



Col. Daniel Lehoski:

Good afternoon, AFA. I'm Colonel Daniel Lehoski, and I'm humbled and privileged to serve as the commander of the 53rd Operational Test and Evaluation Wing at Eglin Air Force Base, Florida. I'm honored to be here hosting this highly relevant panel on killing moving targets. Over the last 22 years, I've watched firsthand the exponential growth and importance of being able to engage moving targets. Indeed, as a brand new lieutenant in the 44th fighter squadron, moving targets were the exception. They're now the rule. The shift in importance has been driven by both increasing numbers and capability of our competitors' mobile systems, driven by both military necessity and technology advancements.

From the military necessity perspective, our competitors have been watching us. They've watched us in the Persian Gulf War as we dismantled the fourth-largest military in the world, they've watched us destroy specific city buildings in Kosovo, they've watched us as we sent bombs into caves in Afghanistan and they've watched us in Iraq target specific individuals, all with a level of precision and accuracy only attainable by the United States Air Force and United States Space Force.

They have indeed been watching us and they have learned with absolute clarity that if you're a fixed target you're going to die, you're going to die early and you're going to die often. As is often the case in the history of warfare, the emerging and military necessity and technology advancements has opened a new competitive arena. Computer processing power at ever decreasing cost of size and weight, increased data link technology and precision navigation have all combined to greatly expand the capabilities of mobile systems. These technology advancements are not exclusive domains of the Department of Defense, which means we must continually improve our advantage to hold any target, whether it's fixed or mobile, at risk of an early retirement via weapon delivered by the Department of Air Force.

Before I introduced our distinguished panel to discuss options to improve our advantage in killing moving targets, it's important to add some scoping to the discussion. For me, I see the trade space of moving targets as the quad chart with two axes. One axis is type of engagement. On the low end of that axis is things like small quadcopters or small unmanned vessels, low-cost, probably low-tech, but high numbers. On the other end of that axis, you'd have everything up to a capital ship like a Luyang or Renhai. Exquisite assets, high cost, but probably low numbers.

The other axis of the quad be defined by the method of engagement, either direct attack or standoff weapons employment. The panel will cover all those topics today and we'll explore that trade space through the discussion.

Joining me today is our esteemed panelist, all with both operational and industry expertise in moving target engagement trade space. First, Major General Retired Jon Stormin' Norman, who served in numerous positions both in and out of the Air Force, including F-16 weapons officer, commander at the squadron group and wing level, and completed his active duty service as chief of staff at US Southern Command. Currently, he works as vice president at Raytheon for air power requirements capabilities.

Next we have Colonel Retired Mick Guthals Magoo, senior manager of business development for precision weapons systems, Elbit Systems of America. Mick is responsible for all US campaigns and pursuits relating to seekers for air-to-ground weapons, a US Air Force Academy graduate and command pilot with more than 3000 hours, he retired from the Air Force as vice commander of the 53rd wing at Eglin. Magoo, I'll be standing by for feedback on how I'm doing as commander here after this.

Lieutenant Colonel Retired Dan Ourada, as VP of Strategic Captures for Amentum, a leading global engineering systems modernization provider, heading a \$9 billion capture portfolio across the DOD and other federal agencies. Dan also directed Amentum's joint unmanned systems and training solution campaign and was a 26-year combat veteran and command pilot in the United States Air Force.



Thank you gentlemen for your service as Airmen and for joining the panel today. To start the panel, I'd like to open up to our panelists for their thoughts on engaging moving targets. General Norman, sir, we'll start with you.

Maj. Gen. Jon Norman, USAF (Ret.):

Well, thank you very much. Well, I think all the tacticians in the room, you start at the target set, so define the attributes of that. How fast is it moving? Where's it moving? Is it on the ground, in the air, in the sea? How hard is it, and is it going in a straight line or can it move any direction? That sets some of the parametrics that you're going to need if you're going to attack it with an effect. And then what type of defense is around there? So is it a turkey shoot, so you're on a range dropping on it where, "I don't care about anything else around," or "Is there a level of standoff that I need so I can't do that direct attack and I have to have some level of survivability."? And that sets the stage for what we need to do and then it falls back to, "How do we find these targets?"

