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March 2022. Vol. 105, No. 3

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DEPARTMENTS

FEATURES

Blurring the lines between military and civilian space missions could prompt a reconsideration of the accepted laws of war. See "Resilient Architecture vs. Civilian Risk," p. 54.

ON THE COVER

Mike Tsukamoto/staff/USAF

Africa is a vast continent, and USAF is helping stabilize a volatile region. See "The Air Force in Africa," p. 36.

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By Tobias Naegele

Truth and Consequences

Any good information operator knows that truth wins over lies. But even truth can lose its power in the face of overwhelming doubt. Under Vladimir Putin, doubt may be Russia's most valuable export.

Russia's recipe for misinformation stirs together one part truth, three parts whopper, then puts it all on a low simmer, fan on, until the stench permeates the internet. It works.

Consider this recent incident. When a U.S. Navy F-35C crashed in the South China Sea, someone on board leaked video and images of the jet's ill-fated wobbly approach, its fiery collision with the deck of the aircraft carrier USS Carl Vinson, and its crash into the sea. As is normal, the Navy said little about the crash, leaving an opportunity for mischief. Fake news purveyors quickly produced a backstory in which the pilot allegedly complained of chest pains and cursed his COVID-19 vaccination just before punching out. Amplified by a few social media posts, the story spread. Within 24 hours, well-meaning, retired general officers were wondering if it might actually be true.

The false story was built on a foundation of disconnected truths. The plane really did crash; evidence really was leaked from aboard the Vinson; the military really does require COVID-19 vaccines; myocarditis is a real, if rare, adverse effect of mRNA vaccines.

"If your mother says she loves you, check it out."

Now look at what happened when the Pentagon and the State Department looked to expose a Russian plot to use manufactured video of battle scenes and wounded actors to justify an incursion into Ukraine. State Department spokesman Ned Price held a press conference in early February at which he shared this newly "declassified intelligence," but Associated Press reporter Matt Lee wasn't ready to take Price's word for it. He asked for evidence. The two argued for several awkward moments until an exasperated Price blurted out: "If you doubt the credibility of the U.S. Government, of the British Government, of other governments, and want to find solace in information that the Russians are putting out, that is for you to do."

Price later apologized for the exchange. Lee, after all, was doing his job, following the journalism 101 maxim: "If your mother tells you she loves you, check it out." Sometimes spokesmen get the facts wrong through no fault of their own. At other times, they spin the truth intentionally. They want you to look at the other side of the Coke can." When you do, you see it says Coca-Cola, not Coke.

At the Abbey Gate attack at Kabul International Airport, 13 American service members and some 170 civilians were killed. This is a case where the early disclosures turned out to be wrong. Gen. Kenneth F. McKenzie Jr., Commander, U.S. Central Command described the attack at the time as a complex operation by both a suicide bomber and ISIS-K gunmen. Nearly six months later, McKenzie corrected the record on Feb. 4, following an investigation that found the attack involved only a single explosion. McKenzie hadn't lied, but he had misreported.

"The fact that this investigation has contradicted what I originally said, demonstrates to me that the team went into this investigation with an open mind in search of the truth," McKenzie said. Unfortunately, cynics see this as part of a pattern: Get out a useful story quickly and correct the record later.

Days after the Abbey Gate incident, a U.S. drone tracked and destroyed a white Toyota in Kabul, having identified the occupant as an imminent terrorist threat. The driver, however, turned out to be a human rights worker, who died in his driveway along with seven of his children. After further investigation, the U.S. military acknowledged its error.

Terrible mistakes happen in war. When life and death is at stake and time is short, some judgments will inevitably prove wrong. Explaining what happened accurately and in a timely way is harder and more complicated than it looks. Those first drafts of history are often based on too little information and often incorrect. So, when the facts change, credibility crumbles.

Here's another: After U.S. Special Forces attacked ISIS leader Abu Ibrahim al-Hashimi al-Qurayshi on Feb. 3, in a multistory dwelling at a small village in northwest Syria, Pentagon spokesman John Kirby explained to reporters that the United States chose a more complex and risky operation to minimize the risk to women, children, and other innocents in the operation. Instead of a drone strike, special operators helicoptered in, risking their lives in the process. They issued warnings. They gave the occupants time. They successfully rescued several children. But exactly how many people were killed and who they all were remained unclear. Soon after, aid groups questioned the official death count.

This is a classic Catch-22. The more the Pentagon reveals, the greater the risk of error. And yet the more that is withheld, the greater the risk of being accused of a cover up. When a skeptical public conflates error with lies, all bets are off.

The hard part is deciphering the difference. Each of us has a moral obligation to bring our own thoughtfulness, doubt, and benevolent skepticism to the information we consume. More important, we have an even greater obligation to ensure the information we convey to others is legitimate. To do this effectively, we must first question ourselves and those whispering in our ears. The admonition to reporters—"If your mother says she loves you, check it out"—applies to readers, too. Rephrase it this way: "Never doubt the possibility that you might be wrong."

Be a good intelligence officer. Weigh the value of each source. Decide what to discount. Like a passenger in a canoe, leaning too far right or left leaves you wet all over. A lone source will almost inevitably lead to an unbalanced story.

Our nation faces many serious risks and challenges. The unholy and growing alliance between China and Russia, the nefarious aims of Iran and North Korea, and expanding unrest in Africa each pose real and present dangers. But the greater threat to our Republic is our own inability to trust and work together. We can see that plainly in a Congress that cannot pass a budget, and the heated and often hateful arguments over mask mandates and mandatory vaccinations. We must learn to see in shades of gray and not just black and white.

It is one thing to say we do not negotiate with terrorists. It's quite another to see our fellow countrymen in that same light. ✪

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LETTERS

Tanker Tanking

The continued buy of the KC-46 with the Remote Vision System (RVS) only shows us that the Preliminary Design Review and Critical Design Review Teams of the RVS for the KC-46 didn't do their job ["KC-46, F-35, Provide Lessons for Future Testing," November, p. 22].

The Critical Design Review is supposed to stop a program from going further when it doesn't meet specifications by the customer, the customer being the USAF.

The USAF is scheduled to buy 179 of the KC-46 tankers of which over 40 have been delivered with a mired of issues too numerous to mention here.

But the elephant in the room is the ability to refuel aircraft.

The USAF needs to stop the bleeding and buy the Airbus tanker which is operational with many of our NATO partners and is being built in Mobile, Ala.

Terminate the team that came up with the Remote Vision System for refueling aircraft in-flight. They failed miserably and cost the USAF something it can ill afford right now, tanker support.

What's the USAF term for this, lack of confidence in a leadership role?

What's it going to take, a lightning strike that disables the camera system and a missed refueling of an important mission for the AMC leadership to see this tanker isn't working?

The AMC commander has had this problem long enough. Get it fixed, our troops deserve better.

Col. Clyde Romero,
USAF (Ret.)
Marietta, Ga.

If Boeing is serious about any future tanker business it should:

1) Grab the drawings for the KC-46.

2) Pull the next KC-46 airframe on the assembly line.

3) Figure out where to put a pod for two-plus boom operators in the aft bottom with a panoramic window (boom plus instructor—minimum).

4)ADMIT THE TV CAMERA SYSTEM DOESN'T WORK.

5) Take the old boom and new one and make the new one work like the old one.

6) Refit the produced KC-46s free of charge to the new B standard.

Then offer more KC-46Bs to the Air Force.

Charles McCormack
Danville, Calif.

Definitely Uncomfortable

Perhaps it's high time USAF refocused on war fighting capabilities ["More Uncomfortable Conversations," November 2021, p. 35]. I'm really getting tired of hearing about the latest community health assistance efforts, not to mention the latest failure to evoke a spirit of real warfighter mentality in all our young people—enlisted and officer alike. Get it going or get left behind, people!

Lt. Col. Harvey Lyter,
USAF (Ret.)
Meridian, Idaho

Our penchant for fairness is running amok. This is lately expressed in the form of proposals to draft women. A much better idea would be to abolish the draft completely. If the government can take over the life of a person who has committed no crime, this is akin to slavery. The United States should

WRITE TO US

Do you have a comment about a current article in the magazine? Write to "Letters," *Air Force Magazine*, 1501 Langston Blvd, Arlington, VA 22209-1198 or email us at letters@afa.org. Letters should be concise and timely. We cannot acknowledge receipt of letters. We reserve the right to condense letters. Letters without name and city/base and state are not acceptable. Photographs cannot be used or returned.

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Contacts

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not enter any war that its citizens are unwilling to fight. If we did not have the draft during the Vietnam War, it would likely have ended much earlier and thousands of American lives would have been spared. Let's make sure that we have no more unpopular wars and, at the same time, ensure that we do not enslave American citizens—men or women.

Col. Roy Miller,
USAF (Ret.)
Phoenix

I'm now convinced the Air Force (and other services) are more focused on being woke than ensuring the services are ready to protect this country. I'm not sure why this article is titled as it is—"Uncomfortable Conversations"—as these issues have been around for more than 50 years. In my opinion, it is not until the last sentence of the article that what is most important is stated (... recruiting and training the best possible warfighters is a losing proposition), but the hard words are never said. We'll get to that.

It's not like these issues haven't existed for a while. Broad statements inflame instead of inform. Underrepresentation in career fields. Pilots—the least diverse—may have a perfectly good explanation. The last part of the pushback section had the answer—if one looks at qualifications for the field vs. diversity.

Are warfighting services looking for equal representation of race, color, gender, or whatever in our services, or the most qualified individual to perform the mission? I vote for most qualified. Brig. Gen. [Shawn] Campbell said, "Diverse teams outperform homogenous ones," alluding to one thing, but not saying it.

Diversity is never defined in the article, and neither is "where we want to be." Do we want the most qualified pilots or someone to sit in the seat? Do we want warfighters or bodies to fill a slot? Do we want our services to be equally represented by society or be individuals that are the best qualified to do the job and have the desire to do the job? Do the services want quotas? Please, general officers, tell us what you want.

Who do you want leading a wing? The individual who knows operations inside out, or an individual who knows supply? I'll take the operations individual. Not saying the supply type isn't good, but a good operations type has a pretty good idea of what supply is about. When I was a lieutenant, I was told by a master sergeant to find myself a chief or senior master sergeant in each of the various organizations that made up the wing and get educated on what their organizations do in the mission—some of the best advice I ever received. Maybe there's a reason for the promotion rates in operations. I'd sure like to know what "a lack of diversity there has a disproportionate impact" means *in context.* Air Force flying is operations. Support helps the Air Force do its job. Without the airplane, there's no reason for the maintenance, supply, logistics, etc. Yeah, I've heard it before, without the other sections, the airplane doesn't fly. Let's get the cart and the horse in the right position before you joust that dragon.

So, Gen. [Sami D.] Said, how are you going to force the population to want to join the services so that the services are more reflective of the population? Society may not agree with an organization's expectations. If the services are to be reflective of society, let's put the blame where it might belong—the leaders, the generals.

I've been through Social Actions training and Green Dot, Red Dot training because they were mandated but, in my opinion, did little to address the "uncomfortable talk" issues. In fact, when one is told they're the problem because of the color of their skin, their gender, or where they come from, it makes the issue worse and solves nothing. Perception is reality and lots of people don't like to be told their perception is incorrect and won't listen to someone trying to educate them to help alter that perception. Don't you dislike that? If topics are "just uncomfortable to talk about", maybe commanders should have addressed them more vigorously.

Let me get this straight: I want an individual to go to pilot training. My candidates are one that has no experience but has the qualifications, and one that has 500 hours of pilot time and all the qualifications. Note, financial means has no place in this selection. Which do I pick? Or, let's look at that football coach looking for players. He's got candidates—one has played football since junior high school and was the Heisman Trophy winner, and one who played football in high school but not college. Which one does he pick? Bad idea to not look at prior experience.

We, the armed forces, have one mission, FIGHT and WIN. It has been said that war is politics by another name. I wonder if David thought that when he faced Goliath?

Col. B. E. Foster,
USAF (Ret.)
Fayetteville, Ark.

The Chief of Staff said the pilot selection process is being tweaked to reduce the value, for example, of prior flight

training. That will reduce the advantage wielded by someone with the financial means to afford private flying lessons.

This is an absurdity. First, a pilot training candidate with such training is much more likely to succeed in Air Force pilot training than most others, and is more likely to achieve mission-ready status sooner than others. I am sure there are many cases where such an individual worked a second job to cover his or her flying lessons.

This "political correctness" is all too common these days.

Col. Frederic H. Smith,
USAF (Ret.)
Peachtree City, Ga.

I hesitate to write this letter because I know our Air Force senior leadership, and this supporting magazine, are under extreme political pressure to "do something" about the imbalances of racial minorities in career fields and leadership positions. However, as a very senior former Air Force pilot, the words of General Brown that the pilot selection process is being tweaked to reduce the selection value of prior flight training got my attention as a policy change very poorly thought out. Many, if not most, of these candidates paid for their private pilot training through years of working summer and after school jobs. This is not white privilege. They are focused individuals dedicated to becoming the very best pilots possible and that path is open to anyone who wants to make the effort.

We had two candidates in my class with prior flight time (not including the ROTC Private License Program). They did very well, finishing in the top of the class. These are the pilots we absolutely need in our Air Force.

Unfortunately, what appears to be happening today is a return to the quota system across the board. This tells me that the decision has been made that we will be OK with being "good enough" as long as the "data" are good … instead of constantly striving to be the very "best." We can be assured China and Russia are looking for their very best.

Col. Mike Sexton,
USAF (Ret.)
Albuquerque, N.M.

I believe it's time for our Air Force and Pentagon leaders to have an uncomfortable conversation among themselves about the fact that their obsession with instituting the woke politics in our military has caused them to take their eyes off the "ball," namely, China and Russia, to the detriment of our national security and national objectives. Their preoccupation with the politics of diversity and inclusion and white rage is the reason we had the"very close to" a Sputnik moment, as characterized by Gen. [Mark A.] Milley, of the Chinese testing of a hypersonic missile.

The Air Force for years has always worked admirably at improving the human relations environment. The environment in the Air Force is not as bad as our leadership portrays it to be. However, countries like China and Russia will interpret these signals by our leadership as dissension in the ranks and continue to press the limits such as Russia's unfettered massing of its troops along the Ukraine border. We need to stop berating and brainwashing our troops by saying how bad they are and instead focus on what unites us in a common cause, and that is the defense of our country and the liberties and freedoms many have sacrificed their lives for.

SMsgt. Bob Mienscow Jr.,
USAF (Ret.)
Woodstock, Ga.

The No. 1 student in my UPT class was an Embry-Riddle University graduate with several hundred hours of flying time when he arrived at Webb Air Force Base, Texas. That guy lived and breathed flying and airplanes. He made a fine Air Force pilot. He was the right man for the job.

If we go to war, I sure hope we have a person that loves their job flying our aircraft. If you like your work, you usually excel at it.

Let's not let political correctness cause us to lose an air war.

E.D. Shaw III
Monroe, Calif.

The article brought to mind Gen. [William P.] McBride's "Listening Program" at Air Force Logistics Command (AFLC) in about 1974. He formed a team of military and civilian representatives from the various directorates, and armed us with "lead-in questions" related to a full range of life at the AFLC bases.

We went to each base where we met with several different small groups of civilian and military personnel, presented them with subjects for discussions—and listened. The results were summarized, provided, and briefed to staff at the headquarters, who proposed solutions in appropriate areas.

Subjects included civilians rating military and military rating civilians, traffic, and parking rules on base, discrimination problems, selection for upgrade training, and housing concerns, to name a few.

We operated under the Full Force concept, where the civilian input was important. For example, today Wright-Patterson Air Force Base, Ohio, has about 15,000 civilian and 1,700 military personnel.

When studying Air Force-related problems, do not forget our 171,000 civilians.

Lt. Col. Frank L. Powers,
USAF (Ret.)
Schertz, Texas

Designation Error

We hear the term, "Total Force," a great deal during our service careers. Our civilian population has little knowledge that when the military strength of the United States is projected in news reports it is seldom broken down to reflect the reality that more or less than half our forces are Reserve or National Guard. Since Desert Storm, those Reserve and National Guard forces have been deployed in an operation tempo that has made the difference between, USAF, Air Force Reserve, and Air National Guard almost seamless.

On p. 51 of the December issue ["Revamping Homeland Defense"] the accompanying caption identifying the two F-16s as Air Force F-16s. In one way, it could be a compliment that the Air Force considers those fighter pilots and jets as equal to the regular Air Force and that we have achieved "Total Force." As a component of the "Total Force," I feel that recognition should be given where it is due. To anyone familiar with tail markings, the two F-16s are clearly Colorado Air National Guard F-16s.

As a proud retired member of another marking on the tail, "Mile High Militia," I would just like to see my current members of the Colorado Air National Guard properly recognized as members of the "Total Force."

SMSgt. Mark Bashaw,
Colorado ANG (Ret.)
Greeley, Colo.

▪ *The F-16 description came directly from NORTHCOM, but you are correct—we should have caught the error.—THE EDITORS*

Leadership By Example

"I'm only holding myself accountable to the same standards I expect from the amazing Airmen and families that surround me. ... Mental health is simply health. There can be no stigma in my headquarters, command, or family. Warrior Heart is leadership. Warrior Heart is fine tuning mind, body, and craft to ensure individual and team readiness. It's a wingman and warfighting imperative necessary to win."

—Gen. Mike Minihan, AMC commander, Twitter post on his upcoming mental health appointment [Jan. 28].

Changing Space

"The private sector is technically and financially capable of developing and operating commercial low-Earth orbit destinations, with NASA's assistance. We look forward to sharing our lessons learned and operations experience with the private sector to help them develop safe, reliable, and cost-effective destinations in space."

—Director of Commercial Spaceflight at NASA, **Phil McAlister,** stating that the ISS will be crashed into Point Nemo—a South Pacific Oceanic Uninhabited Area—in 2031, after representing a continuous human presence in space since 2000 [Jan. 31].

United Front

"Russia and China stand against attempts by external forces to undermine security and stability in their common adjacent regions .... [The two nations] intend to counter interference by outside forces in the internal affairs of sovereign countries under any pretext, oppose color revolutions, and will increase cooperation."

—Joint Statement by China & Russia released after Russian President Vladimir Putin met Chinese President Xi JinPing in China on Feb. 4 at the start of the Winter Olympics.

Kremlin

"I understand that opinions can differ and that there can be misunderstandings and even traumatic elements. I know that many EU countries did not have the same experience in the 20th century as France did. We must not forget this experience. ... However, we cannot accept the collective risk of another confrontation between spheres of influence in Europe, another period of instability and unrest. This is creating new grievances and new threats. Starting a conflict is easy, but ending it and building a lasting peace is difficult."

—French President Macron following a meeting with Putin Feb 7-8.

Turn Back Time

"Call it 'the Putin Doctrine.' The core element of this doctrine is getting the West to treat Russia as if it were the Soviet Union, a power to be respected and feared, with special rights in its neighborhood and a voice in every serious international matter.

Russia Ministry of Defense

The doctrine holds that only a few states should have this kind of authority, along with complete sovereignty, and that others must bow to their wishes. It entails defending incumbent authoritarian regimes and undermining democracies. And the doctrine is tied together by Putin's overarching aim: reversing the consequences of the Soviet collapse, splitting the transatlantic alliance, and renegotiating the geographic settlement that ended the Cold War."

—Angela Stent, senior advisor to Georgetown University's Center for Eurasian, Russian, and East European Studies and former U.S. National Intelligence Officer for Russia and Eurasia in Foreign Affairs [Jan. 27].

Throwing Darts at the Map

Ding Zengyi/Xinhua via China Ministry of Defense

"Ten years ago, if we had this kind of disaster, nobody would be talking about geopolitics. Everybody would be talking about how we can help. Now, it shows just how contested the region is. In every conversation, we have to talk about geopolitics."

—Jonathan Pryke, director, Australia's Lowy Institute Pacific Islands Program, on his country's response to the recent catastrophic volcano eruption and combating Chinese influence in Tonga. The Washington Post, [Jan. 20].

Can't Keep Up

"We're struggling to be able to make our systems adaptable, and that's a problem internally and externally because adversaries—they're just moving fast, and we're not able to move internally. It's a problem because that means we've got these old systems that we can't upgrade."

—**Preston Dunlap,** chief architect, Department of the Air Force, in an interview on LinkedIn with the department's former chief software officer Nicolas M. Chaillan [Feb. 1].

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INNOVATING FOR FREEDOM

Fired Up for ACE

Gen. Jeffrey L. Harrigian commands both U.S. Air Forces in Europe and U.S. Air Forces Africa. His roles include leading Allied Air Command under NATO and director of the Joint Air Power Competence Centre in Germany. Air Force Magazine Pentagon Editor Abraham Mahshie interviewed Harrigian during the African Air Chiefs Symposium in Rwanda. Their conversation has been edited for length and clarity.

Abraham Mahshie/staff

Gen. Jeffrey Harrigian, U.S. Air Forces in Europe and Air Forces Africa commander, speaks to reporters during a press conference during the 2022 African Air Chiefs Symposium in Kigali, Rwanda, Jan. 27, 2022.

Q: How is U.S. Air Forces in Europe operationalizing the Agile Combat Employment concept?

A: Through 2021, we had several wing-level activities ... for us to work through the command and control at the operational level that would facilitate the necessary situational understanding—and then decision making—for anything that would require Agile Combat Employment. We have made tremendous progress. I'm very proud of our Airmen. And I will tell you, probably the best part about Agile Combat Employment is the empowerment piece for our Airmen. They are fired up to do this, and to me, that has been really the largest benefit that I'm seeing out of this. We're going to get the operational, the strategic capabilities built over time, but getting back to our roots of distributing decentralized execution, and then empowering our Airmen at the forward edge is the foundation of ACE, and that's what we're seeing happening.

Q: Have you declared initial operational capability for ACE yet? What would that mean, and how will that compare to full operational capability?

A: We have not yet declared IOC. With everything that's going on in the world right now, we've kind of been focused on those other activities. But I think from a commander's perspective, I'm very comfortable with where we're at. We're looking at what the right timing would be to declare IOC, and I have no doubt we'll do it in 22.

But it is, as you highlight just a point on the journey, so as we look at the full operational capability, we're still working through the specifics of what that definition actually is. The key challenge, really, will be the logistics piece of this. And for us, in Europe, that means working closely with our partners to make sure they understand what the concept is. Through the wings' activities, they've brought our partners, our allies into those discussions, and that's been really helpful. Now they're quite interested in [ACE], and trying to expand their understanding and work with us on that.

As we sort through the logistics, which is everything from weapons, to fuel, to access, spacing, we've now had those conversations [with our allies]. But we need to think our way through what FOC really would be before we can throw down what those specifics are and what that criteria is, and sort out how long it will take us to get there.

Q: You mentioned things going on in the world right now. Can you describe USAFE'S ability to quickly protect its forces and to defend NATO allies in the event of Russian aggression?

A: The work that's been occurring over the past couple of months to draw USAFE and AIRCOM [Allied Air Command] close together from the headquarters perspective has been tremendous. We have made huge progress. Because as you can imagine, right now, we've been doing a fair amount of planning. As USAFE staff works through options along the U.S. line and then the AIRCOM does it in the NATO sphere, we want to make sure there's a clear understanding of, not only what the scheme of maneuver would be, but importantly,

we've got the right people talking to each other so as the U.S. makes decisions it's aligned with where we're going in NATO. That's been really important.

As we think about our posture, you've seen we've been moving airplanes in support of NATO activities. That's been done internally, but we've been able to work that between USAFE and AIRCOM because the planners are talking to each other. And I'll take that a step further, it's not only the people, but we've sorted out a lot of the interoperability challenges we've had of sharing info from our classified systems to the NATO systems. I think some think it just happens, right, but that takes an awful lot of work. How do we come together to produce a single air tasking order? We figured that out. So there's some really specific activities that we've made progress on that ensure alignment between U.S. activities and NATO activities, because, as the Secretary General's talked about, as [Defense] Secretary [Lloyd J.] Austin has talked about, this is about making sure that we keep the Alliance strong and cohesive. And the U.S. being a member of NATO needs to play a very important role in fostering that attitude as we work together to manage any potential activity that could happen here in the near future.

Q: Do you have the air and space assets, and the people that you need? And if not, what shortages are you experiencing?

A: We've done our analysis of [what we will need] should the activities accelerate. We find ourselves with the requirement for more assets. We have worked through that. I don't really want to get into the details, but you can imagine if we find ourselves in a situation where there could be some increased activities, there probably will be some specific capabilities we'd want to get to.

The other part that's important is how we leverage our people internally to take a long view. In other words, you can sprint for a while, but at some point, we probably need to plus-up the number of people in our headquarters to make sure we can manage 24/7 ops for a period of time. And we're looking at how we do that with our NATO partners and make sure we've got the right presence in the right locations. That's really important to me, as the commander, to make sure that we've got the right liaison entities and the appropriate headquarters. We spend a lot of time talking about platforms, but the people part of it is also really important, particularly as it relates to the command and control requirements for something that would be a fairly challenging scenario.

Q: What is USAFE doing to make sure it can properly defend its bases in Europe?

A: We continue to refine the inner workings of the software capabilities and the sensors that are feeding those systems. We've been fortunate that we've been able to get some cross-domain solutions. We've focused largely on the bottom-up approach of taking the sensors that are available to us and feeding them into a system that allows us to provide shared understanding of the situation, so that decisions can be made more quickly. I think, importantly, what we are trying to march to is how do we help build an architecture that takes the data and then doesn't require a myriad of people to make the decision, but refines it in a way that says, 'Hey, a specific target is here. Here's what it recommends you do.' And I'm oversimplifying it a little bit, but then as this hits another range, here's the next step. That's the kind of matrix we're working through from a software perspective, to advance our capabilities, and we're sharing this with big Air Force. I think there'll be a broader discussion at the Air Force level on where we go.

Q: You're referencing the Ramstein Air Defense Systems Integration Laboratory in Germany, but how do you expand that elsewhere in the theater?

A: In the near future, we're going to have the RADSIL at a place where we're going to start to take the brains of the system and move it. We're working through whether we go to Spangdahlem [Air Base, Germany], or down to Aviano [Air Base, Italy] next. We haven't decided for sure yet, but Aviano will be part of this. And again, as we think about the relationships with our allies, because we are relying on them as we think about the sensors that are available, the goal is to use that collective defense of all of us as we're focused initially on the base. We see a lot of potential with this, the brain, if you will, to be able to leverage that. And we'll see how big Air Force responds as we think about how we take this capability and grow it. We're always constrained on resources, and if you think about some of the peer fight potentialities that could happen, defending our bases is going to be an important part of how we execute our mission.

