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Q&A: AIR FORCE CHIEF OF STAFF
GEN. DAVID ALLVIN 08

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FIGHTING UNDER ATTACK

Countering China's Strategy to Deny U.S. Air Bases 37



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AIR & SPACE FORCES

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Chris Gordon/Staff

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Staff Sgt. Jessi Roth

Airmen assigned to the 391st Fighter Generation Squadron work on an F-16 Strike Eagle during a no-notice fighter dispersal exercise at Kadena Air Base, Japan, in 2023.

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Relearning Old Lessons

Election 1940: President Franklin D. Roosevelt, seeking an unprecedented third term, is challenged by Republican Wendell Willkie, former Democrat and businessman.

Germany's bombers rain terror on Britain, and its U-boats hunt merchant ships crossing the Atlantic. In the Pacific, Imperial Japan has invaded Manchuria and threatens to expand its reach across South Asia. Roosevelt sees the election as a referendum on democracy and fears fascism will spread to America.

Hitler had already invaded Czechoslovakia, Poland, Denmark, Norway, Belgium, Holland, and France by the fall of 1940. He split Poland with Russia and had a Tripartite Agreement with Japan and Italy, in which they pledged mutual support in establishing a "new order" in Europe and the Pacific.

Roosevelt knew support for Britain would likely pull the U.S. into the war. But he favored that over the alternatives—appeasement, nonconfrontation, and isolationism. Both he and Willkie promised to keep America's sons from fighting another world war.

When Japan bombed Pearl Harbor 15 months later, those hopes were dashed. The United States joined World War II, mobilizing 16 million troops and the nation's vast industrial resources.

The risk of world war today has never been greater since then—and the United States has arguably never been less ready. Waking the nation up to that fact should be a top priority for our national leaders, though precious little has been said or will be said over the remaining days of the 2024 presidential campaign.

China's territorial ambitions in southeast Asia are no secret, with the taking of Taiwan at the top of its list. Russia's invasion of Ukraine did not go as Vladimir Putin wished, but he's shown no sign of giving up. Iran, gun shy after Israel and

its allies neutralized a barrage of missiles and drones in April, isn't letting go of its proxy forces or its desire to erase Israel from the map.

Their new tripartite marriage is eerily reminiscent of the WWII version. They too want a New World Order, one based not on liberty and self-determination, but on intimidation and centralized control.

All three interfere in the U.S. information sphere, planting cyber weapons, sewing doubt about elections and U.S. institutions, undermining confidence by leveraging American's constitutionally guaranteed freedom of speech to spread disinformation with impunity.

Economically, they support each other, while China holds sway over vast segments of the global supply chain, including 98 percent of the world's gallium, a critical material for computer chips and LEDs, and 90 percent of the world's supply of rare earth metals. In wartime, such market power is a threat worse than the economic tumult of the COVID-19 pandemic.

The U.S. military is undersized for the challenge. The bipartisan Commission on the National Defense Strategy sounded the alarm in July, criticizing the National Defense Strategy as inadequate for the threats facing the nation. Sized to fight one major war, the current strategy could be paralyzing: A future leader could prove unwilling to risk the force we have, and simply choose to surrender. Think of France in June 1940.

The commission rightly urges a two-war strategy and a Cold War-sized defense budget, harkening to a time when the U.S. spent 6 percent of Gross Domestic Product on defense, versus the 3 percent we spend today.

When Air Force Secretary Frank Kendall unveiled plans to reorient the Air Force and Space Forces for great power competition in February, he began with a warning: "We are out of time." What's clear today is that we've already entered that gray area between competition and hostility where a single misstep could trigger a wider conflagration.

Yet Kendall decided this summer to "take a pause" on the Next-Generation Air Dominance fighter—a critical element of a deep-penetration fighting force. Air Force leaders warned that cutting in half the F-22 buy, as the Pentagon decided in 2009, would have far-reaching implications. Time proved them right, but then-Defense Secretary Robert Gates was blinded by America's ill-fated wars in Iraq and Afghanistan and fired them for fighting back.

This time, however, the Air Force is giving up on a next-generation air superiority fighter of its own volition, a self-inflicted wound that again risks an unaffordable long-term impact.

Kendall hit stop on NGAD not because he didn't want it, but because he was out of money. The Sentinel ICBM replacement is non-negotiable because the 50-year-old Minuteman IIIs it's replacing are already beyond reasonable service life. The B-21 is going into production and can't go any slower than the few per year currently planned. The F-35 is short of required numbers as it is. Add overdue T-7 trainers, E-7 AWACS replacements, collaborative combat aircraft, munitions stockpiles, the proliferated space architecture, offensive space, advanced weather, targeting, and GPS satellites, and Kendall's conundrum is clear.

But that doesn't make it the right call.


By late 1940, Roosevelt was already ramping up weapons production to wartime levels, cognizant that Britain would not survive without U.S. support. New weapons were on the drawing board, and B-17 bombers were already in production.

Even so, it still needed the better part of two years after Pearl Harbor to build the mass needed to fight in Europe. It took another year to gain the upper hand. Undersized, and without the right mix of fighters and bombers to gain strategic advantage, the Eighth Air Force suffered hideous losses to gain the air superiority needed to make D-Day a success. And it took two nuclear bombs to finally end the war in the Pacific.

America's win-hold-win strategy worked in World War II. But that approach might not be feasible today, where a second theater could reach a culminating point well before victory is assured in the priority warzone. And unlike World War II, the U.S. industrial base is ill-suited to rapid mass production of war materiel.

The Air Force is the only military service that can provide "night one" offensive power at scale to rapidly blunt and deny a Chinese or Russian invasion. To be effective, its force must be sized to do that in both theaters at once.

Kendall's plan to reorient the Air Force and Space Force for great power competition pointed the department in the right direction. Paired with his operational imperatives, he has set the stage for developing the right portfolio of advanced capabilities to deter future war and win if needed. But plans without resources are only wishes—and wishes do not deter adversaries, much less defeat them.

The Roman adage applies: If you want peace, prepare for war. 

Plans without resources are only wishes—and wishes do not deter adversaries, much less defeat them.

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Our mission is to promote dominant U.S. Air and Space Forces as the foundation of a strong National Defense; to honor and support our Airmen, Guardians, and their Families; and to remember and respect our enduring Heritage.

To accomplish this, we:

- **Educate** the public on the critical need for unrivaled aerospace power and a technically superior workforce to ensure national security.
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- **Support** readiness for the Total Air and Space Forces, including Active Duty, National Guard, Reserve, civilians, families and members of the Civil Air Patrol.

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Tell Me More

Two of Greg Hadley's articles in the July/August edition ["World," pgs. 19-21] have caused me to ask questions about the current subject, "re-optimization of Air Force combat power for great power competition."

I have consulted several retired senior officers about Secretary of the Air Force Frank Kendall's plan to reorganize the Air Force to effectively counter China's threat, and I've read bits and pieces about it, including Gen. David Allvin's words in this latest issue, but I am at a loss to understand much of it.

I understand this "re-optimization" is an ongoing effort, but it sure would help if those leading the effort provide some organizational charts to help us all understand this effort better.

Perhaps charts showing the current Air Force structure and charts to show where we are headed would help those of us in the trenches to better understand this massive reorganization.

And like writer Col. Frank Arnemann wrote about in "Letters: Educate, Develop, Train" (July/August, p. 6), I am not so sure about some of the decisions being made and how those decisions will help us defeat any greater power.

Col. Frank Alter,
USAF (Ret.)
Beavercreek, Ohio

No Excuses

It is with dismay and disgust that I read that only half of our F-35s are mission capable and that the already dismal MC rates of the rest of the fleet continue to decline even further.

In 1981 I was pulled out of my position as Ops Officer of the 435th Tactical Fighter Squadron (Lead-In Fighter Training) at Holloman Air Force Base, N.M. Col. Russ

Violett said to me simply, "I need you to take over the AGS [Aircraft Generation Squadron]; I just fired ____." I didn't even know what or where the AGS was. But I did know that we were having half a dozen in-flight emergencies daily, that the MC rate of our 130 AT-38s hovered in the low 60s.

I made only two changes in the realm of maintenance: I scrapped the inferior and cheaply bought foreign-made tools and replaced all with guaranteed Craftsman (I could have chosen MAATCO or other excellently produced U.S. sourced tools, but did make a hit with the local Sears store.) And, I eliminated the mostly idle third shift.

So, how by the end of my 16-month tour had we reached a MC rate of high 80s and low 90s? A week into my position I imposed my first Article 15 punishment on the installer, observer, and inspector of an improperly installed nosewheel that left a plane at liftoff. (They all later recovered and excelled.)

Other offenses were met with Article 15s—I imposed more monthly than Holloman's three larger maintenance squadrons (F-15) and the nearly same sized sister squadron in the 479th. Usual punishment was a suspended bust and a letter of reprimand, all cleared later.

And I also discharged 50 nonperformers. The end result? The highest MC rate in Tactical Air Command and the highest reenlistment rate of all the Tactical Air Command maintenance squadrons. Maybe it's a simple matter of leadership and discipline—and not excuses for failure.

On the \$141 billion Sentinel overrun of another \$45 billion: Haven't we yet learned that industry builds better than the government? Turn it over to SpaceX and Blue Origin (not Boeing) and let them compete and succeed.

By the way, the Airman 1st class who was embarrassed and abashed at his mistake in

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WRITE TO US

Do you have a comment about a current article in the magazine? Write to "Letters," *Air & Space Forces Magazine*, 1201 S. Joyce St., Arlington, VA 22202-2066 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.

the wheel installation, later refused to let an instructor and trainee take his plane. I got involved and interfered with the line chief and said, "Get them a spare," and asked, "now, what's wrong?" He responded, "This wing, sir. It should hit me here (on his waist), but, see, It's an inch off." I argued that it was a matter of tire inflation, strut inflation, or ramp slope. He was adamant. "I think it's spar bolts." We removed the thin fairing around the wing root and found two of the three huge spar bolts broken!

All T-38s and F-5s worldwide were grounded and spar bolts inspected. An entire lot was found to be defective. The Airman was commended by Gen. Wilbur Creech and promoted!

Lt. Col. John F. Piowaty,
USAF (Ret.)
Cape Canaveral, Fla.

Military Education

I believe the best way to fix military recruitment and avoid a draft is to require all high school students, male and female, to serve for one year in the military ["AIMS: Advocates to Inspire Military Service," July/August, p. 55].

This would provide us with plenty of Soldiers, get young people on the right road, and enable them to secure good jobs in the future.

It would also provide them with good pay, proper nutrition, physical fitness, and skills for future military or civilian jobs.

Staff Sgt. Norman North,
USAF (Ret.)
Springdale, Ark

TMI

As a retired U.S. Army Warrant Officer, I have been reading the Air Force magazine, now the Air & Space Forces magazine for several years, courtesy of my retired USAF neighbor. The magazine continues to publish great photos and articles, and at times, it seems like it publishes a bit too much information about USAF projects and problems.

Which leads me to the Annual Air & Space Forces Almanac. Although much of this published information is publicly accessible, each year the almanac tries to outdo itself by including more and more military information. With China currently purchasing vast areas of land near military installations and our current open border situation, with dozens of suspected terrorists already caught within the USA, why does this magazine need to publish a quick reference guide for individuals that wish to do harm to the USA?

The latest issue of the Almanac [May/June 2024 issue], includes a map of all

USAF and Space installations, type and number of aircraft and weapons systems at each base, to include strategic missiles and drone development, project budgets and future plans of those systems and much more. And military personnel information is not left out. The Almanac lists unit commander's names, the number of personnel and job type at each base, their gender, race, rank, education, and again, much more.

The Almanac also publishes in great detail the same information about our overseas commands. The only thing not published (yet) is the service member's political affiliation and the operating hours of the security gates. When I was in the USAF many years ago, we used to read the technology magazine "Aviation Week & Space Technology." It published so much information, we called it, "Aviation Leak & Waste Technology."

Why can't the Air & Space Forces Magazine downsize much of its published Almanac information and if that person needs more information, just contact the USAF Public Relations Office? I can only assume Russia, China, Iran, North Korea and even our allies smile when they get their copy each year. Why make it easy?

Chief Warrant Officer 5 Keith Davis,
USA (Ret.)
Colorado Springs, Colo.



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War Games

"What is happening in Ukraine will determine the geopolitical future of Europe. ... We must think about Ukraine when we become participants in the game. We are part of this game. We are not a party to the war, but we are part of the conflict, and how this conflict is resolved will affect peace and our security."

—**Joesph Borrell**, European Union (EU) High Representative for Foreign Affairs and Security Policy [Aug. 23].

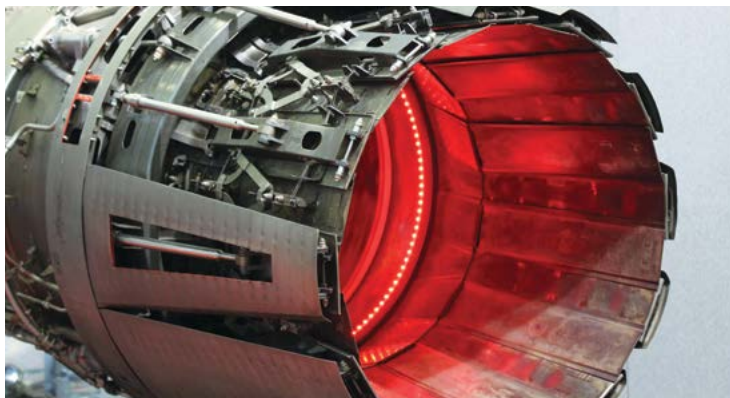


Mike Tsukamoto/staff; Pixabay

Bad to Worse

"It is business as usual now for China, but that is dramatically stepped up from where it used to be. It is an order of magnitude worse."

—**Brandon Wales**, former executive director of the Cybersecurity and Infrastructure Security Agency, on Chinese government-backed hackers penetrating U.S. internet service providers to spy on users [The Washington Post, Aug. 27].



Ahmet Salih/Pixabay

The Next Fighter Engine

"Cost is going to be a significant variable. ... You could do a lower-cost engine and actually use something that's available today, ... or you go into something that's brand-new. ... Both of those variables are going to be determined by the final requirements of the system. ... The program we have for NGAP [Next-Generation Adaptive Propulsion] is actually agnostic of any platform out there. What we're really trying to do is put great propulsion options on the shelf for the warfighter ... to help inform and give options for the future. ... It takes us about 10 to 15 years to get new propulsion technology on the shelf, which means that we have to lean into this right now."

—**John Sneden**, Propulsion Directorate director, Air Force Life Cycle Management Center, on plans for engines for the Next-Generation Air Dominance fighter, at Air Force Life Cycle Industry Days, July 29. Air Force Secretary Frank Kendall said the service is taking a "pause" on the NGAD program to see if there are more ways to reduce the fighter's cost.

EN GUARD

"One of my proudest achievements in my first term was to create Space Force, the first new branch of the armed forces in over 70 years; it's a big deal. Now that Space Force is up and running, I agree with your leadership—you want this very badly—but I agree that the time has come to create a Space National Guard as the primary combat reserve of the U.S. Space Force. So as President, I will sign historic legislation creating a Space National Guard."

—**Former President Donald J. Trump**, addressing the National Guard Association of the United States, Aug. 26.



Image from C-Span video

ACE IN THE HOLE



Airman 1st Class Melany Bermudez

"I would feel more confident if we had a more robust, active base defense, quite frankly. ... If we can't have [air defenses] at every space, we want to be able to decide where to place them" and also ensure some are mobile. ... The old school things of camouflage, concealment and deception are still alive and well, we just need to upgrade them to a 21st century context."

—**Chief of Staff of the Air Force Gen. David W. Allvin** speaking to a reporter's roundtable in the Pentagon [Aug. 22].

NO MORE B-1 RESURRECTIONS

"We have not been asked to resurrect another one to replace the loss at Ellsworth. I don't believe we will be asked. I think the Air Force HAF [Headquarters, Air Force] is happy with the 44 number, not the 45 number, so I don't think we'll be asked that, and I think we're going to have a fleet of 44 going forward!"

—**Joseph Stupic**, Senior Materiel Leader, B-1 Bomber Division, press conference at Air Force Life Cycle Industry Days, July 29, discussing a replacement for a B-1 that crashed at Ellsworth Air Force Base, S.D., in January. The service retired 17 of its 62 B-1s to the Davis-Monthan Air Force Base, Mont., "Boneyard" three years ago, setting a new force of 45, but in recent months has regenerated two of those aircraft to replace aircraft that were condemned after accidents.

Stay Ahead of the Front at Prodacity 2025

In a world where technology underpins nearly every function of government and the stakes are national security and public welfare, software isn't just bits, bytes, and lines of code—it's about critical outcomes that impact everyday lives. Success is measured in lives saved, disasters averted, patients receiving care, Warfighters returning home—a future where fewer bad things happen because of bad software.

Rise8 is transforming the way large enterprises build, deploy, and utilize software, driving relentless progress for a better tomorrow. Rise8 Founder and CEO Bryon Kroger, a U.S. Air Force Veteran turned bureaucracy hacker, is spearheading initiatives to deliver software solutions 25x faster than traditional methods. A former targeteer with firsthand experience of the devastating impact inadequate software has on mission success, Bryon co-founded Kessel Run, the DOD's first software factory, where he served as COO leading acquisitions, development, and operations for the enterprise-scale software lab that defined DOD DevOps. While there, he pioneered the first continuous Authority to Operate (cATO). Frustrated with the lack of industry partners capable of leading defense digital transformation, Bryon founded Rise8 to fill that gap.

