas Bucci:

Yeah, and I guess I'll just add to that. I think every service as we've tried that first step into cooperative engagement, if you want to call it that, we found that that's extremely important, John, that fire control quality information to be able to close that fire control loop is the driver for, as I share that information, I can't just get a single track data point and assume I'm going to be able to put that weapon on that target.

Heather Penny:

Yeah. Because whether or not we're using electronic attack, whether or not there are organic information requirements that are driven by the target. A static target that doesn't move that's geographically defined has very different informational requirements than a highly dynamic hypersonic target. And we have to ensure that the data that we're feeding to the platform and then to the weapon is specific and relevant to closing that particular kill chain. So I'd like to bring Colonel Shelton back into the conversation with how would you describe ABMS and how it plans to build these networked kill web type operations? And the training piece, too? Gosh, the people matter so much.

Col. Adam Shelton:

And I'll look at it through the capability and the training lens and realizing I got General Cropsey here, so I'll make sure that my comments are on point, but I'd say it's... Before you dig into the details of ABMS, you got to look at it from a perspective of the joint approach and the ways that the different services have tackled this. And you rewind tape about three or four years when all the services really started to unwind the ways they're going to tackle this, the department of the Air Force's solution with ABMS was really just focused on the unsexy nature of building a network, of how do you get after digital infrastructure, how do you get after the actual forward based edge capabilities that allow you to tie back to a larger network, and then how do you start looking at interfaces and what that user is going to have to interact with and building that initial foundation before we started getting into some of the more niche capabilities.

The Army on the other hand, took the approach with project convergence to look at down and in fielded capabilities, what's the dismounted Joe need today to be able to rapidly execute in the dynamic environment that we're facing? And the Navy looked at it from a maneuver perspective of their primary fighting vehicle, which is the carrier strike group, and how they make comms as a system to connect all those things. And while many opportunities exist to poke holes in each services' approach, if you pair them all together and you look at the ways that there are interactions that are built within the services to try and tackle this problem, it's a powerful message and it's a powerful solution that's all geared around the JADC2 reference architecture that was passed under the joint staff.

And when you look at previous examples to get after air-land battle, air-sea battle, effects based operation, network centric warfare, the terminology has changed, but the desired instate never has. What's different now is the fact that with this reference architecture, you have all the services that have signed off and said, "We're going to build to that and we're going to make alignment happen as we're resigning the capabilities that are going to get after our specific domain requirements to accomplish the mission sets we've been given." So from an ABMS lens, that's the capabilities that they initially started out with is building that network from the ground up, the unsexy part to start with. But from the training lens, this is where it gets back to how do you make a long range kill chain effective? My personal opinion, it comes down first and foremost to a common operating picture. A common operating picture, not multiple pictures on 14 different screens across the big board.

And being able to communicate across those domains are things that ABMS is trying to tackle right now with cloud-based command and control, focus first and foremost with the NORAD Northcom mission set, and then figuring out what that displacement and disbursement capability is going to look like as it starts to touch other organizations. And that type of training interface is not just stove pipe to one community or AFSC as 13 Bravos, but bowel management's going to happen within the intel community, it's going to happen within the cyber community, it's going to happen within your traditional comm lanes. And allowing those type of capabilities like a cop to field and force all those conversations to happen on operations floor that are traditionally in large organizations or dispersed at forward edge with smaller teams is really what I think the power of ABMS is going to provide.

Heather Penny:

So gentlemen, you're working on building ABMS. One of the things I think that's important is battle management clearly covers more than just kill chains, but we're here today to talk about kill chains, and part of that is also ensuring that we understand the aircraft, the weapon, the appropriate weapon, that the aircraft is in the appropriate place to either kinematically or non-kinetically be able to create effects. How are we tying that operations, that operational concept, to the information architecture, because they really do need to be overlayed, they really do need to be connected, and we have to ensure that the data links, the comms, the spectrum is available so that we can make that happen.

John Clark:

So I think what's exciting to me, so having done BMC2 in various capacities within the Air Force for two plus decades, part of what historically has been done is that the model was very centralized control and then decentralized execution. But the Air Forces began to move toward more decentralized control, decentralized execution. And as the experiments with agile combat employment are being carried out, what that's doing is it's stress testing the environment to understand what information needs to be held at each individual level. Because as you start to get these more distributed architectures, you can't share all pieces of information with everybody, and you end up with that challenge of what's the relevant information for each actor in that space such that you can then make the decisions very rapidly. I think that's one of the exciting things. So in that spirit of things that our Skunk Works team are doing within Lockheed Martin is that we're exploring how we navigate working at that tactical edge, what type of edge processing is necessary, what decision elements are needed and what information is needed to facilitate those decisions.