I think today we're focusing on that maritime target, and so you have to have the ability to sense that range. You talked about finishing up down in SouthCom. So 12th Air Force in SouthCom, we use the over-the-horizon radar quite a bit. Turns out we've greatly improved that for the US military, to be able to see at range over the horizon. And we use that to track ships but it's not really good enough for targeting, but it gives a good, "It's about there," solution. And then we bring in different electrical optical, we bring in airborne radar or moving target sensors so that we can get a very tight cue to be able to attack.

We've helped our ability to precisely locate these tracks in the sea by advancing the seekers in some of the new weapons, whether it's a joint strike missile or our small diameter bomb, and then building in capabilities into these weapons so that they can do automatic target recognition, which helps with some of the combine ID, all challenges that our services face as we look at how we do air battle management and how we're going to do JADC2 in the future.

All that said, there are ways to attack these different target sets, and it's taking some of the systems that we have today, we've done recent tests down at Eglin with JDAMs against ships, to our newer weapons, with StormBreaker with JSM. It's refreshing to see that history does in fact repeat itself because I think Billy Mitchell faced a similar challenge just a few decades ago. So thank you very much and look forward to the discussion. Mick?

Col. Mick Guthals, USAF (Ret.):

Thanks Lager for the kind introduction of being put in the distinguished category. That's a first, so thanks. I look back on where we were probably 30 years ago, going through weapons school, and it was not out of the curriculum to be doing moving targets. The difference is that we were doing moving targets that were in radar range, we're in visual range, and we had a very, I'll say a scripted, more scripted order of battle coming through the Fulda Gap.

That paradigm has shifted some. We're finding that today's pacing threat is getting more than their fair share of the vote, and that's putting a stress on the paradigms that we've had growing up and we'll face in the future. That risk may be changing, the risk that we face operationally, fiscally through policy, and now we have to bring in the risk that industry faces because industry needs to provide some of the solutions. And I'll put the AFRL portion of the air force into that industrial basket because the technologies that they are investigating today are going to lead to the successes of tomorrow. But I think at the end of the day we're going to need to find those solutions that really have an AI component all to their own, really have multi-mode capabilities, network capabilities both for the pre-strike post-strike changes in the battle space, and then the ability to conglomerate all of that into, because there's



such a quantity of targets out there, "How do we pick those targets and prioritize those in that battle space?" So like Stormin' says, should be a great discussion today and should be a really interesting future

Col. Daniel Lehoski:

Dan?

Lt. Col. Dan Ourada, USAF (Ret.):

So as with the previous two gentlemen, I agree with them, the past 30 years it was about that target that was in the sensor range that I could eventually see with one of my sensors. And we've got to look at our equation, how we as Airmen and Air Force have solved that problem. And it's been with large, very high value sensors, what we think are outside of the lethal radius, doing the sensing and then projecting weapons forward that may or may not be survivable in the environment.

And as we look at that problem, we're applying that same equation with newer and newer technologies. If you take a look at some of the papers that you'll find in the back here through the Mitchell Institute, we'll talk about a cost per effect as a way to think about how we achieve dominance in certain regions and especially in that maritime environment. We need to look at how fast we can push the sensor to the weapon, to where the sensor and the weapon are one and operating autonomously either with a human in the loop or a human on the loop in a denied environment. This creates a whole new calculus for our adversaries and it creates what we think could be an affordable mass in the future.

Col. Daniel Lehoski:

Great. Some good discussion on the trade space already. So we'll jump to the next question I have for you, gentlemen. As we look at increased operations in maritime environment and considering the pacing challenge, what do you see as the key attributes for future Department of Air Force weapons to service the spectrum of moving targets, everything from that small UAV all the way up to that capital ship in a maritime environment?