Bryon's vision for Rise8 also inspired the creation of Prodacity, the symposium for govttech leaders at every level who are committed to the continuous delivery of valuable software users love into challenging production environments. Prodacity embodies Bryon's belief in the power of community and collective learning through shared experiences, lessons, and best practices to shape the future of technology and governance—making history with our actions today.

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Prodacity is a movement committed to authenticity and learning that sets the standard for achieving mission outcomes in government. Organizational change, bureaucracy hacking, and practical implementation strategies are at the center of a meticulously curated agenda around people, processes, and technology—without sales pitches and innovation theater.

In a significant departure from its previous venues in Washington, D.C., Prodacity 2025 is headed to Nashville, TN, a central



Bryon Kroger, Founder & CEO of Rise8, kicks off Prodacity on the mainstage in 2023 with his talk "A future where fewer bad things happen because of bad software."

location that provides an opportunity to step outside of traditional government environments and have a blank slate for change.

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Prodacity is February 4-6, 2025 in Nashville, TN. Learn more and register for the exclusive government rate: rise8.us/prodacity

Re-Optimizing from the Top

The Air Force's ambitious effort to overhaul its organization, deployment model, and training to better prepare for great power competition with China was just six months old when Air Force Chief of Staff Gen. David W. Allvin returned from Exercise Bamboo Eagle on the West Coast in August. He took time for an interview with Pentagon Editor Chris Gordon soon after. It has been edited for space and clarity.

Q. Bamboo Eagle was tied to Red Flag, but it's also very different. Can you explain?

A: Red Flag, if you go back in history, is designed to ensure our tactical dominance and ... enhance tactical competency. [Bamboo Eagle] is really having more of the Air Force involved. ... We had over 1,000 joint members ... over 150 aircraft. And we went to 10 different locations. ... The Airmen who weren't necessarily climbing aboard the cockpits or maintaining those aircraft were getting a better understanding of the expectations of what it's going to be like to fight in that [contested] environment. By having them actually deploy to these simulated hubs and spokes, we were designing it to have them understand what it would be like to have to operate under the threat of attack. ...

It is simulating Agile Combat Employment, which is well beyond just the pilots and the cockpits. It is the entire apparatus.

Q. What else were you looking at there?

A: We are also looking at developing these units of action ... deployable combat wings, and severing them from our air base wings. We are expecting our wing commanders to be able to do more than just be the senior tactical experts who know how to take a wing forward and execute the air tasking order. We're expecting them to develop the competencies to be able to do the joint warfighting functions, including movement and maneuver, and protection for their forces to move within and throughout an [area of responsibility], sometimes with connectivity to senior leadership and sometimes without.

We had two wings [at Bamboo Eagle completing] their certification phase for AFFORGEN [the Air Force's new force generation model]. They're going to certify to go deploy over the Middle East, but in that AFFORGEN cycle we are training them to be ready for the high-end fight as well. We have the 9th Reconnaissance Wing and the 23rd Wing. ... The 9th is a reconnaissance wing, but underneath the reconnaissance wing's command echelon, the mission-generation force elements, the squadron equivalents ... [of aircraft such as] F-15s, F-35s, and F-22s, those wing commanders do not have those at their normal bases. That's not what we expect wing commanders to do anymore. So we're evolving them to include their combat air base squadrons underneath them. Now they have to understand how to operate, survive, and support different types of combat capability. So that's another area where it's beyond just Red Flag Plus.

Q: The Air Force recently got an order to deploy and fight tonight. The Secretary of Defense ordered F-22s to the Middle East on Aug. 2. They were off from Alaska and, in a couple of days, were in the Middle East, to bases that we're familiar with. But what Bamboo Eagle aimed to do is to prepare units to go somewhere you're not used to operating from?



Airman 1st Class Brianna Vetro

U.S. Air Force Chief of Staff Gen. David Allvin, right, speaks with Maj. Gen. Christopher Niemi, the U.S. Air Force Warfare Center commander, inside the Shadow Operations Center-Nellis (SHOC-N) at Nellis Air Force Base, Nev., Aug. 5, 2024, to observe Bamboo Eagle.

A: The F-22 deployment is a great example of being able to rapidly deploy anywhere in the globe and deliver combat power. In this particular case, it was to established infrastructure that was close enough to where we may want to employ them so that they could get there relatively quickly. If you're going to a place that is not fully established, we have to lift and shift the entire wing apparatus. So that is a mindset shift, ... that you actually have to be able to go between the hub and the spokes. ... It was really getting back to the basics of going to a place or places where you did not have mature infrastructure and still be able to make your first pulsed go. It's a significant shift, and the Airmen saw it.

Q: For Bamboo Eagle, some Airmen were not in their comfort zone?

A: We're developing a new skill set. I don't want people to be comfortable because that means we're probably not changing fast enough, but they are understanding how to do different functions rather than just being the senior tactical experts.

Q: What did the Airmen tell you?

A: I know it sounds pollyannaish, maybe, but there was an excitement that Airmen are embracing this, and here's why: ... These guys do great things. But when you have people understanding that you rely on me and I rely on you to do an overall mission, that's purpose-filled service that they're embracing. They get it, that 'I'm doing something different. ... I get to be part of this in which I know that the success is dependent upon me.' ...

REFORPAC next summer is going to be even on a larger scale. ... We're understanding better how the training events need to be improved, what other sites we might need when we start trying to scale this to an entire Air Force. That's where I think we have a lot of learning to do. That's how it gets scaled faster.

Q: It's now been a year since the first Expeditionary Air Bases, or XABs, deployed in the Middle East. What were some lessons learned in CENTCOM?

A: We've seen a couple of different examples of the very concept of going from many bases aggregating and falling in on one site to actually more unit cohesion leading up to it. XABs were step one, the ATFs [Air Task Forces] are step two, the deployable combat

wings are sort of the final instantiation of that. But the XABs paid off last October when they went over there, because the first XAB went over Oct. 1. The units over there in AFCENT [Air Forces Central] ... had already done the pre-deployment site survey, had gone over there, had done those things, and that familiarity, that understanding, that already gave them a leg up [before Hamas attacked Israel on Oct. 7]. So that was the first inclination that we're doing things better. ...

The next real big step ... is going to be these deployable combat wings—getting that severability between the air base wing and deployable combat wing. Because another part of this is the dissolving of operations and maintenance groups. ... If we want the wing commanders to not really focus on the tactical and we want to let the tactical be really run at the squadron command level, we need a lot of leadership understanding of how to do all the warfighting functions that the wing is going to need to do. [Today], those who have that expertise reside in the groups. We're about the only service that has two levels of O-6 command, right? Perhaps unintentionally, what we've been doing is stunting the growth of our young officers who we want to go out there and execute mission command, because they've got an O-6 group command and then an O-6 wing command [over them].

[We need to] give the squadron commanders room to breathe, grow, and train because we're going to expect them to execute out in that environment. You're going to see that come to fore in many of our wings this next summer. We're already picking our commanders that are going to be commanding next summer, and so we're going through now which of the wings are going to transition by next summer, to have both the deployable combat wing and an air base wing construct on the base.

Q: Which of the re-optimization initiatives is still the furthest away in terms of implementation?

A: I would say—for the vision that I have, at least—is a final answer on Integrated Capabilities Command, because it involves moving people. ... It's going to be maybe the longest pole in the tent for a permanent solution. However, we can't wait for the functionality to start. So we are now ... making the congressional notifications for doing as much in place as we can. There will be a core element that starts doing some of the functions of the Integrated Capabilities Command, and the Airmen at the major commands are being identified [who] will cut over ... [and] change their patch. ... I do believe that there is value in proximity. ... If I'm Major Allvin, and I am now assigned to work for Integrated Capabilities Command, but I'm still at [Joint-Base] Langley-[Eustis, Va.], or Barksdale [Air Force Base, La.], or Scott [Air Force Base, Ill.], there's a little bit of tension, either real or perceived. ... I might be in the same vicinity as my other, former four-star commander. ... Once we have everyone all in one spot, that's probably going to be the ultimate solution.

Q: ACC will be in charge of readiness. So what does “readiness” mean to you?

A: People say, well, ‘It's readiness versus modernization.’ I don't see that. I see readiness today versus readiness tomorrow. Because it's not an either or. Readiness means the ability, when called upon, to effectively execute the missions that are expected of you in the context of when you are being asked. And so if we say we're going to focus it all on our ability to execute all those things that we anticipate happening in the next one to two years, we'll be ready to do that. That's a form of readiness. But if, at the same time, we forego the investments and the development of the force that we believe, as we see the arc of technology, the pace of the threat, etc.—if we don't account for that—then that is killing

future readiness. It's just the ability to marshal the forces that have the capabilities and the competencies required to execute the missions that were asked.

Q: How do these changes reflect great power competition with China?

A: One of the things that's becoming more clear to me is that, in the absence of a pacing threat like the Soviet Union, a very well-meaning United States Air Force has moved forward and modernized, but in a way where it has strengthened our functional areas sometimes at the expense of ... a coherent force design. What did our Air Force do when Saddam [Hussein] attacked [Kuwait in 1990]? Well, in the Cold War, we were used to projecting power as wings, from fixed infrastructure. ... We practiced REFORGER, we'll go beat them to Fulda Gap. So when Saddam attacked, we did the same thing, except we didn't have any forward infrastructure. So we built it. It took us six months. Desert Shield took six months, but we built it. That was us taking our old Cold War Air Force and saying, that's what you want us to do.

Q: And then?

A: In the 2000s, the joint force didn't need the air campaign that we did in Desert Shield and Desert Storm. They didn't need us to go and roll back the [integrated air and missile defense], establish and maintain air superiority, prep the battlespace through interdiction. ...


What did the joint force need of its Air Force? Unblinking ISR [intelligence, surveillance, and reconnaissance] on call, the “Golden Hour” [for rapid casualty evacuation]. They needed bits and pieces of our Air Force. So we focused on that bit and piece, that bit and piece, and that bit and piece. And then so we started developing functionally ... to solve for efficiency, bureaucratically, if you will. Management headquarters was bad because it was bloated. So what did we do? Well, we sort of took the same functions and we put them out to the Majcoms. ...

So you can see not with malice, but the way that the Air Force evolved ... we didn't stay with a coherent single force design, because we didn't have a threat against which to galvanize. ... And so that's really the [reason for] this re-optimization ... to bring back one Air Force, larger-scale exercises. Rather than inspect on task, we inspect on mission. One force design, integrated capabilities that fit together, ... the way we project power, not crowdsourcing the fight, but going as units, developing Airmen with one person involved with policy. It's about bringing back one Air Force.

Q: How does that translate to weapons and platforms?

A: Think systems over platforms. ... Because if you buy a platform, I want that platform to do this, and then you put [that platform] into a system—I need a radar, I need an EW suite, I need navigation, I need weapons integration. There it is, and you put it there, and, oh, by the way, you design it specifically, which means it might have to have bespoke support equipment. ... Then build this other one over here and you've got the same thing. Now you're spending all your money trying to put these together. ... Whatever platform you're going to build, it's got to integrate ... so that when the system gets upgraded, [that happens] at the speed of software, and everything gets upgraded with it. ... That's the environment we're adapting to.

Q: Are Airmen getting the message?

A: I came back from that day at Bamboo Eagle pretty energized because we sit here in the Pentagon and we think we're working ... but to get out there and to see that the Airmen are using the language and embracing it was very encouraging. 

By John A. Tirpak

A National Defense Strategy Under the Gun

The congressionally appointed Commission on the National Defense Strategy (NDS), after a thorough two-year look, concludes that the strategy is deeply flawed.

The bipartisan panel of experts unanimously urged revisions to address emerging threats and advised a steady increase in defense spending to meet growing threats and to ensure a joint force capable of fighting major conflicts in multiple theaters simultaneously.

Led by Jane Harman, a former congresswoman from California, and vice chaired by Eric Edelman, a former undersecretary of defense for policy, the panelists said the U.S. has gone too long without a clear construct for defining the appropriate size of U.S. military forces.

"We propose a Multiple Theater Force Construct—with the joint force, in conjunction with U.S. allies and partners—sized to defend the homeland and tackle simultaneous threats in the Indo-Pacific, Europe, and the Middle East," the commission proposed.

Today's global security environment poses "the most severe" challenges since the end of the Cold War, and the situation is "getting worse, not better," the report states. The U.S. military is unprepared for that environment, and already "at the breaking point of maintaining readiness today. Adding more burden without adding resources to rebuild readiness will cause it to break."

Congress is making matters worse with budget constraints imposed by the Fiscal Responsibility Act. Those spending caps should be erased as soon as possible, the commissioners recommend, and spending should be increased "to begin a multiyear investment in the national security innovation and industrial base." The nation needs a 2025 defense budget with "real growth" above inflation, and the military should be set on "a glide path" to achieving investment levels commensurate with Cold War spending.

The nation needs a 2025 defense budget with "real growth" above inflation, the report said, and the military should be set on "a glide path" to increasing annual spending from today's 3 percent of Gross Domestic to Cold War levels, which ranged from 6.5 percent to 8 percent of GDP for most of that period.

Commissioned by Congress in 2022, the panel reported its findings in late July. Although emphatic in its delivery, only time will tell if it will find a willing and ready audience in Washington. The authors emphasize that the nation is now years late in appreciating how fast global threats are increasing and how quickly China has not just pulled even with the U.S., but in some cases exceeded it in capability.

The U.S. military was capable of managing global conflict "during the Cold War, which ended 35 years ago," the commission stated. "It is not prepared today."

Worse, if a major fight does break out with multiple opponents, the U.S. "could lose," commissioners concluded.

America's industrial might, which won World War II and the Cold War, is now "grossly inadequate" to rapidly build military strength. Despite years of attempted acquisition reform, the military remains hobbled by a ponderous procurement system that slows innovation and the fielding of new equipment.

Meanwhile, China, Russia, Iran and North Korea are increasing military collaboration. U.S. and Canadian forces intercepted a joint Chinese/Russian flight of bombers near Alaska in July, and both Iran and North Korea continue to supply Russia with munitions for its war with Ukraine.

The NDS, which was largely written before Russia's invasion of Ukraine, which delayed its release, does not take that war or the Isra-



China Central Television image via China Ministry of Defense

Two Chinese J-16 fighter jets, lower right, conduct an escort mission for a Chinese H-6K bomber, center, and a Russian Tu-95MS bomber during a China-Russia joint strategic patrol over the Bering Sea in 2022.

el-Hamas war in Gaza into account, and it underplays "the possibility of a larger war in Asia," their report says.

A 'SHARP BREAK'

"The Commission on the National Defense Strategy recommends a sharp break with the way [the Pentagon] does business and suggests an 'all elements of national power' approach to national security. It recommends spending smarter and spending more across the national security agencies of government," the report states.

"The time to make urgent change is now," with "fundamental alterations to the way the [Department of Defense] operates, the strategic focus of other government agencies and the functionality of Congress," it continues. The U.S. must also forge closer ties and cooperation with allies and mobilize the public and private sectors.

The 2022 NDS says the right things about using an all-of-government approach to "integrated deterrence," but the government isn't really doing that.

In addition to Harman, a Democrat, and Eric Edelman, who served under the George W. Bush administration, the other commissioners were: retired Gen. Jack Keane, former Vice Chief of Staff of the Army; Thomas G. Mahnken, president and CEO of the Center for Strategic and Budgetary Assessments; Mara Rudman of the Miller Center, a former national security official in the Clinton and Obama Administrations; Mariah Sixkiller, former strategic defense affairs director at Microsoft and a national security adviser to the White House and Congress; Alissa Starzak, former General Counsel to the U.S. Army; and Roger Zakheim, Washington director of the Ronald Reagan Presidential Foundation.

FORCE-SIZING CONSTRUCT

The NDS does not specify the scale of forces needed to meet the nation's defense obligations. The U.S. "should be able to defeat aggression by a major power while deterring conflicts in other parts of the world," the NDS states. The nation needs more clarity, the commission said.

"We believe that there is a high probability that the next war would be fought across multiple theaters, would involve multiple adversaries, and likely would not be concluded quickly," they wrote. "Both China and Russia independently have global reach and have committed to a 'no-limits friendship.' Both coordinate closely with North Korea and Iran.

The U.S. and its allies “must be prepared to confront an axis of multiple adversaries,” the commission stated.

“Not building a force construct that is appropriately resourced and sufficiently agile to deal with this environment could deter the United States from committing itself in any one theater, given the threat of conflicts in other theaters,” they said.

The result is paralyzing: “As a defense strategist warned,” the report says, “A force that can only wage one conflict is effectively a zero-conflict force, since employing it would require the President to preclude any other meaningful global engagement.”

As a global power, the U.S. cannot focus on a single threat at a time. Doing so, the authors said, “is a fundamentally flawed response.” It is not enough to prepare for China and count all other challenges as lesser-included contingencies, they said. No threat—the panelists also included “violent extremism” as an ongoing concern—can be ignored.