And in particular, Heather, what you brought up in particular with weapon target pairing, I think that weapon target pairing when you're talking at a theater level, the type of information that you're going to need for weapon target pairing there is very different than the weapon target pairing that you're going to need for a package of four F-35s and a couple of F-22s, that weapon target pairing, that

information, you have to figure out how is it actually going to be sourced and how do you navigate that information through the network and these distributed conops and exploring how those apply, that creates an incredible problem for our adversary because at that point, they've been looking for those linear kill chain elements to go disrupt. And if decisions are suddenly being made from a second island chain or a third island chain and they're happening at different places at different times and a nodes on the network and then it's off the network and then somewhere else that nodes on the network and making decisions, that's going to create a complicating factor for them where they're having to worry about how they're actually expending their weapons.

And given that our adversary is going to have a home game, that dimension, the more that we can cause them to either keep their weapons in cash or storage, sorry, I used a computer term, you might think money. So the more that we can keep them from launching, I think the better off we're going to be. And that diversity and our ability to play that shell game on those islands, I think is going to be very powerful. And I'm excited about how the Air Force is navigating and exploring that trade space.

Maj. Gen. Scott Jobe:

So our approach to force design to instantiate distributed control over thousands of square miles is a different problem set than we have encountered in the past. And part of it's a technology piece, and that's what we've mostly touched on today. So right, interconnected forces that are distributed across the battle space, whatever the area of operations is, is part of it. And so our approach has been that not only do we need a common operating picture, but we don't need the same operating picture for all people at all times because if I have a battle management particular node somewhere that's now handing off responsibilities for a force package or an assembly of forces, that technology piece is there, but then there's a training aspect of it that goes into us.

We're baking in from the beginning, what does that look like from a force package that only needs to encounter organic, only their own onboard sensors, own onboard weapons, own onboard communications, that part is already largely part of the force that we have today. So there's no need for us to overlay the larger construct, which is very specific target sets that are more limited in scope and scale and numbers, and now need to only go out to certain sensors, shooters, and battle managers to actually put those together to close those particular kill chains. And that cycle of very, very long range type of specific targets is one part of the overlay, but not everyone in the battle space needs that entire picture. And so we're approaching it in a layered effect on exactly the problem that we're trying to solve. And they're all slightly different, but the technologies at the core are very similar, right?

The same communications that's going to go through similar, different paths are all there. But while we're doing that, we're looking at the distributed control parts. We actually have our battle management, CRC nodes and CRE nodes, and our airborne nodes, and our joint partners that are either a float or a land, a field, all have the ability to plug into that ABMS or advanced battle management system.

Nicholas Bucci:

I guess I'd like to talk a little bit about some of things we're doing from a data link perspective. John talked about the data and being at the tactical edge, and we've relied a lot on radio frequency communications for a very long time, but what we found is that there are limitations in radio frequency in terms of systems tend to be larger, more power hogs, and don't necessarily operate over as long of distances as we want to as we start looking at these expansive areas of operations that we're dealing with. And so we're looking to move forward with free space optical communications, and how does that help us? Well, it's more resistant to jamming from the opponent. Because I have a very small beam, I

can move that beam to where it needs to go, and so I can communicate from aircraft to aircraft, from aircraft to space, from space to ground, from aircraft to ground, wherever the data needs to go.

It also provides me a significantly higher bandwidth. And so as we start to look at trying to get the best data from a sensor to the best effector, we need to be able to move it where we have the capabilities for each of those. If they're in space, great. If they're on an aircraft, great. If they're on a vehicle on the surface, that's great as well. And being able to communicate the amount of data, the right amount of data as the General and John said, to the right trained personnel as the Colonel has said a number of times, is really what's important. And getting that data through these kinds of high speed, reliable links is really what's going to help us create the network that we need going forward.

Heather Penny:

Thank you. Because bandwidth will be a precious commodity in a highly contested environment, not only because of what the adversary is planning to do to us, but just simply the volume of information that we'll need to share and to be able to act upon. So having that layered approach ensures that we have the bandwidth available for the necessary information that we need to be able to execute our mission. And moving into the optical regime is huge. Did you have something, Colonel?

Col. Adam Shelton:

I did, ma'am. And just from the layered approach is an accurate way to look at, but it also has to be the organizational design that matches it.

Heather Penny:

Yes.

Col. Adam Shelton:

You have to have the authorities, the responsibility, and the resources aligned to the organizational structure that will support the technology that's going to feed this. Otherwise, you're going to end up in the same C2 in the gap seams that we saw on the Glowing Symphony Operation. Or, when you look at the Indo-Pacific and how many different combatant commands, both theater and global will have an impact in that type of region. We've got to make sure that those C2 seams are straight.

Heather Penny:

Oh my gosh, you are now polishing one of my pet rocks. You have to come up with your operational architecture. How do we operate? How are we going to close those kill chains? So with that operational architecture, then the command and control architecture needs to be seamless with that. It has no daylight. And so when you finally have that, that then dictates the informational architecture. So if you can overlay and have no daylight between how you operate, is the foundation of how you build this, work your command and control on top of that and the information then supports all of that, then you reduce the friction and reduce the fog of your combat operations. General Jobe?