Maj. Gen. Jon Norman, USAF (Ret.):

Okay. So start with the hard problem first. So the capital ship, probably very heavily defended, so it means standoff. You're going to have a force package of some sort. I don't look at this as a future problem, I look at it as a problem now. So what do we have now that we can use against this? And so there are a couple of different weapons options, certainly different package options, but you need to provide some sort of non-kinetic effect, a kinetic effect determining what type of impact you want to have on the capital ship. Do you want to mobility kill, do you want to take out the defenses so that you can put other ordinance in on top of it or do you want to put it out at the bottom of the sea, which is exponentially more complicated?

So locating it, we talked about use of an over-the-horizon capability, whether it's one that we make, one that one of our competitor makes, it's still a way to see surface ships at a great range. To Mick's point, you got to be able to ID this, and so we have a bunch of national means that we can do that. It's correlating and fusing that picture though and then projecting that out to the force package. It's then being able to provide that real-time targeting. I don't know if you necessarily have to say it's time-critical targeting because it's not going to be a jinking target in the middle of the sea, it's going to have a predicted uncertainty volume. But you have to be able to project that out to the force package and then you have to put ordinance on target.



We've been working with Kongsberg on a joint strike missile, which has the ability to have incredible survivability as it gets in there. Not a huge warhead though, so this is a mobility-type kill and that's where the planners have to look at, "If we're going to put this at the bottom of the sea, will that mobility kill be enough so that we can take down the defenses that allow us to penetrate in or not?" And that becomes part of that tactical problem. If it's not a heavily defended capital ship, now your options are greatly expanded. You can do a standoff attack on that or you can do a direct attack, and I think the hardest part of that is the total number of those target sets.

So as that target gets smaller, so I look at the ... Pick a generic area in the world where they have light attack boats that harass shipping in different locations, you can have quite a few of those and you want to be able to have a set of ordinance that you can employ from range or in a direct attack mode that are able to go out, sort those targets, be able to find them actively and engage them while not inadvertently targeting one of our friendlies. So part of that is the AI to be able to do the active target recognition, part of it is to be able to provide that battle damage coming back so that we don't have to restrike a target set, and then part of that is being able to simplify the employment for the Airmen that are going to be employing these weapons.

I think we have a lot of capability today, but as we look at the future of our air force, whether it's a teamed occupied aircraft, whether it's a bomber or fighter with a unmanned platform or if it's just a manned platform, we have to be able to greatly simplify this for our war fighters so that they can react to those targets in real time and they can employ ordinance at depth.

Col. Daniel Lehoski:

Sir, before I move to Mick and Dan on that question, you mentioned earlier some recent success with tests off of Eglin. Can you expand on that for the group?

Maj. Gen. Jon Norman, USAF (Ret.):

Yeah. So the test wing, they used a JDAM, and they were able to explode that just below the surface level on a ship and it was able to heave the ship up, crack it in half and put it at the bottom of the gulf. So another new natural reef. We've done a bunch of testing and we continue to do that with Eglin, with the StormBreaker against fast moving targets, both ships or boats and land attack targets.

So I think that there's a lot of growth area in there for looking at some of the effectors, some of the capabilities that we have today and using them in new ways. So it is really exciting to see what the wing is doing and what the test group is doing down there.

Col. Daniel Lehoski:

Awesome. Mick, over to you for your thoughts on requirements and key attributes for future DAF weapons.

Col. Mick Guthals, USAF (Ret.):

Yeah. I think as I said, the distance that we're going to be engaging targets at, I think we all probably assume it's going to be significantly larger than we've done for the last 20 years. That doesn't necessarily mean that the direct attack will not happen at some point in time. I think if our plan works out, and plans only go to the first engagement, but there will be opportunities for our more independent-thinking aviator to do the things that we are currently doing and that will require advanced targeting capabilities from in cockpit married up with the advanced targeting capabilities from outside the cockpit, which will have to go and it'll be engaging at distance, but that will all be driven by the threat.