Indeed, by focusing on the Pacific to the detriment of Europe and other theaters, they wrote, American strategy has “emboldened U.S. adversaries and required the United States to surge forces back.”

Strength “in one theater reinforces deterrence in others,” the panelists said.

The commission’s suggested force-sizing construct is “distinct from the two-war construct” that arose after the Cold War—“essentially, one in northeast Asia and one in the Middle East”—because “neither model meets the dimensions of today’s threat or the wide variety of ways in which, and places where, conflict could grow, erupt, and evolve.”

The U.S. must also recognize and prepare for “the possibility that future wars will be protracted.” America’s experience in Afghanistan and Iraq, and the war in Ukraine shows that “modern wars often last a long time.” If the U.S. finds itself in a great power conflict, such a war would “likely last more than a few weeks or a few months.” Sustaining the fight demands a larger force, a greater arsenal, and a more resilient and robust defense industrial base—one capable of ensuring the U.S. does not run out of munitions before its military objectives are met.

“Fixing the munitions shortfall” should be a top priority for the Pentagon. While Congress has given multiyear authority for some weapons, it’s been “slow to provide and enable appropriations” to implement the concept. Congress should “significantly increase the level of investment domestically in munitions and the capacity to build them,” the commission said.

At the same time, DOD needs to work with other countries and expand munitions production “across U.S. allies” while building supply chain resiliency. It must constantly invest in new weapons to keep pace with adversaries and should “fund the recapitalization of armories and invest in advanced manufacturing and further stockpiling of munitions.” Greater “interoperability of parts” could help ensure the Pentagon buys the munitions it needs “at sufficient scale to deliver the desired operational effect.”

Commissioners warned that failures to hit recruiting targets indicate cracks in the All-Volunteer Force, and may require some re-evaluation of the sustainability of that model.

MORE AIR FORCE

Commissioners noted that the Air Force is “at the forefront of a host of missions,” ranging from homeland defense to rapidly projecting power worldwide, to intelligence support “that allows the rest of the joint force to function.”

But “the size of the service (as measured in either personnel or aircraft) has stagnated, if not declined.” The Air Force’s platforms suffer from “lackluster” mission capable rates, leaving “only a fraction of the force ready for combat” at any given time.

New capabilities like the B-21 bomber are in development, but “still years away” from being produced in volume and available for combat operations.

“The Air Force requires significantly more resources to expand both its capacity and its capabilities,” commissioners said. They did not detail the number of wings, aircraft or personnel needed to achieve the multiple-theater capacity needed, however, saying only that USAF needs to “maintain sufficient aircraft” to support multiple theaters of readiness.

Commissioners applauded the Collaborative Combat Aircraft program, urging the Air Force to pursue “attritable and runway-independent aircraft” to achieve needed numbers in places where adversaries will target air bases. They also voiced support for the Next-Generation Air Dominance system, the Next-Generation Air Refueling System, and improved air base defenses—“both active and passive ... to prepare for the future fight.”

As for the Air Force’s effort to “re-optimize” for great power competition, the commissioners said it “is necessary but not sufficient.” The Air Force needs “more than just a reorganization.”

THE HIGH GROUND

The nascent U.S. Space Force provides “a critical asymmetric advantage in modern warfare, underpinning nearly all military operations,” the commissioners wrote. Critical communications; position, navigation, and timing; and intelligence come through space. With China, Russia and other adversaries fielding anti-satellite capabilities, “space increasingly is a warfighting domain in its own right,” they recognized. Both the Space Force and U.S. Space Command “must be given continued attention and resources as they organize, bolster space defense and resiliency, and present forces to the joint force.”

The commission didn’t offer an opinion on how big Space Force needs to be, but “given the indispensable reliance on these capabilities and the advent of space as a warfighting domain, the Commission recommends continued investment in diversifying and dispersing satellite constellations, developing redundant communication pathways, enhancing cybersecurity measures for space systems, investing in on-orbit defensive and offensive capabilities, and fostering international cooperation to enhance the resiliency of U.S. space capabilities.”

It urged the Space Force to continue to work with commercial and international partners noting that “commercial space offers significant potential to augment existing government systems, and the United States should continue to expand this area of American advantage.”

THE NEW BASICS

Instead of specific force-size suggestions, the commission laid out broad capabilities the joint force must acquire as soon as possible. The military needs to be big enough to:

1. Defend the homeland, maintain strategic deterrence, prevent mass casualty terrorist attacks, maintain global posture, and respond to small-scale, short-duration crises;
2. Lead the effort, with meaningful allied contribution, to deter China from territorial aggression in the Western Pacific—and fight and win if needed;
3. Lead NATO planning and force structure to deter and, if necessary, defeat Russian aggression; and
4. Sustain capabilities, along with U.S. partners in the Middle East, to defend against Iranian malign activities.

While it said the U.S. should be advocating a steady increase in defense spending, the commission also counseled DOD and Congress to “spend smarter.” The two entities should “review all major systems against likely future needs, prioritizing agility, interoperability, and survivability.”

The Office of the Secretary of Defense and the Joint Staff “should be more empowered to cancel programs, determine needs for the future, and invest accordingly.” Priority areas for more investment include cyber, space, and software, “which have enabled warfighting for decades but are now central to conflict and are global.”



FACES OF THE FORCE



Senior Airman Sabrina Fuller-Judd

Senior Airman Malachi Ward of the 51st Logistic Readiness Squadron saved a choking child while bowling. When the child's older brother alerted Ward, he performed the Heimlich maneuver and cleared the obstruction from the child's throat. He drew from his training in Tactical Combat Casualty Care and Red Cross classes to handle the situation. "I didn't second-guess what I was doing. I was relieved that I was able to help avoid a dire situation," said Ward. As a new father with a 3-month-old son, he believes every service member should regularly practice cardiopulmonary resuscitation, TCCC, and first-aid skills.



Staff Sgt. Joseph Pagan/ANG

California Air National Guard Lt. Col. Patrick Cichon discovered his father's World War II Japanese artifacts in an old trunk. These items, preserved by his father, U.S. Marine Corps Sgt. Casimir Joseph Cichon, during the Battle of Okinawa, were intended to be returned to Japan. Cichon, who is active in the Japanese-American community through his local nonprofit, felt compelled to repatriate these artifacts. He brought the items to Japan and collaborated with local museums to identify and distribute all the artifacts—a sack, a handkerchief, a towel, photos, and letters—to the appropriate Japanese institutions, including Okinawa Prefectural Peace Memorial Museum. Cichon said, "My father preserved them on the battlefield so that today, we could return them to their rightful country."



Cynthia Griggs/USAF

Hill Air Force Base's **Chief Master Sgt. Vanessa Espinoza** made history as the first female Active-duty fire chief. Her 20-year Air Force career, driven by a passion for firefighting, has seen her overcome many challenges in a male-dominated field. A pivotal moment during deployment to Kuwait has taught her that true leadership involves navigating obstacles and finding solutions. When a 15,000-square-foot warehouse caught fire, she chose defensive firefighting over property salvage, emphasizing the importance of protecting lives. Espinoza is focused on mentoring future firefighters and inspiring the next generation, regardless of gender. She also plans to write a children's book.



Senior Master Sgt. Ted Daigle/USAF

Tech. Sgt. Jeremy Vickers of the 307th Bomb Wing is the creator of the Engine Pod Stand, which has significantly improved efficiency for B-52 maintenance. The stand was first put to use in July during a B-52 Phase inspection at Barksdale AFB, La.,—previously a weeklong process requiring dozens of maintainers to work on the bomber simultaneously. The old maintenance stands from 1994 supported only two people at a time, delaying the inspection process and posing safety risks. Vickers' new design features a large, single platform that allows multiple maintainers to work safely. "We've already halved the engine-top inspection time," said Vickers. Development was challenging due to funding issues, but Vickers secured National Guard and Reserve Equipment Appropriations funding.



Tech. Sgt. Ariana Freeman/ANG

Lt. Col. Jim Avery is the definition of a man of many hats. After practicing medicine for 20 years, he joined the Illinois Air National Guard in 2010 and became a flight surgeon four years later. Passionate about health care, Avery leverages his extensive experience across multiple roles. He's the Chief of Aerospace Medicine with the 126th Air Refueling Wing. In his civilian life, Avery is a board-certified internist and bone specialist at Washington University's Bone Health Program. He also works full-time with the 375th Medical Group at Scott AFB, Ill., providing similar care in his Air National Guard role. "I enjoy all my jobs," said Avery. "But if you ask me on the street, ... I'm a flight surgeon in the U.S. Air Force."



Airman Lauren Torres/USAF

Airman 1st Class Benja Rayamajhi of the 97th Force Support Squadron left Biratnagar, Nepal, in 2022 for a better life in the U.S. for herself and her young daughter, despite the heartache of leaving her daughter in Nepal. Upon arriving in Tucson, Ariz., she faced challenges, including a language barrier and difficulty finding fulfilling work, even with a business degree from home. After consulting with a recruiter, she joined the Air Force, which allowed her to pursue U.S. citizenship and eventually bring her family to the country. Although the separation from her daughter was "the hardest thing" she had ever done, Rayamajhi knew each step brought her closer to reuniting with her.



Janice Crowder/USAF

Imagine walking 100 miles over four days with a weighted backpack—that's the Nijmegen International Four Days March, a grueling rucking event held annually in the Netherlands since 1909. **Air Force Capt. Alexander Nastas** of the 97th Force Support Squadron began rucking while stationed in Germany, aiming to complete this march. Last year, he participated with 450 U.S. troops and completed the challenge. Nastas stresses extensive training for the march, similar to marathon training, to build physical and mental strength. With proper preparation, he encourages others to participate, calling it "a great way to learn about yourself" and "a great bonding experience."



Courtesy photo

Mac Carr, a 7-year-old visually impaired boy, had an extraordinary day with the **190th Air Refueling Wing, Forbes Field ANGB, Kan.**, experiencing aviation through sensations of touch and sound. As a Coyote pilot for the day, he began by exploring a KC-135 Stratotanker, feeling its wings and cockpit controls. Mac grew excited as he engaged with the aircraft. He got to activate fire truck sirens and try on firefighting gear. A surprise tour of T-38 Talon fighter jets allowed him to feel the roar of the engines and the rush of wind from a special takeoff. Mac ended his day simulating an in-flight refueling mission with the Boom Operator Simulation System, feeling like a true aviator. Nicole Carr, Mac's mother said, "These people all had a lasting impact on our lives, and we are forever grateful!"

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

How the KC-46A fleet is maximizing warfighter capability with urgency

Optimized operations, sustainment efficiencies and evolutionary upgrades are advancing multi-mission capability to stay ahead of peer threats.

In the face of emerging threats around the globe, the U.S. and allies are rapidly growing aerial refueling capability to meet the challenge. As the KC-46A global fleet has more than 90 aircraft with tens of thousands of flight hours in aggregate, **operators are optimizing operational concepts, accelerating preparation for sustainment logistics in a contested environment and driving evolutionary capability upgrades** to outpace peer threats.

"Now that KC-46 has been in service for a few years, the young men and women who fly and maintain the aircraft are capitalizing on all the knowledge and experience they've gained to generate innovative ways to employ and maintain the fleet," said Sean Liedman, director of Global Reach for Boeing Defense, Space & Security's Mobility, Surveillance & Bombers division. "There's an opportunity to improve the efficiency of our sustainment posture with all of the data that's been garnered over the course of its service."

Maximizing fleet efficiencies

It all starts with learning from KC-46A operations in the field to advance mission readiness for the future fight. A good example is the recent contract that the Air Force awarded to Boeing for KC-46A software and data enhancements for more efficient flight planning. These improvements—based on information gleaned from years of crew experience with the platform's cargo loading and takeoff and landing data management—further advance the mission readiness and performance envelope of the world's most advanced multi-mission tanker.

"The U.S. Air Force and allies are performing crucial global missions with the growing KC-46A tanker fleet and finding ways to extract more capability from the platform," said Lynn Fox, KC-46 vice president and program manager. "We're collaborating to integrate enhancements like these and bring additional capabilities to the battlespace as rapidly as possible to meet the evolving needs of the mission."

Strengthening sustainment

With growing knowledge of the platform based on thousands of flight hours and maintenance checks, there are also opportunities to finetune initial maintenance parameters in order to optimize KC-46A fleet sustainment. As the Air Force leads on organic sustainment of the fleet, there are innovative ways to implement predictive maintenance and supply chain logistics methodologies to ensure the fleet is at the highest level of readiness.

Honing sustainment with the fleet today accelerates the path for solutions to future challenges such as logistics in contested environments.

That challenge intensifies as battlespace capabilities become ever more advanced. Consider software sustainment. Under a recent contract from the U.S. Air Force, Boeing is supporting these efforts by developing a Systems Integration Laboratory supporting software maintenance and sustainment for the KC-46A weapons system. As part of Boeing's contracted support, Oklahoma City Air Logistics Complex at Tinker Air Force Base will be equipped with the necessary infrastructure and resources for advancing the Air Force's organic sustainment of the tanker's mission systems.



Image: DVIDS - The appearance of U.S. Department of Defense (DoD) visual information does not imply or constitute DoD endorsement.

During exercise "Bamboo Eagle 24," KC-46A crews enhanced readiness for the speed and agility required to meet pacing challenges by practicing disaggregated operations and agile logistics across the western U.S.

"This new capability will play a vital role in supporting the US-AF's mission and maintaining the cutting-edge technology of the KC-46A," said Janelle Bakke, KC-46 Support and Training Program Manager.

Rapid evolution

With more than 90 KC-46A tankers in service for the U.S. Air Force and allies, the Pegasus is already delivering crucial multi-mission capability around the globe, including connectivity and battlespace awareness that are unprecedented in a tanker.

As Air Force and allied operators continue to prove out the current capabilities of the KC-46A, they can also rapidly test and integrate new capabilities to continuously evolve the platform to stay ahead of peer threats.

Indeed, the world's most advanced aerial refueler also offers a testbed for further advancing evolutionary aerial refueling capabilities.

The KC-46A Block 1 upgrade does just that, further enhancing the data and communications connectivity the Pegasus provides with additional line-of-sight and beyond-line-of-sight communications technologies including antijamming and encryption features.

Boeing continues investing in new capabilities and emergent technologies to ensure future KC-46A operational effectiveness and mission readiness into the future.

Threats around the globe won't wait for joint and allied warfighter readiness.

Continuing to advance the in-service and in-production KC-46A delivers the maximum aerial refueling capability along the fastest, most affordable timeline for the warfighter.

"We're laser focused on continuing to deliver capacity and new capabilities into the field as rapidly as possible," said Liedman, "because we know the U.S. and allies can't wait."

As the U.S. Air Force analyzes next generation aerial refueling systems requirements, the KC-46A Pegasus is advancing aerial refueling capabilities, operational concepts, and logistics for contested environments with aircraft that are in operation right now—and paving the path for the future of multi-mission aerial refueling.



Exercise Pitch Black 24 in Australia featured aircraft from 17 nations, plus personnel from four other countries. Fighters shared the sky over Australia's Northern Territory, a rare view of such a wide array of allied combat jets. From left to right: an F-35 from Australia, a JAS-39 Gripen from Thailand, a Spanish Eurofighter Typhoon, an F-15K from South Korea, an F-16D from Indonesia, an F-35 from Italy, an F/A-18D from Malaysia, a British Eurofighter Typhoon GR4, and a USAF F-22 Raptor.



AFWERX, the Department of the Air Force's innovation arm, took a look at the unusual BlackFly, an electric vertical take-off and landing aircraft from Pivotal, at Springfield-Beckley Airport, Ohio, in July. AFWERX's Agility Prime program is assessing the aircraft and its supporting ecosystem through an operational leasing arrangement, looking for ways the aircraft could benefit warfighters.

Schneider Electric Transforms Yokota's Power Grid with Self-Funded Energy Upgrades

By Patrick Reardon

Yokota Air Base's location in Japan gives the U.S. Air Force a strategic operational advantage of rapid response within the Indo-Pacific region—but it's also a location fraught with weather events that threaten the installation's power grid. With tsunamis, typhoons, and earthquakes comes the risk of losing primary power, leaving critical infrastructures out of operation and in the dark. To manage this risk at Yokota Air Base, the Air Force turned to Schneider Electric, the global leader in the digital transformation of energy management and automation, to execute one of the largest resilience-focused performance contracts ever undertaken by the Department of Defense. Construction on the comprehensive project began in January 2021 and was implemented in November 2023. The improvements delivered through an Energy Savings Performance Contract (ESPC) includes \$406 million of guaranteed energy savings over the course of the 25-year contract—meaning it requires no upfront investment from Yokota Air Base or U.S. taxpayers.

“[Yokota Air Base] leveraged funds that they're already budgeting—that's the benefit to doing an Energy Savings Performance Contract,” said Meghann Ison, Schneider Electric's project development manager.

Schneider Electric has executed five other ESPCs with the Air Force over the last five years. Each one uses Schneider Electric's off-the-shelf technologies but is customized for the specific mission needs of the base. Yokota Air Base needed uninterrupted, base-wide power and continuous service to thermal loads, even during emergencies and power disruptions. Schneider Electric's solution included a new 10-megawatt combined heat and power plant as an alternative source of primary power, along with a new-and-improved “intelligent” microgrid equipped with across-the-board automa-



Photo courtesy Schneider Electric.