Q: Is there sufficient airspace and air training opportunities in the European theater?

A: We have made a huge amount of progress as we prepared to bring our F-35s in. As you know, we've got the 495th [Fighter Squadron] up at [RAF] Lakenheath, U.K., with four jets now. And so in preparation for that, we did a whole bunch of work with the RAF in the U.K. to refine our airspace and work closely with them to ensure that the training airspace would be appropriate for both our F-35s and their F-35s. Then the Dutch, the Norwegians, and their F-35s, that airspace to the north has really got us in a good space. As you look to the south, I was just in Italy, and we're working closely with them. The wintertime can be a little challenging here, but they afford us an opportunity to go back and look at how do you have the right distances to fly in altitudes. And then you've got to think your way through emitters and those kinds of things, which the Italians are doing, and I see some potential there.

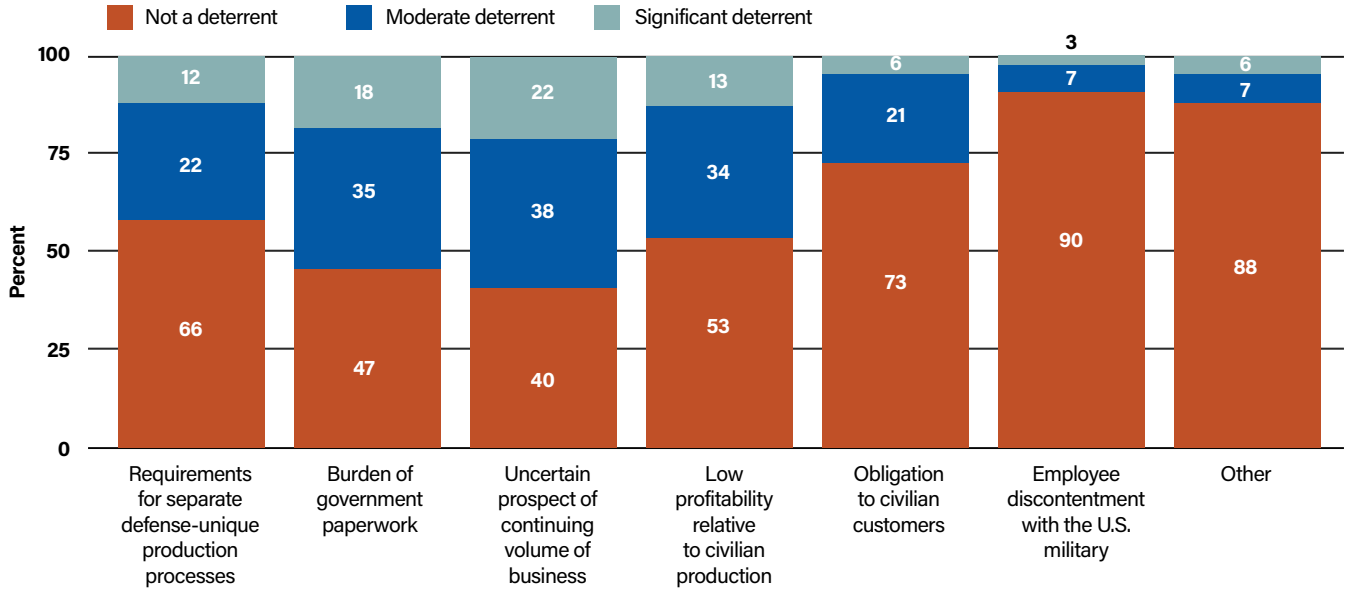
We've got work to do, but we're going to work closely with our allies and see how we do that so as to be able to ensure that we have those options here in Europe. And while we'll still go back to the states for Red Flag and Green Flag, we really want to be able to incorporate our F-35s and fourth-gen capabilities with our partners here in theater, because that really drives home the interoperability requirements. And, frankly, the trust and confidence between the different squadrons to be able to work together. So, I think we're in a good place.

It's also important to recognize that as we bring on fifth-gen, we have to have the simulator capability, the virtual capability, to train at the very high-end. There's some things you just can't do out on the range with these fifth-gen airplanes, so we're working very hard to ensure that we can connect in the simulators with our F 35s, with the U.K., and then with all our F-35 partners, so that we can train together in the virtual environment. Because to me that is fundamental to our long-term success, as we think about interoperability and recognizing that if something happens here, we're going to be in it together. We don't want to have to figure it out on Day One. Let's go work through it, and if we can, do this virtually, where Norwegians are flying out of their simulators, and the Dutch, us, the Italians. It's powerful, and that's the path we're on, and we're going to figure that out. ✪

By John A. Tirpak

Why Some Businesses Shy Away from Defense

The National Defense Industrial Association surveyed 400 companies to better understand the current business climate. More than one in three cited regulatory burdens, uncertain orders, and low profit as the primary deterrents to seeking more government work.



Source: NDIA

Government is Failing the Industrial Base

The COVID-19 pandemic imposed supply chain and labor shortages on the defense industrial base, earning the current business climate a failing grade from the National Defense Industrial Association (NDIA) in its third annual report on the health and readiness of the defense industry.

NDIA scored the business environment as 69 on a 100-point scale, citing COVID, cyber espionage, and Congress' inability to pass timely defense budgets as key factors in its "Vital Signs" report. Developed in cooperation with the federal spending data firm Govini, the latest report represented a decline from a "C" in 2020, and NDIA suggested scores could get worse before they get better.

Vital Signs is based on a survey of 400 businesses that work in the defense sector, both large and small. It examines their experiences on workforce availability, intellectual property rights, the speed of obtaining security clearances, workplace productivity, regulatory burdens, public opinion, and profitability, among other factors.

NDIA President and Chief Executive Officer Gen. (Ret.) Herbert J. "Hawk" Carlisle said the survey offers a "sobering" indicator that dangerous military shortages could loom without greater attention from Congress and the Pentagon.

"We can't admire the problem anymore," Carlisle said. The pandemic has had a "moderate or large negative" impact on business, according to 71 percent of respondents, and they expect that to be a lasting effect; only 14 percent said they don't expect their business to return to pre-pandemic norms.

"We expect scores to be further impacted next year as supply chain disruptions and inflation rise as concerns with the continued follow-on effects of the pandemic," the report said.

NDIA offered no recommendations or legislative prescriptions. Wes Haulman, NDIA's senior vice president of strategy, said the unique value of Vital Signs is that it is the only comprehensive and unclassified assessment of the defense industry's health.

A huge drop—36 points—was recorded in the "cash conversion cycle," which illustrates how quickly companies "regain a dollar invested in product inventory as cash receipts," the NDIA said. Longer cycle times indicate that companies "face greater difficulty in relying on sales for the liquidity necessary to fund critical operations." There were also inventory problems—an eight-point decline from a score of 75 last year—and only 12 percent of respondents said they expected supplier networks would be more reliable in 2022.

Haulman said that a possible "silver lining" of the pandemic is that it's highlighted underlying supply chain issues, such as the availability of computer chips and reliance on overseas suppliers. He added, NDIA now has a "company by company" visibility into supply chain problems. Inflation pushed indices lower on supply, broadly.

Competition remains under threat, the report shows, with"30 percent of respondents ... [reporting] that they were the sole eligible provider of a product" for the Defense Department. "This is a risk to innovation," NDIA noted, citing "an overreliance on a smaller pool of entrants [that] may create production or innovation shortages in the future."

This dwindling supply base, Haulman said, creates "more and more fragile networks."

Govini CEO Tara Murphy Dogherty said government must make working for the Pentagon more attractive to small, innovative businesses. Perhaps the most troubling vital sign was industrial security, according to NDIA, citing a grade of just 20 out of 100.

Cybersecurity vulnerabilities "continue to rise at a very high rate," NDIA said, describing "steadily declining" new intellectual property investigations by the FBI and an uptick in "newly reported common IT cybersecurity vulnerabilities." Industrial security faces "escalating risk" in the future, it said.

Of the companies surveyed, 78 percent said that the availability of skilled labor was a "moderate or significant problem." The report said the industry's "output gap," a proxy indicator for the ability to surge defense production, plunged in 2021, falling from a score of 48 to 20.

The impact of COVID "continues to reinforce" the need for surge capacity, the NDIA said, noting that "surge readiness" scores fell to 52 from 67 in a year.

The slow pace of security clearances also continues to hinder business. Nearly two in three respondents called this a moderate or significant problem, even as they reported a somewhat quicker speed of clearing workers. Companies face similar difficulty finding workers with clearances, trade skills, or STEM—science, technology, engineering, math—degrees.

In its "political and regulatory" section, the report compared the number of hearings and examples of congressional interest from year to year, showing growth in attention to artificial intelligence, microelectronics, and biotechnology, but a decline in interest in hypersonics, space, directed energy, autonomy, and other key fields since 2019. The NDIA cautioned that, due to its reliance on unclassified data, the reality may be a little bit different than the numbers suggest.

"Evidence points toward a significant drive for technological innovation by members of Congress," the report noted. "For example, the creation of a Congressional Hypersonics Caucus is a strong indication of continuing interest in that area, despite a drop in hearings."

Carlisle cited the damage and disruption of continuing resolutions (CR) to fund defense, mentioning delays to new starts and uncertainty as undermining orders for long-lead-time materials and supplies.

Haulman added that Senate delays in confirming nominations also puts a drag on the Pentagon. Nominees "need to set a strategic vision and they need to carry [it] out," but many nominations languish, he said.

"Without having those folks there, we lose something we can never get back, and that is time," Haulman said. "We harp on the fact that time wasted is time that we actually cede to our competitors."

China and Russia do not have to operate under a CR, which only exacerbates the uncertainty of doing business with the government.

"We need to leverage the creativity" of the civilian economy, he said, and CRs discourage companies "to make those investments ... or jump into this sector," Haulman said.

Mark Lewis, head of NDIA's Emerging Technologies Institute and the former Pentagon deputy undersecretary of defense for research and engineering, said declining government investment in basic research is also troubling. NDIA reported that "between 2011 and 2016, U.S. government funding for R&D projects fell by 12 percent in absolute terms." By contrast, Russia increased R&D investment by 13 percent and China by 56 percent over the same period. The score for corporate R&D investment also declined by two points since 2019. Healthy investment by both industry and government in basic R&D is "crucial" to innovation, the NDIA stated.

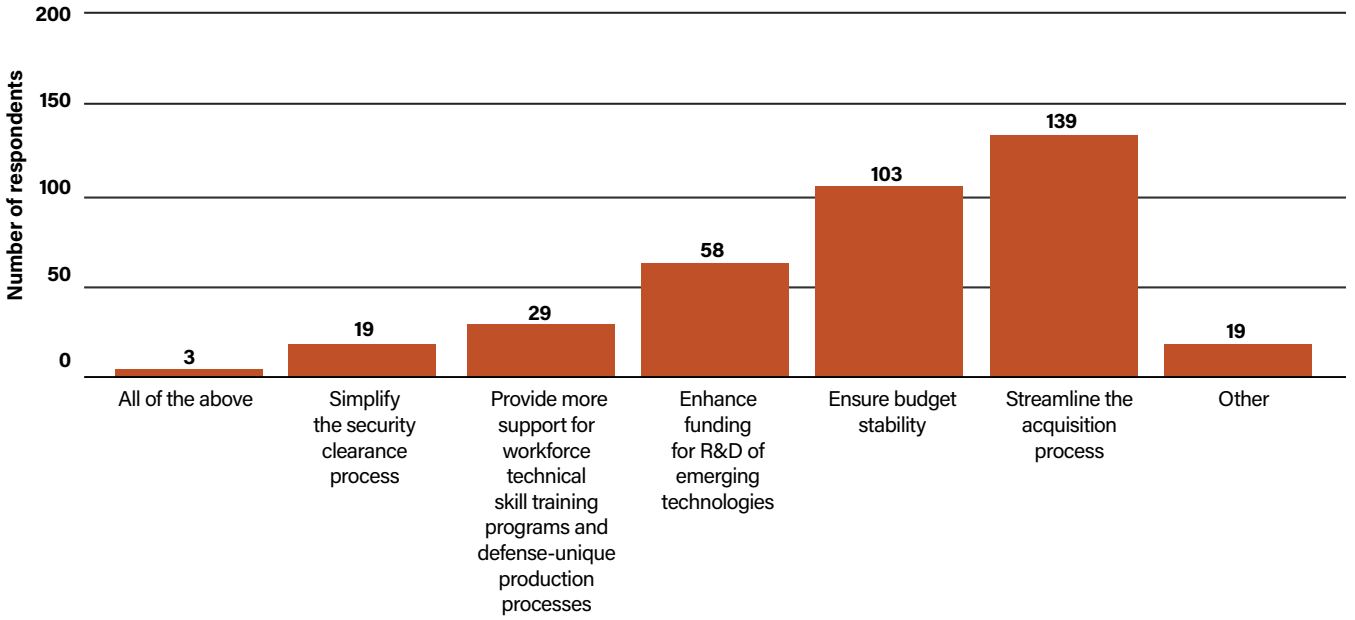
NDAA said raw materials supplies, particularly for rare earth elements sourced from overseas, remains a problem, but companies seem less concerned than in prior years.

Nick Jones, NDIA regulatory policy director said the U.S only has about 32 percent of global rare earths mine production, so "it's definitely an area of concern," but the industry perceives improvement, with the Vital Signs score rising from 10 to 39 in the past two years. Concern over rare earths prices also improved slightly, from 75 two years ago to 83 today.

The economic disruptions of 2021 indicated how crucial it is to keep Congress focused on the health of the defense industrial base, Carlisle wrote in the report. It is a reminder that: "Our industry's work ... can never be taken for granted." ✪

Pass a Budget and Cut the Red Tape

Defense contractors see many ways to improve the business environment, but two factors stood out in a survey of 400 companies by the National Defense Industrial Association: budget stability and streamlined acquisition.



Source: NDIA

From Warning to Tracking: Defending America Against Hypersonic Missile Attacks

From Warning to Tracking: Defending America Against Hypersonic Missile Attacks

China's August launch of a nuclear-capable hypersonic missile that circumnavigated the globe before reentry demonstrates the need for innovative solutions to spotting and tracking such threats. Unlike conventional intercontinental ballistic missiles, which follow a predictable ballistic arc, China's hypersonic glide vehicle circled the world at low-Earth orbit, a path current missile warning systems cannot easily track.

Millennium Space Systems, a subsidiary of The Boeing Company, sees this challenge in line with the U.S. Space Force's Track Custody Prototype program.

"The threats are getting more advanced, so that's why the Space Force pivoted to this Track Custody Prototype contract," said Jason Kim, CEO of Millennium Space Systems.

Today's Space-Based Infrared System (SIBRS) satellites fly in geosynchronous orbit (GEO) some 22,236 miles above the Earth, using infrared sensors to detect heat from the missile plumes of ICBM boosters during launch.

"[SBIRS] was developed as a missile warning system for the traditional ballistic threat," said Dr. Kevin Paxton, Senior Technical Fellow at The Boeing Company. "Now that hyperglide vehicles can be deployed to change an ICBM's direction, we must transition to a missile tracking architecture that uses a more proliferated network of satellite constellations to contain its entire trajectory."

To meet this goal, Millennium Space Systems proposed a satellite constellation that is flexible across orbits, including medium-Earth orbit (MEO) and low-Earth orbit (LEO).

But flying at MEO—between 1,243 and 22,236 miles above Earth—and LEO—altitudes up to 1,243 miles—has its own unique challenges.

"At GEO, the satellite is going around the Earth at the same rate that the Earth is turning, so the satellite sees exactly the same place on Earth all the time," Paxton said. "As you move to these lower altitudes, however, the satellite is actually going faster than the Earth's rotation, so there is relative motion between the satellite and the places on the Earth you're trying to watch."

That relative motion is like the blur experienced when looking out the side windows of a moving car.

"We have to suppress that relative motion," Paxton said. "Using a car analogy, if you look through the window and focus on a tree as it goes by, you can see the tree crisply because your eyes are tracking that spot—called 'back-scanning.' We can do the same thing on a satellite."

Each orbit also comes with its own distinct advantages and disadvantages.

"At GEO, you can cover the entire Earth with fewer satellites—but if it's a dim target, you might not see it," Paxton explained. "At LEO, you can identify a dim target, but the target may move outside of your field of vision, so you need a lot of satellites to cover the Earth. MEO strikes a balance in between, where you can track dimmer targets with fewer satellites."

Therefore, Millennium Space Systems sees a unique opportunity in using satellites across multiple orbits.

"It requires a layered, robust architecture and not just a single orbit of systems," Kim said. "So we're developing commonality across our spacecraft and payload designs to have economies of scale across all those orbits."

Millennium is applying the latest design and engineering technologies to ensure its design and manufacturing process is as efficient and proven as possible before launch.

"We're implementing digital and model-based systems engineering upfront to manufacture and deliver these large constellations on faster schedules," Kim said. "Then once launched, we can operate those systems with more autonomy and onboard processing, which speeds up the timeline from sensing to shooting."

This digital design process follows Phase 1 of the Track Custody Prototype program, in which various approaches were considered. The Space Force then awarded Millennium Space Systems a Phase 2 contract, beginning an 18-month Payload Critical Design Review of their mission architecture.

"This program enables Space Systems Command to 'try before you buy,'" Kim said, referring to Chief of Space Operations Gen. John "Jay" Raymond's preference for greater assurance before committing vast resources to a project.

If the design review is successful, the Space Force can pursue Phase 3 of building and hosting the technology on a bus for flight-tests and demonstrations in space.

"We're well-positioned to meet the ultimate delivery timelines of 2025 on our Track Custody Prototype contract and can accelerate the schedule with the appropriate funding and resources," Kim said. "We look forward to seeing progress on fielding systems for the Track Custody Prototype program that will address these advanced threats."

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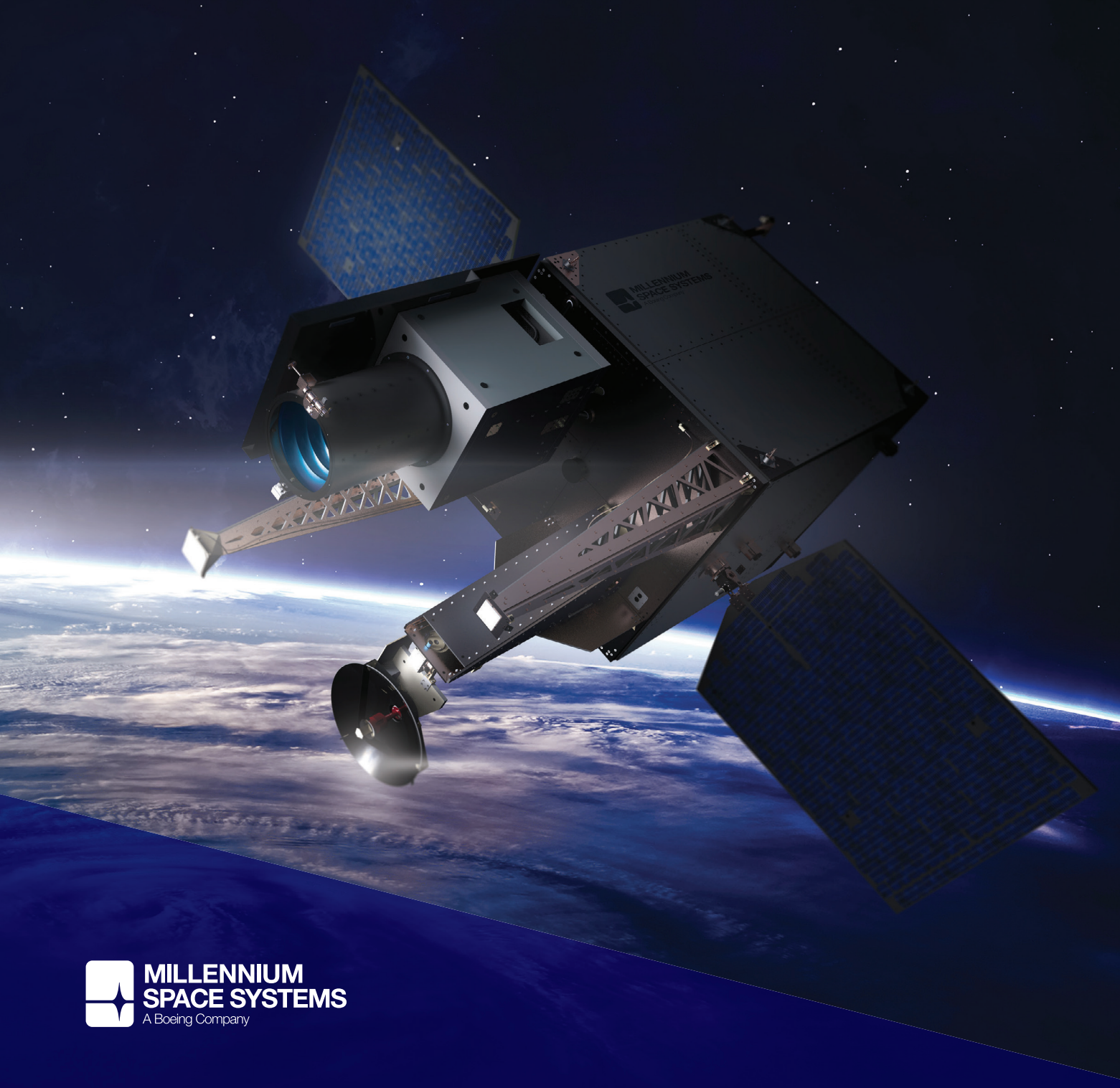

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The Air Force Thunderbirds Demonstration Team opened their 2022 season in January at Spaceport America, N.M., located near White Sands Missile Range. It is the world's first purpose-built commercial spaceport. The Thunderbirds revamped their show in the past year in preparation for 2022's ongoing celebration of the Air Force's 75th anniversary coming up Sept. 18.

Tech. Sgt. Nicolas Myers

Tech. Sgt. Justin St. Thomas inspects the liner of an F-16 jet engine for damage at Morris Air National Guard Base in Tucson, Ariz. The single engine F-16 is powered by either a GE Aviation or Pratt & Whitney engine, variations of GE's F110 or Pratt's F100. All but one variant deliver 29,000 pounds of thrust.

Senior Master Sgt. Charles Givens/ANG

A 229-foot-tall SpaceX Falcon 9 rocket carried 49 Starlink satellites into orbit on Jan. 6, the first in a series of January launches supported by Space Launch Delta 45 at Cape Canaveral Space Force Station, Fla. Five more Falcon 9s launched over the next month. SpaceX's Starlink constellation now includes nearly 2,100 satellites of a planned constellation of about 4,400 communications spacecraft orbiting about 210 miles above the Earth.

SpaceX/courtesy

Senior Airman Thomas Karol

Airmen load supplies onto a C-130J Super Hercules aircraft at Ramstein Air Base, Germany, on Feb. 4. U.S. Air Forces in Europe-Air Forces Africa forces strategically positioned to rapidly surge forces into and across the theater.

Russia Tests NATO's Resolve Over Ukraine

By Abraham Mahshie

Russia's steady buildup of troops on the Eastern border of Ukraine reached an estimated 130,000 troops in early February as the long-awaited freeze took hold, making a mechanized land invasion possible. With diplomatic efforts intensifying, the United States prepared 8,500 troops to deploy to Europe and NATO forces began to move to NATO members' borders with Ukraine, reinforcing the alliance's eastern flank.

Russian President Vladimir Putin said his forces are merely conducting military exercises on their own turf and blamed the crisis on the West and NATO's open-door policy for continued expansion. Ukraine is not a NATO member, and one of Putin's objectives is to ensure it never becomes one. He wants Ukraine to fall under his influence, as does Belarus, which borders both countries. Both nations were joined with Russia in the Soviet Union until it collapsed in 1991.

"Russia and Belarus have achieved an incredible level of integration and support toward each other to execute any sort of action they would wish," one Lithuanian defense official told Air Force Magazine. "There is no direct threat against either Lithuania or NATO in this perspective. However, [putting] Russian troops in Belarus decreases the window of indications and warnings and that's what worries us."

President Joe Biden increased U.S. pressure, growing more specific about sanctions, putting U.S. forces on alert, and authorizing troop movements. The Pentagon will deploy members of the 82nd Airborne to Poland to establish checkpoints, tent camps, and temporary facilities to house Americans fleeing Ukraine if an invasion occurs.

Biden also convinced German Chancellor Olaf Scholz to stand with him as he warned that if Russian tanks or troops cross the border into Ukraine, the Nord Stream 2 pipeline intended to deliver Russian natural gas to German industry and power plants will not go forward. Meanwhile, French President Emmanuele Macron headed east, visiting first with Putin and then with Ukraine's President Volodymyr Zelensky. These followed bilateral U.S.-Russia Strategic Stability Dialogue in Geneva, a NATO-Russia Council meeting in Brussels, and meetings between the Organization for Security and Cooperation in Europe (OSCE) and Russian diplomats in Vienna.

Putin stoked the fear of conflict throughout. A Romanian defense official described "worrying" Russian naval activity in the Black Sea, which could signal a potential move on Odessa, Ukraine's most important port since Russia seized and annexed the Crimean Peninsula in 2014. "Despite all the engagement at a political level," the Romanian official said, "we are still seeing that forces are coming and not only combat but ... also logistics and command and control" units.

"The worst-case scenario for us is for them to actually erase Ukraine from the Black Sea," the official added. "After that, we'll have a common border with Russia—not only us, but NATO will have a new common border with Russia."

The United States demonstrated its own capacity for power projection, conducting refueling operations with Finland—a NATO partner that shares a border with Russian—in late January. The first U.S. F-35s based in Europe arrived at Lakenheath, U.K., in January, providing both stealth and the F-35's unique sensor suite to the European Command. While no U.S. bomber task force transited the region since November, the Air Force completed an air policing mission in Estonia and the Netherlands sent two F-35s to Bulgaria, while Denmark sent additional F-16s to Lithuania to enhance air policing in the Baltics.

United States Air Forces in Europe Commander Gen. Jef-

frey L. Harrigian said planning and movement of assets is well underway to defend NATO allies in the event of Russian aggression.

"We've been moving airplanes in support of NATO activities," he said in late January. "We've been able to work that between USAFE and AIRCOM because the planners are talking to each other," Harrigian said of NATO Allied Air Command and USAFE, co-located at Ramstein Air Base, Germany. "It's not only been the people, but we've sorted out a lot of the interoperability challenges we've had of sharing info from our classified systems on U.S. to the NATO systems."