So on the attributes, first off, we have to be able to detect the independent dimples that we're going to go after. Second is we're going to have to sort and prioritize those targets and then we need to find a way to successfully engage them. And then finally as Stormin' said, we need to pass that success or success minus back to ... it might be the decision maker, but more than likely it's the next volley or the next inbound. And so the ability to do all of that at the edge or in the cockpit is going to be ever more reliant.

So getting a multi-mode capability so that we can truly detect threats or targets no matter what the environmental conditions are, and by multi-mode I'm talking maybe an IR capability, an EO capability, a RF capability, and a passive capability, all of those will be critical to identifying those targets, putting that into the cloud computing system to prioritize those, whether that is within the volley of weapons or whether that is done in the rear, that will have to take place in order to get the priority threats knocked down so that we can be successful.

Communicating all of that through the network, through the command and control networks is going to be key to moving forward, and getting those answers back so that we can execute the next phase of the plan. And then having those weapons be able to do some of that on their own like we do in the cockpit, getting that capability so that we are truly knocking off the prioritization list one at a time based on which poses the greatest threat.

Col. Daniel Lehoski:

Thank you. Dan?

Lt. Col. Dan Ourada, USAF (Ret.):

So I agree with both problem sets. The thing that we have to recognize is that the pacing threat we're facing has a quantity that is a quality on its own. And when we opened up this conversation, we talked about that affordability matrix that you talked about, everything from that small UAV all the way up to the exquisite high-value target. We have to conduct a new series of mathematics when it comes to taking out that moving target, it is going to be that multimodal system that can come back to the cockpit or be the sensor and the weapon itself. We have to talk about the effects we want to achieve when we talk about, let's take the example, General, that you offered, of the capital ship.

If I can make that capital ship expend all of its defensive weapons and expend all of its fuel, I can make it withdraw from the battle or I can make it more vulnerable to that large exquisite kinetic weapon that sends it to the bottom, all right? Or I can create a permissive environment that allows us to get in there with legacy systems, even some of the ones that just exist today, to go and achieve that particular kill.

But the backside of this equation is you have to understand the quantity we're facing. This isn't something that we're going to have to acquire in tens or twenties. This is something that's going to be in the tens of thousands. It's something that's going to have to be ready, pre-positioned, pre-trained, with crews and systems ready to go at a moment's notice, otherwise you lose that deterrent effect. When we look at that pacing threat, the tyranny of distance creates the terror of time, and our adversaries know that. So we have to shorten the loop that it takes to get a weapon and a sensor to that point to achieve that kill even if that kill is just to making it withdraw from the battle.

Maj. Gen. Jon Norman, USAF (Ret.):

So as you look at this problem set, we could make it incredibly complex, just incredibly complex. Saw this out of weapons school, you get the newest weapons officers to come back and they take what could be a relatively simple problem, they make it really, really difficult because they're hard thinkers.



I contend that as we take this very complex target set, the moving target at sea or on land, and we try our very best as industry to make it as simple as possible, the only way we're going to do this right is if we change around the way that we do acquisition on programs and we do development on programs a little bit so that we bring in the war fighter much earlier into the process, not after we're fielding but during the development so that as we're mechanizing the way that we do at ATR, as we're developing the way that we do the mission planning for the crews that have to employ these things in combat, as we're working the way that we do the in-flight target updates and provide that feedback across this ABMS network to the war fighters, that they're getting the data that they need to make those real-time decisions against that full on targeting set. I think that's where we as an air force are going to really improve our capability.

Col. Daniel Lehoski:

Great. You both alluded to the trade space cost, capability, capacity. Can you expand on that some and give us some of your thoughts on that trade space? How do we balance putting a multi-mode seeker in a weapon but also keeping the cost at a level that we can have the capacity we need? And I think that's going to be one of the key struggles. Thoughts?