Schneider Electric recently executed an Energy Savings Performance Contract (ESPC) at Yokota Air Base in Japan. The upgrades will reduce Yokota Air Base's energy and water costs by nearly 30 percent, translating to \$12.3 million in annual savings by conserving more than 30 million gallons of water, 75 million kWh of electricity, and 33,000 metric tons of carbon dioxide emissions per year.

tion systems.

“By tying those three main automation systems together—building automation, process automation, electrical automation—they have a wealth of information because it's all digitally connected and inter-networked together,” said Jeff Worley, Schneider Electric's global solution architect on the Yokota Air Base ESPC. “They have a single pane of glass to view those systems from various places across the base—having that eco-structure of a digital ‘internet of things,’ if you will, is a big advantage to them.”

Ison and Worley estimate Schneider Electric's upgrades will reduce Yokota Air Base's energy and water costs by nearly 30 percent, translating to \$12.3 million in annual savings. Schneider Electric reports that the state-of-the-art improvements will conserve more than 30 million gallons of water, 75 million kWh of electricity, and 33,000 metric tons of carbon dioxide emissions per year.

Completing the project didn't come without technical, logistical, and language barriers. Not only was Schneider Electric challenged with an OCONUS project, but also with getting equipment from around the world to Yokota Air Base during the Covid-19 pandemic.

“These projects are the ultimate team sport,” Worley said. “It was not just the team

of a hundred Schneider Electric people from all over the world that helped with this, but it was also the facilitation of the Air Force Civil Engineering Center (AFCEC) and Defense Logistics Agency (DLA), the local squadron of engineering on the base, and just keeping that mission in front of us. That if the base has no power, they have no technology. And if they have no technology, they cannot complete the mission. And that was the rallying point for us through the project.”

Installing a brand-new power plant at one of the Air Force's largest and busiest bases presented another challenge. Transferring Yokota Air Base's critical loads from the old system to the new one required

a complete shut-down of utility power in 750 buildings on base—including air traffic control towers and other mission-critical infrastructures. But Schneider Electric's “islanding” test proved that the base could operate independently of the utility and critical operations wouldn't be interrupted, even during a blackout.

“It was very satisfying how quickly the engines were able to add load,” Worley said. “We had the base from total blackout to restored 10 megawatts of power in 30 minutes. And even we didn't know it would do it that quickly.”

Ison added that Schneider Electric will continue to play an important role in Yokota Air Base's new resiliency measures throughout the ESPC's entire 25-year lifecycle. She said Schneider Electric personnel will remain on base as augmented support to Yokota Air Base's Civil Engineer Squadron.

“We have several full-time employees on site day after day to ensure that those sources are up and running, and the base has a resilient, secure power solution,” Ison said.

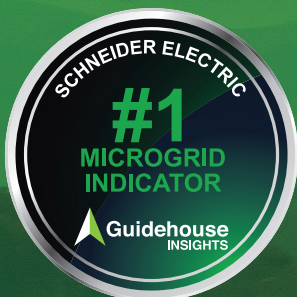
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SCAN



A B-1B Lancer assigned to the 37th Bomb Squadron, 28th Bomb Wing, taxis on the flight line at Ellsworth Air Force Base, S.D., in January. Next year, 17 B-1s, as well as maintenance and support personnel will be relocated to Grand Forks Air Force Base, N.D., freeing up Ellsworth for the B-21 Raider arrival.

B-1 Bombers from Ellsworth to Grand Forks

USAF plans to relocate B-1s in 2025.

Staff Sgt. Jake Jacobsen

By Unshin Lee Harpley

The Air Force is planning to relocate 17 B-1 bombers from Ellsworth Air Force Base, S.D., to Grand Forks Air Force Base, N.D., for 10 months starting early next year, as Ellsworth gears up to host the incoming B-21 Raider.

Air Force Global Strike Command is proposing the move from February to November 2025, a spokesman said in an email statement to Air & Space Forces Magazine on Aug. 19.

The final relocation decision hinges on an ongoing environmental review that is evaluating the impact of moving the aircraft and personnel to Grand Forks. If the review is favorable, Ellsworth plans to send around 800 Airmen along with the Lancers to provide maintenance and support for the bomber operations.

"The B-1s will continue to fill their operational requirements to the President and the Secretary of Defense while at Grand Forks," the spokesman noted in the statement.

The proposal hints at progress in the Air Force's plan to start fielding the new B-21 Raider. After Ellsworth was selected as the initial operating base and training unit for the new stealthy bombers, the base began construction on a 95,000-square-foot

Low Observable Restoration Facility in 2022 to support the bomber. According to budget documents, additional facilities at the base are expected to be completed by the end of this year.

In July, Lt. Gen. Andrew Gebara, deputy chief of staff for strategic deterrence and nuclear integration, confirmed that B-21s are coming to Ellsworth "very soon" and that the program remains on schedule.


"The good news is the B-21 is succeeding, it's in flight test," Gebara said during an event with AFA's Mitchell Institute for Aerospace Studies on July 15. "I always caution people to say it's early in flight test, so I will be happy when I see it flying into Ellsworth for the first time. I have these visions in my head of B-21s flying over Mount Rushmore and circling to land, and I can see it happening. It's going to happen before we know it, very soon, but it isn't there yet."

In May, the Air Force and Northrop Grumman unveiled new photos of the B-21, providing the first official images of the highly secretive bomber in flight. These photos, offering some new details about the aircraft, show the bomber at Edwards Air Force Base, Calif. Since its initial flight at the manufacturer's California facility in November, the bomber has been conducting test flights from the base.

The service recently told Air and Space Forces Magazine

that the new bomber aircraft will not necessarily replace the B-1 and B-2 on a one-for-one basis as new bombers become available. However, Global Strike Command has indicated it does not expect to have the resources to field four types of bombers simultaneously. The goal is to narrow the fleet to B-21s and B-52Js after the B-1s and B-2s retire.

Grand Forks has previously served as a cornerstone of U.S.

bomber operations. Beginning in 1963, the base housed B-52 bombers under the 319th Bomb Wing until it transitioned to B-1 missions in 1986. It played a key role in the nation's nuclear deterrent until 1994, when the last B-1s departed and the wing was redesignated as the 319th Reconnaissance Wing. The base today focuses on ISR missions with unmanned aerial vehicle operations including the RQ-4 Global Hawk. 

B-2 Bombers Back in Australia After Two Years

By John A. Tirpak

Three B-2 stealth bombers landed at Royal Australian Air Force Base Amberley in August to begin a Bomber Task Force deployment—showcasing U.S. presence in the region and conducting exercises with allied nations. The bombers were accompanied by two KC-135R tankers from the Illinois National Guard.

The last time B-2s were in Australia was in the summer of 2022. More recently, the stealth bomber deployed to the Indo-Pacific earlier this summer, landing in Guam for the first time in five years.

Neither Air Force Global Strike Command nor Pacific Air Forces announced how long the trio of B-2s will stay in Australia, but Bomber Task Forces typically last two to three weeks, with training events with allies in the area to practice interoperability and secondary deployments to other locations to gain experience operating from airfields unaccustomed to supporting a bomber presence.

The B-2 deployment is just the latest display of U.S. airpower in the region. Last week, Air Force F-22 stealth fighters deployed to Brunei, Indonesia and the Philippines, making a similar show-of-force in the region. All three countries have long-simmering disputes with China over boundaries in the South China Sea.

The deployment was not announced in advance, but Defense Secretary Lloyd J. Austin did hint at it earlier in August after the U.S.-Australian defense ministerial conference.

"We're increasing the presence of rotational U.S. forces in Australia," Austin said at the time, to include "more maritime patrol aircraft and reconnaissance aircraft operating from bases across northern Australia. It will also mean more frequent rotational bomber deployments."

RAAF Amberley is on Australia's east coast, near Brisbane.

Pacific Air Forces released a statement saying the bombers are from the Active-duty 509th Bomb Wing and Guard 131st Bomb Wing, both at Whiteman Air Force Base, Mo. A video posted by the DOD identified two of the aircraft as being the Spirit of Arizona and Spirit of Indiana, both from the 393rd Bomb Squadron.

A third B-2 arrived later, according to an Air Force official, and was not immediately photographed or identified by DOD. PACAF did not say how many Airmen traveled to Australia to support the task force.

"This deployment is in support of Pacific Air Forces' training efforts with allies, partners, and joint forces and strategic



Staff Sgt. Whitney Erhart/ANG

U.S. Air Force Airmen execute post-flight procedures on a B-2 Spirit stealth bomber at Royal Australian Air Force Base Amberley, Australia, in August.


deterrence missions to reinforce the rules-based international order," PACAF said.

The last time B-2s deployed to Australia was in July 2022, when they also operated from RAAF Amberley. The bombers took part in the bilateral Koolendong 22 exercise and conducted drills with Australian F-35As.

The RAAF's F-35As also exercised with B-2s at Nellis Air Force Base, Nev., in January, when both types participated in a Red Flag exercise. That event marked the first time RAAF F-35As participated in a Red Flag at Nellis.

Reuters has reported the U.S. and Australia may be seeking to build facilities at RAAF Tindal, in the Northern Territories, to support deployments of up to six B-52 bombers and associated refueling aircraft.

At the U.S.-Australian defense ministerial, the two countries also announced plans to expand defense cooperation, exercises, and production of weapons. At a May meeting that included Japanese defense officials, the three countries announced plans for new trilateral joint exercises, to include Bushido Guardian—an F-35 wargame which will be held in Japan—and Pitch Black, a regular large-force exercise in Australia. They also agreed to conduct live-fire exercises in Australia in 2027.

In the Indo-Pacific, F-35s are operated by the U.S., Australia, Japan, South Korea, and Singapore. 



Boeing illustration

An artistic rendering of a U.S. Air Force E-7A Wedgetail, which is set to replace the aging E-3 Sentry AWACS and become the Air Force's next-generation early warning and control aircraft.

Air Force, Boeing Ink \$2.5 Billion Deal for First E-7s

By Chris Gordon

The Air Force has ordered its first E-7A Wedgetail battle management and command and control aircraft, announcing Aug. 9 it has agreed to a deal with Boeing worth \$2.56 billion for two platforms. The service says the deal is for “operationally representative prototype E-7A weapons systems,” which Boeing plans to deliver in fiscal 2028.

“This agreement is a significant win for our warfighters, paving the way for ensuring the Air Force’s ability to provide advanced airborne moving target indication in the coming years,” Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics Andrew Hunter said in a news release.

The aerospace giant and the Air Force had been hung up on the price for the first E-7As for months, delaying the fielding of aircraft, Secretary of the Air Force Frank Kendall said earlier this year. The Air Force and Boeing agreed to a price last month but the amount was not disclosed. The service and Boeing already had a contract for an unspecified amount to purchase and adapt the aircraft, which was originally designed for the Royal Australian Air Force, to U.S. Air Force requirements.

The E-7A will become the Air Force’s next-generation airborne early warning and control aircraft, which will also provide “moving target indication capabilities.” The E-7A is part of the service’s vision of a DAF Battle Network of connected sensors and shooters in multiple domains to be able to fight across the vast distances of the Pacific, its contribution to the Pentagon’s Combined All-Domain Command and Control (CJADC2) effort. The E-7 will replace the aging E-3 Sentry AWACS, which by the time of its planned retirement toward the end of the decade will have served in the Air Force for half a century.

“Its advanced multirole electronically scanned array radar will enhance airborne battle management, providing improved

situational awareness and enabling long-range kill chains with potential peer adversaries,” the Air Force said of the E-7A in the release announcing the deal.

The E-7As will allow the service to ditch its E-3s, which, in addition to having an increasingly obsolete radar, are also based on an 1950s-era airframe design. The E-3 suffers from a lack of parts and maintenance issues, Air Force leaders say. The E-7A is based on the Boeing 737-700 NG commercial airframe, while the distinctive radar is built by Northrop Grumman. The Royal Air Force is also buying the E-7, and the variants of the platform are in service with the Republic of Korea Air Force, Turkish Air Force, and the RAAF.

Hunter said the E-7A is “an exemplar of our ability to leverage and support the expertise and investments of our partners and allies to support our common security objectives.”

The Air Force has had its crews training on Australian E-7s since 2022 through an exchange program that embeds Airmen in the Royal Australian Air Force. The crews were recently put to the test in the joint Pitch Black exercise.

“For us, the purpose is really to get a familiarity of the E-7A Wedgetail from the Australians who have been operating it for a long time,” U.S. Air Force Maj. Oliver Ngayan, 2 Squadron E-7A Wedgetail air battle manager, said in a July 29 news release. “We integrate into their unit to learn how they operate the E-7A and take back that knowledge to develop our own procedures.”

In a statement, Boeing said the contract award includes “life cycle development, training, and support for the Air Force’s E-7A fleet.” For now, the Air Force plans to have a fleet of 26 E-7As. The service said the prototype aircraft will “inform a planned production decision in FY 26.”

In the long term, the Department of the Air Force believes space-based capabilities will increasingly replace AWACS aircraft such as the E-3 and E-7.



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Space Force Payload Launches Historic First

By Greg Hadley

A SpaceX Falcon 9 rocket blasted off from Vandenberg Space Force Base, Calif., on Aug. 9, carrying a historic collaboration between the U.S. Space Force and a foreign ally—two satellites procured by Space Norway that will host USSF payloads for Arctic communications.

The launch marked the first time an operational Space Force payload has deployed on a foreign-owned satellite, a collaboration USSF leaders say will save millions of dollars.

The original Enhanced Polar System (EPS) is still on orbit, hosted by two classified satellites, according to a Pentagon acquisition report. Its projected service life is 10 years—but polar elements for successor programs like Evolved Strategic SATCOM and Protected Tactical SATCOM are not scheduled to launch for years. The Department of the Air Force decided to procure new EPS payloads as a stopgap in 2017.

The challenge was cost. Two years later, the U.S. Air Force and the Norwegian Ministry of Defense signed a memorandum of agreement to join forces on the Arctic Satellite Broadband Mission, laying the groundwork for a long and complicated partnership. Space Norway, a commercial company owned by the Norwegian government, procured the satellites from Northrop Grumman, which also made the EPS-R payloads. Additional payloads for the Norwegian Ministry of Defense and ViaSat, a satellite communications company, are also on board.

In July 2023, the RAND Corp. wrote in an analysis of Air Force security cooperation projects with allies, including EPS-R: “The Arctic Satellite Broadband Mission effort experienced budgetary, bureaucratic, regulatory, cultural, and technical barriers, with bureaucratic and regulatory barriers being the most problematic.” It took almost two years to finalize the memorandum of agreement, even with leaders pressuring acquisition officials to get the deal done.

While the Space Force hoped to have the satellites and their payloads on orbit by early 2023, delays pushed the timeline back. Not until May 2023 did the U.S. accept the ground system for the program. When the payloads passed their final tests, the stage was set for the Aug. 9 launch.

According to Space Force budget documents, USSF plans “on-orbit testing, operational utility evaluation, and operations acceptance” in fiscal 2025.

In a release after the launch, Northrop Grumman noted that it is providing two Satellite Control Systems for Space Norway to operate, suggesting the U.S. Space Force will not be responsible for operating the satellites themselves.

Space Systems Command did not immediately respond to a query from Air & Space Forces Magazine seeking additional operational details.

Future international projects are already in the forecast. In 2020, the service signed an agreement with Japan to host



Space Norway

A SpaceX Falcon 9 rocket carrying two Arctic Satellite Broadband Mission satellites for Space Norway and the U.S. Space Force.

space domain awareness payloads on the Quasi-Zenith Satellite System. Those payloads have already been delivered to Japan and are awaiting launch, which is currently projected for fiscal 2025. RAND analysts noted in their report that the payload going on QZSS will provide “a space domain awareness capability that the United States arguably did not need but pursued for the overall sake of cooperation.”

International complexity will continue to be a challenge. RAND analysts noted that “the large size and complexity of these programs, as well as the lack of a single voice across the U.S. space [security cooperation] enterprise, challenge the scale and pace of collaboration.”



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Airman 1st Class Paris McGraw, 521st Contingency Response Squadron Aerial Porter, prepares to load cargo onto a C-17 Globemaster III during Exercise Bamboo Eagle 24-3 in August at Edwards Air Force Base, Calif.



Capt. Stephanie Squires

Sun, Spades, and Forklifts at Bamboo Eagle

By David Roza

MOJAVE, CALIF.

It was a quiet Sunday morning before the C-17 arrived. Hundreds of wind turbines churned the 100-degree desert air over the nearby Tehachapi Mountains, and the only air traffic above the Mojave Air and Space Port was a football tossed back and forth by a few Airmen waiting on the sun-blasted flight line.

But when the whale-shaped transport jet with its four roaring engines finally appeared in the empty blue sky, the Airmen put down the football and donned ear protection as they prepared to download the gray beast's precious cargo.

Time was of the essence: the C-17 had a long list of stops to make and materiel to move before the start of one of the Air Force's largest exercises of the year, which would see thousands of troops and more than 150 aircraft practice air warfare over the deserts, valleys, and waters of the West Coast. The aircrew would keep the engines running to avoid the long shutdown and restart process; but that also put pressure on the ground crew to move its 25 tons of unwieldy cargo as quickly as possible.