LOOKING FOR CRACKS IN NATO

Prior to Scholz' U.S. visit, Germany had been NATO's most reluctant partner. Under a new coalition government, and dependent on Russian energy supplies, Germany contributed no offensive weapons to support Ukraine, declined to permit German-made weapons to be sent from NATO allies, and refused to allow aircraft carrying arms to Ukraine to overfly its territory. It limited its aid to helmets and medical supplies.

A Jan. 19 British flight delivering Swedish NLAWs, or Main Battle Tank and Light Anti-tank Weapons, had to avoid flying over German air space and U.S. troop movements were delayed as well.

The United Kingdom offered to double its Enhanced Forward Presence (EFP) troops in Estonia, and Canada was considering an increase in Latvia. Germany, after Scholz U.S. visit, was said to be considering increasing its NATO EFP troops in the Baltic state of Lithuania.

Macron, whose nation led the four-nation Normandy Format designed to resolve the war in the Donbas of eastern Ukraine, visited Moscow and Kyiv Feb. 7-8 seeking a diplomatic solution. France offered to send a NATO battle group to the Black Sea state of Romania, but Putin's courting of Hungary and Turkey—and Germany's hesitance—left the future of that mission unclear. Putin met with Hungarian Prime Minister Vicktor Orban Feb. 1 ahead of that country's April elections, promising 15 years of preferential gas prices at 20 percent of the going rate in Europe as a means of steering Hungary to his side. Soon after, Hungary blocked Ukraine's participation as a partner to the NATO Center of Excellence for Cyber in Tallinn. Russian cyber attacks on Ukraine increased in January.

RUSSIA READY, UKRAINE WAITS

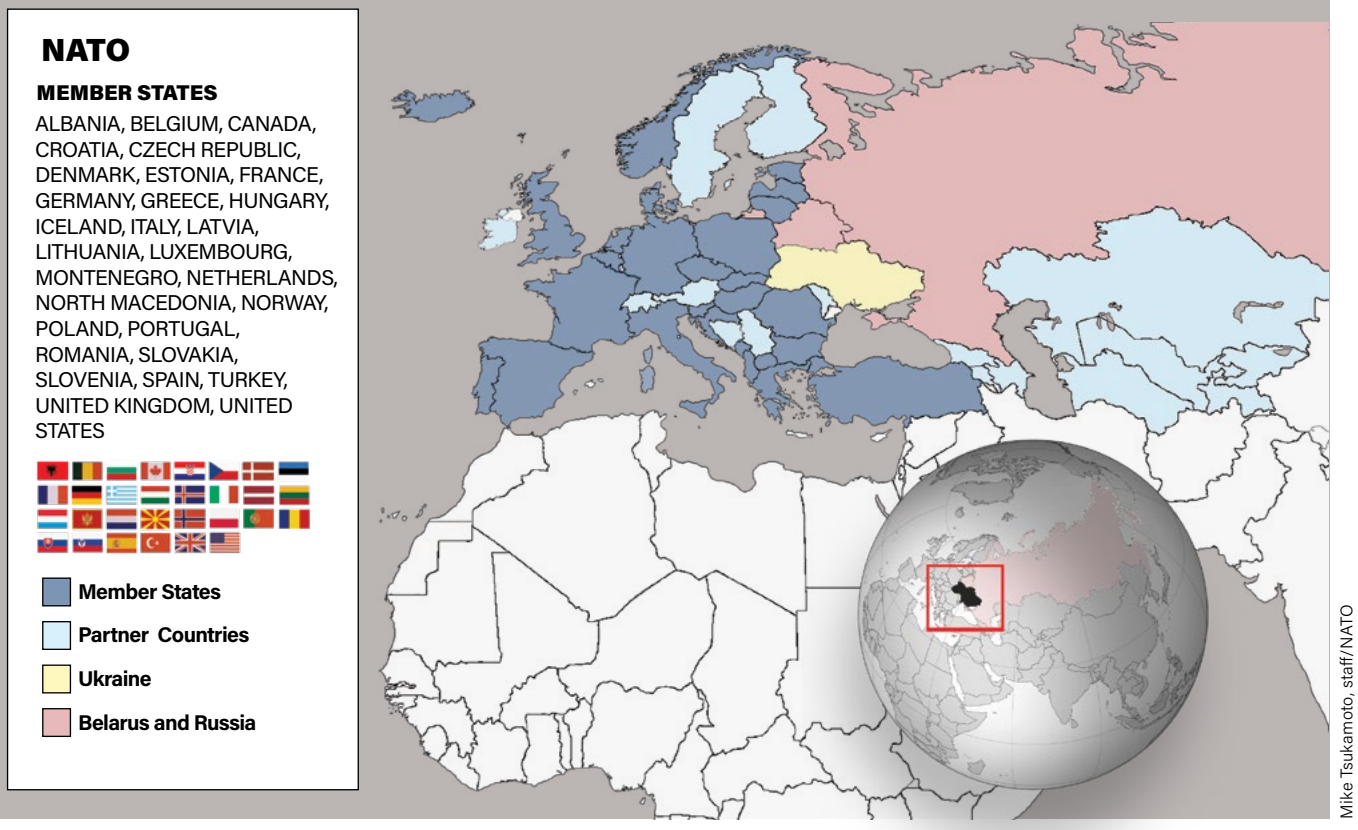
Russian troops in Belarus have come with combat, logistics, and command-and-control capabilities for joint exercises Feb. 10 to 20, which could be a prelude to invasion. Integration of the two militaries is robust and the Baltic States fear a permanent Russian presence on their southern border. The Baltic States and Poland have recently received U.S. third party transfer licenses to convey American military hardware systems they own to Ukraine, including Javelin anti-tank, short-range air defense Stingers and other items.

Eight American Boeing 747s have already arrived in Ukraine filled with additional defense assistance, including Javelin anti-tank weapons. While Ukraine awaits air defense capabilities and other specialized legal assistance from partners, ammunition is arriving, a Ukrainian defense official told Air Force Magazine. But Putin's preparations mean the additional assistance, and in some cases integration and training, may not happen fast enough.

"He needs only to say go," the official said. ✪

NATO Worries Russia

NATO's 29 members and 18 Partners show the extent of Russia's isolation and Europe's eastern edge.



Mike Tsukamoto, staff/NATO

The COVID-19 pandemic put even more stress on USAF's IT systems as more Airmen worked remotely.

Airman 1st Class Alison Stewart

'Fix My Computer'

By Shaun Waterman and Greg Hadley

A cry of frustration in social media struck a chord with Airmen, Guardians, and even Air Force Secretary Frank Kendall and the service's chief information officer.

"You tell us to 'accelerate change or lose,' then fix our computers," demanded Michael Kanaan, the director of operations for the Air Force's Artificial Intelligence Accelerator at MIT, in a widely shared LinkedIn post that referenced the service leadership's demand for digital transformation.

Although Kanaan is an Air Force employee, his "open letter" is addressed to the Department of Defense and addresses complaints that are widespread across the services, as evidenced by the more than 1,700 reactions to his post. "Before buying another plane, tank, or ship, fix our computers," Kanaan continued. "Yesterday, I spent an hour waiting just to log-on. Fix our computers."

A litany of complaints followed, mostly centered on the sloth-like slowness of DOD IT. "I wrote an email the other day that took over an hour to send. … I opened an Excel file today, my computer froze and needed to be restarted. … I turned on my computer and it sat at 100 [percent] CPU usage." Each barrage ending with the same invocation: "Fix our computers."

At a virtual Coffee Talk event Jan. 27, Kendall was asked for his thoughts on Kanaan's letter.

"I haven't seen as extreme conditions as were described in … [that] list," Kendall said. "We're certainly working those problems. And, as I mentioned earlier, giving our people the tools they need to do their jobs—in many cases, that's their IT tools, so things that they use every day at their desks. So, we've got to get better."

Fellow DOD employees echoed Kanaan's observation that the Pentagon has lost *"hundreds of thousands"* of employee hours last year because computers don't work."

The Air Force's Chief Information Officer Lauren Barrett Knausenberger acknowledged the issues in a written response to the post.

"Oh man," wrote Knausenberger, "I echo your open plea to fund IT. It's the foundation of our competitive advantage and also ensures every single person can maximize their time on mission."

"We need to make big, bold capital investments in IT to drive the tech and process modernization we need to compete," she told Air Force Magazine in a text message interview later. "The most successful corporations have figured out that IT is a huge contributor to the value chain and a key source of [competitive] advantage. We seem to still think it's a cost center in the DOD, and that's a huge mistake."

Kendall also cited funding as an issue, but he quickly noted that didn't make the current state of affairs

"There's just not enough money to fix it all at once."
—Lauren Barrett Knausberger, USAF's chief information officer

acceptable.

"There are resource issues that affect that, there are things that we have to do to comply with certain requirements that affect that a little bit," Kendall said. "But there's really no excuse for not having IT that's responsive and capable, so we get it, and we're working on it."

Kendall's pledge was backed up by Chief Master Sergeant of the Air Force JoAnne S. Bass, who added that Knausenberger has already been working on the issue.

"Folks always say like, 'I wonder if they know?' I assure you, we do, because we do experience those same challenges, and it's frustrating as heck that we have to do so," Bass said. "What I will tell you is this is a complex issue on multiple fronts: networking, infrastructure, hardware, etc. Where my faith really is, is in our chief information officer. I've seen the strategy that she's outlined myself, ... here's what we have to get after. We'll just have to work really hard to make sure that we're able to budget for the foundation of what every single one of our Airmen and Guardians need."

Knausenberger said a major command technology refresh and ongoing work to streamline the various security programs that run on Air Force endpoints would help address Kanaan's complaints.

"We've updated the [hardware] standard and proven it works. There's just not enough money to fix it all at once," she told Air Force Magazine. "Everything is harder than it needs to be due to our legacy debt."

She said she had tasked a team at Air Combat Command last year "to streamline our endpoint solution." Currently the service uses both McAfee and Tanium software packages to scan and protect service-issued endpoints like laptops. But the computing power required by multiple programs often interferes with the user's work, and damages the user experience, or UX. Knausenberger said the ACC team would "streamline [existing programs] into one endpoint solution that meets our security, operations, and UX needs."

Many commentators on Kanaan's post highlighted the barriers that IT problems created for recruitment and retention.

"It's not just a retention issue, it's a recruiting issue," pointed out Jeremy Buyer, director of strategic communications for the USAF chief human resources officer. "USAF says we need top talent cyber warriors," he continued, enumerating the many barriers to competing with the private sector for such individuals. "Let's say we successfully do that, and let's assume we can cut through the bureaucracy/policy and assign them meaningful work that keeps them engaged and allows them the autonomy to move fast. The hardware alone will cause them to leave."

"What little leverage we might have over the Googles of the world—i.e., a noble mission set like 'service to country'—we undoubtedly lose with our Stone-Aged IT infrastructure," Buyer concluded.

"We are losing Reservists in droves right now because of how difficult it has become simply to serve," added Cynthia Brothers, a Reservist who was an assistant professor at the Air Force Academy and the director of strategic engagement for CyberWorx.

Others pointed out that governance and security issues could be just as frustrating as performance ones, describing fights to get modern IT capabilities like open source coding languages and software repositories available to Airmen and women. "I wasted the last nine months fighting the local comm squadron," said Matt McCormack, an instructor at the U.S. Air Force Test Pilot School at Edwards Air Force Base, Calif. McCormack said he was trying to get local "instances" (installations) that would allow his pupils to use open source tools like Anaconda and GitHub for work with DOD's software factory PlatformOne.

2nd Lt. Jason Barkey

USAF's IT enterprise affects all mission areas. Here, Senior Airmen Jordan Abasolo, left, and Lucas Pfarr troubleshoot a tactical meteorological observing system laptop during deployed weather systems training at Hurlburt Field, Fla.

Several contributors described using workarounds involving personal devices accessing Air Force networks remotely through services like Desktop Anywhere or Outlook Web Access (OWA), while inside USAF offices.

"It has been the absolute most frustrating thing in the world since the [Department of the Air Force] ... made OWA crazy locked down," said Oliver Parsons, chief of esports and virtual fitness for the Department of the Air Force. He added that he didn't even bother getting issued a government laptop. "I'd rather deal with the annoying backdoors to get work done through my personal gaming laptop than even deal with the hassle of getting issued a government computer," he said.

Knausenberger said that many of the laptops still being used by Air Force personnel had been bought four years ago under a "lowest price technically acceptable" acquisition process when the DOD was rushing to deploy new endpoints so it could meet deadlines to transition to Windows 10.

Those laptops used "spinning" hard drives, which had been rendered obsolete by new, faster, and a more reliable solid state drive. But now, with the updated standard introduced two years ago, "anyone buying a standard laptop today from the catalog will be very happy with their performance," she said.

Some commentators highlighted the responsibility of users. "Some of the blame falls on the Airmen, Soldiers, Civilians, etc., who don't take any initiative," to get their equipment fixed or maximize its utility, argued Packy Hill, a Reservist who founded and runs Bedrock, the innovation accelerator at Dover Air Force Base, Del.

Benjamin Marshall, a special assistant supporting the Commander's Action Group at Air Force Materiel Command, recounted how, when his laptop became unusably slow, "I complained and received a new [one]. I can't tell you how much faster this new one is from my previous 'fast' computer. Even in a year jump, the computers are next level now."

Knausenberger called this "a cultural issue. ... We need people to call the help desk to complain and order a new laptop when it breaks." She said a service culture of stoically persevering in the face of impossible odds didn't do anyone any favors. "If we suffer in silence it doesn't get fixed," she said. ✪

GAO to Air Force: Think Twice Before Owning KC-46 Tanker Fix

By John A. Tirpak

The Government Accountability Office wants the Air Force to do more testing and evaluation of Boeing's fix for the KC-46 Pegasus tanker's Remote Vision System (RVS) before proceeding with it, because the Air Force would be on the financial hook if it doesn't work out.

In a new report released Jan. 27, the GAO said that Boeing's fix for the RVS—one of a number of KC-46 deficiencies still being corrected—involves new technologies that may not yet be mature enough to move forward, posing a risk of cost and schedule growth.

Boeing has eaten more than $5.4 billion in overruns on the Pegasus. The company took a charge of $406 million on the program in the last quarter of 2021 that pertain to the RVS.

Senior Airman Ariel Owings

The Air Force sees RVS 2.0 as a step toward autonomous tanker refueling, but until that comes to fruition, boom operators are still needed. Here, Senior Airman Jon Vermont and Staff Sgt. Jared Evans train Tech. Sgt. Joseph Deltoro on system operations during a KC-46 air-refueling mission.

So far on the program, "the government's financial risk has generally been limited to the ceiling price of its contract with Boeing," the GAO said, but "the Air Force plans to close its review of the contractor's proposed redesign and assume financial responsibility for it" without:

- Assessing the system's Technology Readiness Level (TRL);
- Developing a plan to raise it to the appropriate TRL; and
- "Integrating and testing the system prototype in an operational environment."

The GAO worries the Air Force will accept an RVS "that contains immature technologies and greater risk of cost and schedule growth." The sooner the Air Force makes the technology assessments and fit-checks the system operationally, "the sooner it can identify design issues and proactively take steps to mitigate any further cost growth and delays in delivering promised capability."

The Air Force disagreed, saying it needs to take an accelerated approach to the RVS in order to field it at the "speed of relevance." It also took issue with the GAO's findings overall, saying the audit agency suggests the new RVS doesn't work, when "the Air Force made extraordinary efforts to ensure the RVS 2.0 design will meet warfighter requirements." The service said the system will provide "significantly enhanced capability to the warfighter" when deployed. The design is "on track to meet all but one relevant contract requirement," and Boeing and USAF are working "collaboratively on a corrective action plan," USAF said.

The Air Force and Boeing are still working on "seven critical deficiencies," which will delay the declaration of full-rate production on the KC-46 until "at least September 2024 and will contribute to nearly $1 billion" in cumulative cost growth, the GAO reported. However, the Air Force will have procured the majority of the planned 179 KC-46s "before the critical deficiencies are addressed" and full-rate production is declared, the audit agency said.

Of the seven, two are related to the RVS. Among the others, one has to do with excessive stiffness in the refueling boom; one is a flight management system instability; one has to do with cracks in a drain tube, while another is about cracks in the drain mast, and the last has to do with fuel system leaks. Previous problems with cargo pallet locks detaching and air duct clamps cracking have been resolved.

The deficiencies in the existing RVS, include the camera system—by which the boom operator, behind the cockpit, views the tanking operation. The system doesn't deliver a clear picture of the boom as it makes contact with the receiving aircraft under all lighting conditions. This lack of clarity has caused some unintentional contacts with the receiving aircraft, which can damage the low-observable features of stealth aircraft.

Although the RVS is supposed to provide a "3D" image to the boom operator, depth perception also has been a problem. On the KC-135 and KC-10, the boom operator views the tanking operation directly, through a window.

The Air Force is assuming more responsibility—and risk—for the program because it wants to go beyond the original requirements for the airplane. The RVS 2.0 is seen by the Air

Force as a pathfinder for a future autonomous refueling system that won't require a boom operator at all. When the Air Force asked for industry interest last summer in a KC-Y follow-on tanker, it said it's interested in "autonomous" refueling.

This will be especially important if a future "KC-Z" tanker is an uncrewed drone, although Air Mobility Command has been noncommittal about the requirements for that aircraft. Tanking autonomy could also reduce crew needs on the KC-46.

The RVS 2.0 will allow the KC-46 to automatically see and identify an aircraft as it approaches the tanker, then configure the refueling system—boom angles, etc.—to match the approaching aircraft's specific needs.

The service and Boeing agreed to a cost-sharing arrangement on the new system, which corrects Boeing's deficiencies but answers newly added service requirements. Boeing is releasing interim software updates on the way to the RVS 2.0.

In disputing the GAO's findings, the Air Force said its memorandum of agreement with Boeing on the RVS 2.0 allows a "nonstandard" approach to achieve an "accelerated timeline" to getting the capability fielded. The design was vetted "to a level of detail that exceeds" what would normally take place at a preliminary design review, USAF said. Moreover, the service said it's "unlikely" that technical readiness assessment would discover "significant risks not already identified and tracked by the program," and this step would probably add between six and 12 months to accomplish. That would be "either too late to affect the design" or delay RVS 2.0.

USAF uses "a robust Risk, Issue, and Opportunity Management program," with "tightly monitored Technical Performance Measures," to obtain a solid understanding of the maturity of the critical technologies involved in RVS 2.0, the service said.

The Air Force likewise disagreed with GAO's recommendation to develop technology maturation plans for RVS 2.0 technologies, for the same reason: It would cause delay.

There's a "comprehensive plan" to burn down every "identified risk" in technology maturity, USAF said, and there are numerous reviews at various milestones to ensure this is happening.

Finally, the Air Force disagreed that there should be testing of an RVS "full prototype" on the KC-46 in an "operational environment" prior to closing the Preliminary Design Review, saying this is "not practical." The time it would take to get a prototype ready "is similar to the time necessary to get the first developmental test article." Having to comply with this recommendation would add up to two years to the RVS fielding timetable, USAF said, and it's unnecessary because "prototypes of the cameras have already flown," with more flights already scheduled.

The RVS 2.0 components have been tested in the laboratory and it's been confirmed that the "flight environment will not result in degraded performance." Besides, there will be the usual developmental and operational testing of the system, the Air Force said.

Even so, the Air Force has decided not to close the Preliminary Design Review, service officials said, because the panoramic viewing system isn't yet up to USAF's comfort level. ✪

USAF Sees Fewer Major Accidents

By John A. Tirpak

Numbers of major accidents involving Air Force aircraft are down slightly over the past five years, the service reported Jan. 18. There were fewer Class A accidents in fiscal 2021 but a slight increase in Class B mishaps during the year, the third year Class B accidents have increased.

In fiscal 2021, the Air Force saw 21 Class A aviation accidents, down from 30 in fiscal 2020 and "well below the five-year average" of 27.2, the service said. Class A mishaps result in a death or permanent disability, cause more than $2.5 million in damage, or result in the destruction of an aircraft.

Class B mishaps, however, increased from 41 in fiscal 2020 to 42 in 2021, which USAF said was "consistent" with a five-year average of 42.5. A Class B mishap causes permanent partial disability; causes damage valued at between $600,000 and just under $2.5 million; or hospitalizes three people, not counting those admitted for observation or administrative purposes who are treated and released.

The Class A accidents in fiscal 2021 resulted in four deaths, including one contractor pilot, compared with seven who died in Class A events during fiscal 2020. Eight aircraft were destroyed—versus 14 the year before—of which two were Air Force-owned manned airplanes, five were USAF-owned unmanned aircraft, and one was a manned contractor airplane. Six unmanned aircraft were involved in Class A accidents in fiscal 2020, according to data provided as of Dec. 15, 2021.

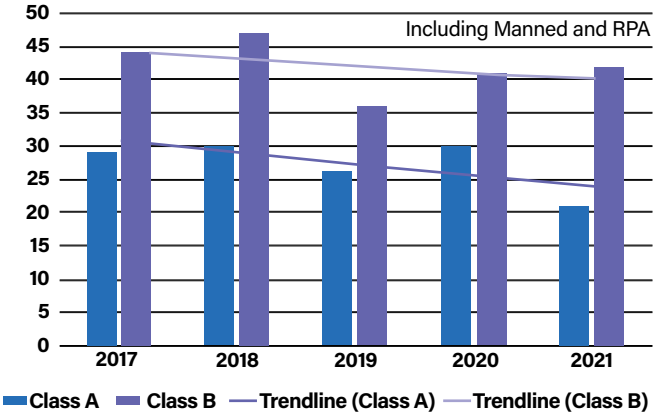
Of the 2021 "flight mishaps," 19 were Class A and 30 were Class B, for a total of 49. "Ground operations" accidents tallied two Class A and 10 Class B, for a total of 12, and there were two Class B accidents under "flight-related mishaps," for a grand total of 63 Class A and B mishaps combined in fiscal 2021.

The Air Force did not provide data on Class C accidents, which cause damage valued at up to $600,000 or result in injuries causing loss of workdays.

The Air Force Safety Center has noted that statistics "fluctuate from year to year," so it looks at trends in the data in search of significant changes or common issues. ✪

Mishaps down

The most serious Air Force accidents—Class A mishaps, causing death, permanent disability, and/or more than $2.5 million in damage—were down in fiscal 2021. The number of less-serious Class B mishaps, causing permanent partial disability and/or $600,000 to $2.5 million in damage, was on a three-year rising trend, although still below the peak of fiscal 2018.



Source: Air Force Safety Center

Senior Airman Koby Saunders

A U.S. Air Force F-35A Lightning II assigned to the 495th Fighter Squadron takes off from the flight line at Royal Air Force Lakenheath, U.K., Feb. 2. A new maintenance system is smaller and promises to be more effective.

F-35 JPO Finishes First Phase in Overhauling Logistics System

By Greg Hadley

The F-35 Joint Program Office's efforts to revamp the fighter's troubled sustainment and maintenance enterprise reached a new milestone as the JPO announced the installation of 14 hardware systems for its new Operational Data Integrated Network.

The hardware systems, called the ODIN Base Kit (OBK), were installed between July 2021 and January 2022 and replace the troubled Autonomic Logistics Information System. All "first-generation ALIS servers" are now out of the field, the JPO said in a press release.

ALIS was intended to be a vast information-gathering system that tracked F-35 data in-flight, relaying to maintainers on the ground the performance of various systems in near-real time. It was meant to predict part failures and otherwise keep maintainers abreast of the health of each individual F-35.

Instead, the system was crippled by outdated technology, false alarms, laborious data entry requirements, and clumsy interfaces. By January 2020, the JPO announced that it was dumping ALIS in favor of the rebranded ODIN.

ODIN, officials said at the time, will be more secure, produce fewer errors, and be easier to use. It will also provide improved insight into F-35 parts usage and enable predictive maintenance, driving down costs.

The ODIN Base Kit is the first part of the new system to be rolled out to military installations and will continue to be installed through 2023, the JPO said. It is "75 percent smaller and lighter than previous hardware and was procured at nearly 30 percent lower cost," the office stated.

The reduced weight is especially key, considering a Government Accountability Office report found that the ALIS servers "weigh approximately 200 pounds and require at least two people to lift … [and] need a whole room to operate," creating logistical challenges, especially for deployments. In contrast, the OBK has two modules that weigh under 100 pounds each.

"Recent global OBK installations mark a major milestone in modernizing the F-35 logistics information systems in support of global operations," F-35 Program Executive Officer Lt. Gen. Eric T. Fick said in a statement. "This was a team effort between the Department of Defense, defense industry, and our F-35 partners, and is a giant step forward in support of international logistics and operational management of the global and expanding F-35 fleet."

The ODIN Base Kit is designed to run both the ALIS software and future ODIN software programs, the Joint Program Office added.

"We're excited about the improvements ushered in by the ODIN Base Kit in 2021 and look forward to outfitting the entire fleet with this enhanced capability as schedules and funding permit," said Air Force Col. Dan Smith, JPO maintenance systems program manager overseeing ALIS and ODIN. "OBK feedback has been overwhelmingly positive and will save our F-35 maintainers time and operating costs throughout the maintenance life cycle."

While the first generation of unclassified ALIS servers are now out of circulation, other units will be replaced throughout 2022 and 2023, and OBK itself will also be updated as Lockheed Martin and the JPO look to design and develop "improved hardware for classified functions."

If Lockheed Wins KC-Y Contest, It Will Build the Planes in Alabama and Georgia

By John A. Tirpak

Lockheed Martin illustration

Lockheed Martin has selected an Airbus location in Alabama and its own former C-5 Galaxy building in Georgia as the sites where it will build its LMXT next-generation tanker, if it wins the Air Force KC-Y contest.

If Lockheed Martin wins the Air Force's upcoming KC-Y tanker competition, the jets will be built in the U.S., in partnership with Airbus, at facilities in Alabama and Georgia, company LMXT Director Larry Gallogly said Jan. 31.

"Green" Airbus A330 airliners would be assembled in Mobile, Ala., and then modified to a unique U.S. Air Force configuration of the Multi-Role Tanker Transport (MRTT)—already serving with 14 countries—at Lockheed's L-10 building at its Marietta, Ga., plant, Gallogly told reporters on a conference call. The cavernous L-10 building hosted the C-5 Galaxy production line, and then the modification of the Galaxy fleet to the C-5M configuration, now complete.

Studies are underway to determine how much under-roof square footage would be needed to accommodate the A330 production effort in Mobile. No new construction is necessary at Marietta.