Maj. Gen. Jon Norman, USAF (Ret.):

Yeah, I guess it's, don't ask for everything. If you ask for a weapon that can do everything in all weather against every adversary at every speed, it's going to get really expensive. You have a lot of cost drivers, the propulsion costs something, if you run it above a certain speed where you have to deal with thermal, it's going to cost more because you have to change the way the front end is designed, the way the seeker's designed, the way the ray dome is designed on that to survive that environment. If it has to be able to operate at -65 instead of -45, it may take a different type of propellant to do that where it doesn't fracture and it doesn't become a bomb, it stays a rocket. If you put a weapons data link that can do everything for everybody on multi-bands, it's going to be very expensive.

And so I think as the war fighters look at it, and I know the teams in the Pentagon and at the MAJCOMs, they're doing a really good job. They understand that mom and dad are broke, we're all taxpayers and we don't want to pay a cent more in taxes than we're already paying, and there's a finite amount of new stuff that we can buy. So when we do buy new stuff, we want to get the best value we can for the dollar. And there's a lot of very, very smart people doing the analysis, making sure that as we're looking at the new programs, we're really asking for exactly what we need, and that's where we got to be.

There's some ways that we can get about this, and Jason Bartholomew down there as the weapons PO, and he exposed ... he's doing a great job at looking how we can break the cost curve. He's sending teams out, they're engaging across industry. The latest one is CTV. How can we make a cruise missile that can go about the range of a JASSM but doesn't cost nearly as much, cost is one quarter of that. And so we're breaking down the different cost drivers of any given weapon system and we're finding areas where perhaps if the government contracts for this one thing, call it a weapons data link, and they provide that as government-furnished equipment, there can be great savings to the government because we make that common across all the weapons.

And now for industry, you just integrate it into a size, weight, area and power requirement within our weapon. We save a lot of money. Or we make the propulsion GFE, or we make the warhead GFE. If we can do that, then we can really break the cost curve and we can accelerate the way that we deliver this capability. And they do that under a government reference architecture.

The other thing that they've done is this WOSA MOSA design. So design these weapons so that the parts plug and play. Design them so that they're very easy to integrate in an open system architecture with all



the new platforms, whether we're fielding an NGAD or it's a CCA or a follow-on to F-35 Block 5, make it so it's very easy to integrate so we're not spending two years to do all the regression testing, so we're sure it works across the envelope. I think that's probably the way we're going to deliver capability faster and we're going to deliver it at less cost.

Col. Daniel Lehoski:

Thanks sir. Mick, any thoughts on the costs, capacity, capability?

Col. Mick Guthals, USAF (Ret.):

Yeah, I do. I think there's always going to be this cost-capability mismatch. If you want all the capability, well it's going to cost you. Well, yeah, the "Do everything anytime, anywhere," is unobtainium, probably. So I'll get on with Stormin' that good requirements yield good designs, yield good programs. And it's interesting, we've got General Cropsey up here in the front row who probably has one of the toughest integration problems in the Air Force, and bringing in all different elements into the end solution early is probably going to lead to the early success. And all of those government reference architectures get those firmly established, firmly adhered to, and then firmly executed in accordance with. Those things will pay dividends.

But I'll go back to what I said or what I referenced in my intro, and that's a change in the paradigm of risk, whether it's operational, fiscal, policy or industrial. There are a lot of things that we are all talking about doing that increase today's standard and acceptable level of risk. Engaging highly capable threats, operational risk. Doing that at range, operational risk. Doing that with a different degree of certainty that we have with direct attack weapons, that's a policy change. Doing it affordably becomes the fiscal change and doing it with a steady funding line in today's environment of continued resolutions adds risk to everything that we talk about. But there are a lot of things that will really enhance our ability to achieve this that are on an industry side, and finding that way to transition, say energetics, finding ways that RW, the energetics that they are working on today, transitioning those into an industrial capability is going to yield great results. So tackling all those upfront, acknowledging them, and I hate to say tackling them as a group, I think will yield to that success.

Col. Daniel Lehoski:

Thanks sir. Great segue to the next question, and with General Cropsey here, perfect segue as well. We've seen in both combat ops and recent high-end exercises, the left side of the kill chain is often the problem. We've talked a lot today about some of the weapons and the right side of the kill chain. I'd like to get your thoughts on what do you see as key enablers to the left side of the kill chain? The find, the fix, the track, the target piece of it, to include the command and control piece, which is often strained as the kill chain gets longer and longer. So what are your thoughts on what we can do better on the left side of the kill chain to ensure we're improving the entire kill chain, not just the right side of it?