Luckily, Engine-Running Offloads/Onloads (EROs) were nothing new for the seven Airmen waiting on the flight line. An experienced crew from the 621st Contingency Response Squadron, the team included aircraft maintainers, airfield managers, and, perhaps most important for this exercise, aerial porters. Also known as "port dawgs," aerial porters take cargo and people off and on military aircraft under difficult conditions and tight deadlines.

While it sounds simple, aerial porting is a delicate balance of math, physics, technique, and elbow grease which, if improperly mixed, can endanger aircrews and slow the movement of

war-winning equipment or life-saving supplies by days when every minute counts.

"Planes are most vulnerable when they are on the ground," said Lt. Col. Andrew Morris, director of operations for the 621st. "The faster we can get the stuff on and take it off, the better it is for them."

The C-17 touched down at about 10:19 a.m. on Aug. 4. The clock began to tick.

THE ART OF THE LOAD PLAN

The Mojave download was part of a new series of exercises called Bamboo Eagle, where combat aircraft operate out of small, scattered air bases instead of large ones that present juicy targets for long-range missiles. The concept is called Agile Combat Employment (ACE), and it requires working closely with mobility aircraft—the transports and tankers that move bomb carts, generators, and other equipment for re-arming and refueling combat aircraft.

"Air Combat Command does not have a heavy port footprint, so when they're trying to establish their mission generation force elements [MGFEs], they need someone to catch that equipment that comes on cargo aircraft: all the things they need to bed down a base," said Lt. Col. Andy Nation, commander of the 621st.

At Bamboo Eagle, the simulated war lasted from Aug. 5 to 10, but in the days leading up to it, mobility Airmen pre-positioned combat equipment at unfamiliar airfields in a system of hubs and spokes across the West Coast. Port dawgs not only load and unload the aircraft, they also design the load plan, the blueprint for what cargo goes where on an aircraft.

A poor or unsafe load plan can have serious consequences; too much equipment on the plane's tail end can prevent takeoff, while fuel leaks or loose parts can damage the aircraft or the



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crew if a steep bank or climb sends parts flying through the hold.

Calculating a solid load plan involves a long list of factors such as the weight and center of balance for each piece and how it affects the plane's center of gravity. For example, the T-tail of a C-17 generates lift, which pushes the nose down and makes it fly less efficiently, a key factor in the Pacific where places to land may be few and far between, explained Tech. Sgt. Russell Basile, one of the port dawgs at the Mojave airport.

To make things easier, the length of the C-17 cargo hold is marked with numbers like a ruler, and the centers of balance on cargo pieces are marked with duct tape and aligned with those numbers according to the load plan.

Port dawgs also have to consider the cargo's weight under 3 Gs, which means an 11,000-pound piece has to be secured as if it weighs 33,000 pounds. The porters and loadmasters tie down the cargo with chains, and different chains support different amounts of weight. Likewise, a C-17 has 295 rings on its cargo deck for tying down chains and straps, but the weight tolerance varies among rings.

To make things more complicated, all the chains and straps have to be arranged symmetrically and in pairs, and they have to secure the movement of the piece in multiple directions, which means there is a specific way to tie down cargo.

"It's playing Tetris and putting puzzle pieces together," Basile said. "And as you're putting the pieces together, you're also thinking, 'How am I going to balance everything? And how is it going to be for tie-down?'"

EXPERIENCE COUNTS

Regulations require the load plan be put together six hours before an aircraft's scheduled departure. But once the load plan is complete, the cargo still needs to get onto or off the jet via a forklift, a conveyer belt, or just rolling it up or down the ramp, all of which takes math, since the forklifts can take only so much weight and the cargo ramp may be too steep or shallow for the piece rolling off.

There's an entire agency, the Air Transportability Test Loading Agency at Wright-Patterson Air Force Base, Ohio, that certifies cargo for air transport and calculates things like the degree pitch for getting the cargo down a ramp, sometimes just based on photos and measurements sent by the port dawgs.

"They can generate a cert letter saying, 'Hey, based on the dimensions of that bomb loader and the degree pitch of the ramp, if we don't decrease the angle, then it's going to scrape the ramp as it goes down,'" Basile explained.

The port dawgs keep scraps of wood and other materials that serve as "shoring," which lets expensive cargo safely on and off the aircraft. Juggling all these factors with jet engines running takes practice.

"Experience is looking at the piece and knowing immediately, 'hey, I'll need shoring for this, I just don't remember the dimensions. Where's the cert letter?'" Basile said.

Loading cargo via forklift also takes experience: It can take as long as six months to master the All Terrain Materials Handling Forklift, a green behemoth that port dawgs rely on to move up to 10,000 pounds over nonpaved surfaces.

"Like with everything, proficiency takes time," said Senior Airman Victor Colas, another port dawg at the Mojave airport.

The "AT" tends to be the most important piece of equipment port dawgs take downrange with them, Colas said. They can even take the cab off the top so it can fit aboard a C-130, though that requires removing a counterweight and reducing the AT's lift strength to about 8,500 pounds. Forklift availability makes a big difference, said one of the pilots of the C-17 that flew into

Mojave on Aug. 4.

"If you have only one forklift and a cargo load full of pallets, it's going to take a while," said Capt. Robert Talbot of the 15th Airlift Squadron. If there are not enough aerial porters around, sometimes the pilots pitch in to move the cargo. Those changing factors mean crews are constantly "recrunching, rethinking about the time you need on the ground," Talbot said.

The port dawgs at Mojave went to work fast, falling into a choreography guided by hand signals and huddles with the loadmasters. For all the math and machines port dawgs rely on, sometimes it takes raw elbow grease to move cargo on and off aircraft, a tall order in the 100-degree Mojave morning.

There are worse conditions: Senior Master Sgt. Doug Karaffa remembered his boots sticking to a runway in Iraq in 142-degree heat. Still, port dawgs are "blessed," he said, because at least they can take off their uniform blouses and often don't have to wear body armor or weapons like Security Forces Airmen or the trigger-pullers in other services.

ACING ACE

Bamboo Eagle is meant to prepare the Air Force for ACE, which aims to project airpower with the smallest, most maneuverable logistical footprint possible. The port dawgs at Mojave belong to the 621st Contingency Response Wing, which specializes in standing up air bases at austere locations. But even the CR field wants to go smaller for ACE: A new feature at Bamboo Eagle was the Contingency Support Element (CSE), teams of just seven or eight Airmen who can fly out to a spoke, download all the cargo that combat aircraft and ground crews need to start turning fighters, then fly to a new location.

"Our job is to be on alert for any mission that comes in," said Staff Sgt. Jonathan Esqueda, who led one of the CSEs at Bamboo Eagle under the 521st Contingency Response Squadron, a component of the 621st Contingency Response Wing.


Esqueda and his six CSE teammates packed 72-hour bags so they were ready to fly out with an aircraft and download its cargo at a moment's notice, a rare opportunity in the aerial port field, where most squadrons remain at a single base and work regular schedules.

"I'm usually just in one location, working 12-hour shifts, and that's it, so this is awesome to me," Esqueda said.

The card game spades is a pastime among port dawgs, Esqueda said, and with good reason, several flights at Bamboo Eagle were delayed or canceled when jets broke down or cargo was improperly configured, which slowed the pre-positioning process and led to CSE teams waiting for flights that never arrived.

To illustrate how complicated Air Force logistics can get: Half the aircrew aboard the C-17 at Mojave was from Joint Base Charleston, S.C., while the other half and the jet they flew were from Joint Base McGuire-Dix-Lakehurst, N.J., and the cargo they carried was from the 388th Fighter Wing at Hill Air Force Base, Utah, but they picked it up at Travis Air Force Base, Calif.

To an extent, Bamboo Eagle was designed to practice dealing with those complications. But when the port dawgs finally had a chance to do their job, they didn't disappoint. At Mojave, the team of porters and loadmasters finished downloading 50,340 pounds of bomb transport carts, nitrogen carts, air conditioning systems, and other gear with just one forklift in about 40 minutes.

That kind of speed "is on par with an experienced crew," Basile said, as the unladen C-17 taxied back onto the runway. "When you have loadmasters and aerial porters on the same wavelength, it's like 'hey, we know what we're doing, let's just go.'" 

Change of Station Easier by 2025

By David Roza

The top civilian in charge of Air Force and Space Force personnel matters wants to make moving between permanent assignments less stressful for Airmen, Guardians, and their families, and he wants to do it fast.

Alex Wagner, assistant secretary of the Air Force for manpower and reserve affairs, said he and a cross-functional team at Air Force Headquarters were working on a batch of “initiatives, policy changes, financial incentives” and a service member’s bill of rights with movers that he wants in place by the permanent change of station (PCS) season next summer.

“In 76 years of the United States Air Force, we have not figured out how to move people without having all of your stuff broken, without your movers holding your things hostage, without creating extra expenses, stress,” Wagner said to a wave of applause on Aug. 13 at a panel on quality of life at the Air Force Sergeants Association’s Professional Education & Development Symposium in Houston.

“It is mind-blowing to me,” said the assistant secretary.

While he did not provide details on specific initiatives, Wagner’s comments address a long-running theme of PCS horror stories. Over the years, service members and their families have reported moving companies attempting to bribe them to leave a positive review of their work; losing or stealing boxes or entire shipments; letting rainwater soak household goods and cause mold damage; not delivering shipments for months or more, and other hardships.

In recent years, family pets died aboard PCS flights. Only about 77 percent of service members reported satisfaction with their household goods move in 2023, which translates to several thousands of service members left unhappy, according to a Department of Defense press release. To make matters worse, in 2023, many Air Force families were left in limbo when the service ran out of personnel funding and had to delay PCS moves and stop awarding new bonuses.

“Plans to sell or buy a house or car, enroll children in schools and daycares, transition jobs for spouses and partners, or deliver babies in known or planned locations evaporated under the PCS pause,” wrote RAND political scientist Kelly Atkinson in a commentary at the time.

This summer, U.S. Transportation Command began implementing a new contract it says will improve the PCS shipment experience. The Global Household Goods Contract (GHC) hired a single company, HomeSafe Alliance, to coordinate the scheduling, packing, and moving functions performed by hundreds of other companies. The GHC is meant to improve communication, reduce wait times, and increase transparency for shipments through new mobile tracking tools.

HomeSafe also had to stand up an academy to train its subcontractors to provide a “standardized” moving experience, according to the DOD. The new GHC was limited to just 15 military installations this year, but the department hopes feedback from the initial moves will inform wider adoption of the contract.

If Wagner is successful, other changes may be on the way for Airmen and Guardians. The assistant secretary said he is working with Chief Master Sergeant of the Air Force David Flosi



Rodney Speed/USAF

Personal Property manager Staff Sgt. Brent Rochette, 78th Logistics Readiness Squadron's Traffic Management Office, inspects the condition of shipped items at Robins Air Force Base, Ga., as part of assisting Airmen and families with relocations.

and Chief Master Sergeant of the Space Force John Bentivegna to craft effective changes. Other issues he is working on include spouse employment, child care, health care, and recruiting.

“We should be able to figure this out,” he said about PCS moves. “That is one of the big strategic initiatives that I have said, ‘I want things in place for summer PCS season 2025.’ More to follow on that.”



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Ukraine Unveils Its First F-16 Fighters

By Chris Gordon

Ukraine's first F-16s were unveiled by Ukrainian President Volodymyr Zelenskyy on Aug. 4, ending a lengthy wait for the Western fighters Kyiv says it needs to defend its airspace from Russia.

"Now we have a new reality in our skies. The F-16s are in Ukraine," Zelenskyy said in a speech at a ceremony to unveil the country's first Vipers.

He spoke near two F-16—sporting Ukraine's blue and yellow trident on their tails—while a pair of F-16s conducted a flyover. But his speech also highlighted the difficulties Ukraine still faces in the skies. The location of the event was not publicly disclosed, lest it come under Russian attack.

"These jets are in our sky and today you see them," Zelenskyy said in his remarks, according to multiple reports from the ceremony and video of the event posted on social media. "It's good that they are here and that we can put them to use."

The venerable, multirole F-16s just celebrated its 50th anniversary, and the jet has been steadily upgraded over the years. Zelenskyy did not say which countries provided Ukraine's first F-16s or how many are in the country. But the Netherlands and Denmark have led the effort and said they would be first to provide Ukraine with F-16s. Belgium and Norway have also pledged F-16s. All told, allies have promised to give Ukraine more than 60 F-16s, though the process will be gradual.

"Since the beginning of this war, we have been talking with our partners about the need to protect our Ukrainian skies from Russian missiles and Russian aircraft," Zelenskyy said.

The Biden administration did not sign off on the Europeans' decision to provide Ukraine with the F-16s until August 2023 amid pressure from allies. The U.S. is not proving its own F-16s but must agree to the transfer of U.S.-made weapons.

There are a host of other unanswered questions, including how the planes will be maintained, the full range of munitions that will be used to arm them, and what missions they will perform.

Washington has put stipulations on how Ukraine can use the advanced weapons it has already provided. And it remains to be seen whether the U.S. and its allies will authorize Ukraine to use the aircraft to engage enemy aircraft over Russia or target sites inside Russia with air-to-surface weapons.

"This decision is probably a difficult one for our partners, as they are always afraid of unnecessary escalation," Zelenskyy said.

The nonstealthy, fourth-generation F-16 has its limitations even in taking on a narrow set of missions, such as protecting Ukraine skies. It is vulnerable to Russia's advanced surface-to-air missiles. Ukraine also needs to take precautions so the aircraft are not destroyed on the ground. U.S. officials and airpower experts have cautioned that F-16s will not turn the tide immediately.

"It's not going to be the ... golden bullet, that all of a sudden, they have F-16s, and now they're going to go out and gain air superiority," U.S. Air Forces in Europe commander Gen. James B. Hecker said recently. "We started the clock, and I think that's a good start."

The New York Times reported Aug. 4 that roughly half a dozen pilots, flying about the same number of jets, were practicing in "uncontested" Ukrainian airspace.



Photo provided by the Office of the President of Ukraine

F-16 aircraft are already in Ukraine, announced President Volodymyr Zelenskyy, center, at an undisclosed air base, flanked by F-16s on the Day of the Air Force of the Armed Forces of Ukraine, Aug. 4.

"Since the beginning of this war, we have been talking with our partners about the need to protect our Ukrainian skies from Russian missiles and Russian aircraft," Zelenskyy said. "We made it happen. I am proud of our guys who are mastering these aircraft and have already started using them for our country."

The jets on display Aug. 4 were mounted with what appeared to be AIM-120 AMRAAM radar-guided medium-range, air-to-air missiles and AIM-9 Sidewinder infrared short-range air-to-air missiles.

The capabilities of those weapons vary depending on the variant. The jets in Ukraine appeared to be equipped with the AIM-9L model. They are able to hone in on their target from higher angles—so called off boresight capability—compared to the oldest Sidewinders. But the U.S. Air Force has moved on to the new, advanced AIM-9X, with lock-after-launch, better maneuverability, and enhanced countermeasures.

It was not immediately clear which variant of AMRAAM—or its inert training model, the CATM-120—was mounted on the jets. Ukraine is unlikely to receive the newest models of AMRAAMs. Air & Space Forces Magazine previously reported that AMRAAMs were being considered for Ukraine's F-16s.

Ukraine's F-16s will likely employ HARM anti-radiation missiles, JDAM guided bombs, and Small Diameter Bombs, which the U.S. has already given to Ukraine for use on its existing MiG and Sukhoi jets.

"Now they're going to have the opportunity to actually drop them off of an airplane that they were designed to come off of, which will give them more capability to change the targets in flight and things like that," Hecker said recently. "That's going to increase the capability."

The U.S. will work with its allies to provide Ukraine's F-16s with "precision munitions designed to enhance Ukraine's air combat capabilities to defend its airspace and carry out effective air-to-ground operations," a Pentagon spokesperson told Air & Space Forces Magazine in late July. Some of the weapons will come directly from U.S. and allied stocks and some will be procured from defense companies.

"Our combat aviation will bring us closer to victory," Zelenskyy said.

New B-1 Pylon Creates 'Hypersonic Testbed'

By John A. Tirpak

The Air Force has begun using a new Boeing pylon to test a variety of weapons on the B-1 Lancer, the 412th Test Wing announced in August, and now has a second way—besides the B-52—to test large weapons like hypersonic missiles.

The Load Adaptable Modular (LAM) pylon streamlines weapons tests because its modular attachment points can be repositioned, reducing the need for unique pylons and making it possible to test weapons for which an appropriate pylon may not exist. Designers and testers liken it to a “Lego” pylon.

“We met the intent of Congress ... and we now have a B-1 hypersonic testbed,” Joseph Stupik, senior materiel leader for the B-1 bomber division, told reporters at the Life Cycle Industry Days Conference in Dayton, Ohio, in August. Congress provided additional hypersonic testbed funds last year.

Boeing, which developed the LAM, envisioned the pylon as relieving the B-52 of hypersonic weapon assessments, as test B-52s are fully engaged with evaluating new engines, radars, communications systems, and navigation gear for its B-52J upgrade, as well as the AGM-181 Long-Range Standoff nuclear weapon.