Lockheed announced the LMXT effort last September and was leaning toward Mobile and Marietta as the build locations, but the company had not yet nailed down the particulars of construction at that time.

An undetermined number of initial KC-Y aircraft would be built as A330s at Toulouse, France, and reconfigured outside Madrid, Spain, for military duty, Gallogly said. U.S. workers would train on the existing lines before the production enterprise is created in the U.S., to reduce the learning curve and get up to max production rate as quickly as possible. The two U.S. sites would build tankers only for the U.S. Air Force; international versions of the MRTT, including Canada's, would still be built in Europe.

Airbus would do the majority of the engineering on the U.S.-unique versions, Gallogly said, building on its engineers' intimate knowledge of the aircraft. Lockheed would also do some engineering on the U.S.-unique systems.

A total of about 1,300 jobs would be created across Alabama and Georgia, and Gallogly said the figure referred to "direct jobs" and isn't inflated with "supply chain jobs or anything else."

No "used" A330 airliners will be converted for the Air Force, as was done for Australia, Gallogly said: all the jets will be new-build. Converting used aircraft injects "a lot of uncertainty … in the process … when you open up a huge airplane," he said.

"The customer wants uninterrupted recapitalization of their tanker fleet," Gallogly reported, and assuming a win, Lockheed expects to begin delivering aircraft "in the 2029-2030 time frame." He called that timeline "notional," based on the company's discussions with the Air Force and the service's public requests for information so far. It takes two years to build an A330 and 18 to 24 months to convert one to an MRTT; Lockheed hopes, with rapid learning curve reductions, to quickly get down to 18 months for conversion at Marietta.

The Air Force is expected to issue a request for proposals about a year from now, in March 2023, with an award in late 2024. The service wants between 140 to 160 KC-Y aircraft, which would complement the service's KC-46 fleet and would replace most of the KC-135s still flying in the 2030s. The Air Force is not interested in a "clean sheet" or stealthy aircraft, and wants a nondevelopmental item, meaning the LMXT will compete with the KC-46, being the only large tankers in production. The jet will be "built in America, by Americans, for Americans," and will comply with Buy American laws, Gallogly said.

Mobile was selected for the work because, Gallogly noted, Airbus made good on its promise in the last tanker competition to do airline work there, and the port in Mobile will make it easy to move large sections of the aircraft. There is also an established aerospace labor pool in the Mobile area. The Marietta facility has been a Lockheed production location for decades, with "an incredibly skilled workforce," he said.

"We're taking advantage of a highly capable, highly experienced" labor pool, he said. Lockheed claims a $8.3 billion economic impact across the two states, "with 24 facilities in Alabama, 22 throughout Georgia, and then all the supply chain jobs that go with it."

While Lockheed will work to source as much content of the tanker as possible in the U.S., it recognizes that "there's a very successful existing supply chain that supports the MRTT right now. So we don't want to do anything that is going to increase the overall cost of the aircraft or induce any risk into our producing and performing with this aircraft." He added, "This airplane has to work on Day One." Engines will be sourced from either Rolls-Royce or GE Aviation in the U.S.

"There's a lot of U.S. content on this aircraft already," he added.

The LMXT would have an autonomous refueling capability, and by virtue of its large size, be able to go further with a larger load of fuel than the KC-46, Gallogly asserted. Two pallet stations on the MRTT's lower level will be converted to fuel tanks to give the aircraft more offloadable fuel capacity, and the jet will be able to take off with all tanks full, he said. A large capacity is USAF's "No. 1 priority," he said. "That's the gap that needs to be filled … [and] … that's what we have

based our proposed configuration on." The longer range and capacity is needed to multiply options in the Pacific theater, where distances are great, he pointed out. It will have "almost 10,000 nautical miles of unrefueled range."

The jet will also have a "full" joint all-domain command and control suite, he said, as the Air Force expects the jet to be "out there all the time" and functioning as a communications platform as well as a tanker. The JADC2 suite the Air Force wants is "far more than … just hanging a pod on the wing, but … a more robust communication node."

The JADC2 suite and self-defense capabilities would make the LMXT different from the MRTT. Gallogly also said the existing MRTT boom system would be retained; again, to minimize disruptions and risk from creating a new one.

Gallogly said that a "very senior" USAF official asked him if the boom and vision system would be retained, and when Gallogly said they would, the senior official said, "'Good. Don't mess up the boom.'"

Gallogly said the LMXT would be unusual in that the U.S. is used to being the leader on a new system, which international customers then modify for their own use. In this case, it's a "little backward" in that the foreign partner is the leader, but he counted this as a benefit, because Airbus and its customers have already dealt with the MRTT's "growing pains," and "bumps in the road." The jet is already certified to pass fuel to the F-35 and F-22.

Broadly, Lockheed expects new specifications for the KC-Y. "These will definitely not be 'KC-X' requirements," Gallogly said, as those needs were determined "some time ago, in a very different geopolitical environment." ✪

New Panel Aims to Reform DOD Budgeting Process

By Greg Hadley

A new commission aimed at reforming the Defense Department's budgeting process will include former Pentagon acquisition and sustainment chief Ellen M. Lord as well as several former high-ranking Air Force leaders.

Lord will be joined on the newly formed Commission on Planning, Programming, Budgeting, and Execution (PPBE) Reform by Eric T. Fanning, who served as undersecretary of the Air Force from 2013 to 2015 and as acting Secretary for six months in 2015; Robert F. Hale, former comptroller and chief financial officer at the Pentagon and former head of Air Force financial management; and Raj Shah, an Air Force Reservist who headed up the Pentagon's Defense Innovation Unit Experimental (DIUx).

Fanning, Shah, Hale, and Lord were selected to the commission Feb. 1 by the chairmen and the ranking members of the House and Senate Armed Services Committees—Reps. Adam Smith (D-Wash.) and Mike Rogers (R-Ala.) and Sens. Jack Reed (D-R.I.) and Jim Inhofe (R-Okla.), respectively.

Staff Sgt. Jack Sanders

Ellen Lord, former Pentagon acquisition chief, will join former high-ranking officials on a committee to examine DOD acquisition practices.

That quartet will be joined on the commission by 10 other appointees, selected by the Secretary of Defense, Republican and Democrat leaders in the House and Senate, and the top lawmakers in both chambers' Appropriations committees.

Together, the commission will be tasked with looking at ways to shake up the Pentagon's planning, programming, budgeting, and execution process. Officials in Congress and observers have frequently bemoaned the budgeting process as slow, inflexible, and unresponsive.

"One of the relics of those days gone by is the current DOD budget process," Reed said at a SASC hearing in 2021. "It was a product of [former Secretary Robert] McNamara, the Whiz Kids, and I can assure you those Whiz Kids are not kids anymore. It's been 70 years."

The commission was established under a provision in the 2022 National Defense Authorization Act and will have until September 2023 to send a report to Congress. Under the NDAA, the commission will review the current PPBE process, evaluate its effectiveness, consider alternatives, and issue policy and legislative recommendations.

Lord served as the top weapons buyer for the Defense Department from 2017 to 2020, where she oversaw the development of the Adaptive Acquisition Framework, a rework of the DOD's acquisition rulebook aimed at making the process faster and easier. She also was in office for the first portion of the COVID-19 pandemic, which created some stress on the defense industrial base.

Fanning, in addition to serving as the No. 2 civilian leader in the Air Force, also served as Secretary of the Army and Chief of Staff to the Secretary of Defense, among other positions.

Hale is a former Navy officer who also spent more than a decade at the Congressional Budget Office analyzing defense issues. He then served as the Air Force's comptroller from 1994 to 2001 before returning to the Pentagon from 2009 to 2014.

Shah is an F-16 pilot who in 2016 was appointed by then-Secretary Ash Carter to oversee a DIUx program aimed at connecting with private industry as a technology hub to acquire new capabilities faster. ✪

Space Force Builds Off Flag Exercise, as USAF Exercises ACE

By Greg Hadley

Tech. Sgt. Alexandre Montes

Airmen prepare A-10 Thunderbolt IIS to land and take off from a dry lakebed during Green Flag-West. Space Force is looking to break out exercises—called "skies" instead of "flags"—similar to the model used by USAF.

The Space Force will debut a new training exercise this year, aimed at improving the service's command and control capabilities, the head of Space Training and Readiness Command (STARCOM) said Jan. 26.

The event, called Polaris Hammer, will happen sometime this fall, Brig. Gen. Shawn N. Bratton said during an AFA Air and Space Warfighters in Action virtual seminar.

"We had a request before STARCOM even stood up to develop a command and control exercise for the Space Force, really geared at the ops center level—so what would be the AOC equivalents, or for us the [Combined Space Operations Center] out of Vandenberg [Space Force Base, Calif.] or the National Space Defense Center here in Colorado Springs," Bratton said.

STARCOM officially stood up this past August, making it the newest of three field commands under the Space Force. And with only a few months under its belt, the new command has plenty of work to do to develop the training doctrines and exercises that will shape the new service branch, Bratton said.

"We'll have our first go here in [2022] and see how that goes and if we're meeting the training objectives," Bratton said of Polaris Hammer. "And then, of course, we continue to support the combatant command tier one exercises, getting after that. But, … we need to develop a little more of that on the service side, and from my seat, really … tease out the doctrine we need to gain and maintain space superiority."

That won't be the only exercise that STARCOM organizes in 2022, though. Bratton said the command is set to host an "initial planning conference" in the coming weeks for an exercise called Black Skies, intended to be a more focused version of the Space Flag exercise.

"We do an exercise today called Space Flag that is probably most akin to Red Flag, but it's sort of got everything in it, and it tries to be everything to everybody," Bratton said. "I think we'll break that out into pieces over time, starting with [electronic warfare.]"

That's not to say the Space Force won't continue to run Space Flag exercises, Bratton added, but they hope to develop more specific exercises "modeled" after the Air Force's Flag exercises.

"I think there's nothing too creative going on here, but we replaced 'Flag' with 'Sky,' and I see the Space Force going down that road of Black Skies, Blue Skies, Red Skies exercises to get after the needs of those specific training audiences," said Bratton.

The Air Force uses Red Flag exercises for aerial combat training, Black Flag exercises as a way to test large weapons and capabilities, and Blue Flag exercises to train participants at the operational level. It also hosts Silver Flag exercises, in which civil engineers practice operating in a contingency environment, and Green Flag, a predeployment exercise for Air Combat Command flying units to practice close-air support and precision-guided munitions delivery.

And just as the Space Force is looking to refine its command and control operational capabilities, the Air Force will likely look to refine its own Blue Flag exercises, said Maj. Gen. Case A. Cunningham, commander of the USAF Air Warfare Center.

Air Combat Command has designated five units to serve as "lead wings" as the Air Force looks to overhaul its force generation model and pivot to strategic competition with China and Russia.

The five wings, scattered from Idaho to Georgia, will be designated to "rapidly generate combat power as a deployed force," ACC commander Gen. Mark D. Kelly said in a Jan. 5 memo.

"As we look at what it means to be a lead wing in an Agile Combat Employment environment, at wing-level C2 and distributed C2 in the contested environment, the 505th [Command and Control Wing] is also supporting those efforts to more fully develop what those kind of war games will look like to support Agile Combat Employment and make sure we're rapidly iterating the capabilities there as we continue to get at that," Case said.

The five wings are:

- 4th Fighter Wing, Seymour Johnson Air Force Base, N.C.
- 23rd Wing, Moody Air Force Base, Ga.
- 55th Wing, Offutt Air Force Base, Neb.
- 355th Wing, Davis-Monthan Air Force Base, Ariz.
- 366th Fighter Wing, Mountain Home Air Force Base, Idaho

The lead wing concept "further refines Agile Combat Em-

ployment and Multi-Capable Airmen concepts," Kelly said in his memo.

"This shift takes us from a reactive force optimized for counterinsurgency ops over the past 20 years in permissive environments, to wings ready to deploy as high-performing, task-organized combat teams, and operate in a contested environment with joint and coalition partners," Kelly said in a statement.

Kelly also designated five wings as "Lead Wings in Extremis" to provide support when additional forces are required for a lead wing. Those five are:

- 1st Fighter Wing, Joint Base Langley-Eustis, Va.
- 20th Fighter Wing, Shaw Air Force Base, S.C.
- 325th Fighter Wing, Tyndall Air Force Base, Fla.
- 388th Fighter Wing, Hill Air Force Base, Utah
- 633rd Air Base Wing, JB Langley-Eustis, Va.

ACC is still working to determine "required force elements and organizational structures" for the new lead wings, it said, but experiments and exercises are planned in 2022 to test the new structure.

Kendall: Air Force Still Digging Itself Out of 'Readiness Hole'

By Greg Hadley

The Department of the Air Force is set to embark on a readiness review as it works to dig itself out of a "readiness hole," Air Force Secretary Frank Kendall said during a virtual Coffee Talk event with Chief Master Sgt. of the Air Force JoAnne S. Bass.

During the Jan. 27 event, Kendall was asked by a viewer how he planned to address bureaucracy that inhibited acquisition of parts and equipment and affected maintenance. Kendall said bureaucracy is just one of several problems facing the service's sustainment enterprise.

"I'm very concerned about our readiness levels, our availability of the current fleet. Some fleets like our battle management fleet, AWACS as well, are not anywhere near where they need to be," Kendall said.

"In some cases, we're operating pretty old aircraft, and it's hard to get the parts for them," Kendall said. "It's a long lead time to get them made for us because they've been out of production for a long time, so there's a range of things there that we have to look at."

Reports from the Government Accountability Office and the Congressional Budget Office show the availability and mission capable rates of Air Force aircraft declining over time. The average age of the fleet at over 29 years old, with some of the battle management/C3 aircraft that Kendall referenced is more than 40 years old.

The E-3 Airborne Warning and Control System (AWACS) in particular is frequently cited as being in need of replacement. Commander of Air Combat Command Gen. Mark D. Kelly noted in 2021 that "it takes a miracle … every day just to get it up in the air."

All these readiness issues, Kendall said, are the result of sequestration—automatic spending cuts that started in 2013 and extended for nearly a decade.

"We dug a readiness hole during that period just because we didn't have resources for it," Kendall said. "And to be honest, we're still digging our way out of it. Sequestration has been gone just a short period of time now, and I think we're getting better. It's a trade-off we have to make, between near-term operational capabilities and things longer [term] as we look at budgets, try to balance some of the costs."

Kendall's sense that the Air Force's readiness issues are improving will be put to the test soon. "We've got a big readiness review coming up at headquarters here pretty shortly. We'll be looking at all these issues," he said.

Regardless of what the review finds, the department needs to take a more integrated approach to sustainment to ensure its aircraft are ready to fly, said Kendall.

"We need to basically design our systems for sustainment, for maintenance. We need to put the systems … in place that will support them efficiently," Kendall said. "And frankly, we haven't paid enough attention to that."

Mike Tsukamoto/staff

Secretary of the Air Force Frank Kendall speaks at the AFA Air, Space & Cyber Conference, Sept. 20, 2021.

First 'Integrated Warfighting Network' to Go Live in 2022

By Amanda Miller

Small teams of Airmen will be able to start taking their work laptops on deployments this summer.

The Department of the Air Force's Chief Architect Officer Preston Dunlap revealed in a webinar Feb. 1 that the first "integrated warfighting network" will boot up in the summer of 2022. The department's former chief software officer Nicolas M. Chaillan interviewed Dunlap on LinkedIn.

The new network is designed for troops engaged in Agile Combat Employment (ACE) operations, Dunlap said.

"Whether you're in a conflict with Russia or China, having a handful of operating locations—or one or two operations centers or intelligence centers—is not going to win the fight," Dunlap said, describing ACE from an IT perspective. "It's just too risky with too many weapons pointed at you."

Instead, the department wants troops to be able to take all those activities on the move.

"We want to be able to break up the ability to do intelligence, and break up the ability to do operational … [command and control], to even small echelons and small units," Dunlap said. The integrated warfighting network, or IWN, "will tie together two things that have been almost totally separated," he explained—enterprise IT and "warfighting IT."

The IWN "is the composition of the equation of enterprise IT, plus edge IT, and together you have integrated warfighting that allows you to be able to go to various strips in Europe or various islands in the Pacific, take that same mobile-computer-laptop-slash-tablet that you've got in your office—which we don't currently have, generally, but we want to make this pervasive on the enterprise level—and that's the same device that you use at the classified level going out to operate with in the field."

FACES OF THE FORCE

Chelsea Ecklebe /USAF; Tech. Sgt. Dylan Nuckolls

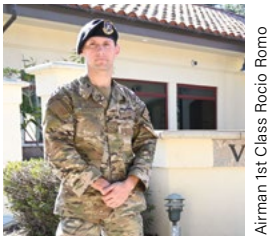
Capt. Kyle Cassady flew a B-2 from Whiteman Air Force Base, Mo., over the Rose Bowl college football game between Ohio State and University of Utah, Jan. 1. The game is one of the most high-profile college football games of the year. That's cool, but even cooler is the tie between Cassady and one of the teams. Cassady is the grandson of Howard "Hopalong" Cassady, a Heisman Trophy winner who attended Ohio State in 1955. Said the young captain: "I hope that through these flyovers, I'm able to kind of inspire the next generation of kids ... to join the Air Force."

Staff Sgt. Brandon Esau

The **Air Force Special Operations Command History and Heritage Office** received the Department of the Air Force's Excellence in Command History Program Management Award for 2021. The award recognizes the best primary or field command history office for outstanding history and heritage program leadership, providing exemplary historical services to improve organizational effectiveness, esprit de corps, and combat capability. Lt. Gen. James C. Slife presented the award Jan. 4.

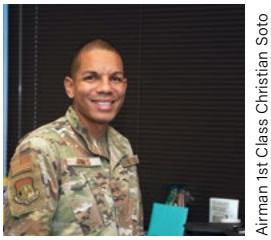
USAF/courtesy photo

U.S. Airman **Lt. Col. D.J. Abrahamson,** was named one of the Korean Air Force 's Outstanding Airman of the Year. Each year, the ROKAF Chief of Staff recognizes eight Airmen and civilians in Combat Power Development, Operation of Organization, Digitization, Volunteer, Cooperation and Special categories. Abrahamson, 7th Air Force Inspector General, took home the Cooperation Award after devoting 13 of his 26 years in service to the alliance between the U.S. and Republic of Korea.



Airman 1st Class Rocio Romo

Senior Airman William Boyce aided a child who was showing signs of a stroke at the Vandenberg Space Force Base Visitor Center in California on Nov. 3. Erin Forte asked visitor center personnel to dial 911 for her son who was experiencing shortness of breath and droopiness on the right side of his face, while Boyce kept the child comfortable, aiding his breathing and conducting a quick neuro exam. The child's mother credits Boyce with keeping her son, who is on the spectrum, calm until first responders could arrive.



Airman 1st Class Christian Soto

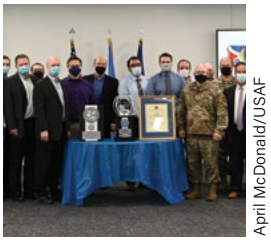
Master Sgt. Robert L. Jones was named the recipient of the CMSgt. Larry P. Gonzales Superintendent of the the Year Award for 2021. The award highlights the best Financial Management and Comptroller senior enlisted leader throughout the Air Force. "This is my first time in a superintendent position," said Jones, the senior enlisted leader for the 71st Comptroller Squadron and Wing Staff Agencies. "To win this award is a big deal to me, because it shows that I am doing what I am expected to do at the Air Force level in order to take care of people and to carry out the mission," said Jones.

Airman 1st Class Kaitlyn Preston

Staff Sgt. Derek Merkley was recognized as the 36th Wing's Team Andersen Linebacker of the Week, Jan. 12, 2022. The award recognizes outstanding Total Force Airmen. Merkley has improved corrosion prevention methods on Andersen AFB, Guam, impacting more than a hundred assets and saving the USAF millions. Andersen has a pervasive corrosion problem due to the salty, damp air. Merkley is also a mentor for local Air Force Junior Reserve Officer Training Corps cadets.

USAF

Michael P. Imhoff will retire as chief executive officer of the Air Force Museum Foundation at the end of January 2022. Imhoff has served as CEO since 2014, a tenure that saw the museum add a fourth building, which hosted the Space, Research and Development, Presidential, and Global Reach galleries. He also oversaw new initiatives, including an augmented reality exhibit and a new program of special exhibits that aim to appeal to a broader audience.

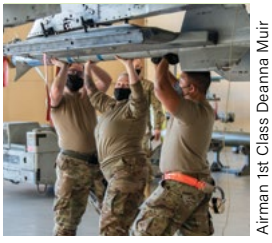


April McDonald/USAF

The 76th Software Engineering Group won DOD's 2021 Rear Admiral Grace M. Hopper award for Software Maintenance Excellence in December. The "Stanley Cup of the software engineering world" was presented to the 76th SWEG at the Oklahoma City Air Logistics Complex at Tinker AFB, Okla. The 76th was cited for providing training and tools to implement Open Mission System, including a Critical Abstraction Layer—a multimillion-dollar piece of software that allowed the warfighter and smaller contractors to design systems that were Open Mission Systems compliant.

US Air Force Academy Association of Graduates/Facebook

Three United States Air Force Academy graduates have been chosen as USAFA Distinguished Graduate honorees for 2021 by the Air Force Academy Association of Graduates. They are **Col. (Ret.) Leonard Ekman,** a highly decorated F-105 pilot during the Vietnam War; **Dr. William Wecker,** an F-4 pilot, former chief of protocol in Berlin and a founder of the Air Force Academy Foundation; and **Maj. Gen. (Ret.) Gene Lupia,** a 32-year USAF veteran who served during his final four years of Active duty as the Air Force Civil Engineer.



Airman 1st Class Deanna Muir

The 476th Maintenance Squadron from Moody AFB, Ga., took home the win for the fourth-quarter weapons load competition against the 74th and 75th Aircraft Maintenance Units, Jan. 7, 2022. Load competition participants are judged on speed, accuracy, safety and reliability when loading aircraft munitions. They are also evaluated on their uniform dress and appearance, they take a 25-question test, and receive a toolbox inspection. The winning team, **Staff Sgts. Brianna Stone, Ace De Dios,** and **Justin Castellow** have been a team for two years.

Tell us who you think we should highlight here. Write to afmag@afa.org.

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The Air Force in Africa

At two air bases in Niger, USAF quietly helps stabilize an unstable region.

U.S. Air Forces Africa

Airmen stationed at Nigerien Air Base 101 in Niamey, Niger, and Air Base 201 in Agadez, support partner forces and international efforts to counter violent extremist organizations in the region.

By Abraham Mahshie

AIR BASE 101, NIAMEY, NIGER

In the arid strip of northern Africa known as the Sahel, the sun is not a yellow orb in the sky, but a white blur against the haze, beating down through sandy air.

As the cool morning quickly fades, and fluids evaporate imperceptibly in the dry air, the heat rises, making living and working difficult on the land below. The five vast Sahel nations bordering the Sahara desert are as long as the continental United States but combine for just 44 million inhabitants. Their fragile and unstable governments are among the poorest on the globe. They lack the resources to fully patrol their borders or deliver services throughout their territories and must fend off terrorist and insurgent groups that have grown larger and bolder over time. Attacks have increased against civilian and military targets, exporting chaos that now threatens African coastal states, as well.

The tan and yellow landscape and orange-hued mud structures contrast modestly with the the half-dome tents of the 409th Air Expeditionary Group, set up at Air Base 101 in the Niger capital, Niamey, and at Nigerien Air Base 201, in the central city of Agadez. The 435th Air Expeditionary Wing under U.S. Africa Command is in six locations in West and East Africa, and these two Niger locations offer what may be the best hope for stemming the growth of terrorism in Africa.

"We don't want this to be something like Afghanistan." —USAF detachment commander in Niamey, Niger

Some 800 Airmen are deployed here on six-month rotations, working for group and squadron commanders serving one-year tours. They endure extreme temperatures, sandstorms, and rainy seasons, along with maintenance and supply chain challenges familiar to anyone who has operated in a remote and austere base. Missions include intelligence gathering with MQ-9 Reapers and other surveillance aircraft and operations against terrorist groups across the Sahel.

U.S. forces here share ISR data with allied and partner nations and train local military units to combat terrorists on the ground. If not for the U.S. Air Force and partner nations, a new terrorist safe haven in the Sahel of Africa would be a certainty.

"We don't want this to be something like Afghanistan," said an Air Force major serving as a Forward Aviation Detachment commander in Niamey. Full names are not used for certain personnel out of operational concerns.

As a special operator, he oversees fixed and rotary wing aircraft and unmanned ISR platforms at AB101. "Yes, what we're doing out here is making a difference. And if you make the sacrifice to come out here, leave your family, then we are going to be

able to help the Nigeriens as well as stop any sort of blowback coming to the U.S.," said the special operator.

"As far as day in-day out, it's very difficult to maintain all the aircraft in the austere locations that we're dealing with," he continued. "The high temperatures affect aircraft performance, and then just all the blowing sand, dust, gums up engine components, everything like that. So, day in-day out, our maintainers are working extra hard to keep these planes in the air."

Rapidly changing weather patterns, including high winds at AB201 curtail missions as commanders protect platforms amid an insatiable demand for intelligence gathering.

A dearth of spare parts and long wait times to receive them lead to delays and canceled sorties. Sometimes maintainers arrive hand-carrying parts. Other times, maintainers show up but parts do not. On one recent visit, a temporary duty maintainer sent from Spangdahlem Air Base, Germany, shot billiards alone in the long, air-conditioned tent that is AB101's rec room. He had already waited a week for a spare part to arrive needed to repair a C-17.

The Air Force has no permanent presence in the African theater, relying on deployed assets and expeditionary bases to detect terrorist threats, assist partners, train up local forces and, in some cases, conduct special operations.

"We're the only Air Force Active-duty MQ-9 unit that's out here," said the detachment commander at AB201.

"The MQ-9 has a good endurance capability. So, long endurance capacity, and with that said, it enables us to support areas that are contested, but from areas that aren't," said the special operator, a major responsible for MQ-9 maintenance, launch, and recovery at AB201.

Unlike typical deployed locations that have a separate squadron for maintenance and operations, the two are combined at AB101 and AB201. The maintainers, pilots, sensor operators, and others range from newly trained Airmen to seasoned operators on their fifth or sixth deployment. Morale is high.

"What's unique to us here it's probably the level of authority, autonomy that we push to them because of the unique shape of our base," said Capt. Andrew Cook, security forces flight commander at AB101. Leadership leans heavily on noncommissioned officers and responsibility is delegated, Cook said.