Maj. Gen. Jon Norman, USAF (Ret.):

I'll keep mine real quick. You have to have a common operational picture. We have a phenomenal amount of sensors. We develop great sensors, certainly in the business I'm in, but we have to be able to share the source code, we have to be able to get them cyber-certified, we have to be able to integrate them with everything from national level to airborne to terrestrial-based so that everything is correlated and fused, and you deliver a single picture, a single icon on the screen with all the targetable data for each single target. You can't have ghost targets, you can't have two targets for a single one, they have to be correlated and fused and it has to be accurate and it has to be targetable. It has to have some level of



quality to it so that we can automate it through AI and we can pair it up with the weapon that's on the right platform that's in the right location to address that threat. That, in a nutshell, is the find, fix, target and track.

For the ID, I hate all the analysis where we just wave that off. "Oh, ID is soft. It's easy. Yeah, we got it." It's never been solved. It's the hardest thing that we do as war fighters, is trying to ensure that we have valid combat ID so we can employ at range, we can take advantage of the max range of these great weapons and these great sensors that we're spending a lot of money and time training and buying. So we've got to be able to do that.

And I think the key to that in the future, it's going to be the work that the folks working on ABMS and JADC2 today are doing, as they design this future for our weapons and our platforms that they're collaborating. So they're collaborating on the edge. As those effectors are flying out, they're passing back that data that's correlated and fused, because they're at a much closer range. They're going to see things that no other platform, airborne or space-borne or terrestrial, can see and pass those back and help us build that ID picture.

And then most importantly is providing that BDA. Without BDA, we cannot fight a future war. We don't have the capacity in our weapons or platforms to fight a future war if we're constantly retargeting what was already struck. So we've got to have effective BDA. Mick?

Col. Mick Guthals, USAF (Ret.):

I got to agree with everything that you've said, and that first initial picture is critical. Whether it's to align an onboard INS, whether it's to launch to a launch basket, whether it's to send something off the rails to engage on a precision target. That picture at launch needs to be the highest quality. Beyond that, we know that the enemy gets a choice in here, they get an input. So being able to adapt is critical to being successful. Whether that's a two kilometer shot, whether that's a 200 kilometer shot or a 2000 kilometer shot, we have to be prepared to adjust what we're doing, what we're going after and what we expect our results to be at the end. And that needs to go into the next volley. And so that is all going to fall on how robust is our network? How visionary is our command and control network? And how much autonomy are we trusting to be in the front of that weapon, to make some of those decisions on its own?

Lt. Col. Dan Ourada, USAF (Ret.):

And I say this with knowing who's in the audience, but one of the things that stops our development of this and our test programs, is the risk management framework, okay? It is an exquisitely tight criteria that was very, very valid for technologies and sensors and networks 25 years ago or even 15 years ago. But the thing that limits us from harnessing the power of industry and truly applying accelerating change in our acquisitions is bumping up against that risk management framework and failing to look at, "Well, that might've been a risk 10 years ago, but it's not now." So it's probably time to re-look the risk management framework as it approaches sensors, weapons, communications, networks, technologies, and re-look at a different way. Not necessarily talking about changing or opening the aperture, but we probably ought to look at how many apertures we needed to go through to achieve what we're talking about. When we talk about accelerating change or losing, one of the things that's stopping us is our acquisition process and the risk that we're willing to tolerate. That's something we need to think about in that macro sense to change this equation.

Col. Daniel Lehoski:



Awesome, thank you. In our last few minutes, I want to open up to our panelists for any final thoughts and I'd like to focus on ... we've talked a lot of challenges today, but I'd like you to key in on any decisive opportunities or advantages you see from our forces going forward in relation to pacing challenge as far as targeting moving targets.