Stupik said the Air Force has done a number of tests with the LAM so far, and it has “worked well.” Those included a 2,000-pound GBU-31 test in February, as well as “a bunch of flights” to qualify the LAM for the 5,000-pound GBU-72 Joint Direct Attack Munition advanced penetrator.

“We actually flew it behind a tanker to see what the handling qualities were with a large store on the outside” of a B-1, Stupik said.

Boeing built four LAMs, and Stupik said the Air Force has been using one at Edwards Air Force Base, Calif., where two B-1Bs are earmarked for flight test.

“We can put it on either one of the test jets out at Edwards. So it’s swappable right now,” he said.

“We’ve only qualified the one hard point,” which is in the location of a former external-carriage hardpoint originally meant for cruise missiles, “but we could put it on either test jet at Edwards,” Stupik said. The hardpoint seems to be the same location on which B-1s carry the AN/AAQ-33 Sniper AT targeting pod.

The LAM can accommodate weapons weighing up to 7,500 pounds, Boeing said in revealing the pylon to reporters at the Oklahoma Air Logistics Complex in May 2023.

The Air Force has seemingly stopped test-flying the large AGM-183 Air-Launched Rapid Response Weapon (ARRW), all the flights of which were made off a B-52, but has not yet begun heavy testing of the Hypersonic Attack Cruise Missile (HACM), a smaller, air-breathing missile meant to be carried by fighters.

At the time of the LAM’s unveiling, Boeing said a B-1 could carry 24 HACMs internally and 12 on LAMs mounted externally,



Richard Gonzales/USAF

A B-1B Lancer assigned to the 419th Flight Test Squadron conducts flight tests on the Load Adaptable Modular pylon in February.

for a loadout of 36 weapons. Likewise, it could carry 36 AGM-158 Joint Air-to-Surface Standoff Missiles (JASSMs) in the same configuration. The JASSM is physically and functionally similar to the Long-Range Anti-Ship Missile (LRASM), and Air Force officials have increasingly talked about the B-1 taking on an anti-shipping role in recent years.

According to an Edwards press release, “while the B-1B was chosen due to aircraft availability at Edwards, the LAM can be modified for attachment to a variety of

other aircraft if the need were to arise.” The LAM is “one of several ways teams at Edwards are working with private industry to provide an innovative increase in test infrastructure.”

In recent years, insufficient test infrastructure has been pegged by the Government Accountability Office as one of the key limiting factors preventing the Air Force from speedier testing of a tsunami of new aircraft and weapons.

The LAM project “also gives test professionals valuable experience in applying engineering and analysis objectives that could be applied to future programs,” the Edwards release states. ★



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Airman 1st Class Sydney Lee

The Civil Reserve Air Fleet has played a big role in providing aid to Ukraine and Israel. Here, Airmen from the 436th Aerial Port Squadron load cargo bound for Ukraine onto an Atlas Air aircraft at Dover Air Force Base, Del., in 2021. The U.S./Ukraine defense partnership goes back to 1993.

Still Delivering ... After All These Years

The Civil Reserve Air Fleet is almost as old as the Air Force.
It's still going strong.

By John A. Tirpak

In a potential fast-moving future conflict, spread widely across the Pacific, the U.S. would depend on mighty Air Force C-5 and C-17 airlifters to move vast amounts of military materiel. But they can't do the job alone. Air Mobility Command's 1,145 tankers and cargo aircraft will be augmented—as they have been for 73 years—by the Civil Reserve Air Fleet.

That fleet numbers some 441 aircraft belonging to 27 volunteer commercial carriers, and already carries more than 90 percent of the U.S. military's passengers and 40 percent of its cargo on a daily basis. That includes everything from big equipment to small packages. The number of participants has remained above 25 for three years, and Transportation Command (TRANSCOM) is looking to add two more this year.

In exchange for day-to-day contracts to move people and cargo, participants in the Civil Reserve Air Fleet, or CRAF, agree to make aircraft and crews available to TRANSCOM in times of crisis. That means their airplanes and flight crews can, in effect, be “drafted”; if enough carriers fail to step up, the military can order an activation.

“We’ve already seen a couple of our companies struggling with recapitalization, both in terms of the costs and availability, ... [though] we are not expecting to lose any carriers right now.”

—CRAF Program Manager David Atkinson

The first CRAF activation came during the Berlin Airlift, and only a few major activations have occurred since: Operation Desert Shield/Storm in 1990-91; Operation Iraqi Freedom in 2003, and the 2021 evacuation of U.S. and coalition personnel from Kabul, Afghanistan.

Following that last chaotic evacuation, TRANSCOM questioned whether CRAF needed an overhaul. But a 2023 study concluded “the current setup of the program is sufficient,” said David Atkinson, CRAF program manager at TRANSCOM, in a July interview.

CRAF was born in the 1950 Defense Production Act, at the dawn of the Cold War. Today, a quarter-century after that conflict ended, the U.S. is again competing with a peer rival, in China, as well as other challengers around the globe. The question of how many aircraft are available remains open, Atkinson noted.

“There might be a requirement for increased capacity, depending on how the enemy evolves and emerges,” he said. There could also be some adjustment to the “stages” of CRAF—each of which calls up a portion of the fleet, depending on how serious the crisis is—and the configuration of the aircraft.”

A classified Mobility Capabilities and Requirements

Voluntary Peacetime Capacity to Support DOD Airlift Needs

Year	Short Tons	Passenger Seats
2012	190,555	468,436
2013	160,288	507,416
2014	67,392	452,949
2015	70,393	443,613
2016	78,775	326,390
2017	125,892	434,259
2018	150,359	409,492
2019	136,644	474,187
2020	130,004	444,666
2021	58,767	360,340
2022	134,791	385,767

Source: Airlift Tanker Association

Study (MCRS) defines the capacity and makeup of CRAF every five years. The last MCRS was completed in 2020, and changes are likely in the next iteration, which will be conducted in 2025, Atkinson said.

The MCRS is coordinated with the Pentagon's Cost and Program Assessment shop and TRANSCOM's Joint Distribution Process Analysis Center.

"They do an extensive analysis, based on the most stringent threat," Atkinson said. The last version included "Great Power Competition" scenarios, and the existing program, which calls for a minimum of 256 "wide-body equivalent" aircraft. "We have more than that in the system now," Atkinson acknowledged.

CRAF demands fall into three categories:

- Stage I for "minor regional crises" and humanitarian/disaster relief operations;
- Stage II for major theater wars; and
- Stage III for national mobilizations.

Operational needs for passengers and cargo are further divided into long-range international, short-range international,

and domestic requirements.

The long-range international segment comprises transoceanic aircraft to augment AMC's long-haul C-5 and C-17 airlifters, while short-range international supports requirements for nearby and intratheater airlift. Cargo craft must be fitted with hardened floors and tie-downs to transport pallets and equipment.

AGING FLEETS

Like the Air Force, CRAF participants are also flying increasingly aging air fleets, and aircraft makers are no longer building large cargo and passenger aircraft like the 747, a CRAF staple.

For commercial carriers, "costs are pretty large," Atkinson said. "Those are large capital investments ... with every single aircraft [costing] \$150 million to \$200 million."

Many carriers postponed or canceled new aircraft during the COVID-19 pandemic, and only now that air travel levels are back to pre-pandemic levels are most of those orders being reinstated. "Some older [aircraft] ... may be on their third iteration through different companies," Atkinson added.

Meanwhile, Boeing delivered its last 747 freighter to Atlas Air last year. "So no more 747s are coming," Atkinson said. Boeing still makes the 777 and Airbus sells the A330, "But those ... capitalization costs are extreme," Atkinson said, and even if a carrier did order 100 new aircraft, they would not "all show up at once." Modernizing the CRAF therefore will take both time and money.

"I think we've already seen a couple of our companies struggling with recapitalization, both in terms of the costs and also availability," Atkinson said. "Difficulties in manufacture, difficulties in quality and safety, and everything else are affecting delivery times for those new assets," he added. "It affects bottom lines."

TRANSCOM holds regular conversations with its CRAF carriers to ensure its needs are unambiguous and that it understands carriers' challenges. The two sides are in final negotiations for the next CRAF contract, which is expected to be executed in October of this year, Atkinson reported. "We're expecting full subscribership," he said. "We're not expecting to lose any carriers right now."



Evacuees from Afghanistan board a commercial aircraft at Ramstein Air Base, Germany, in 2021. Civil Reserve Air Fleet aircraft were used for the onward movement of evacuees from temporary safe havens and interim staging bases.



Senior Airman Zachary Cacicia/USAF

Cargo pallets are loaded onto a Kalitta Air Boeing 747 by 436th Aerial Port Squadron Airmen in 2017 at Dover Air Force Base, Del. In addition to military airlifters, Dover regularly sees civilian cargo planes that support Department of Defense missions.

More freighter aircraft are actually coming to the market, but they may not have the hard decks, cargo doors and other features CRAF needs. Aviation analyst Mordor Intelligence, in a mid-2024 study, noted “the rising preference of airlines to modify and update their old passenger aircraft” as “passenger-to-freighter conversions.” However these new-to-the market freighters will tend to “carry lighter, more voluminous cargo like e-commerce packages,” and not the heavier cargo needed for military movements.

The company assessed the world freighter aircraft market at \$6.57 billion in 2024, and said it’s expected “to reach ... \$8.70 billion by 2029.”

No new incentives will be included, but the work itself appears to be a sufficient draw. Among the contracts available are the Next-Generation Delivery System—for small package delivery—and Global Heavyweight, which utilizes empty space on airliners. The General Services Administration City Pair Program and the Defense Travel System round out military contract offerings.

“We have a lot of incentives that are extended to the carriers, but we’re always considering” other business opportunities for them,” Atkinson noted.

AGILE COMBAT EMPLOYMENT

A new wrinkle for CRAF is the way the Air Force and Marine Corps deploy. Both services anticipate more distributed operations spread out among numerous bases instead of at the large megabases that defined the recent era. What the Air Force

CRAF Industry Partners

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AIR TRANSPORT INTERNATIONAL

AMERICAN AIRLINES

AMERIJET

ATLAS AIR

DELTA AIR LINES

FEDERAL EXPRESS AIRLINES

HAWAIIAN AIRLINES

KALITTA AIR CARGO

NATIONAL AIRLINES

OMNI AIR INTERNATIONAL

POLAR AIR CARGO

UNITED AIRLINES

UNITED PARCEL SERVICE

WESTERN GLOBAL

(Current as of January 2024)
Source: TRANSCOM

Short-Range International

ABX AIR

ALASKA AIRLINES

AMERIJET

DELTA AIR LINES

EASTERN AIRLINES

JET BLUE AIRWAYS

LYNDEN AIR CARGO

NATIONAL AIRLINES

NORTHERN AIR CARGO

SUN COUNTRY

UNITED AIRLINES

Domestic

ALLEGiant AIR

SOUTHWEST AIRLINES

EVERTS AIR

now calls Agile Combat Employment (ACE), a hub-and-spoke model that spreads smaller units out to increase complexity for an adversary, will require a logistics system to match.

“We have a good mix of both long-range and short-range aircraft,” Atkinson said. For locations with shorter runways and fewer support facilities, additional capacity exists in the Federal Aviation Regulation Part 135 community; which includes smaller fixed-wing aircraft and helicopters. They’re typically used

Are There Commercial Tankers in the CRAF's Future?

There is a "viable commercial market" for aerial refueling, with two companies now offering such services to military customers, TRANSCOM's Civil Reserve Air Fleet (CRAF) Program Manager David Atkinson said, but CRAF does not at this time contract with them. That could change, however.

Retired Gen. Mike Minihan was still head of Air Mobility Command in July when he told Congress that AMC is looking at contracting for commercial air refueling, and even the possibility of selling recently retired KC-10s—now parked at the David-Monthan Air Force Base, Ariz., "Boneyard"—to commercial operators, to bolster the Air Force's air refueling capacity.

"There's enormous value in aircraft that have the potential to provide readiness in the commercial sector," Minihan said, adding "the important first work has been done" along these lines. "The analysis on the oversight and the certification is what's next, and we now have enough data to do that," he

said. The potential shortcoming of the idea is that AMC has to ensure "with commercial refueling, that we don't decrement the readiness of those in uniform flying the tankers." Meaning, he doesn't want to cut into the organic force's tanking activity so much that it could hurt tanker crew proficiency. The two commercial tanker companies, Omega Air and Metrea, service a number of military air arms, but they can't refuel aircraft headed into combat.

Metrea acquired four retired KC-135 tankers from Singapore and 14 from France, and performed the first air refueling of an Air Force jet in the summer of 2023. Omega refueled an Air Force airplane in December of last year. The mothballed KC-10s were retired last year not because of their performance—the type achieved a mission capable rate of more than 80 percent in fiscal 2023—but because the Air Force needed to shed logistical tails to save money.

to support "functional command" activities, such as medical evacuation, "casualty evacuation, airdrops, parachute training, and international partnership support missions," but they can also execute "the last mile of the mission" when needed. Part 135 operators "help us meet the requirements in the more austere environments," Atkinson said. "They usually have smaller lift capacity and are designed to meet that tactical need. They also operate under a different set of regulations."

Part 135 operators "help us meet the requirements in the more austere environments," Atkinson said. "They usually have smaller lift capacity and are designed to meet that tactical need. They also operate under a different set of regulations."

Innovations in aviation suggest there could be long-term uses for new electric or autonomous aircraft for the CRAF mission, but Atkinson said TRANSCOM "has no concerted efforts" underway at this time. The Air Force has flirted with reintroducing

seaplanes, particularly to support ACE operations, but Atkinson said "very little seaplane infrastructure exists for large-scale seaplane operations."

By design, CRAF assets do not fly into high-risk areas. They land short of a battle zone and then unload materiel and troops to move by air, rail, or truck to their final tactical destination.

CRAF operations in support of the Ukraine resupply typically include five or six freighters landing in Poland each day, where supplies are off-loaded and moved by truck or rail to Ukraine.

"That number's gone up and down, obviously, but you know, that's about the sustained number that we ask for volunteers, and that's ... how much the commercial carriers have been supporting us day to day," Atkinson said.

During the 2021 evacuation of Kabul, the Air Force held a several-times-weekly "CRAF summit," in which briefings gave carriers a classified-level insight into the dangers they faced in



U.S. Air Force Airmen assigned to the 721st Aerial Port Squadron load luggage onto an American Airlines aircraft during Operation Allies Refuge at Ramstein Air Base, Germany, Aug. 27, 2021. Civil Reserve Air Fleet Aircraft are being used for the onward movement of evacuees from temporary safe havens and interim staging bases.

Tech. Sgt. Donald Barnec

different destinations.

The summits were reinstated after Russia invaded Ukraine in February 2022. “We knew we were going to need freighter capacity,” Atkinson said. “But we wanted to avoid an activation. ... Activation is not necessarily a bad word, but it’s something we try to avoid, and we need to be very judicious with our carriers in order to not needlessly affect their business.”

At the summits, carriers got “an outline of the overall operational requirement” and TRANSCOM asked for volunteers, Atkinson said. Five companies did so, and have sustained that effort since Feb. 20, 2022.

Resupply operations supporting Israel are similar. “We again had another summit in response to Oct. 7 in Israel. ... We had our CRAF carriers come in, we again gave them a classified briefing, gave them an update, and said, be prepared to volunteer. And we were able to avoid activation for that contingency as well,” Atkinson said.

More transparency is still needed. To sustain operations and enhance communications, efforts have included “adoption of mission collaboration communication tools, distribution of essential communication equipment, and robust engagement from tactical-level exercises to executive-level working groups,” Atkinson said. Stakeholders support these efforts, and “this strategy has already paid dividends. ... We anticipate [it] will continue to strengthen the CRAF program.”

LOOKING AHEAD

Besides aging aircraft and geopolitical threats—“which lengthen routes, increase costs, and raise our carbon footprint,” Atkinson said—inflation is also a challenge. “It’s a constant hindrance to bottom-line profits for all carriers,” he said. “From fuel to labor costs—both pilots and maintainers, and salaries—these are a constant battle for them.”

Man-portable anti-aircraft defense systems pose a constant threat, but so far no CRAF carrier has been hit by such a weapon.

Atkinson said carriers have sought in recent years to reduce their crew sizes. The Air Force has not agreed, but TRANSCOM understands that the availability of experienced military pilots for commercial carriers has diminished.

“With the reduction in total military aircraft over the last two decades, and the commensurate reduction in the [Department of Defense] pilot force, the availability of ready-made and trained pilots for the commercial industry has declined,” Atkinson said. Yet because demand for commercial airline pilots continues to balloon, this “has the potential to exacerbate the problem.” At least for now, TRANSCOM is not doing anything to address the aircrew shortage.

“Commercial carriers bear an increasing level of responsibility to train their own personnel in-house,” he said.

In 2023, 72 years after its founding, the CRAF program was inducted into the Airlift Tanker Association Hall of Fame for “significant contributions to the advancement of air mobility.” The award marked the only program so recognized by the association. “CRAF is one of the longest enduring and best examples of industry and the government working together to offset a gap in capability and capacity at a low cost to the government,” the association wrote in a lengthy citation.