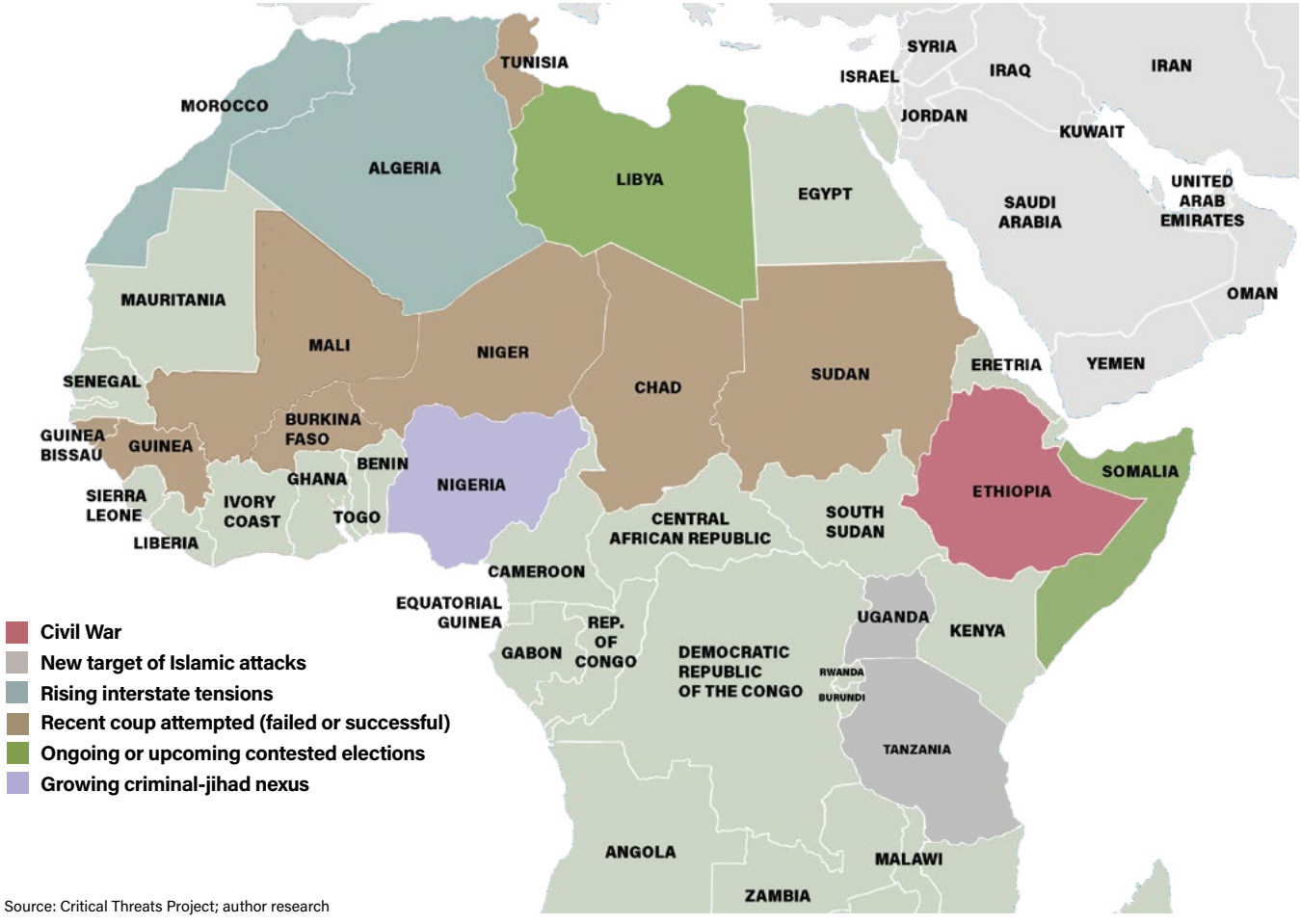
The sense of mission and fulfillment are clear among the tightknit team, operating out of tents and containers at a base where the only pavement is for the runway and the combination basketball court/outdoor gym.

"The time flies by," Cook said. "There's just a great sense of getting things done, because everyone's geared to focus on the mission. … You get a lot of sense of accomplishment. It's just an amazing opportunity to see folks really hone their own leadership skills, but also challenge you as well."

Slow internet and unpredictable mail delivery means the distance and remoteness are palpable. It can take three to eight weeks for a letter or package to arrive. Contact with Cook's wife

Africa: A Complicated and Contested Continent

Africa's 54 states, many of which are landlocked, struggle with a range of issues, ranging from scarce resources and inadequate infrastructure to political instability, jihadi insurrections, and civil wars. Within the past year, Mali, Burkina Faso, Guinea, the Central African Republic, and Guinea Bissau have all experienced either a coup or attempted coup.



Source: Critical Threats Project; author research

Mike Tsukamoto/staff

Balancing Engagement With Human Rights in Africa

AFRICAN AIR CHIEFS SYMPOSIUM, KIGALI, Rwanda—Security is the thing many Rwandans love most about their country. The land of a thousand hills has clean streets, where citizens can safely walk at night. The countrysides of rice and banana plantations are lush and carefully manicured. Police officers man the corners of city streets in the capital, Kigali, and the Rwandan military participates in peacekeeping missions across the continent, with the U.S. Air Force providing strategic lift to Rwandan defense forces.

But another Rwanda emerged since President Paul Kagame's Rwandan Patriotic Front entered the country from Uganda, overthrew the government, and ended the 1994 genocide that killed nearly a million Tutsis.

Kagame, 64, now presides over a peaceful oasis in a continent plagued by instability, military coups, violent extremist groups, and deep poverty, but accusations of human rights abuses plague the celebrated hero known by most as "his excellency." President since 2000, Kagame's government is accused of targeted assassinations, disappearances, and torture, including the deaths of journalists and opposition figures, according to the nonprofit group Human Rights Watch.

The president has elevated his international reputation militarily by participating in peacekeeping missions in troubled regions of Africa. This year, Rwanda also co-hosted the 11th African Air Chiefs Symposium (AACS) with United States Air Forces in Europe-Air Forces Africa Jan. 24-28 in Kigali.

"Most observers would agree, Rwanda is not a stable country," National Defense University scholar Joseph Siegle told Air Force Magazine in a telephone interview before the symposium. "They've just put a lid on all of these, building up pressures that are there, even though outwardly, it seems to be so."

But Rwanda is secure, Siegle amitted, and it has the influence in the Great Lakes region of Africa to prevent instability from spreading from the troubled eastern region of the Democratic Republic of Congo.

"It's a smoldering set of challenges, and they are pursuing regional solutions," Siegle explained.

Hence Rwanda's hosting of this year's AACS, the first in-person event in two years, with a goal to work toward shared strategic airlift on the continent.

"Many of Africa's emerging security challenges are transnational, and so, no one country has the resources to respond alone. We must prioritize the benefits of working together," Kagame said during his brief and much-celebrated symposium attendance to deliver opening remarks amid intense security.

"Security and prosperity are two sides of the same coin, you cannot have one without the other," he concluded.

USAFE-AFAFRICA Commander Gen. Jeffrey L. Harrigian told Air Force Magazine that balancing human rights concerns with the U.S. military's strategic objectives requires engagement that can lead to improvements.

"The important part for me personally has been, let's understand the entire picture," he said in an exclusive interview before the start of the final conference day.

"Clearly, human rights is important to us, and something that, as the United States, this is who we are. But at the same time, understanding the nuances of what's happening here was something that was important to me, because it gives context to the relationships," he said, noting that he had several engagements prior to the event with U.S. Ambassador to Rwanda Peter H. Vrooman. The conference week also helped to deepen U.S. Air Force and Rwanda Defence Force (RDF) trust and cooperation.

"As we've, I'll call it, 'matured,' our relationship with the Rwanda Defence Force here, at least this past week, it's clear to me, they are extremely professional, dedicated to their mission set," Harrigian said. "I think it's in our best interest to stay close to them and continue to grow this relationship because at the end of the day, they will continue to grow their capabilities."

He added: "We walk the journey together, and if we're not here, that will come to an end. ... I would offer it's not in our interest to do that."

RWANDA-U.S. COOPERATION

Rwanda's participation in African Union peacekeeping missions across the continent has contributed to stability and allowed African nations to manage their own crises with reduced external assistance from the U.S. Air Force and European partners.

In January and February 2014, two U.S. Air Force C-17s airlifted a Rwandan mechanized battalion of 850 soldiers and more than 1,000 tons of equipment to the Central African Republic for a peacekeeping mission.

In recent years, Rwanda has sent peacekeeping forces to Mozambique and Sudan, providing airlift, evacuation, and use of air assets in joint actions. Before Rwanda's participation in the United Nations–African Union Mission in Darfur, which ended in 2016, Rwanda was the second largest contributor of peacekeeping forces in the world. It now stands at fourth, according to the RDF.

In remarks July 21, 2021, at a U.S.-Rwanda preparatory meeting for the 2021 Peacekeeping Ministerial in Seoul, Vrooman highlighted the U.S.-Rwanda partnership, and Rwanda's peacekeeping efforts over nearly two decades.

"Rwanda undertakes peacekeeping as a constitutional and moral obligation," Vrooman said, reflecting on how the U.N. failed to act to prevent the 1994 genocide.

The ambassador noted how the United States has trained and the RDF has deployed more than 45,000 personnel in support of U.N. missions globally. As of July 2021, Rwanda had more than 5,000 troops, police, and others on U.N. missions.

In a pull aside interview after his remarks at AACS, Vrooman told Air Force Magazine about the delicate balance between human rights concerns and military-to-military ties.

"I'm really a strong believer in engagement, diplomatic as well as military engagement," Vrooman said. "Some people don't always believe in that, but I have found that that's really how you come to greater understanding. It doesn't mean that you will always have influence. But, if you don't try, you won't have any effect."

The Rwanda Defence Force cooperates with the United States mainly in the training of some Air Force cadets and senior officers at air staff and command courses, RDF said. Such courses often include human rights and law of war training.

Vrooman said he has seen firsthand the benefits of U.S. training to instill human rights values.

"Rwandans are very receptive to it," said Vrooman, a former student at National Defense University.

Vrooman said using pressure tactics like sanctions are hard to roll back and can limit the opportunity to deepen a partnership and exert positive influence.

"That limits your ability at times to be able to engage. So, it's a balancing act," he said.

In written responses to questions from Air Force Magazine, Rwandan Defence Force spokesman Col. Ronald Rwivanga flatly denied that his country commits human rights abuses.

"False and unfounded accusations," Rwivanga said. "Where the answer is not satisfactory there are courts to deliver individual concerns."

Asked what is being done to strengthen human rights in Rwanda and the RDF, Rwivanga said: "They are already strong enough."

"A people-centered transformation agenda, a justice system that satisfies Rwanda[']s needs, and an economy that is steadily growing and strives to improve the livelihood of the citizens is what we consider to be the principle human rights," he said. "All dissent and contestation is managed through democratic channels by electing the right leaders that people want. This is what is happening and will continue to happen."

and children—one, two, and the other four—is as good as the internet connection.

Games break up the grind, he said. "So, bingo night is pretty hoppin,' we've got Family Feud. We got pingpong, a pool table, stuff like that," he said. "I'd say, within my flight, and across the air base as a whole, I think it's a great operating location, and a lot of people enjoy it. I think there's more enjoyment than not."

The United States, France, Germany, and Italy are invited guests of the government of Niger, each with their own strategic objectives. The U.S. uses AB101 and AB201 for medical evacuation, logistics support, ISR and air refueling for allies, and it helps train the Nigerien forces, as well.

SURROUNDED BY TERRORISM

Across Niger one can find practically every known terrorist group on the African continent. Elmikkaiel Adam Maiga, 54, a Nigerien translator who used to work at AB101, says it was not always this way. He recalls a time before his fellow Nigerien citizens worried about indiscriminate massacres by terrorist gangs on motorcycles, who burn villages and kill soldiers at military outposts.

"A lot of things are happening right now in this country—a lot of things. Things that we are not used to," he told Air Force Magazine, waiting for friends under the cool shade of a tree in the quiet Niamey neighborhood where he grew up. Dressed in a dark green desert shawl, his open-toed sandals nestled in the sandy Earth.

"I remember when I was growing up, sometimes in the middle of the night, one, two, three o'clock in the morning, somebody could come and knock at your door, you will open your door, and the person would tell you, 'I came from Tilbury. I came from Ayarou. I came from Agadez by foot walking' without any problem. You know, peaceful country, very, very peaceful. And all that, all of a sudden, has changed."

In 2021 alone, nearly two dozen terrorist attacks took the lives of more than 600 people, among them hundreds of civilians and dozens of soldiers.

The fall of Muammar Qaddafi's government in Libya in 2011 let loose a stockpile of weapons that soon spread to armed militants and terrorist groups across North and West Africa. Ongoing economic disparity and government corruption contributes to a stagnant economy and high, youth unemployment, despite Niger's rich mineral resources.

"Those villages where you have terrorists, who are they?" Maiga posed. "At the beginning, yes, they came from the outside. But then they recruited the local people, local youth, who have nothing to do. They offered them some money."

Special Operations Command Africa (SOCAF) spokesperson Maj. Andrew Caulk said the country is disadvantaged by its neighborhood.

"Niger is surrounded really on three sides and sort of almost four vectors by instability and violent extremism," he said.

An arms trafficking route traces the northern border of Niger from Libya west along the Algerian border down into the West African tri-border region of Niger, Burkina Faso and Mali. Islamic State Greater Sahara operates there, as well as the Al Qaeda-affiliated JNIM and subordinate organizations.

"We're also seeing threats rise in what we call B2/N2—so that's Burkina Faso, Benin, Nigeria and Niger," Caulk said. "We're also seeing some Al Qaeda-related activity start to spring up again in the form of a clone Islamic organization called Ansaru, in northwestern Nigeria."

To the southeast, the Lake Chad Basin, along Niger's border with Nigeria, remnants of Boko Haram remain, along with a new threat, Islamic State West Africa Province, rising.

"You have this situation where there's a lot of instability surrounding Niger. Despite that, we've seen them doing just an extraordinary job of managing to keep those threats out of their country, for the most part, they are confined to the border regions," Caulk said. "Part of that has been our partnership with them and working with them over the last few years."

Air Force Tech Sgt. Frank Jimenez leads an eight-week training program at Air Base 201 with the Nigerien Armed Forces, or FAN for its French acronym.

"I've been all over the globe from Iraq, Afghanistan, Qatar, Saudi Arabia and here," he told Air Force Magazine. "How this is different is the constant interaction with the host nation. ... You're working side by side with them, you train with them, building up the partnership face-to-face is a different aspect, a more rewarding one."

Jimenez shares tea with the Nigeriens he trains and joins them for joint patrols on the installation. The air adviser highlighted the FAN soldiers' inquisitiveness, dedication and clear rank structure.

Vice Commander of the U.S. European Command 435th Air Ground Operations Wing and the AFRICOM 435th Air Expeditionary Wing at Ramstein Air Base, Germany, Col. Calvin B. Powell told Air Force Magazine that Niger is critical in stemming the violent extremist organization (VEO) expansion in both the Sahel and Lake Chad region.

"The U.S. steadily invests in further building Niger's

Abraham Mahshie/staff

Every known terrorist group on the African continent is operating somewhere in or around Niger, underscoring the need for U.S. military assistance. The U.S. works closely with allies such as the French in the Sahel to share knowledge, as shown here.

counterterrorism, intelligence and aviation capabilities," he said in an email.

"Africa is an emerging front in the strategic power competition. A destabilized Africa not only impacts Africans and Americans but also our allies and partners in other places around the world," he said. "VEOs present a long-term threat to the U.S., international partners, and regional interests. It is important that we degrade their ability to act now or risk paying the price later."

The U.S. commitment to Niger, including the training of its forces, is making an impact in strengthening relationships with the host nation.

Nigerien Air Base 101 Commander Lt. Col. Ismael Ka described to Air Force Magazine some of the capacity building the U.S. Air Force is doing, including a C-130 program and a Cessna 208 program.

The programs teach the Niger Air Force casualty evacuation and ISR, reaching 15,000 flight hours in six years.

"The U.S. is one of our best partners now," Ka said in an interview during the African Air Chiefs Symposium in Kigali.

"In this fight against terrorists, there had been a lot with this particular Cessna program if you see how many people we will transfer in terms of casualty evacuation since we acquired these platforms," he said.

In addition to cooperation and intelligence sharing with the U.S. and partners hosted in Niger, Ka highlighted how the know-how and assets are helping make Niger a leader among the G5 Sahel countries that include Burkina Faso, Mali, Mauritania, and Chad.

Niger's capability improvement has allowed it to conduct air-to-ground and air-to-air integration with the Burkina Faso Air Force and to better partner with French ground troops to fight terrorists. Niger contributes two battalions to the multinational G5 Sahel Joint Force and hosts its Central Sector Headquarters.

Terrorism is "not a Niger problem, it's regional. It's a regional problem," Ka said, while acknowledging his air force still has a ways to go in terms of ISR capabilities, logistics, and intelligence collection. "We have support for our partners. So, this support, I think this is the point that keeps Niger safe."

But Niger's partner countries have suffered instability in recent years. Of the five G5 countries, Mali, Chad, and Burkina Faso have all suffered military coups in the last two years, with the most recent happening just weeks ago. Such non-democratic transitions freeze U.S. assistance to the country and halt intelligence sharing. France is also preparing to pull some 3,000 troops out of Mali, a country it has helped stabilize since 2013. French soldiers from Operation Barkhane who spoke to Air Force Magazine believe Russia is behind a recent spree of coups across West Africa. Russia's Wagner Group is already helping Mali manage its restive north. The French soldiers believe should their country pull out of Mali, Russia would have an open invitation to move in.

GREAT POWER COMPETITION IN AFRICA

National Defense University scholar Joseph Siegle told Air Force Magazine that there is strong evidence Russia is trying to displace France and other Western influence in Africa through tacit or outward support for military takeovers, as well as propaganda. "It's an easy way to expand Moscow's role within a quick time frame and add more influence," he said.

"Let's be clear, the Russians are not there to solve those problems," Siegle said. "The Russians are there to expand their own influence and they're doing that by helping to prop up some of these military governments and other

Shared Strategic Airlift Is Focus of Africa Air Chiefs Meeting

KIGALI, Rwanda

With 54 nations spread out on a continent three times greater than the United States and comprising 20 percent of the world's land mass, strategic airlift is essential to establishing a semblance of unity and security.

The U.S. Air Force contributes airlift in the fight against terrorism, supports peacekeeping, and responds to humanitarian disasters across the continent, working closely with both African and European allies. Now, Air Forces Africa is calling for increased sharing as a better solution to strategic airlift.

At the four-day African Air Chiefs Symposium in Kigali, Rwanda, this past January, the U.S. proposed sharing airlift as a way to draw nations together. "The goal here is to find ways that we can look at it across the continent and leverage the regional expertise that is so prevalent here," said U.S. Air Forces in Europe-Air Forces Africa Commander Gen. Jeffrey L. Harrigian in an exclusive interview.

Harrigian said air liaison officers across the continent have helped develop a shared understanding and identified what is "in the realm of the possible."

Rwandan Air Force Gen. Jean Jacques Mupenzi said distance poses unique challenges here. "Our region is vast [and] characterized by limited transportation infrastructure," he said. "Hence [it] requires effective air mobility mechanisms to bridge distances, support replenishment of troops in theatre ... and attend to humanitarian assistance. ... Strengthening regional cooperation in the air domain is critical in order to respond to common security challenges."

Terrorist and criminal groups operate from remote safe havens beyond the reach of some governments. Lt. Col. Jared Cordell, a combat aviation adviser with Air Force Special Operations Command, said in a phone interview that airlift is the key to shrinking the long distances that make it so hard for African governments to crack down on terrorism.

"In a lot of places, airlift is the most valuable and most important thing that they can do because it brings cargo, men, and equipment to places that need it," he said in a phone interview ahead of the conference. "It ... brings governance to those outlying areas and shows the country's flag in disparate and outlying parts of the various countries."

U.S. forces maintain a low profile here. "It's not the U.S. flag that's showing up at a random airstrip in another place," Cordell said. "It's their own country that's bringing their own country's governance to that area."

FINDING A WAY FORWARD

Nine African nations from the Maghreb and Western and Eastern Africa met with U.S. Air Force officials six times from April to August 2021 to focus on how to increase sharing. Regional groups, including the African Union and the Economic Community of West African States (ECOWAS), joined as observers.

Tunisian Air Chief Maj. Gen. Mohamed Hajem said shared strategic airlift in Africa will require a common doctrine and standard operating procedures. "That's really the vision with the program, with the planning, and we should be aware of our actual capacity and the threats and challenges of the future," he told Air Force Magazine in an interview.

Harrigian said the first step is developing command and control and leveraging existing capabilities within regional organizations. "There are some really unique relationships—multilateral ones—that happen regionally. We have to try to pull that together into a continental view," he added. "That's not easy—it's a heavy lift."

Senior Airman Brooke Moeder

U.S. Air Force Gen. Jeffrey Harrigian (right), and Rwandan Gen. Jean Bosco Kazura talk during the 2022 African Air Chiefs Symposium in Kigali, Rwanda, Jan. 25.

Egypt, Morocco, Algeria, and Tunisia have the most advanced air forces on the continent, but do not have a cooperative work agreement in place for their air forces. Now Tunisia is taking a lead role in promoting the sharing of air assets in Africa.

Hajem said Harrigian's leadership has already advanced peace and security in the region, and in particular elevated the U.S.-Tunisia relationship. But much more needs to be done. A working group presentation at the symposium indicated operational-level potential for sharing, but a lack of high-level political and military agreements among the nations. Cooperation will also require greater commonality and interoperability, ensuring reliable supply chains for spare parts and common operating practices.

"All that should be ready so that you can employ your air assets and procedures on U.S. standards to be sure that you are interoperable with the U.S. side and other partners," Hajem said.

Botswana Air Chief Maj. Gen. Hendrick Tbuthu Rakgantswana said his nation relies on the U.S. for both training and equipment, and noted he learned to fly C-130s at MacDill Air Force Base, Fla. Botswana recently acquired three C-130s through U.S. Foreign Military Sales, but one is currently grounded due to financial constraints.

"In our regional economic community, the Southern African Development Community, we face a lot of disasters and crises, and we don't have the requisite airlift capability," he said. "So, it means, now, that we have to come together and pool our resources."

That could mean funding, aircraft, and trained personnel. Botswana contributes to peacekeeping efforts in Mozambique and provides airlift assistance to neighbors Lesotho and Malawi. But Rakgantswana argues that a clear structure of sharing would allow countries to do more. "This mechanism is the answer," he said. "We just now have to make it fit in the existing structures," he said, such as the African Union or SADC. "We just need that link. They just need to appreciate the existence of the Association of African Air Forces and how it can assist from strategic airlift mechanisms."

Abraham Mahshie/staff

Concerns about force protection and security mean photographs of flight line operations are barred. At right, security forces practice perimeter security and related drills to hone self-defense skills.

leaders who they've been able to co-opt. And that works."

China, too, is seeking influence across the continent, building and financing infrastructure projects and casting its eyes on the continent's untapped mineral resources.

China seeks access to deep-water ports, especially an Atlantic naval base to balance its port and military installation in Djibouti on the Horn of Africa and the Gulf of Aden. In Djibouti, China's base is literally down the road from the U.S. Naval Expeditionary Base at Camp Lemonnier.

Gen. Jeffrey L. Harrigian, U.S. Air Force in Europe-Air Forces Africa commander, said the African continent is bigger and more complicated than most Americans realize.

"Broadly, our goal is to be great partners with the nations across Africa in that, the natural resources, the people, the potential that's here in Africa," Harrigian said. "Strategically, our goal is to make sure that we're the partners they want to come to, the partners that they feel they have trust and confidence in, and that we're going to work together to achieve their objectives."

DRILLING FOR PRACTICE

One cool February morning, two armored vehicles with gun turrets pulled up alongside the basketball court at AB101. Airmen dismounted and ran between the two vehicles, the turrets turning to cover their movement while Master Sgt. David Worley stood between the vehicles, pointing and shouting questions and instructions.

"What side is contact?"

"Driver side contact."

"OK, go in and do your portion. Where is your gunner facing? All right, gunner. Come on!"

"Once he's down, you need to communicate with the gunner. What's he doing?"

The vehicle cross loader training for convoys mimicked a real-world scenario in which one vehicle is immobilized and the second must provide cover as Airmen transfer to the operable vehicle. Worley ran the exercise again later that morning as part of a knowledge exchange with French Soldiers from Operation Barkhane visiting AB101 from their adjacent base.

"A lot of opportunities here to really make things your own," Worley told Air Force Magazine after the first training session. "And what I mean by that is, build up programs, build up defenses, improve process, all that good stuff.

"I'm excited to see what Air Base 101 will look like in the next, you know, five to 10 years—if we happen to be here that long—to see how the fruits of our labor kind of improve what we have here," he said. "The reward is completely something you can't really ... you have to feel that, right? Being able to be part of a team that is doing so much, growing so much—and that's something you can see down the road and say, 'Hey, I was part of that.' That's an amazing feeling all by itself."

It's an opportunity worth taking, he said, though perhaps not for the uncommitted. "If you get the opportunity to come out here," Worley said, "be ready for the challenge." ✪

Tech. Sgt. Stephanie Longoria

International cross training is a cornerstone to U.S. involvement in the region. U.S. Air Force Tech. Sgt. Sean Douglas demonstrates how to make a sling during training with Niger's armed forces at AB201.

Turning the ABMS Strategy into a Reality

By Elaine Bitonti

The need to enable Joint All Domain Operations (JADO) to keep ahead of the adversary threat has been well-documented and studied, as has the Joint All Domain Command and Control (JADC2) infrastructure needed to enable JADO. The Department of Defense's focus is now on the transition from concept and planning to implementation and capability delivery. Industry has been working aspects of the problem with each of the individual services and brings a unique perspective on how to combine existing and new capabilities to solve the joint service gaps.

The recently released ABMS Digital Infrastructure Strategy provides insight into the USAF's approach to build up the backbone of JADC2. This vision for a cloud-based battle management infrastructure providing secure and resilient data sharing from strategic centers to the tactical edge is supported by the core capabilities of connectivity, secure processing, and data management.

There are two major challenges to realizing the JADC2 vision. The first is finding ways to utilize existing assets in future solutions, and second is determining how best to apply the commercial cloud to military environments. Collins Aerospace is focused on addressing both challenges at the tactical edge.