Maj. Gen. Scott Jobe:

Yeah. So the organizational part I agree, is part of it. There's another step though as we're getting after what you described, Ms. Penny, is there's another way to get after it because you don't know what the enemy's going to do and you will encounter problems with whatever organizational structure you pick. And so instantiating mission command through mission type orders and having task force commanders,

air task force folks that are out there that can orchestrate and control the fight or command the fight, is equally important that you have the ability to do that and the flexibility. So it's either inherent to your organizational authorities or delegated down through whatever mission type orders that you encounter.

Heather Penny:

Can I ask a really creepy question? When it comes to command, are we providing those young warriors with the necessary orders to be able to do that kind of command? Or are we simply talking about battle management and control? This is completely off script, by the way.

Maj. Gen. Scott Jobe:

Right. So it's a complicated question. And I would say that we are moving in the direction of providing the tools, the skills, and the authorities to do command, not just battle management. There's more to it. So if I am a task force commander, maybe at a low echelon, maybe I'm a force ship flight lead who now diverts to an airfield and vicinity of a hub and spoke, for example, there are times when I need to reach down into my G-suit pocket and pull out my mission type orders because I'm not connected to the rest of force. I have what I have in terms of fuel, time, ordinance, and I know what my roles and responsibilities are because I've been given mission type orders. I'm going to then assemble what I can and I'm going to go pick a fight and I'm going to take the fight to the enemy. That's command. And it's not just one layer of it. There are multiple layers of it. And so that's what we're driving to get to.

We're doing it with our lead wings and with our agile combat employment concepts and with training that we do day in and day out at places like Nellis and others around the world, we do it in our flag exercises. So we need to do more of that thinking and then layer it into what our command and control battle management looks like because there is an operational layer, which is traditionally handled by our air operation centers, but then there is a tactical layer and there are probably sublayers in between that we typically do not talk about, but do happen in warfare. There's a command element through mission type orders that we've got to be thoughtful about what that looks like because it's really difficult to write a clear mission type order that has boundary conditions and roles and responsibilities and authorities inherent in them. But we have to drive towards that. And that is something I know that we're training to. I would say, are we there today? Probably not.

Nicholas Bucci:

And I think, General, I absolutely agree. And I think we need to evolve the rules of engagement as we go into these complicated competitions of kill webs, one going after each other's kill webs. What happens when that pilot is all alone and unafraid? They have to fall back on their training to be able to do it, but we also need to evolve that training and have the secondary rules of engagement that they can pull out as well.

Heather Penny:

Colonel Shelton, did you want to say anything?

Col. Adam Shelton:

I'll be really brief because this could boil down to a dissertation. So we have to be cautious of the difference between command and control. The inherent command to be able to execute operations as delegated within a mission type orders does lend itself to the discussion of more of control of what you've been able to provide from a delegated standpoint. But in reality, from a training aspect, we have just started to barely open this discussion space. Recently, the Warfare Center through Red Flag 23-3

really took its first stab to try and figure out how to get after this and start to distributing capabilities and locations and units to try and figure out what that looks like. And we're just continuing to try and finesse that function.

From a traditional theater air control system perspective, the tax has always been tasked as unit specific capabilities and not actually tasked as a system. That's where I think we lend itself to some opening up of the conversation from a Futures Game 23 that General Jobe's team recently concluded. And as we look at future war games, taking things we've already looked at and start to mature them and put them in exercise environments where we can really work out some of the niche details.

Heather Penny:

Okay. Lightning round. Lightning round.

Maj. Gen. Scott Jobe:

We're not starting from scratch though. Real quick. So, in World War II, we did this activity. In Desert Storm, we had wing commanders that ran mission type orders. As a wing commander in Afghanistan, I ran mission type orders. We know how to do it, it's in our DNA. We just got to get back into the battle rhythm. It's like going back to the gym.

Heather Penny:

Last words? John, anything to add, last words?

John Clark:

On this topic? No, I'll leave that to the Air Force.

Heather Penny:

No, on kill chains. On kill chains.

John Clark:

So yeah, I'll say that the other dimension of things that we're continuing to explore, and I think it's a critical part, is the availability and release ability of data. So as we fight as coalition partners, we don't collectively fight by ourselves. We're actively working on strategies to help release data. On an F-35 today, there's an incredible amount of data that doesn't actually get used in the fight that come from all the wonderful sensors on that platform. That same story you could copy and paste with a number of other Air Force assets. And so I think that finding ways to get that data available, promulgated into the network and available, I think that's going to be another critical element such that we can fight as a collective coalition team and bring their assets and their resources to bear.

Heather Penny:

Thank you. Nick?

Nicholas Bucci:

I guess as I'll talk about that fighting integral piece again, but I think we can't forget that the fighting integer is still important. As John just said, we have very capable platforms and we're developing new capability on new platforms. We have to keep doing that and keep updating the training for the personnel aboard those platforms as well.

Heather Penny:

Gentlemen, thank you so much. And so just as a foot-stomper, speed, scale, scope, and survivability for those kill chains. And gentlemen, thank you for your insights here today. We've unfortunately come to the end of this Mitchell Institute session. Thank you again for taking the time to speak with us today. Come visit the Mitchell Institute booth and have a great aerospace power kind of day.