Atkinson said CRAF is regarded as successful, “but it’s a trust issue, right? We want to make sure that ... these carriers continue to subscribe to the program.” He said his job, as the program manager, is to ensure “the health of the program remains intact, and a lot of that is through communication and through ... very judicious use of the CRAF program overall.” Volunteerism will be encouraged because that “is how we avoid activation, quite frankly. And we will continue to do so,” unless a requirement emerges that outstrips the number of volunteers. ★



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Fighting the Air Base

How the USAF can ensure it can generate combat sorties while under fire.



Staff Sgt. Kristen Heller

Two B-2 Spirit bombers from Whiteman Air Force Base, Mo., deployed to Andersen Air Force Base, Guam, for Exercise Valiant Shield 24 in June. The Air Force sought to build hardened shelters to protect B-2s in Guam in the 2000s, but canceled the program for lack of funds.

By J. Michael Dahm

Front-line air bases are like any other weapon system: They are only effective if they can function under enemy fire. Air bases at forward locations in the Indo-Pacific, Europe, or other theaters must be able to fend off complex integrated air and missile strikes, rapidly reconstitute operational capabilities when damaged, and continue to generate combat effects.

The Air Force is facing many of the same air base defense challenges it did late in the Cold War. However, it is unprepared and ill-equipped to counter similar threats to its air bases today. Air base defenses have atrophied due to a lack of funding and resourcing over the past 30 years, imperiling their ability to generate the sorties and strike options that joint commanders will need to secure U.S. interests and defeat aggression.

In a future conflict, the United States must fight alongside its allies and partners as an “inside force,” operating forward against adversaries that have substantial advantages in terms of time, space, and



J. Michael Dahm is a Senior Resident Fellow for Aerospace and China Studies at the Mitchell Institute for Aerospace Studies. Download the entire report at <http://MitchellAerospacePower.org>

combat mass. If adversaries can effectively suppress U.S. airpower, joint force operations will be unable to achieve operational or strategic objectives in near-peer conflict with China’s People’s Liberation Army (PLA) or the Russian Armed Forces. China now possesses substantial reconnaissance and long-range strike capabilities that could potentially win an air war by destroying infrastructure and aircraft on the ground without engaging in air-to-air battle.

Air Force Chief of Staff Gen. David W. Allvin underscored the need for air base defense in Senate testimony earlier this year: “We are also committed to building forward basing resilient enough to enable continued sortie generation, even while under attack.” To be an effective deterrent and to shape adversary decision-making, air base defense must do more than protect forces. It must ensure the Air Force retains the ability to project power at the forward edge of the battlespace.

Effective air base defense supports three operational objectives, especially in a large-scale, force-on-force conflict:



USAF

An armored bulldozer operated by the 7007th Explosive Ordnance Disposal Flight clears debris and unexploded ordnance from the runway after a simulated air attack during Exercise SALTY DEMO '85. Air base survivability exercises evaluate passive and active defenses, aircraft operation and generation, and base recovery systems.

- Effective combat sortie generation,
- Force preservation, and
- Imposition of costs on adversary attacks.

An informed assessment of present-day threats reveals how the Air Force might achieve these objectives with cost-effective air base defense.

Many in the West are seemingly convinced of a prevalent and persistent myth: that China seeks to avoid combat—to win without fighting, in the tradition of ancient Chinese military strategist Sun Tzu. This is sometimes called a *fait accompli* strategy, in which an enemy force is forced to concede before hostilities commence because defeat is all but ensured. However, in historical context, Sun Tzu's maxim is better interpreted as routing enemy soldiers before they have an opportunity to form ranks and fight back—that is, it is better to launch a preemptive strike against an unprepared enemy that brings victory without engaging in reciprocal battle. Italian air strategist Gen. Giulio Douhet made the same observation in 1921: “It is easier and more effective to destroy the enemy's aerial power by destroying his nests and eggs on the ground than to hunt his flying birds in the air.”

BACK TO THE FUTURE—1985 TO 2024

Today's Air Force finds itself in a position similar to where it was at the end of the Vietnam conflict—with significant deficiencies in air base defense due to decades of underinvestment. However, by the early-1980s, the Soviet Union developed power projection and precision strike capabilities that threatened to overwhelm air base defenses in Western Europe. Despite initiatives to enhance European air defenses like the Patriot surface-to-air missile system and the Air Force's Collocated Operating Base program, computer simulations still showed that strikes against U.S. Air Force bases in the first week of a Soviet attack would likely cut the service's aircraft sortie generation by 40 percent and destroy up to 40 percent of its deployed aircraft on the ground.

“Salty Demo,” a multiweek airpower exercise in the spring of 1985, simulated a Soviet strike on Spangdahlem Air Base, West Germany. The simulated attacks “destroyed” aircraft, buildings, and equipment, and knocked out utilities and communications. Air Force combat engineers cratered the alternate runway with live explosives just so they could attempt repairs. As reported in this magazine in a 1988 article, the exercise was “a sobering demonstration of the synergistic chaos that ensues when everything goes wrong at the same time.”

That same year, Air Force leadership stated the priority for base defense had progressed from “urgent” to “critical.” New initiatives included hardening infrastructure and employing passive defenses such as camouflage, concealment, and deception. Damage control and rapid runway repair became priorities. In advance of those initiatives, the Air Force and Army signed a memorandum of understanding securing an Army commitment to provide ground-based air defenses for air bases. Air Force leaders began talking about “fighting the air base,” effectively operating their bases like weapon systems.

Then the Cold War ended. Over the next 30 years, regional conflicts including in Southwest Asia and the Balkans dominated military operations and planning. The U.S. Air Force enjoyed air superiority by default, operating from bases that were sanctuaries far from the battlefield. The 1984 agreement delineating Army responsibilities for providing ground-based air defense for Air Force bases expired—unnoticed—in the 1990s. Distracted by counterinsurgency operations, few military planners recognized the renewed threat to forward air bases posed by new generations of long-range precision strike weapons developed by Russia and China. While Pacific Air Forces (PACAF) advocated for building hardened shelters at Andersen Air Force base on Guam to protect B-2s and F-22s at a cost of \$1.8 billion with an estimated completion date of 2008, the Air Force dropped the proposal for lack of funds.

China's Threats: Ballistic Missiles, Cruise Missiles, and Drones

China's People's Liberation Army's weapons are unlikely to be employed at maximum ranges. Reasonable ranges are ~75 percent of demonstrated maximum range. The PLA's short-range ballistic missiles are optimized for strikes on Taiwan and cannot effectively reach U.S. and allied air bases.

MISSILE NAME	TYPE	NUMBER OF LAUNCHERS		WARHEAD	MAX RANGE	3/4 MAX RANGE
		2022	2028			
DF-11 (CSS-7)	SRBM	54-72	27-36	500 KG (1,100 LBS)	600 KM (324 NMI)	450 KM (243 NMI)
DF-15 (CSS-6)	SRBM	54-72	27-36	500 KG (1,100 LBS)	900 KM (486 NMI)	675 KM (365 NMI)
DF-16 (CSS-11)	SRBM	54-72	54-72	1,000 KG (2,200 LBS)	1000 KM (540 NMI)	750 KM (405 NMI)
DF-17 (CSS-22)	MRBM (HGV)	27-36	108-144	UNK	2,000 KM (1,080 NMI)	1,500 KM (810 NMI)
DF-21A (CSS-5)	MRBM	12	0	600 KG (1,300 LBS)	2,150 KM (1,160 NM)	1,600 KM (864 NMI)
DF-21D (CSS-5 MOD 5)	ASBM	48	48	600 KG (1,300 LBS)	2,150 KM (1,160 NMI)	1,600 KM (864 NMI)
DF-26 (CSS-18)	IRBM/ASBM	216	252	1,500 KG (3,300 LBS)	4,000 KM (2,160 NMI)	3,000 KM (1,620 NMI)
DF-10	GLCM	54-72 (DUAL TEL)	54-72 (DUAL TEL)	400 KG (882 LBS)	2,000 KM (1,080 NMI)	1,500 KM (810 NMI)
DF-100	GLCM	24 (TRIPLE TEL)	24-48 (TRIPLE TEL)	500 KG (1,100 LBS)	2,000 KM (1,080 NMI)	1,500 KM (810 NMI)

MISSILE/DRONE NAME	TYPE	LAUNCH PLATFORM	WARHEAD/PAYLOAD	MAX RANGE (ONE-WAY)	3/4 MAX RANGE
ASN-301	GLCM loitering	Canister ground-launched	32 KG (70 LBS)	500 KM (270 NMI)	375 KM (202 NMI)
YJ-63	ALCM	Bomber	500KG (1,100 LBS)	200 KM (108 NMI)	150 KM (81 NMI)
AKF98A	ALCM (Like U.S. JASSM)	Fighter	UNK	UNK	UNK
AKF088C (TL-30)	ALCM loitering	Fighter/bomber	UNK	280 KM (150 NMI)	210 KM (113 NMI)
YJ-18B	LACM	Ship/submarine	150-300 KG (330-660 LBS)	540 KM (292 NMI)	405 KM (219 NMI)
CJ-10 / CJ-20	ALCM	Bomber	400 KG (882 LBS)	2,000 KM (1,080 NMI)	1,500 KM (810 NMI)
Q-5	UCAV (2 nd Gen Fighter)	Air base	500 KG (1,100 LBS)	2,000 KM (1,080 NMI)	1,500 KM (810 NMI)
J-6	UCAV (2 nd Gen Fighter)	Air base	500 KG (1,100 LBS)	1,690 KM (912 NMI)	1,268 KM (685 NMI)
J-7	UCAV (3 rd Gen Fighter)	Air base	1,500 KG (3,300 LBS)	2,200 KM (1,188 NMI)	1,650 KM (891 NMI)
J-8	UCAV (3 rd Gen Fighter)	Air base	4,500 kg (9,900 lbs)	2,200 km (1,188 NMI)	1,650 km (891 NMI)

Key: SRBM – Short-Range Ballistic Missile, MRBM – Medium-Range Ballistic Missile, HGV – Hypersonic Glide Vehicle, IRBM – Intermediate-Range Ballistic Missile, ASBM – Anti-Ship Ballistic Missile, GLCM – Ground-Launched Cruise Missile, ALCM – Air-Launched Cruise Missile, LACM – (Ship-launched) Land-Attack Cruise Missile, TEL-Transporter Erector Launcher, UCAV – Uncrewed Combat Aerial Vehicle.

Greyed out weapons lack range to effectively target bases in the first island chain.

Coming full circle, in 2023, Secretary of the Air Force Frank Kendall's fifth operational imperative, Resilient Forward Basing (OI-5), repackaged the Cold War-era Air Base Operability (ABO) program as Agile Combat Employment (ACE). Both ABO and ACE disperse aircraft and spread operations across established and remote air bases rather than present a concentration of forces for adversaries to attack at main operating bases. ACE, like ABO, also necessitates more active air and missile defenses, requiring the Air Force to again seek agreement with the Army on their shared responsibility for air base defense.

REMAINING AN INSIDE FORCE

The U.S. Air Force must be able to generate combat sorties under hostile fire from both established and dispersed forward air bases alongside allies and partners. As stated in the Pacific Air Forces Strategy 2030, reinforcing allies and partners is a core strategic priority. Fighting forward with a coalition of like-minded nations is a cornerstone of U.S. alliance agreements and regional military strategies. Indeed, current force structure and basing simply do not allow the U.S. to "go-it-alone." The U.S. must fight as an allied and coalition team, whether in Europe, the Middle East, or the Pacific.

More importantly, without air base defense to enable a forward-deployed inside force, the math in a near-peer adversary conflict puts the U.S. Air Force at a serious disadvantage. The current U.S. bomber force lacks the capacity to conduct the volume of strikes necessary across large countries like Russia and China. The decline in the size of the Air Force has resulted in a lack of sufficient strike-fighter aircraft and weapons to generate the sortie rates and mass needed to prevail in a large-scale conflict. This is especially true in East Asia. Relying on a daisy chain of tankers to fly fighters from Guam or Northern Australia to the East or South China Seas might generate a single long-range sortie per day for most aircraft. Strike fighters operating from forward bases along the first island chain could triple that number.

Operating within range of adversary anti-access/area denial (A2/AD) capabilities with effective air base defense capabilities serves key operational and strategic objectives. These include:

- **Effective combat sortie generation.** Defending forward bases and operating from those bases is the only practical way to generate required airstrikes and deliver other combat-relevant effects given the impossibility of conducting all necessary attacks with long-range, standoff capabilities.

- **Force preservation:** Valuable combat aircraft, support aircraft, personnel, maintenance facilities, and fuel may be difficult if impossible to replace, especially during a weeks- or months-long crisis.

- **Adversary cost imposition.** An adversary must expend scarce and expensive weapons in return for minimal operational effects if the Air Force and its partners execute effective air base defense.

Realizing these three air base defense objectives recognizes air base defense as a core capability of a "peace-through-strength" deterrence strategy.

COMPLEX, INTEGRATED THREATS

China's PLA poses the greatest potential military threat to U.S. and allied air bases in any future conflict. The PLA's intelligence, surveillance, and reconnaissance (ISR) capabilities enable a large and growing arsenal of long-range precision weapons. In a large-scale conflict with China, the Air Force

will face sustained, complex integrated attacks on its air bases from aircraft, ballistic missiles, cruise missiles, and drones.

China's ISR in East Asia features layered and overlapping coverage from diverse space-based and airborne sensors generating electro-optic, infrared, and hyperspectral imagery; synthetic aperture radar imagery; and a variety of signals intelligence. Coupled with cyber and human intelligence, China can probably identify the specific location of U.S. aircraft and equipment at an air base and gather information on aircraft launch and recovery. Robust passive defenses, including camouflage, concealment, and deception measures will be critical to defeating the PLA's ISR and long-range kill chains.

PLA attacks on U.S. air bases will attempt to overwhelm active and passive defenses. Projected attacks will include numerous low-cost cruise missiles and drones combined with more expensive ballistic missiles and hypersonic glide vehicles. Ballistic missiles, attacking from high-altitude, may maneuver in the terminal stage of flight. Hypersonic glide vehicles will ingress at high speeds and relatively low altitudes, decreasing warning times. Cruise missiles could attack at either subsonic or supersonic speeds. Additionally, propeller-driven kamikaze drones and modified remote-controlled third-generation fighters crashing into targets will add to the attack. Tracking and engaging multiple, dissimilar air and missile threats that simultaneously arrive from different directions at different altitudes and different speeds will pose a significant challenge to U.S. air defense systems.

PLA kinetic strike capabilities extend as far as 1,500 to 2,000 nautical miles from the Chinese mainland—out to Guam, the rest of the second island chain, and into the southernmost reaches of the South China Sea. Such strikes could seriously impede, if not stop, a U.S. military intervention in the region. By the late-2020s, PLA surface ships and submarines could also threaten U.S. bases in Alaska, Hawaii, California and Washington state, as well as Diego Garcia and northern Australia with land attack cruise missiles (LACM) or conventional ship-launched ballistic missiles.

The threat from the PLA's large and growing arsenal of long-range precision strike weapons against air bases is serious, but not insurmountable. There are practical, physical limits to the number of sophisticated weapons an adversary like the PLA may launch at any given time. Defense analysts' prevailing view is that the PRC would have "hundreds of missiles" available to attack U.S. air bases, but it will also have other targets of equal or greater value—U.S. theater air defenses; command, control, and communications; ISR capabilities; naval bases; ships; and logistics.

Additionally, any growth in the PLA's missile inventories is offset by the replacement of older missiles like the DF-11, DF-15, and DF-21 with newer, more accurate, and longer-range systems like the DF-17 hypersonic glide vehicle (HGV) and the intermediate-range DF-26.

The numbers of PLA ground-based missile launchers and missile reloads available further limits their offensive capabilities. The Office of the Secretary of Defense's annual China Military Power Report suggests that key long-range DF-26 battalions may only have one reload available for its 250 launchers, about 500 missiles. Medium-range ballistic missiles like the DF-17 hypersonic glide vehicle may have two or three reloads, maybe 500 to 600 missiles total by 2028. PLA "shoot-and-scoot" tactics—rapidly relocating launchers after missile strikes—further constrain how many missiles can be launched at any one time. Furthermore, the PLA will

need to use its limited inventory of weapons to target an ever-increasing list of U.S. and allied military capabilities in the region.

These limiting factors combined with the PLA's growing target list serve to limit the number of high-end missiles available for any single strike on a U.S. air base. Dispersing U.S. and allied air forces across multiple operating locations will challenge the PLA to concentrate attacks across the 2,000 to 3,000 nautical miles of the first island chain.

SUSTAINING OPERATIONS UNDER ATTACK

In a recent air base defense study, the Mitchell Institute and analytic partners examined sortie generation rates during a notional Red-Blue conflict in East Asia. In the scenario, enemy Red forces conducted sustained missile strikes against U.S. and allied Blue air bases located along the first island chain. The analysis illustrated how a combination of integrated defenses allowed the Blue air force to continue operations under enemy fire. Dispersed aircraft operations across multiple locations, plus moderately effective active and passive missile defenses and supported by reconstitution capabilities such as runway repair enabled Blue fighter and air refueling tankers to quickly return to combat-relevant sortie rates while under Red attack. This assessment assumed air defenses defeated only 50 percent of Red missile strikes. ACE hub-and-spoke air base dispersal proved to have the greatest impact on countering threats because it forced Red to spread its attacks across five times as many locations.