By adapting and connecting current platforms, the USAF may be able to accelerate its timeline for adopting both ABMS and JADC2. Current connectivity solutions are comprised of various existing, purpose-built networks that aren't easily connected, have limited data rates, and suffer from intermittent connectivity in contested environments. Finding ways to utilize and connect these disparate systems by creating a "network of networks" so each branch can talk to the others using intelligent gateways will accelerate integration and ensure those connections happen throughout the Joint Services and with Coalition Forces.

Over the past year, Collins has demonstrated connectivity and intelligent gateway solutions that integrate multiple existing airborne and ground networks used by the joint forces and coalition partners, including the USAF, U.S. Navy and Army, and the Marine Corps. We demonstrated these capabilities using modular open system architecture solutions, developed in partnership with the Air Force customer on programs like the Software Programmable Open Mission Systems Compliant (SPOC) program.

The second major challenge in realizing the JADC2 vision is addressing the unique processing requirements for operating in tactical environments. Today's commercial infrastructure is built on large, fixed data centers, fixed networks, and 5G towers. Unfortunately, many of these do not exist in or are not functional in contested environments. Collins Aerospace has been militarizing these capabilities all the way to the tactical edge to provide secure processing capabilities that enable multi-level security access to the power of the cloud for artificial intelligence and machine learning.

Once individual systems are connected, the data flowing back and forth is often at different security levels due to differing classifications. Ensuring that cross-domain solutions can resolve differences between and among both Joint and Coalition forces is another critical consideration. We not only connect these systems; we ensure they're secure.

For example, Collins has already proven that existing assets and capabilities can be connected and remain secure via a recent demonstration conducted with our academic partner – the University of Iowa Operator Performance Labs. In this latest demo, intelligent edge applications that can autonomously find, fix, and engage a target using multi-service sensor integration was added to previously showcased intelligent gateway capabilities in support of the U.S. Army's Project Convergence.

Delivering these integrated capabilities on the timeline needed to pace the threat requires adopting commercial Minimum Viable Product (MVP) approaches delivering a capability to the user and rapidly iterating new features. Our experimentation and demonstration activities span different operational use cases and joint services focus areas. While working with the Utah Air National Guard, for example, Collins demonstrated the ability of the KC-135 platform to be an intelligent gateway and interoperate with Air Force, Army and Navy networks. The demonstration was based on highly mature capabilities that could be quickly integrated into the platform via already planned technology insertions to deliver joint force connectivity.

These demonstrations – conducted under different operational scenarios – show that enabling JADC2 can be addressed incrementally. This allows combatant commanders to benefit from operationally relevant, leave-behind capability while building out solutions that will successfully enable cloud operations at the tactical edge. We're ready to support the ongoing efforts that will turn ABMS from concept to reality for the benefit of our warfighters.

Elaine Bitonti is the vice president of JADC2 Demonstration and Experimentation for Collins Aerospace.

The Air Force gave up its dedicated electronic warfare platforms in the 1990s. Those functions are now flying on the F-22, F-35, and soon, the F-15 with the Eagle Passive Active Warning Survivability System (EPAWSS).

Dominating the Spectrum

Foreign advances and U.S. neglect have realigned the electromagnetic battlefield. Here's how USAF is fighting back.

By John A. Tirpak

"Asleep at the wheel." That's how Chief of Staff Gen. Charles Q. Brown Jr. described the Air Force's lackluster approach to advancing the art of warfare in the electromagnetic spectrum (EMS) over the past 30 years.

For most of that time, America was focused on counterinsurgencies in the Middle East, not peer warfare, where mastery of the spectrum can spell the difference between victory and defeat. But with Russia and China having advanced the state of the art, the United States is now fighting to catch up. It's compelled to consider alternative strategies to dominating in EMS warfare while developing new weapons and systems to counter the advances of peer adversaries.

"Generally, we're going to have to be able to fight in a fractured way."
—Lt. Gen. S. Clinton Hinote, USAF deputy chief of staff

The Air Force approved a new Electromagnetic Spectrum Superiority Strategy last April, and Air Combat Command stood up the 350th Spectrum Warfare Wing last summer. In the fall, the service reorganized EMS under the Intelligence, Surveillance, Reconnaissance and Cyber Effects directorate. And this spring, the Air Force and Navy will send Congress a joint report on efforts to accelerate research and deployment of "cognitive" electronic warfare, which leverages machine learning.

Yet as the Air Force strives to put all these changes into effect, China and Russia continue to invest in and enhance their capabilities. Brewing conflicts in Ukraine, Taiwan or elsewhere may not allow the U.S. time to catch up, U.S. forces may have to settle for something far short of spectrum domination: mutual denial. While U.S. skills in EMS atrophied

The Air Force's EW Quarterbacks

To implement an EMS strategy, the Air Force needs hardware. It gave up its dedicated electronic warfare aircraft, the EF-111 Raven and F-4G, in the late 1990s. Their functions have since been taken over by the F-16 Block 50 Wild Weasel, the EC-130 Compass Call, and a number of other tactical platforms, pods, and systems integrated with aircraft such as the F-22 and F-35.

For the latter half of the 2020s, the Air Force's tactical EW game will largely be handled by the F-35 Block 4, with its AN/ASQ-239 EW system, and the F-15, fitted with the AN/ALQ-250 Eagle Passive Active Warning Survivability System (EPAWSS). The EPAWSS is actually based on the F-35's suite, and BAE Systems, which makes both, expects that it will be able to produce modules common to both systems by mid-decade, sharply reducing sustainment costs while maximizing the efforts of software. The Air Force and Boeing are deciding whether to pursue that approach.

Neither the Air Force nor BAE Systems can talk much about how, specifically, the EPAWSS works. Traditionally, such systems have either jammed enemy radars with so much energy that they can't see targets in the cloud of electrons; or they send an inverse wave to fool the enemy radar that it isn't there; or it manipulates the return signal to fool the enemy radar into thinking the jet is somewhere else.

Broadly, it's an internal system—not a pod—that rapidly senses and collects "hits" of electromagnetic energy, even from low probability of intercept radars, creating a wrap-around view of threats for the pilot. EPAWSS is integrated with the F-15's chaff and flare dispensers, and is "interoperable" with the F-15's active electronically scanned array (AESA) radar, BAE said, meaning it can jam enemy radar without interfering with the jet's own radar or radar warning receivers.

The EPAWSS has a modular, open-system architecture so that even small businesses with "neat tricks" will be able to get onto the platform, said Jerry Wohletz, BAE Systems vice president and general manager for electronic warfare. And while he couldn't say how fast the EPAWSS can detect a threat and respond, it's "the fastest system that has ever been deployed."

"We're using fundamental math and physics," Wohletz said. "We're not going after artificial intelligence or machine learning," but "raw, brute force overmatch against what the adversaries can field in speed." He said that provides an advantage in decision-making: "if you're faster than your adversary, you own your adversary."

The system will provide "freedom of maneuver" for the non-stealthy, 1970s-vintage F-15 near highly contested airspace, Wohletz said. The F-15 will be able to get "within meaningful ranges" of enemy air defenses with a large load of weaponry, "so they can use all of that armament ... at a very extended combat range." Without EPAWSS, the Air Force has said the F-15 would be unusable near contested airspace after about 2025.

Rather than rely on a library of set piece responses, the EPAWSS can deliver a "cocktail of approaches" that will challenge an adversary's ability to process the data on a useful timeline.

By building on the F-35's system, the EPAWSS and F-35 will both be able to take advantage of software and update investments, Wohletz said.

"Now EPAWSS is feeding back into [F-35] Block 4 upgrades," he said, "and we're going to take that to the next level, and drive more commonality into the system, toward the ideal situation of some day, getting to ... where the modules start to be interchangeable between aircraft." That's key, because "you hear from DOD leaders, 'sustainment is killing us,'" he said. Common modules would ease maintenance by making more line replaceable units available and reduce cost by producing them in greater quantities.

Major software updates will likely be made in six-to-12 month intervals, Wohletz said, but in development, there have been as many as five a year, indicating that faster updates are possible if necessary.

EPAWSS suffered from serious setback early in development, but BAE Systems put "a lot of skin in the game," and those issues are largely resolved, Wohletz said. The Pentagon's Director of Operational Test and Evaluation, in its 2022 annual report, said the Air Force is testing EPAWSS now and will start fielding it operationally on F-15Es in fiscal 2023, and on the new F-15EX in fiscal 2024.

1st Lt. Savanah Bray

EPAWSS will keep vintage F-15s in the fight by allowing the aircraft to get close to enemy air defenses carrying many weapons. The system will be fielded operationally on the F-15EX (at right) in fiscal 2024.

China Ministry of Defense via CGTN

China invested heavily in electronic warfare capabilities over the past two decades, and it paid off. One such investment was the J-16D electronic warfare aircraft with mounted EW pods, seen here.

during its long counterinsurgency fights in Southwest Asia, China matched and surpassed them. So said Lt. Gen. S. Clinton Hinote, deputy chief of staff for strategy, integration, and requirements—USAF's "futurist"—in a December speech to the Association of Old Crows.

"That was a time of de-emphasis of electronic warfare, electronic attack, electronic defense, maneuvering in the electromagnetic spectrum," Hinote said. "They studied us. … They studied many of you and your work, and they did their best to come up with ways of countering what you were doing in the electromagnetic spectrum."

Today, as a result, China can send pulses from their radars "that are different every time," Hinote said. "Yes—that's happening right now."

The Chinese became so good at electromagnetic spectrum warfare in the interim that today "they absolutely believe that [EMS] superiority is a prerequisite for victory," Hinote said, suggesting that denying China use of the spectrum could be enough to deter it from fighting. "Maybe it's enough that we deny the use of the electromagnetic spectrum to China," he said, by filling "the airwaves with electromagnetic energy to the point where you could walk on it. … To make it so difficult to operate in the electromagnetic spectrum that it's mutually denied space."

Like the "no man's land" between the opposing trenches in World War I, the spectrum would be a region where neither side has superiority or advantage. "Gum it up so much that China is fearful of their ability to operate in that area," Hinote said.

The Air Force is "pretty good" at operating with communication severed, sensors jammed, and space connectivity denied, Hinote said. It's practiced the concept for years in "A Day Without Space" exercises. "Generally, we're going to have to be able to fight in a fractured way," he said. A "fractured versus fractured force fight is a very interesting one to us."

Hinote urged listeners to be "open" to and accept as fact that wholesale superiority may no longer be possible. He urged listeners to be open to the idea of mutually denied EMS and accept that wholesale superiority may no longer be possible.

Critics warn that there are drawbacks to a scorched-sky, no-man's-land approach to EMS. Ret. Maj. Gen. Kenneth R. Israel, in a January paper for AFA's Mitchell Institute for Aerospace Studies, wrote that "slugging it out electronically with our adversaries obviates all the advantages of such innovative operational concepts such as mosaic warfare."

U.S. strategy, he argues, should be using all its technological capabilities to gain decision advantage over adversaries.

Hinote, however, counters that the answer is not so much abandoning dominance as narrowing the focus of where and when it's needed.

"There's no one out there … who seriously believes we can project air superiority in all places, at all times, and at all altitudes," Hinote said. Rather, America must focus on ensuring the ability to dominate airspace at the place and time of its choosing. The same approach could be applied to EMS warfare.

In a densely jammed battlespace, confusion can offer opportunities, Hinote suggested. Given that the battlespace will be filled with platforms that all have "apertures" and "energy producers," the U.S. could "use software to be able to generate certain kinds of directed energy," and could inject cyber weapons into the mix. He declined to elaborate because details are classified, but added: "I'm really excited about this."

NEW INVESTMENT

Brig. Gen. Tad D. Clark, USAF's director of the electromagnetic spectrum superiority directorate, told the Old Crows that it will be important to inject "that doubt, that hesitation" into an adversary's decision-making. "That confusion is winning for us." If adversaries can be forced to pause and reconsider whether "the odds are in their favor … we're slowing their decision matrix down."

Investing in new EMS capabilities will pay off, Clark said, because achieving cyber effects or spectrum denial "gets us to the desired effects—nonkinetic effects—for pennies on the dollar" compared to kinetic weapons.

Col. William E. Young, commander of the 350th Spectrum Warfare Wing, said his job is to take all the sensors, jammers, directed-energy weapons and other tools and generate myriad unpredictable combinations. Like Lego bricks, they can be mixed and matched "into on-demand, ad hoc kill webs." This imposes complexity on adversaries by creating a nearly impossible task: anticipating all the different combinations they could face.

This "Lego" approach signals another change, from packaging such systems "at the platform level" to instead doing so "at the subsystem level," he said.

According to Hinote the U.S. remains the leader in "signature management stealth" in both long- and shortwave frequencies, as well as in other EMS efforts. Stealth "was revolutionary and it still is," he said. "The idea that from very low frequencies to high frequencies, you can manage signature, and you can do

it in all aspects, and you have the ability, in the same platform, to reduce infrared emissions—those are incredible advances." U.S. platforms can now claim "very, very low signature" in radio frequencies and infrared.

The Pentagon is also rapidly building its partnership with the commercial sector, where competition is fierce in developing autonomous systems and leveraging machine learning for all manner of applications. Such automation also has huge implications for next-generation electronic warfare.

Commercial innovation may drive these advances more than defense requirements, making the Pentagon more of an adopter than a developer. By contrast, China requires close cooperation between commercial developers and military customers.

Because there is little commercial value to "catch a pulse," manipulate it, and retransmit it all at very high speed, the military will always need focused programs in EMSO [EMS operations], Hinote said. "We have to bring together the military side and the commercially driven side," he said. "We have to be ambidextrous."

MOVING FASTER

In his paper, Israel said the Air Force has been good at setting EMSO goals, but isn't swiftly reaching them.

"We do not need an aspirational document, but an actionable document that lays out what we need to do and by when, to achieve spectrum superiority," he said. "We do not have the luxury of time or promised future resources to fix our [electronic warfare and] EMSO gaps."

Israel said the Air Force has too few EMS warfare specialists and insufficient incentives to retain the expertise it has, let alone to draw new people into the field.

"We must rebuild and expand our EMSO expertise fast," he said. USAF graduates just 80 electronic warfare officers a year from the Navy's Joint Combat Systems Officers school—too few to meet demand. Talent is needed with "a broad array [of] interrelated, spectrum-dominated technologies, to include artificial intelligence, networks, 5G, complex waveforms, interferometry, antenna designs, microelectronics, phase-reversing phenomena, digital processing, cloud topologies, metadata analytics, encryption, directed energy, and other forms and modes of electronic warfare."

It is unreasonable to expect "a social studies or music major will understand and transition easily into mastering the essentials of cognitive and complex signals," Israel said.

Rather than seek to grow these experts organically, Israel said the Air Force should hire trained industry experts directly and insert them at the appropriate levels of command.

"If we can bring on doctors with special skills into the DOD workforce, we should be able to bring on highly qualified, commercially trained EMSO experts and give them an appropriate … rating commensurate with their expertise and training," he wrote.

Without spectrum superiority, it won't be possible to achieve the dominance promised by joint all-domain command and control, Israel said.

Hinote agreed. In his remarks to the Old Crows, Hinote said that without a fully integrated force, with all domains connected and working together, wargames show clearly that "it's not pretty. …We lose." With the passage of time, "we see an increasing trend where we don't accomplish the objectives. And in fact, we lose faster," without joint all-domain command and control. "That's not a place any of us want to be."

A simple way to look at it is that "if you have vulnerability in one domain, you can use strength in another" to compensate, he said. When broad networking is added to wargames, "then we actually did pretty well against the most advanced threats out there." But there's a "lot of work to do" to bring the domains together and eliminate stovepipe thinking and action. The longer the U.S. waits to truly implement it, the more adversaries will exploit "the investments they have made in tearing apart and fracturing the United States military command and control."

Hinote also said a sea change is underway in how to conduct electronic warfare. The old method where there were "libraries" of threats and how best to respond to each of them "may not help us in the way they helped us in the past." It will take AI and machine learning to rapidly assess and respond to threats.

"You're going to see your worthy rival … change their force presentation in the electromagnetic spectrum pretty quickly. And that's going to require us to be agile."

Hinote's upbeat about the future of EMSO, saying, "I actually think we compete pretty well. … And we certainly do not want a fight. We want to deter and protect our interests and those of our partners and allies."

In a shooting war with China, "nobody wins," Hinote admonished. So, "it's important that we do things that help us accomplish our strategy on the strategic defense" and recognize that using the EMS "to support defense in all domains is really, really critical, and good for deterrence."

It's an arena where "there's been … erosion over time and we need to build back, over time, but we need to build immediate capabilities today," he stated. ✪

Courtesy photo

To come from behind in EMS warfare, the Air Force will likely need to boost its production of just 80 electronic warfare officers a year from the joint EW school run by the Navy. Retired Maj. Gen. Kenneth Israel thinks it's time to bring high-level talent direct from industry.

Senior Airman Kiaundra Miller

Air Force Gen. Jacqueline Van Ovost, Air Mobility Command commander, and Chief Master Sgt. Brian Kruzelnick, AMC Command Chief, share a laugh with Staff Sgt. Christopher Lynch, left, at Ramstein Air Base in Germany. Van Ovost is one of only two currently serving female four-star generals in DOD.

GLASS CEILINGS

America may be on the verge of promoting its first woman to lead a military service. The Air Force has the inside track.

By Amy Hudson

Women have long played an active role in the U.S. military, but it's only in recent times that they have approached its top ranks. Army Gen. Ann E. Dunwoody was the first Army four-star general in 2008; Air Force Gen. Janet C. Wolfenbarger was the first Air Force 4-star in 2012; and Adm. Michelle Howard became the first Navy 4-star in 2016. Three women have led one of the Defense Department's 11 combatant commands. And none has ever led a military service—yet.

Within the next year to 18 months, however, that could change. The Air Force and the Space Force each have senior female leaders with the combination of operational and senior-level Washington experience that will make them competitive in the high-stakes selection process and political conditions are also favorable, as the Biden administration has prized diversity in making appointments to high-ranking positions in defense and across government.

"DOD could benefit from expanding the opportunities for non-pilots. It's better for national security."
—David Norquist, former undersecretary of defense

Making it to the top ranks in any military service is challenging. To be successful, officers must stand apart from their peers early on and continue to excel at every level. Where you start is also critical. The Air Force has never had a Chief of Staff who was not a pilot, and all but one were bomber or fighter pilots. Over the past 60 years, the lone exception was Gen. Norton A. Schwartz, a special operator who flew C-130s and helicopters, who became Chief in 2008 as a surprise choice following the firing of then-Chief of Staff Gen. T. Michael Moseley. All but two of the Air Force's 40 vice chiefs also have been pilots.

Women make up 19.2 percent of Air Force officers, but only 6.5 percent of its pilots. What's more, most women pilots fly mobility aircraft, not fighters.

The numbers dwindle as Airmen move up the ranks. Among the 61 three- and four-star officers in the Air

Force and Space Force, just three are women—4.9 percent. Only one—U.S. Transportation Command boss Gen. Jacqueline D. Van Ovost—has four stars. Among all the armed forces, she and Army Gen. Laura J. Richardson, commander of U.S. Southern Command, are the only two who are women.

"It's not simply the pool you start with," said former Deputy Undersecretary of Defense David L. Norquist. "What are the career fields within that tend to be the ones selected to be combatant commanders or other senior positions?"

Norquist, who left the Pentagon in February 2021 and is now a defense consultant, said the factors that determine who rises highest could change as priorities change. "We know that the character of war is changing. We know that technology is changing," he said. "So how does that change the skill mix that we need to reflect in our leadership? If there's increased demand for cyber and space [and] long-range strike, that puts a premium on people with those backgrounds."

The growing importance of logistics, communications, and intelligence are all fields that have high representation among women.

"Those are often not the positions that are elevated to the most senior levels. But they include a different mix of personnel, and … there are more women in some of those fields," he added.

He suggested DOD could benefit from broadening its talent pool by expanding the opportunity for non pilots.

"It's better for national security and it makes the nation more able to adapt to the change in warfare," he said. "The secondary effect is you get a more diverse workforce in the leadership because you're drawing from areas that are not the traditional ones that tend to bring in a broader set of candidates. So, I think that's one of the driving changes going forward."

But there's a reason the Air Force has long looked to pilots to be its leaders, noted former Air Force Secretary Heather Wilson, who served as a staff officer after graduating from the Air Force Academy. The Chief of Staff requires a deep understanding of the Air Force mission, she said. An instrument-rated private pilot, Wilson did not fly for the Air Force, but went on to have a distinguished civilian career, including serving in Congress and is now president of the University of Texas, El Paso. But she acknowledged the Air Force's mission is evolving, and so too will the characteristics needed to be Chief.

"The service's leadership needs to be at the center of a mission, and that mission has evolved over time," Wilson told Air Force Magazine. "At some point we're going to have a remotely piloted aircraft pilot become a four-star. We have had, of course, mobility pilots as four stars, and Jackie Van Ovost is the most senior one now. … It's very, very hard for me to imagine a Chief of Staff whose background has been in logistics or maintenance, [because] this is the combat arms. … Those experiences that you get on the way to a job do matter."

BREAKING BARRIERS

When President Joe Biden chose Vice President Kamala Harris as his running mate in 2020, it set the stage for her to become the first woman and first person of color to be Vice President of the United States. His appointment of Lloyd J. Austin III as Defense Secretary was also historic, making the retired Army four-star the first Black Secretary of Defense.

Biden has emphasized diversity in his administration, saying he is "committed to ensuring that women are represented equally at all levels of the federal government." He established the White House Gender Policy Council within weeks of taking office, to "advance gender equity and equality in both domestic and foreign policy development and implementation," according to a White House fact sheet. In March 2021, Biden said his commitment, "starts with Vice President Harris, who broke through a barrier that stood for more than two centuries. And it includes a record number of diverse women whom I've nominated to serve in Cabinet-level roles and appointed to senior-level positions."

Biden chose Kathleen H. Hicks to be deputy secretary of defense, the first woman to hold the job, and Christine Wormuth to be Secretary of the Army, making her the first to lead a military department other than the Air Force. Until then, only four other women served as Secretary, all of them led the Air Force: Sheila E. Widnall (1993-1997), Deborah Lee James (2013-

Adrian Cadiz/USAF

Former Secretary of the Air Force Heather Wilson says that it's "very, very hard" to imagine a Chief of Staff coming from logistics or maintenance, but she expects to see an RPA operator to become a four-star at some point, due to the changing nature of warfare. Here, Wilson speaks to a group of Chiefs and their spouses at JB Andrews, Md., Jan. 15, 2019.

4-Star Trailblazers

Only eight women have ever achieved four-star rank. Five came from the Air Force, two from the Navy, and one from the Army. Of the 43 four-star generals serving today, the only women are USAF Gen. Jacqueline D. Van Ovost and Army Gen. Laura J. Richardson.

USAF

AIR FORCE

Gen. Janet C. Wolfenbarger

- First woman in the Air Force to achieve four stars; graduated in the first U.S. Air Force Academy class to have women (1980)
- Promoted to general in 2012 to lead Air Force Materiel Command
- Retired in 2015

USAF

AIR FORCE

Gen. Lori J. Robinson

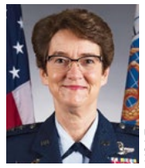
- First woman to lead a unified combatant command; first female commander of combat forces; first woman instructor at Nellis Fighter Weapons School; first female air battle manager
- Promoted to general in 2014 for assignment as commander of Pacific Air Forces
- Confirmed to lead U.S. Northern Command in 2016
- Retired in 2018

USAF

AIR FORCE

Gen. Ellen M. Pawlikowski

- Third woman in the Air Force to achieve four stars
- Promoted to general in 2015 to be commander of Air Force Materiel Command
- Retired in 2018



USAF

AIR FORCE

Gen. Jacqueline D. Van Ovost

- Second woman to lead a unified combatant command, and first woman to lead U.S. Transportation Command. At one point, Van Ovost was the only actively serving woman wearing four stars in the U.S. military. She is now one of two women four-star generals, along with the Army's Richardson
- Promoted to general in 2020 to be commander of Air Mobility Command

USA

ARMY

Gen. Ann E. Dunwoody

- First woman to serve as four-star general in the U.S. armed forces; First female general at Fort Bragg, N.C.; First female battalion commander for the 82nd Airborne Division
- Promoted to general in 2008 to be commander of U.S. Army Materiel Command
- Retired in 2012

USN

NAVY

Adm. Michelle J. Howard

- First female four-star in Navy; first Black woman to achieve four stars in the U.S. military; first female four-star admiral to command operational forces as commander of United States Naval Forces Europe and Naval Forces Africa
- Promoted to admiral in 2014 to be Vice Chief of Naval Operations
- Retired in 2017

USAF

AIR FORCE

Gen. Maryanne Miller

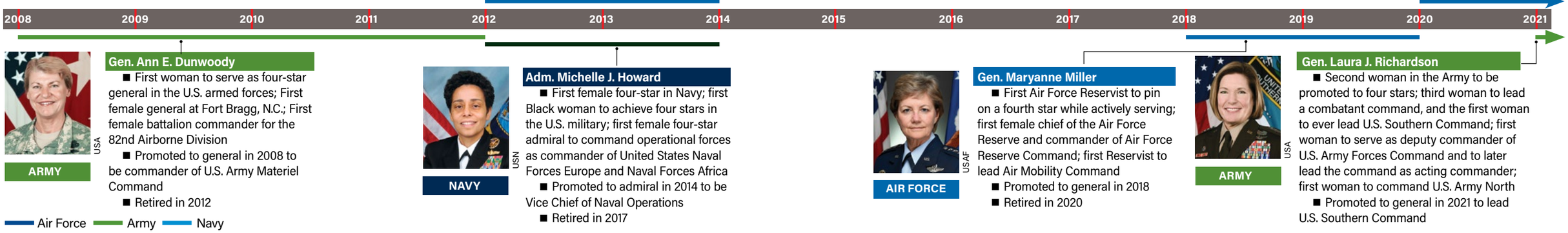
- First Air Force Reservist to pin on a fourth star while actively serving; first female chief of the Air Force Reserve and commander of Air Force Reserve Command; first Reservist to lead Air Mobility Command
- Promoted to general in 2018
- Retired in 2020

USA

ARMY

Gen. Laura J. Richardson

- Second woman in the Army to be promoted to four stars; third woman to lead a combatant command, and the first woman to ever lead U.S. Southern Command; first woman to serve as deputy commander of U.S. Army Forces Command and to later lead the command as acting commander; first woman to command U.S. Army North
- Promoted to general in 2021 to lead U.S. Southern Command



2017), Wilson (2017-2019), and Barbara M. Barrett (2019-2021).