Maj. Gen. Jon Norman, USAF (Ret.):

I talked a lot about StormBreaker today. I'm passionate about it, not because we make it, but I've worked on it since I was in the Joint Staff. This is the weapon we made so we could replace cluster munitions, and we had to have a multi-effects warhead so that we could have blast frag and a hardened target capability. We had to be able to employ through the weather with this, and we had to be able to hit moving targets both on land and at sea. And it's just fielding now, and this is where I get frustrated because I wish I was still operational, so that I could be that patch-wearer in the squadron going, "How are we going to use this thing?"

So we have IOC in the Strike Eagle, we're going to have IOC in the F-35 when TR-3 Block 4 is done. Hopefully ACC gets us fielded in the OFP for the F-16 very soon. But it's an awesome weapon. I know there are other awesome weapons out there, but it's those weapons that we've got to work on today, on the tactics development today, and on integrating those into our war fights. And we exercise all the time in a red flag scenario. We don't have a lot of exercises where we're hitting that swarming maritime target or that capital ship at range, that I think we're going to need if you listen to what the secretary's saying.

So this is where I think industry, again, can partner with the Air Force and help with some of the modeling. We've certainly done it in future games, but as we're looking at exercise design and participation, we can take a lot of our very high-fidelity models that we have for our weapons and for the threats and help the war fighters play out different scenarios to help develop those tactics, techniques and procedures that work and what won't work.

Final thing I'd add is, you touched on it, it's CROE. It's easy to fall back on the test piece of it, but for the operational employment, we got to work that trust and validation with the lawyers because they tend to get a big vote as well. And we need to work in that at range for this moving target set so that our war fighters are going to be able to employ these great sensors and great effectors that the acquisition community and the industry have worked so hard to deliver to them.

Col. Mick Guthals, USAF (Ret.):

Thanks. So I think one thing we old operators need to understand is that there are multiple ways to skin this cat. Some may require a direct application of kinetic effects. There are other avenues to get the effects that we need to achieve our goals, and we as war fighters need to be open to those. Right now we have a real problem with rails to targets. There's a mismatch between rails to targets. And so we're seeing the lethality of smaller warheads, that may become a player. Not to get the catastrophic kill that we all grew up with, but to get the kill that we need to get the mission accomplished.

And I'll jump on the risk problem. Risk and test, cost and test. We need to find a way to get that so that we can really get these things done and get them out to the war fighter. Lager, I'll say our greatest opportunity and our greatest strength is what we see out here in the audience, and that is the partnership between government and industry, and particularly, not to take anything away from the industry guys, but the great ideas that come from our Airmen, sailors, soldiers, and marines that are out there is what's going to win the battle. Thanks.

Col. Daniel Lehoski:



Thanks, Mick. Dan?

Lt. Col. Dan Ourada, USAF (Ret.):

So I echo that comment. The old operators as we look out here, because when we were younger we faced odds of three to one and five to one and thought those were insurmountable. But you know what? Precision entered into our equation and that really changed the definition of mass. Now I look out at a bunch of American Airmen who are looking at 15 and 20 to 1 type of odds, and we're facing an environment where both sides have precision and both sides have that ability to deny, to disrupt.

So we have to recognize some of the equations that we're trying to solve with legacy equations are out of date. The quantity we face is a quality on its own, that's returned. We need to look at the affordability of our sensors and our weapons and getting them into ... to achieve the effects that you talked about, right? Is it that mobility kill? Is that retire from the battle kill?

So when we talk about accelerating change or losing, let's look at our larger equations, both for the rails to weapons count, the effect that we're going to achieve with that, but also fall back on your testing and your acquisition enterprise. We need to accept a little bit more risk in our acquisitions and in our testing to achieve the kind of capabilities we're going to need to face that 20 to 1 match.

Col. Daniel Lehoski:

Thanks, Dan. That's a great point there, Dan. Ladies and gentlemen, thank you so much for joining us for the panel on Moving Target Engagement. This concludes the panel. Please join in a round of applause for the panelists.