Air Force Chief of Staff Gen. Charles Q. Brown Jr. is the first Black service Chief, and the only African American member of the Joint Chiefs besides Colin Powell, who was Chairman from 1989-1993. Gina Ortiz Jones, the Undersecretary of the Air Force, is the first openly gay person and first woman of color to fill the role.

In the next one to two years, both Brown and Space Force Chief of Space Operations Gen. John W. "Jay" Raymond will either retire or move to new positions. Each could possibly be succeeded by a woman.

LOOKING AHEAD

When Army Gen. Mark A. Milley retires next year after four years as Chairman of the Joint Chiefs, he will set in motion a daisy chain of events that could lead to a series of historic nominations.

The fact that Adm. Christopher W. Grady was named Vice Chairman last year (replacing retiring Air Force Gen. John E. Hyten Jr.) says a lot about who might succeed Milley as Chairman, according to Mackenzie Eaglen, a senior fellow at the American Enterprise Institute, a Washington, D.C., think tank.

"What it signals is that the top job is not going to go to someone in the Navy," she said.

Milley is the 20th Chairman of the Joint Chiefs, and the fifth since an Air Force officer last held the job, when Gen. Richard B.Myers retired after four years as Chairman in 2005. That's an indication that an Airman might be in line to relieve Milley in 2023.

Two Marines, two Soldiers, and one Navy admiral have been Chairman since Myers retired, a span of 22 years by the end of his tenure. That's even longer than the 19 years that elapsed between the retirement of Air Force Gen. David C. Jones as Chairman and Myers being sworn into the job just weeks after 9/11. Such long stretches are an aberration rather than the norm for a position that is supposed to rotate roughly equally among the services.

U.S. Air Force Chief of Staff Gen. Charles Brown Jr., salutes the U.S. Air Force Honor Guard during the 102nd Annual Veteran's Day Parade, Nov. 11, 2021, in New York City. Brown began his tenure emphasizing the need for speedy change, and hasn't let up. He may also become the next Chairman of the Joint Chiefs of Staff.

Tech. Sgt. Ryan Conroy

In Norquist's view, the most important characteristic for a senior military leader is "the ability to drive change." With the speed that the threat environment is changing, he said, what worked even five years ago, won't necessarily work in the future.

"So, one of the things I look for in leaders is whether they've been able to drive change in the system in order to make it function differently," Norquist said. "There's a lot of resistance, rightfully, in any bureaucracy to change, because change creates complications, and things may go wrong. A leader who knows how to drive change in an organization without breaking it is incredibly valuable."

Brown's mantra, since Day One as Chief of Staff of the Air Force, is to "accelerate change."

This, too, seems to work in Brown's favor as a candidate to succeed Milley.

"It does seem that the decks are being cleared for General Brown," Eaglen said.

Within months of assuming the Air Force's top uniformed job, Brown challenged the service with a white paper titled "Accelerate Change or Lose." Even now, nearly two years later, he continues to hammer at that same point in nearly every public speech. The Air Force must move now or face dire consequences in the next conflict. Change won't only come from the top, but must be initiated in the field, without waiting for extra resources to pay for new gear. Airmen of all ranks should understand their role in combating threats, and more importantly, they shouldn't wait for the bureaucracy to catch up.

"I hate bureaucracy," Brown has said. "I like cutting to the chase and getting things done."

Brown acknowledges bureaucracy is sometimes necessary, but it can also be an impediment, slowing things down.

Michael O'Hanlon, a senior fellow of foreign policy at the Brookings Institution, also sees Brown as a frontrunner for Chairman.

"I can't think of who would be a female Chairman just now, but I could be wrong," he told Air Force Magazine. "More likely is that we'd see the second Black Chairman (after Powell) and then, if Biden wins re-election, perhaps the first female SECDEF."

O'Hanlon said Michele Flournoy, the former undersecretary of defense for policy, who was edged out for Secretary of Defense by Austin in the first term, is a good bet to get the job if Democrats remain in control of the White House.

Before then, though, more glass could be broken: A female Chief of Staff could be named in 2023 or, perhaps, a woman could be appointed to lead a "warfighting combatant command," Eaglen said. Either "would be very exciting."

If Brown is nominated for Chairman, Eaglen and O'Hanlon agreed, Van Ovost is well positioned to become Air Force Chief of Staff, making her the first woman to gain a seat at the table in the Joint Chiefs' fabled "tank."

"Jackie's interesting. I have a lot of respect for her," said Wilson. Van Ovost was the Air Force's Director of Staff when Wilson was Secretary, so they were in frequent contact. "She has a black belt in Pentagon, and she also has deep operational experience in mobility, which is a huge part of the United States Air Force," Wilson said. "She's an exceptional leader."

The Space Force, now just over two years old, will also get a new Chief in 2023. Aside from Raymond, who has led the new service since it stood up in December 2019, the only other Space Force four-star is Gen. David T. Thompson, the current Vice Chief of Space Operations. That means that unlike the other services, where seasoned four-star officers compete for the top job, the race for the next CSO will likely be a competition among three-star generals.

Timothy Sandland/USSF

The U.S. Space Force has a unique opportunity to build a service designed with women in mind, and could be the first to make a woman Chief. Lt. Gen. Nina Armagno, director of staff, USSF (left), is a three-star that may be in the running. Here, she speaks with Brig. Gen. Virginia Gaglio, Chief of Staff and Air Component Commander of the Massachusetts National Guard.

The Space Force has six three-star generals today, with Lt. Gen. Nina M. Armagno, the services director of staff, the most senior of the six. The others are Lt. Gen. William J. Liquori; Lt. Gen. B. Chance Saltzman, Lt. Gen. Stephen N. Whiting, Lt. Gen. John E. Shaw, and Lt. Gen. Michael A. Guetlein. All things being equal, there's a roughly 50 percent chance that Armagno could become either CSO, Vice CSO, or perhaps commander of U.S. Space Command when the current occupants of those jobs move on.

MORE WORK TO DO

O'Hanlon authored a paper in May 2020 with retired USAF Gen. Lori J. Robinson, titled "Women Warriors: The ongoing story of integrating and diversifying the American armed forces."

Robinson, the former commander of U.S. Northern Command and now a Brookings fellow, was the first woman to lead a combatant command. Robinson, Van Ovost, and Richardson are the only women to lead combatant commands.

In the paper, Robinson tells her story of being the child of an Air Force pilot who earned her commission in the 1980s through Air Force ROTC and never expected to make the military a career.

"Life has a way of figuring things out for you," she writes. "I had no idea that I would stay in for 37 years. No idea that I would be promoted beyond major. … No idea that all of my mentors would be men and fighter pilots."

This proved a critical advantage, and Wilson said it's not surprising. Those who study leadership, both in the military and private sectors, say mentors make a huge difference. And one of the biggest differences between men and women is that about "two-thirds of men say they had a mentor or sponsor who was really important to them, and two-thirds of women leaders say they've never had a meaningful mentor," Wilson said.

A mentor opens eyes as well as doors, Wilson suggested: "You can't be what you can't see." Van Ovost said the exact same thing in a 2020 interview with Air Force Magazine.

Because the Air Force was faster to open more jobs to women, with most barriers removed in the early 1990s, it may now be ahead of its sister services in promoting women.

Wilson said that may be more cultural than policy-driven. The nature of the Air Force, which is more technical and doesn't require as much physical strength as some jobs in the ground services, also plays a role.

THE LONG VIEW

Robinson and O'Hanlon acknowledged in their paper that the Defense Department is more integrated than at any other time in its history, but the lack of women in senior leadership roles demonstrates that the Pentagon has yet to remove all the barriers women face, beginning with the challenges of balancing careers and families. It's "still hard to leave the service for five to 10 years, then return," O'Hanlon said.

Eaglen said the first step to ensuring women are equally represented in senior leadership roles is to "admit there's a challenge here."

"Step two is to ensure consistently high recruiting and retention of women, particularly during prime earning years, which are also childbearing years for most women, which is also, you know, the time of promotion," said Eaglen, herself a mom of multiple children. "Third is to change the personnel system to accommodate exactly that point in time for women. … You've got to make sure the system can support promoting more women up through the ranks, and then secondly, actively search out those women and give them the opportunity."

Several recent reports from the Air Force Inspector General, which looked at promotions, discipline, and ascensions based on race, ethnicity, and gender, showed the service still has far to go in this regard.

"We need talent as diverse as the opportunities and challenges we face as a country," Jones said during AFA's Air, Space & Cyber Conference. "The threat, our ability to address that, is certainly based on the talent we have within our Space Force and our Air Force." ✪

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photo by Master Sgt. Michael Crane

Blurring the lines between military and civilian space missions could prompt a reconsideration of the accepted laws of war. Here, a military small satellite is launched Dec. 7, 2021, from Cape Canaveral, Fla. Now a U.S. Space Force base, both civilian and military launches have been carried out at Cape Canaveral for years.

Resilient Architecture vs. Civilian Risk

The Space Force's strategy to mix military with civilian space raises questions about the law of war.

By Amanda Miller

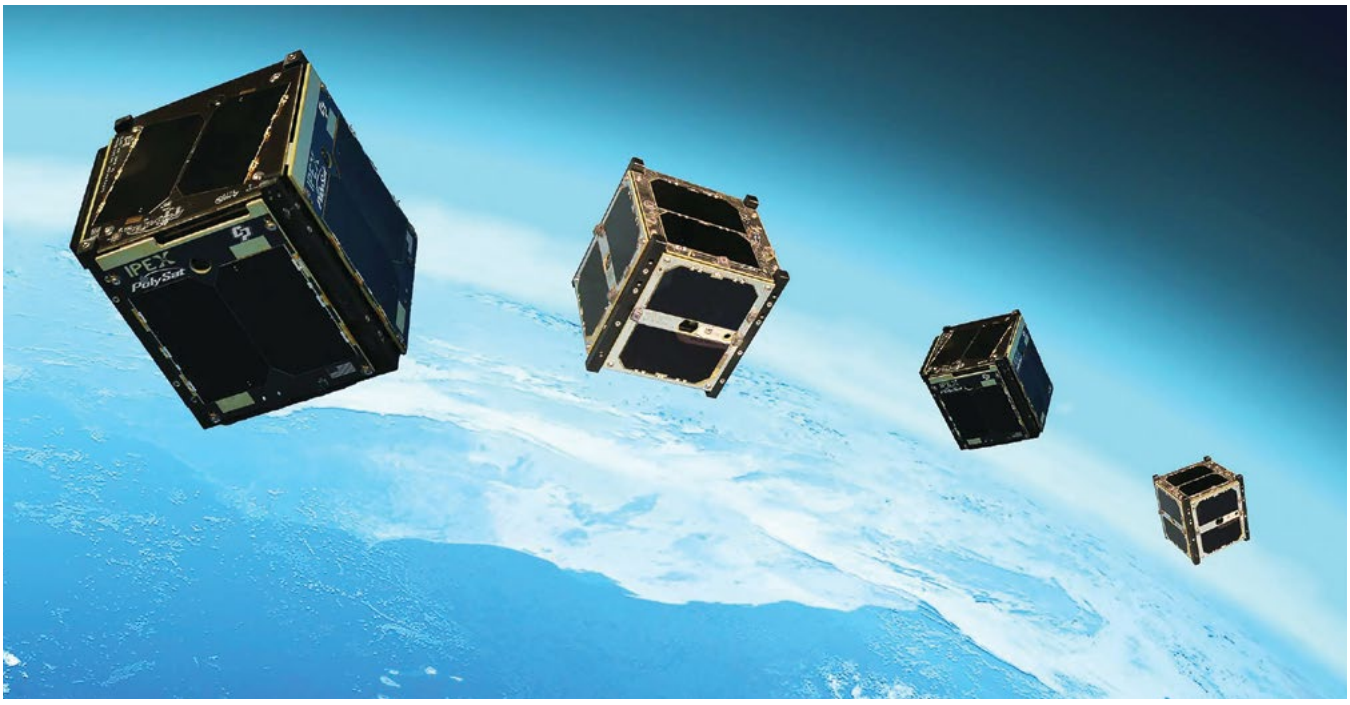
Technological advancements by China and Russia have increasingly focused attention on the relative vulnerability of U.S. military satellites. Since China steered a satellite to grab and move another satellite out of its orbit in January 2022, just months after Russia destroyed a defunct satellite with a ground-launched missile, the risks have only grown clearer.

To ensure satellite systems are available and able to perform when needed, U.S. Space Force officials are proposed a "hybrid" architecture that spreads its space-based sensors and communications systems across multiple constellations, only some of which are exclusively Space Force assets. Also in the mix: satellites belonging to allied governments, commercial satellite constellations, and both military and commercial ground facilities. By situating military satellites at multiple altitudes and supplementing them with commercial services and with assets distributed among foreign-owned satellites, U.S. strategists believe they may even be able to render other countries' anti-satellite weapons impotent as a means to disable U.S. space power.

"It's absolutely imperative that we ... get to a force structure that's more defendable."
—Chief of Space Operations Gen. John "Jay" Raymond, USSF

Over the brief two-year history of the Space Force, it has signed "burden-sharing" agreements with partner militaries and talked about a "space superhighway" with commercial entities, offering space transportation services en route to the moon.

Achieving resilience by intermingling military and civilian space activities, whether transportation or satellite services, has broad implications not just for the Space Force, but also for participating commercial and allied partners. Blurring the lines between civilian and military property could turn civilian systems into legitimate military targets



NASA/JPL

The Space Development Agency's plan for a constellation of hundreds of multi-purpose satellites—such as in this illustration of cubesats—with layers of function exemplifies the USSF's new approach to space defense.

under the Law of Armed Conflict—a prospect U.S. officials generally do not discuss publicly.

Writing in Harvard University's National Security Journal, Georgetown law professor David A. Koplow argues that the Space Force's strategy can be viewed as employing the approach infamously employed by Saddam Hussein during the 1991 Gulf War, when he used antiquities, mosques, and civilian neighborhoods as cover for military equipment and activities. Koplow's article suggests that blurring the distinctions between civil and military space poses serious implications for commercial customers and foreign nations.

THE RESILIENCE IMPERATIVE

As Chief of Space Operations Gen. John W. "Jay" Raymond likes to say, space "was a benign, peaceful domain"—until recently. Appearing on a webcast hosted by AFA's Mitchell Institute for Aerospace Studies Spacepower Advantage Center of Excellence, Raymond explained that the risk to a spacecraft has historically been limited to its launch and deployment.

"As long as you could launch a satellite—and it worked and didn't die in infant mortality because it failed when it first got on orbit—you were good to go," Raymond said. "That's not the case today."

China and Russia both see space as a warfare domain, one in which they intend to fight if they get into a war with the United States. China's Shijian-21 satellite can robotically "reach out and grab another satellite," Raymond said last September at AFA's Air, Space & Cyber Conference. Russia has a satellite built like a "nesting doll," which contains smaller satellites hidden within. "It's a satellite inside of a satellite inside of a satellite," Raymond said. "The satellite launches, opens up—another satellite is dumped out. It opens up, and a projectile is shot out to destroy a U.S. satellite and to destroy the advantages that that provides us."

Ground weapons are also a threat. In November 2021, Russia fired a ground-launched anti-satellite missile and successfully destroyed a derelict Soviet satellite. The strike created a debris field of some 1,500 fragments. China, for its part, has developed ground-based laser weapons that can interfere with a satellite in space. Satellites flying predictable orbits are sitting ducks for such weapons.

"It's absolutely imperative that we move away from legacy force structure and we get to a force structure that's more defendable," Raymond said.

The consequences of an attack in space are too great, he said. At present, striking the right satellites could destroy "our ability to sense data from around the globe, to be able to bring that data down to Earth, to be able to fuse that data with data from other domains, and then to use high-speed computing to be able to solve really tough challenges," Raymond said.

The guiding document for where the Space Force is headed is the 2015 Defense Department white paper, "Space Domain Mission Assurance: A Resilience Taxonomy," and the foremost strategy within it for building a resilient "hybrid space architecture" is something called proliferation, said said Space Force Col. Eric Felt, director of the Air Force Research Laboratory's Space Vehicles Directorate, in an interview.

Felt explained in an interview that proliferation means building larger constellations of smaller satellites, while at the same time employing "commercial capabilities that can do parts of your mission."

Felt transfers to the Pentagon this summer, where he will become deputy executive director of USSF's new Space Architecture, Science, and Technology Directorate. By leveraging commercial satellites, the military can spread its bets, he said. The goal: "Even if all of your military capabilities are taken out," you can still "get the mission done."

The Space Development Agency's plan for a multipurpose constellation of hundreds of satellites with "layers" of functionality orbiting at varying altitudes exemplifies the approach.

Proliferation also makes it harder for rivals to understand what capabilities live where and how they might work together. Lt. Gen. B. Chance Saltzman, in a November 2021 Mitchell Institute presentation, summed up the approach this way:

"If they don't know what to shoot at, then what's the benefit of shooting?"

LEVERAGING PARTNERS

Sharing space intelligence and assets, co-hosting sensors, and other collaborative work with allies and commercial partners brings "a value to all of us," Raymond says. "We have to look across all of the capabilities that we operate in and make this transition from a small number of very exquisite satellites to a more defendable architecture" with many more nodes, according to Raymond in January in a conversation at the Center for Strategic and International Studies.

Commercial and international participation in a hybrid architecture are not limited to leveraging existing satellite constellations or putting sensors on other nations' assets. It could also include ride-sharing missions and contracts for commercial services. Relationships with international military forces, in particular, have now "matured … much more significantly," the Space Chief said. That's enabling "this force design work we're doing now: We've shared that with our closest partners to say, 'OK, where might we build this collaboratively?' "

Norway, Japan, and Britain have all agreed to host American payloads, and the economic benefits are significant. The deal with Norway saved the Space Force time and money: It's "providing Arctic communications two years sooner than we could do it—and $900 million cheaper," said Space Force Director of Staff Lt. Gen. Nina M. Armagno at a Washington Space Business Roundtable event.

Col. Raj Agrawal, chief of the Space Division in the Secretary of the Air Force's International Affairs Office, described the agreements his office works on as "burden sharing." It is no different from what nations do today to spread out the development costs of a weapon such as the F-35 fighter jet, Agrawal said.

The strategy "gives us an opportunity to work with allies and partners to optimize what they're able to do," he said.

Indeed, Saltzman speculated that having many countries share a satellite asset could deter an attack, dissuading a potential adversary from risking conflict with not just one, but with a slew of allied nations. If "so many nations are affected by a single satellite's destruction," he suggested, it "would raise the threshold for an adversary to take that kind of action."

THE LAW OF WAR

Koplow's article in the January 2022 Harvard National Security Journal challenges the concept of proliferation on several fronts.

The Law of Armed Conflict was developed to protect civilians from the effects of war. No military operations or activities take place without staff judge advocates commenting on legality under U.S. and international law, including the Law of Armed Conflict, sometimes called "the Law of War." A 1977 addition to the Geneva Conventions codifies drawing distinctions between military and civilian objects: "In order to ensure respect for and protection of the civilian population and civilian objects, the Parties to the conflict shall at all times distinguish between the civilian population and combatants and between civilian objects and military objectives and accordingly shall direct their operations only against military objectives."

The United States never ratified the 1977 protocol, but Koplow asserts in his article that U.S. policy "accepts much of its content, including the principle of distinction, as binding customary international law."

Koplow writes that the purpose of this law is to ensure a combatant can "fulfill its primary obligation under the distinction principle, i.e., to direct its hostile fire exclusively against … military [targets]."

Koplow's article uses provocative examples to illustrate the distinction principle. For instance, he cites Saddam Hussein, who "ostentatiously parked fighter jets in front of a famous archaeological temple, apparently for the purpose of deterring U.S. strikes against those tempting assets."

Explaining the justification behind the principle, he writes:

National Space Policy Secretariat, Cabinet Office, Japan/Courtesy

USSF signed a memorandum of understanding on Dec. 15, 2020, with Japan's Office of National Space Policy to launch two U.S. payloads on Japan's Quasi-Zenith Satellite System in 2023 and 2024. Many countries sharing a space asset could deter potential adversaries since it would prompt conflict with not just one but many allied nations.

"Excessive co-location of civilians and combatants would inevitably jeopardize the former, as the opponent would be frustrated in attempting to attack only lawful targets that were too intermingled with immune persons and property."

The "ever-increasing entanglement" of military and private-sector space programs has evolved over the course of three presidential administrations and has bipartisan support, Koplow said, driven by a combination of motivations including cost and time savings. But he suggests there is "a less frequently acknowledged motivation," one that he sees as wrong: "the desire to complicate the task confronting any enemy that might seek to attack U.S. national security satellites."

"While this melding of the functions and identities of spacecraft may carry tactical advantages," he asserts, "the greater proximity is both illegal and unwise in the longer term."

The Space Force, in a statement responding to a query on this charge, said DOD "follows the law of war during armed conflict in every domain, including in the space domain." It continued: "While we engage in commercial activities in other domains as well, we recognize the value of commercial space as outlined by statute."

Capt. Sunderlin Jackson

An AFRL technician working on the Ascent spacecraft in the Space Vehicles Directorate's laboratory on Aug. 13, 2020. ASCENT is a demonstration mission to explore various CubeSat operations in geostationary orbit.

SCENARIOS

Koplow sees several scenarios proposed by the Space Force as challenging. A military payload hosted on a commercial satellite, for example, could be "a deliberate insinuation of a military asset into an erstwhile civilian environment," he writes. "The civilian modules, which should remain immune from targeting, are unnecessarily exposed."

Yet this is essentially the same scenario posed by a civilian power grid that also serves a military base, or a transoceanic commercial data cable that transmits both civilian and national security data. If a national government is using a commercial satellite for targeting in a conflict with a second state, for example, that second state would have a legitimate reason for targeting the commercial satellite. The result, Koplow writes, makes the civilian operator's satellite "vulnerable to attack at all times, imperiling its ability to serve civilian functions."

Brian Weeden, director of program planning at the Secure World Foundation, is a former Air Force space and missile officer now engaged in drafting the "Woomera Manual on the International Law of Military Space Operations." He reviewed Koplow's paper before it was published.

"It's a really important question, particularly since there's been a big push recently for the Pentagon to leverage more commercial products and services," Weeden wrote in an email to Air Force Magazine. "I think that's still important to do, but we need to think through the legal and policy implications, including the issues around distinction but also issues like liability."

Commercial assets support military activity in many ways, from highways and railways to aircraft and telecommunications. "But those activities exist under special legal regimes where we've answered a lot of these questions, or at least taken steps to mitigate them," Weeden said.

Retired Air Force Maj. Gen. Charles J. Dunlap, executive directory of the Center on Law, Ethics, and National Security at Duke Law and a former deputy judge advocate general of the Air Force, weighed in on Koplow's arguments for Air Force Magazine, diverging on some points but fully in agreement on one.

The military's use of commercial assets does not constitute necessarily an "anticipatory breach" of the Law of Armed Conflict, Dunlap said. "Determining if something is 'feasible' can properly include the cost and practicality of creating a parallel system," he wrote in an email. "In theory, a government might be able to create a separate road system, electrical grid, petroleum refineries, internet, and so forth for its armed forces. However, doing so for such major systems that serve both civilian and military needs would be so enormously costly as to be impractical."

Dunlap and Koplow do agree on one thing: What would make it illegal is the intent to use "a 'dual-use' system simply in the hopes that its civilian uses might help shield it from lawful attack," argues Dunlap.

In 2016, then-Deputy Secretary of Defense Robert O. Work laid out the strategy this way: "Our allies and partners allow us to add redundancy and resiliency, and they offer opportunities for hosting payloads that will proliferate what we have on orbit," he said in a speech at that year's Space Symposium. "This offers huge advantages—as it's one thing to have to deny the U.S. the use of a few government-owned imagery systems; it's quite another to take on tens or even hundreds of allied and U.S. government and commercial remote sensing systems all at the same time."

Work continued: "By enhancing the resiliency of our own constellation, improving our space [battle management, command, and control], operating as a space coalition, and investing the resources necessary to capitalize on and strengthen our own space-based capabilities and capacities, as well as those of the commercial space … we're going to be able to survive any type of concerted attack, and continue to provide the space-based support that our warfighters need."

Powering Maneuvers in Space

Space nuclear propulsion can support longer missions and make U.S. satellites more resilient and maneuverable.

DARPA illustration

A Demonstration Rocket for an Agile Cislunar Operations (DRACO) vehicle demonstrates a Nuclear Thermal Propulsion (NTP) system on orbit. NTP uses a nuclear reactor to heat propellant to extreme temperatures before expelling the hot propellant through a nozzle to produce thrust.

By Christopher Stone

America's national security satellite constellations were designed at a time when space was an uncontested domain. Their design maximized mission efficiency, life span and reliability, while providing only limited maneuverability and countermeasures. These mostly large, monolithic systems deliver tremendous mission functionality but fly predictable orbital paths, making them easy targets for enemy attacks. Like U.S. B-52 bombers over Hanoi during the Vietnam War, flying the same altitudes and flight paths day in and day out makes them sitting ducks for an enemy seeking to stop the overflights.

In today's increasingly contested operational environment, the United States must revamp its space force design and warfighting strategy so it can conduct maneuver warfare in orbit and beyond. Doing so would enable the U.S. military to take deliberate measures to deter, avoid, and defeat threats—to field an active defense in space—instead of simply allowing its passive constellations to absorb attacks until they fail.

Christopher Stone *is the Senior Fellow for Space Studies at the Mitchell Institute Spacepower Advantage Center of Excellence. Download the entire report at https://mitchellaerospacepower.org/maneuver-warfare-in-space-the-strategic-mandate-for-nuclear-propulsion/*

The U.S. satellites supporting civilian and national security missions today employ chemical or electric propulsion to maintain their orbits and make limited maneuvers to steer out of the paths of incoming objects. Because satellites carry only small amounts of chemical propellant, fuel must be used judiciously, as with aircraft that must limit speed to increase range. Satellites typically use chemical-powered thrusters to maintain orbit, adjust their position, or deorbit after mission completion. Electric propulsion, while more efficient than chemical propellants, is too slow for the kinds of maneuver operations the U.S. Space Force needs to ensure operations in the face of threats in space.

To better maneuver in space, a more powerful and fuel-efficient means is needed, and nuclear energy offers a compelling solution. Space Nuclear Thermal Propulsion (SNTP) is a high-thrust system that heats hydrogen as a propellant. It is the nuclear equivalent of a chemical rocket but more

efficient, enabling the spacecraft to fly longer missions with less propellant. Space Nuclear Electric Propulsion (SNEP) is a low-thrust alternative that consists of a nuclear reactor to generate electricity to power the spacecraft and a slow, but fuel-efficient propulsion system. Nuclear electric power systems could also power space weapons, such as lasers.

Both technologies are safe and could provide a maneuverable satellite force that is more survivable and capable, with both defensive and offensive benefits.

THE TECHNOLOGY

SNTP technology was developed and matured from the 1960s to the 1980s, but never operationalized. Absent a threat to make it necessary, there was no need to rapidly maneuver on orbit. Today, however, China's strategy of maneuver warfare in space, built on both space- and ground-based weapons, changes the dynamic. By 2040, in fact, China is planning to deploy space vehicles powered by nuclear thermal propulsion. Just as mechanized armor transformed the battlefields in World War I, rendering horse cavalry obsolete, the ability to maneuver in space will be transformational.

Nuclear thermal propulsion will be critical to counter China's anti-satellite weapons. While SNTP can't match the thrust generated by chemical rockets, it can conduct longer, more efficient engine "burns," producing higher velocity and more rapid maneuvers. SNTP can support longer, more complicated missions from a single vehicle and operate for years in space without needing to be refueled.

SNTP engines can also deliver the velocity and maneuverability needed to conduct maneuver operations in space with great efficiency—bottom line, they can operate with less "propellant" than their chemical counterparts and therefore can operate for longer mission times. SNTP engines use fission to generate heat. The higher the engine's temperature, the greater the thrust and propellant efficiency (or specific impulse). Advanced ceramic composites under development may be able achieve even greater impulse and thrust-to-weight ratios that are already possible today.

When all factors are considered, nuclear thermal propulsion systems are more than twice as fuel efficient as chemical propulsion systems. Uranium-235 has an energy density 4 million times greater than hydrazine, a common chemical propellant for satellite thrusters. While the mass of the hydrogen propellant is comparable to the mass of a chemical rocket's propellant, the combined mass of SNTP's hydrogen propellant plus its nuclear reactor is less than that of the chemical propellant plus its combustion chamber. At the end of the day, nuclear thermal propulsion systems are more than twice as fuel efficient as chemical propulsion systems, able to generate the same thrust with half the mass. How much thrust? More than 100,000 Newtons, or enough to accelerate an automobile from 0 to 60 miles per hour in 0.3 seconds. This is the kind of responsiveness necessary to maneuver in Earth orbit, between orbits, and in cislunar space.

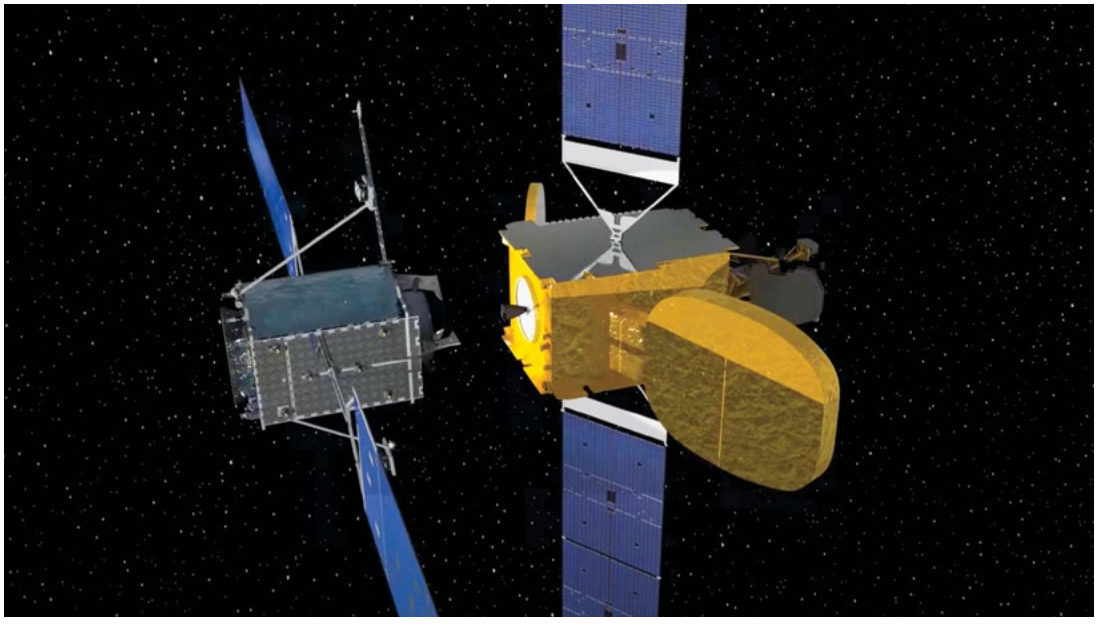
Safety is, of course, a primary concern. Unlike nuclear weapons, SNTP reactors are essentially a heater; they contain no explosives and remain in a "cold, subcritical state" until the reactor is turned on for a prolonged period in space. The relatively low radioactivity of un-fissioned Uranium-235 is comparable to radioactivity found in natural sources on Earth such as soil, rocks, and water. Once deployed above 750 km, the reactor poses no hazard to Earth and runs only during thrust operations—typically only several minutes at a time. SNTP engines generate no radioactivity when not in use, and whatever fission products do escape from the reactor during those short bursts are harmlessly dispersed into the vast expanse of space.

Concerns about an SNTP reactor plunging back to Earth in a failed launch are mitigated by launching the nuclear space vehicle from conventional rockets over water and following a launch path that minimizes risk. Further, the reactor's design ensures that inadvertent criticality events cannot occur—even in the event of a crash into the ocean.

The Defense Advanced Projects Research Agency's Demonstration Rocket for Agile Cislunar Operations (DRACO) is testing the propulsion efficiency of low-enriched uranium (LEU) reactor engines, which do not require presidential authorization. But even if high-enriched uranium (HEU) cores must be used in a given application, that extra step provides a final safety check.

THE THREAT

Both China and Russia have long recognized the vulnerabilities of conventional satellite constellations. To exploit those weaknesses, China is developing a multi-layered counterspace architecture. Starting with radio-frequency jammers and illumination lasers that can temporarily debili-

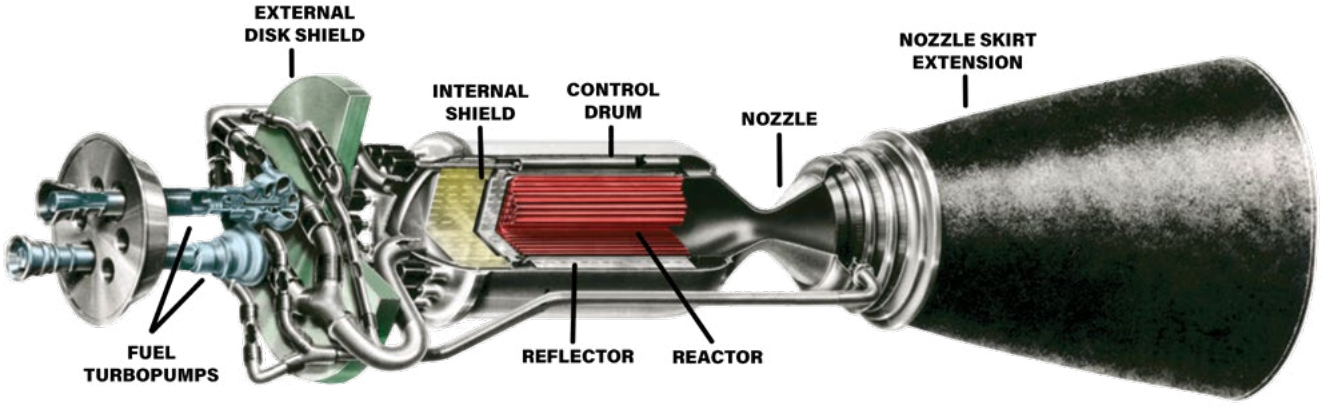


Northrop Grumman image from video

When satellites run out of fuel, they die. Northrop Grumman's MEV-1, shown here in a still taken from an animated video, is designed to extend the service life of satellites in geostationary orbit by docking with them and delivering additional fuel before their tanks are fully depleted. For satellites already on orbit, MEV is a potential lifeline.

How Nuclear-Powered Space Propulsion Works

Space Nuclear Thermal Propulsion (SNTP) uses Uranium-235, a relatively low-radiation material, as a heater to turn hydrogen into a propellant. The hydrogen is fed into a chamber, where it is warmed and then expelled through a nozzle to create thrust. NASA and the Atomic Energy Commission worked together to develop the technology decades ago through the Nuclear Engine for Rocket Vehicle Applications (NERVA) project (shown here). Today, this proven concept can be operationalized to make modern satellites more maneuverable.



Mike Tsukamoto/staff; NASA

tate satellites, its approach adds additional threats: weapons that can permanently degrade and even destroy satellites, such as ground-launched ASAT missiles and directed energy weapons like high-power lasers. Russia is developing similar capabilities and recently demonstrated its ability to strike a satellite in orbit. Gen. James H. Dickinson, who heads U.S. Space Command, said Russia's November 2021 ASAT demonstration made clear that it is "deploying capabilities to actively deny access to and use of space by the United States and its allies and partners."

Understanding how limited fuel affects spacecraft operations, adversaries have designed strategies to degrade U.S. satellite mission life spans by forcing operators into defensive maneuvers that deplete onboard chemical propellant. Even though a satellite may still function in every way, once it's out of fuel, it can no longer maintain its orbit and becomes operationally useless.

China's strategy in space differs greatly from the U.S. approach. While the U.S. perspective bases its deterrence on the threat of force, China has made clear that it intends to preemptively use force to coerce and prevent adversaries from intervening against its operations. China's "attack to deter" concept, which appears in some of their space doctrine, such as The Science of Military Strategy, among others, relies on rapidly maneuvering to exploit an adversary's weak points and achieve psychological and physical effects:

■ **Disruption.** This could include pre-conflict operations such as jamming and blinding an adversary's intelligence satellites with lasers. In a more advanced state of crisis, China could escalate to include simultaneous kinetic strikes.

■ **Preemption.** China's doctrine seeks to "create psychological fear … and have an influence on … national decision-makers" to achieve its strategic objectives—before war is officially declared.

■ **Dislocation.** If an attack to deter fails to achieve its desired result, China's strategy calls for "destructive strikes to the enemy [in space] … in order to fight rapidly, conclude the operation rapidly, and to withdraw from the confrontation."

According to publicly available sources, China continues to expand its operational counterspace weaponry, including ground-launched missiles carrying ASAT kinetic kill vehicles and space electronic warfare capabilities. Its People's Liberation Army (PLA) has demonstrated kinetic ASAT weapons that threaten U.S. space systems in low-Earth orbit (LEO), medium-Earth orbit, and geosynchronous Earth orbit (GEO) and has operational units equipped with radio-frequency jamming to disrupt satellite communications, precision navigation and timing, missile warning, and other vital space systems. The PLA is developing and testing weapons that can rendezvous with orbiting U.S. satellites and observe or attack them electronically or with on-board robotic arms.

WHY NOW?

Military and commercial space operators are already experiencing the contested space environment. Purposeful jamming of space-based assets and their communication links to ground stations is now routine. Space-faring allies, including France, have experienced adversary spacecraft approaching within visual range or closer, without warning or coordination. While these reconnaissance activities could be benign, it is more likely they are preparatory efforts for more aggressive actions. Like the posturing of naval craft at sea or aircraft near sovereign airspace, such maneuvers can be intended to intimidate or incite a defensive response. Such threats alter U.S. military operating assumptions and demand new capabilities in response.

The Department of Defense's 2020 Defense Space Strategy describes China as the "most immediate and serious threat" to U.S. national security objectives in space. This strategy argues that a more resilient national security space architecture is needed to counter emerging threats. Resiliency measures include the development of satellite constellations that can absorb limited kinetic and nonkinetic attacks and continue to provide critical services to U.S. air, land, and sea forces worldwide—in other words, constellations with enough nodes that there is no single point of failure. Most current constellations include just a few large, monolithic satellites, which can be easily targeted. Enemy attacks that eliminate a relatively small number of satellites in these constellations could greatly disrupt the overhead surveillance, global communications, and other capabilities they provide.

Proliferated LEO satellite constellations offer an alternative by deploying hundreds or thousands of small satellites to form a "mesh" network above the atmosphere. Having so many satellites means none can become a single point of failure, making the system more resilient to attack. Denying enemies the ability to inflict a quick, knockout blow is exactly what force designs like this are intended to

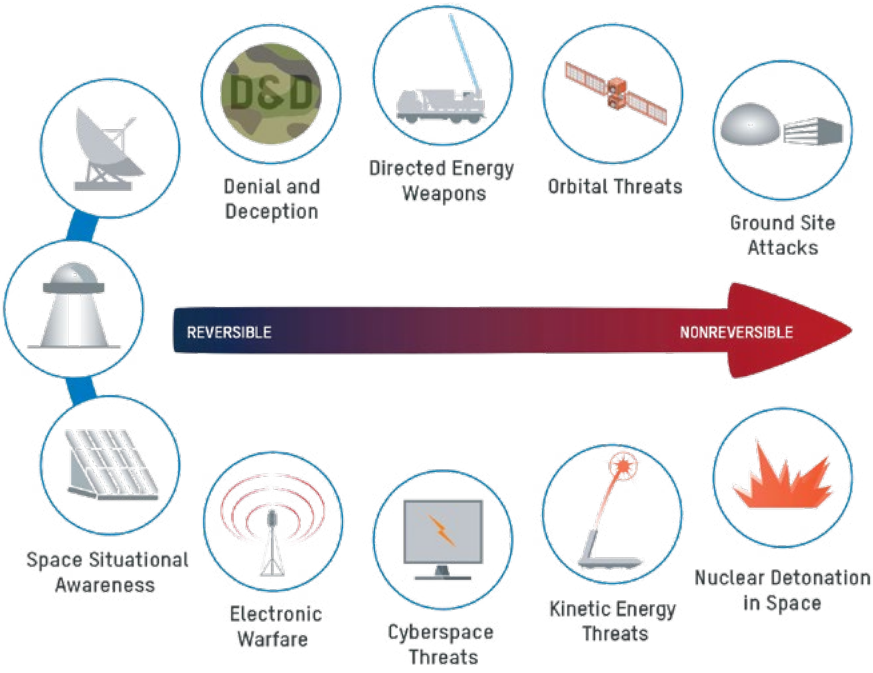
achieve. Yet this alone does not solve the problem. First, some missions do not lend themselves to this approach. And second, even small satellites follow predictable orbits. China asserts that both traditional and proliferated constellations are "easy to attack and difficult to defend." Without enhanced maneuverability, DOD's push to field larger numbers of satellites per constellation may simply provide more targets, rather than targets that are harder to destroy. As Chinese and Russian military space and counter-space operations continue to mature, the ability to rapidly maneuver across orbits and even into cislunar space—the region between GEO and the moon—will become increasingly critical to U.S. security interests.

Today, satellites with limited chemical propellants can take weeks to months to maneuver across orbital regimes. The USSF must address its maneuver disadvantages, change its forces, and alter the way they operate to get ahead of emerging threats, rather than wait for adversaries to fully mature them. This will require the Space Force to field new space vehicles with SNTP technologies. Otherwise, China's pursuit of nuclear thermal and nuclear electric propulsion vehicles and other weapons systems will give them a major advantage in space maneuver warfare.

Maneuverable space forces must be part of a multi-tiered force design that also includes proliferated constellations and hardened systems. Even in a proliferated constellation, there is a tipping point, beyond which operations are seriously degraded; likewise, hardening against radiation, lasers, or the limited use of nuclear weapons in the upper atmosphere and in space protects against certain threats. Adding maneuver expands the options available to commanders and increases U.S. flexibility in space. This is especially important in satellite constellations that are critical national resources and can increase defensive and offensive options, such as GPS and ISR satellite constellations. Whether guiding precision munitions or keeping power plants operating, GPS provides precision navigation and timing data used throughout our economy. ISR satellites operating in LEO and GEO are similarly vital, providing critical information used by military operations and farmers alike. Nuclear thermal propulsion can ensure those capabilities are always available when needed.

Counterspace Continuum

The ability to maneuver satellites rapidly and without concern for shortening the systems' lifespans is critical to countering the anti-satellite strategies of China and Russia. Nuclear-powered energy sources offer more than twice the energy per kilo than conventional chemical thrusters.



Challenges to Security in Space report/DIA

CONCLUSION AND RECOMMENDATIONS

Traditional resiliency measures are no longer sufficient to protect and defend against adversaries that believe rapid and destructive space warfare will be part of future great power conflicts. Following these six steps will help ensure U.S. forces in space are capable of defensive and offensive maneuver operations in the future:

■ DOD should adopt a new space force design capable of decisive maneuver warfare in space. Without the ability to rapidly maneuver, DOD's disaggregated and proliferated LEO systems will only provide additional targets for Chinese and Russian kinetic and nonkinetic counterspace weapons systems. DOD's 2020 Defense Space Strategy is a good start to address changing threats, but it does not go far enough.

■ DOD, in partnership with NASA and the Department of Energy, should develop and field SNTP and other technologies that will increase their ability to deter and defeat threats against the U.S. national security space architecture. After nearly 70 years of development, experimentation, and testing, now is the time to operationalize SNTP space systems.

■ Beginning in fiscal 2024, the Biden administration and Congress should move DARPA's DRACO program from science and technology development to a full acquisition program of record. Doing so will help DOD operationalize space maneuver warfare before America's strategic competitors.

■ DOD should deploy ground-based and space-based kinetic ASAT weapons systems capable of holding Chinese and Russian targets at risk. This will provide U.S. leadership with near-term options to deter and defend against anti-satellite threats. DOD could achieve this objective by repurposing existing initiatives, including its standard missile and ground based mid-course missile defense interceptor programs.

■ DOD should hedge against risk by deploying the mission extension vehicle (MEV) to provide GPS and other vital satellite constellations the ability to conduct limited defensive maneuvers while preserving their onboard chemical propellant.

■ The U.S. Space Force must educate the public and Congress on the growing threat to U.S. space systems and the need to create a more robust force design that will enhance deterrence. SNTP can help create a much-needed agile maneuvering force capable of generating a wide range of defensive and offensive effects in, from, and to space at a time and place of our choosing. ✪

Medina Valley High School CyberPatriot

The Medina Valley High School's CyberPatriot team invited Congressman Tony Gonzales as a guest speaker to discuss cybersecurity. Congressman Gonzales is well versed with cybersecurity as his career started when he enlisted in the United States Navy as a cryptologist.

U.S. Representative Gonzales Visits AFJROTC CyberPatriot Team

By Scott King

Last October, U.S. Representative Tony Gonzales, of Texas District 23, visited the Medina Valley High School CyberPatriot Team in their new cyber competition building in Castroville, Texas.

Congressman Gonzales, a cryptologist in the U.S. Navy for 20 years before retiring as a master chief petty officer, shared insights from his experience working in signals intelligence (SIGINT) and emphasized the critical role of cybersecurity professionals in the national security landscape.

"I want you to become cyber first responders for Castroville and other small towns throughout Texas," Congressman Gonzales said to the TX-20009th AFJROTC CyberPatriot team. "The future of cybersecurity is critical to our national security and it's inspiring to see our students take such an interest in it."

He went on to discuss recent cyberattacks that targeted organizations within our nation's critical infrastructure, such as Colonial Pipeline and JBS Foods. He also stressed how similar cyberattacks can result in the same loss of power or water many of the cadets experienced during the winter storm in February 2021, and how their future as cybersecurity professionals can prevent such threats to their community from happening.

Congressman Gonzales' visit served as the starting point to kick-off the Medina Valley AFJROTC competition season. This year's CyberPatriot XIV competition is the tenth year the Medina Valley AFJROTC CyberPatriot team has participated in the National Youth Cyber Defense Competition, the nation's largest cyber defense competition that puts high school and middle school students in charge of securing virtual networks.

CyberPatriot is the National Youth Cyber Education Program created by the Air Force Association to inspire students toward careers in cybersecurity or other science, technology, engineering, and mathematics (STEM) disciplines critical to our nation's future.

Medina Valley High School CyberPatriot

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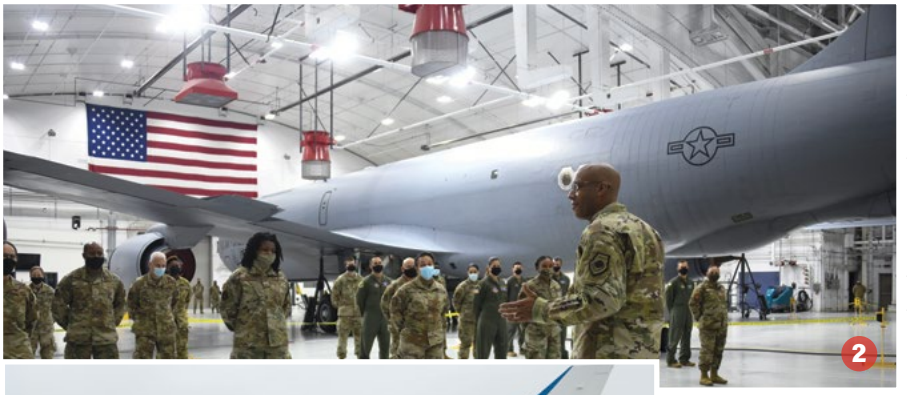

USAF: Senior Airman Spencer Slocum; Airman 1st Class Michael Murphy

1. Lt. Gen. Frank Andrews, 1943.
2. CSAF Gen. Charles Q. Brown Jr. at JB Andrews in 2021.
3. Honoring the casket of the late President George H. W. Bush as it arrives at JB Andrews before his funeral in 2018.

ANDREWS

Horseman, Pass By

Frank Maxwell Andrews graduated from West Point in 1906. He entered the Cavalry and stayed 11 years. He saw the world and built a sterling career, moving in elite Washington social circles.

Andrews, to the dismay of superiors, abandoned that life in 1917 to join Army aviation. He was awarded wings at the age of 34. During the next 17 years, he held numerous executive positions, attended top Army schools, and commanded 1st Pursuit Group in Michigan.

All this was just prologue to his life's main event, one that led to his being honored as namesake for Andrews Air Force Base, Md.

In Fall 1934, he was assigned to the General Staff to develop a plan for an "air force," one that would, for the first time, gather all air combat units under an air officer. Andrews was chosen to command that creation—General Headquarters (GHQ) Air Force.

His elevation on March 1, 1935, touched off a running, four-year battle with the General Staff, Navy, War Department, and rival Airmen, all of whom opposed Andrews' drive for an integrated force.

He staffed GHQ Air Force with the most energetic air power enthusiasts in uniform, giving the command a strong institutional foundation. He won greater autonomy for the Army's fliers.

As an aggressive proponent of strategic air power, he put his career on the line to champion procurement of large numbers of B-17 Flying Fortresses, bucking top Army brass.

His bombers, in foul weather, intercepted and "bombed" *USS Utah* in a 1937 exercise. In a 1938 war game, Army B-17s intercepted a mock "carrier"—the Italian ocean liner *Rex*—725 miles east of New York. Both events infuriated an embarrassed Navy.

Andrews, a consummate pilot himself, insisted on realistic training. He pushed for modern standards of flying in all weather and pioneered instrument flying techniques.

In four years, Andrews took a force that existed only on paper and turned it into a well-organized, though small, combat arm.

Andrews suffered retribution from Army superiors. He was not reappointed to his GHQAF post and was exiled to Texas. Gen. George C. Marshall, as the new Army chief, soon recalled Andrews to help prepare U.S. forces for looming involvement in a new world war.

In World War II, Andrews led joint-U.S. service commands in the Caribbean, Middle East, and Europe, rising to lieutenant general. He was a leading contender to command the 1944 Normandy Invasion, but he perished in a May 3, 1943, crash of his B-17 bomber in Iceland. The job went instead to Dwight D. Eisenhower.

For all his World War II achievements, Andrews' greatest significance rests on preparing the Army's prewar air combat forces for its massive war effort and its future as the U.S. Air Force.

Today, Andrews Air Force Base denotes the airfield portion of Joint Base Andrews, formed from a 2009 merger of the USAF base and Naval Air Facility Washington. It is home to two Boeing VC-25A aircraft, call sign Air Force One when the president is aboard. ✪

FRANK MAXWELL ANDREWS

Born: Feb. 8, 1884, Nashville, Tenn.
Died: May 3, 1943, Mount Fagradalsfjall, Iceland
College: U.S. Military Academy, West Point, N.Y.
Occupation: U.S. military officer
Services: US Army—Cavalry, Signal Corps, Air Service, Air Corps, Air Forces
Main Eras: World War I, Interwar, World War II
Years of Service: 1906-43
War Zones: European Theater of Operations, World War II
Final Grade: Lieutenant general
Awards/Honors: Distinguished Service Medal (2, one awarded posthumously), Distinguished Flying Cross, Air Medal (10), Purple Heart (awarded posthumously), World War I Army Occupation of Germany Medal
Resting place: Arlington National Cemetery

ANDREWS AIR FORCE BASE

State: Maryland
Nearest City: Washington, D.C.
Area: Approx. 6.8 sq mi / 4,346 acres
Status: Open, operational
Opened as Camp Springs AAF: May 2, 1943
Renamed Andrews Field: May 2, 1945
Renamed Andrews Air Force Base: June 24, 1948
Current owner: Air Force District of Washington
Former owners: First Air Force, Continental Air Forces, Strategic Air Command, Military Air Transport Service, Bolling Field Command, Air Defense Command, Eastern Air Defense Force, Headquarters Command, Military Airlift Command, Air Mobility Command.
Home of: 316th Wing, 89th Airlift Wing

[1]**Potential average annual savings, rounded to the nearest $25 increment, based on countrywide survey of new customers who switched to USAA and self-reported savings from March 11, 2019 to March 18, 2021. Individual savings may vary and isn't guaranteed.** Use of the term "member" or "membership" refers to membership in USAA Membership Services and does not convey any legal or ownership rights in USAA. Restrictions apply and are subject to change. Automobile insurance provided by United Services Automobile Association, USAA Casualty Insurance Company, USAA General Indemnity Company, Garrison Property and Casualty Insurance Company, based in San Antonio, TX; USAA Limited (UK) and USAA S.A. (Europe), and is available only to persons eligible for P&C group membership. Each company has sole financial responsibility for its own products. Air Force Association receives financial support from USAA for this sponsorship. 275125-1121-AFA

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