Future assessments of air base defense and combat sortie generation should consider the increased equipment, logistics, and personnel burden inherent in executing the ACE dispersal concept. ACE under attack will require runway repair crews as well as active defense systems present at all

hub-and-spoke bases. Additional, higher-fidelity modeling and assessments will help the Air Force further refine its air base defense requirements.

OPERATIONAL CONCEPT FOR BASE DEFENSE

The analysis of the mix of likely threats and the proof-of-concept assessment outlined here points to three key principles and priorities in defining an operational concept for air base defense:

- Agile Combat Employment significantly improves sortie generation and regeneration during a conflict.

- A diverse, layered arsenal of active defenses including survivable, distributed active and passive sensors, as well as kinetic and non-kinetic effectors provides cost-effective protection against incoming attacks.

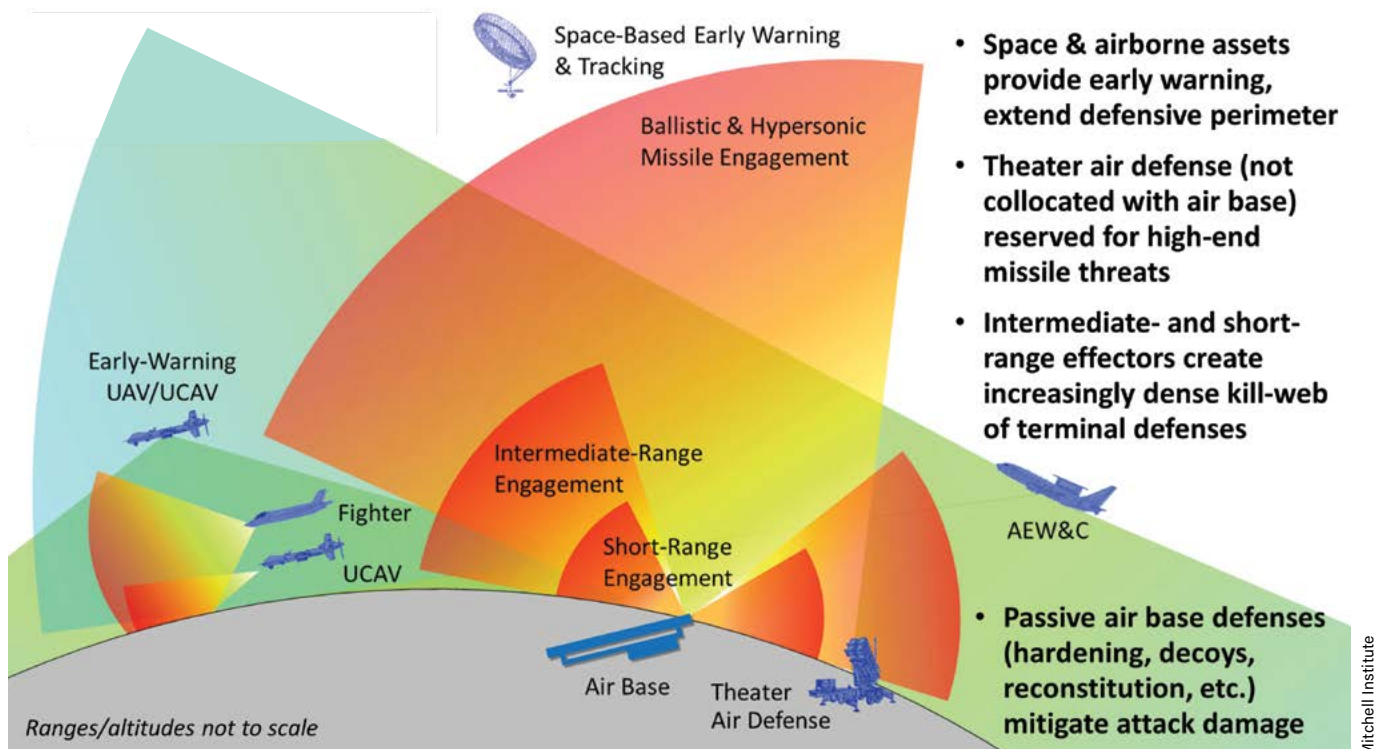
- Passive defenses, including hardening, camouflage, concealment, and deception are among the most cost-effective, sustainable defenses; substantial reconstitution capabilities such as rapid runway repair are essential for regenerating combat power following attack.

Aircraft dispersal across multiple air bases and alternate operating locations complicates adversary targeting with simple math while enabling the Air Force to hold targets at risk from multiple forward locations. In an East Asia conflict scenario, the U.S. Air Force may operate from air bases spread across a 2,000-to-3,000-nautical-mile front. Doing so would force an adversary like China to spread its ISR and strike capabilities across that front, imposing additional costs and potentially reducing the scale of an attack on any one base.

Practical, effective, and enduring air base defense requires an enterprise approach. There are no magic weapons that will solve all the air base defense challenges facing the Air Force. Long-range detection capabilities and a dense,

Air Base Defense Operational Concept

Air base defense priorities should include early warning, Agile Combat Employment, and active and passive defenses in the wake of an attack.



close-in kill-web should complement scarce and expensive long-range air defenses such as Terminal High-Altitude Area Defense (THAAD) and Patriot surface-to-air missiles. A single Patriot costs \$3.8 million; a THAAD costs \$8.4 million. Such systems must be reserved for the most high-end, difficult-to-defeat adversary threats.

The Air Force and its supporting Army air defense forces require more cost-effective and combat-relevant air defense capabilities, including electronic warfare and directed-energy weapons. Airborne assets including uncrewed aircraft provide early warning of inbound threats to the air base that can also engage some low-flying threats. Ground-based air defenses should include a volume of intermediate- and short-range effectors including short-range missiles like ground-based AMRAAM and AIM-9X and cannon-based maneuvering projectiles.

Air base commanders may have to consciously allow lower-end threats to close in on an air base before engaging them with cost-effective shorter-range, systems. A long-range intercept strategy may quickly exhaust long-range interceptors against relatively low-cost enemy weapons. Allowing threats to approach air bases entails risk, but engaging them with lower-cost, short-range air defenses reduces operational risk over time, which would prove invaluable in the face of sustained attacks by a mix of high- and low-end threats.

To address those threats that will ultimately penetrate even the best active defenses, air base hardening, camouflage, concealment, and deception are important passive air defense components. A \$1 million hardened aircraft shelter could last for decades and a \$100,000 decoy is a bargain-priced insurance policy for a \$100 million aircraft. Redundant fuel and power generation, as well as ample rapid runway repair capabilities, are also crucial.

RECOMMENDATIONS

The war in Ukraine and the growing potential for a conflict in East Asia highlight the need to address critical shortfalls in both active and passive defenses for U.S. air bases. Congress, DOD, and the Air Force should consider the following:

■ **Develop, codify, and implement the Agile Combat Employment concept.** ACE is a core element of effective air base defense. Altering the Air Force's posture in forward areas by dispersing its operational forces is a key passive air defense element. The Air Force should define standards for Resilient Forward Basing to guide future active and passive air defense investments and budget requests. The Air Force must also identify the measures of performance and effectiveness necessary to assess air base resilience.

■ **Fund a dedicated air base defense program.** In the face of significantly increasing adversary threats, these requirements cannot simply be carved out of existing budgets. Additional funding is needed to address urgent operational requirements for the defense of U.S. air bases. Congress must fund these capabilities at levels commensurate with the value that air power offers to theater operational plans, alliances and partnerships, and deterrence.

■ **Establish interservice agreements on air base defense.** Unless the Air Force is manned, trained, and equipped to provide its own ground-based air defense, the Air Force must rely on its service partners for these capabilities. The Army—and the Navy in littoral regions—should provide theater-wide, high-altitude air and missile

defense. The Army also should provide intermediate- and short-range ground-based air defenses near air bases. Should such an arrangement prove impractical, Congress should reallocate resources to the Air Force to defend its own air bases.

■ **Fund, build, and deploy substantial passive air base defenses.** A budget-minded Congress should consider that passive defenses such as hardening, camouflage, concealment, and deception are the most cost-effective measures against air and missile attack. Passive defenses will drive up adversary attack costs, creating a tangible deterrent.

■ **Invest in rapid runway repair and air base reconstitution capabilities.** Sustained adversary attacks on runways threaten to close air bases for extended periods and effectively suppress combat sortie generation. Categorized as a passive defense measure, rapid runway repair is also an indispensable and cost-effective capability necessary to return air bases to operational status.

■ **Invest in space and airborne early warning and long-range airborne kinetic and non-kinetic capabilities for air base defense.** An effective air base defense operational concept requires early warning against low-flying inbound threats such as hypersonic glide vehicles, cruise missiles, and drones. Early warning provides advantages for defenses such as surface-to-air missiles, electronic attack, and directed-energy weapons, and it may enable rapid response measures such as quickly sheltering aircraft or closing blast doors. Combining early warning with an airborne air-to-air engagement capability also creates an outer ring of long-range defense against inbound threats to air bases.

■ **Significantly increase investments in cost-effective air base air defense sensor and C2 capabilities.** Coordinating effective responses to attacks is a decisive component of an effective air base defense. Air defenses must have a redundant and survivable sensor and C2 capability to allocate the right defensive capabilities and weapons at appropriate ranges to defend against sustained enemy attacks.

■ **Significantly increase investments in a diverse arsenal of integrated active defense capabilities, especially cost-effective, short-range defenses.** The Air Force and the Army must invest in intermediate-range and short-range capabilities to supplement systems like THAAD and Patriot surface-to-air missile systems. Shorter-range systems deployed in larger numbers should include surface-to-air missiles, air defense cannons with maneuverable projectiles, directed-energy weapons, and electronic warfare capabilities.

■ **Pursue additional studies, modeling, experimentation, and air base defense exercises.** The Air Force should continue to study and develop the most capable, cost-effective mix of passive and active air defense.

Fighting from front-line air bases may mean the difference between winning and losing in a future conflict. The U.S. Air Force must be capable of operating from well-defended forward bases. If not, allies and partners may question the ability of the United States to deter and dissuade would-be adversaries. The U.S. and allied way of war demands a capable Air Force that can operate inside adversary threat envelopes and rebound from potential attacks. This is a no-fail mission. Making necessary investments in capable, cost-effective, and combat-relevant air base defenses is vital to U.S. national security. ★



Defending NATO's Flank

Operations in Europe aren't a summer holiday.
The war in Ukraine has turned up the heat.

An image from video shows a cockpit view of an F-16 from the 480th Fighter Squadron, Spangdahlem Air Base, Germany, operating as an opposition force for a counter-air exercise.

By Chris Gordon

OVER WESTERN GERMANY

Our F-16 burst through the clouds above Spangdahlem Air Base on a crisp early morning in June, one of several Fighting Falcons from the 480th Fighter Squadron operating as an opposition force for a counter-air exercise.

The 480th is on the front lines of NATO's eastern flank, with the combat assignment to knock out Russia's formidable air defenses should a conflict erupt in Europe. Just a couple of weeks earlier, the squadron practiced dispersing to an alternate airfield in case of attack as part of a NATO integrated air and missile defense exercise.

Since Russia's 2022 invasion of Ukraine, the 480th's Fighting Falcons have policed NATO airspace, doing their part to ensure the war doesn't spill over into NATO territory.

"This is not a European vacation tour," said Col. Kevin Crofton, commander of the 52nd Fighter Wing,

"We have to be ready for anything that happens. ... We have to work with our allies. In order for us to be effective we have to be integrated."

—Gen. James Hecker, commander of USAFE-AFAFICA and NATO Allied Air Command boss

which includes the 480th. "Now there's more of a mission involved. Now, there are yellow bands on the missiles on the jets when we're having live weapons out there at times, as we're doing these enhanced air policing events. That's a change."

In preflight briefings, 480th aircrew shout "Magnum"—shorthand for the anti-radiation missiles used to target surface-to-air missile sites.

The 52nd Fighter Wing offers a window into how the U.S. Air Force is answering the challenge in Europe with a fraction of the assets available during the Cold War. Spangdahlem used to house multiple F-16 squadrons; today it has just one squadron of Wild Weasels housed in 1980s-era weather-beaten concrete shelters, slightly overgrown with vegetation.

The Pentagon announced plans to eliminate Spangdahlem's mission in a bid to remove more forces from Germany, prompted by then-President Donald J. Trump's dissatisfaction with Germany's defense spending. The plan was to move the 52nd Fighter Wing to Aviano Air Base, Italy, a decision that would have affected over 5,000 Airmen along with the entire

Chris Gordon/staff

surrounding community. But the decision was reversed the following year when the Biden administration completed its 2021 Global Posture Review.

With the Air Force reorienting for great power competition—specifically the risk of war in the Pacific, Spangdahlem is not the center of activity it once was.

Gen. James B. Hecker, commander of U.S. Air Forces in Europe and Air Forces Africa and the head of NATO Allied Air Command said, “But one thing I have here is a very close-knit alliance that is getting closer and has gotten closer since Feb. 24, 2022.”

That was the day Russia invaded Ukraine and NATO came to terms with the fact it now faces a resurgent Russian threat. The Biden administration calls Russia an “acute threat,” suggesting a possibly near-term concern. Russia’s increasingly close alliances with China and Iran, however, point to an evolving alliance as opposed to separate and distinct threats.

“For 30 years or so, we just didn’t really have to worry about a threat in Europe—being blunt about it,” said Royal Air Force Air Marshal Johnny Stringer, deputy commander of NATO Allied Air Command, in an interview from the command’s headquarters at Ramstein Air Base, Germany. “We sort of came out of the Cold War believing we’ve kind of won it, and conditions were set until further notice.”

Russia’s invasion reset the stage. Although Russia has not proven highly effective in its own use of airpower, its copious use of drones against Ukraine has disrupted the way both sides fight. Some analysts speculate that one-way attack drones and inexpensive quadcopters could dominate future air wars. But, Russia stepped up its use of long-range precision fires, buying ballistic missiles from North Korea and launching glide bombs and missiles into Ukraine from standoff aircraft flying in Russian airspace.

Russia’s resilience in the face of economic sanctions and the ample assistance Russia has gotten from China, including Chinese machine tools and microelectronics, has surprised some in the west.

“Russia remains a capable threat beyond Ukraine,” U.S. Army Gen. Christopher G. Cavoli, commander of U.S. forces in Europe, told Congress in April. Despite major losses in

Ukraine and the Black Sea, Moscow has rebuilt its forces and kept its airpower largely intact.

“During this conflict, Russia’s strategic forces, long-range aviation, cyber capabilities, space capabilities, and capabilities in the electromagnetic spectrum have lost no capacity at all,” Cavoli said. “[Its] air force has lost some aircraft, but only about 10 percent of their fleet.”

For the U.S. Air Force in Europe and America’s NATO allies, the Russia-Ukraine conflict has reinforced the West’s need to reprioritize great power competition after 30 years of counterinsurgency operations in the East and operations in the Balkans.

“The Russians invested in electronic warfare and other capabilities to support their activities and seek to nullify our advantage,” said Stringer.

Now NATO’s challenge is finding ways to bust through Russia’s air defenses, gain air superiority at the time and place needed, and counter with anti-air and anti-missile systems of its own. With the alliance expanding to now include 32 members and extending from the Arctic to the Mediterranean, the stakes have grown. Among NATO’s members are three nations that share borders with Russia’s frontier.

“NATO’s membership has gone up from 17 to 32” over the past three decades, Stringer said. “Our landmass is a lot of nations from the Kola Peninsula all the way down to the Turkish-Iranian border. The landmass, let alone the maritime mass—quite a large chunk of the Atlantic we have to worry about for example—has also gone up considerably.”

The addition of Finland and Sweden are the most recent elements of NATO expansion. So now the alliance has more border and airspace to defend, along with “two more nations who now fit into NATO’s integrated air and missile defense system,” he said.

UNITED AND INTEROPERABLE

Interoperability is the key to making such a large and varied alliance work.

“The best way that I can get the bang for the buck is through integration,” Hecker said.

“We have to be ready for anything that happens,” he said.



U.S. Air Force F-16s mix with multinational aircraft as they prepare for simulated dogfights over the skies of Germany.

Chris Gordon/staff

“And in order to do that at scale, we have to work with our allies. In order for us to be effective, we have to be integrated.”

That’s happening rapidly. Allied air forces are modernizing, ditching legacy jets in favor of fifth-generation F-35 Lightning II fighters. Despite production and technical issues, the Lockheed Martin jets are a hot commodity, the only exportable fifth-generation jet in production. After Russia invaded Ukraine, Germany wanted in as well, with one German official describing the purchase enabling Germany to join the family of F-35 partner nations.

A common airframe with a common operating picture will test just how well partners can integrate in practice. The U.S. and European air forces want more than interoperability. They want to be able to service each other’s aircraft. Most NATO countries are now signed up for the alliance’s aircraft cross-servicing agreement, a previously dormant program that was reactivated in 2018.

In April, U.S. F-35s from RAF Lakenheath, U.K., practiced that level of trust, landing in Norway, where Norwegian maintainers serviced their jets. Then in June, at a one-on-one fighter competition at Ramstein, American maintainers serviced Norwegian F-35s.

NATO partners want to share F-35 mission data files, which collect data from the aircraft’s sensors that identifies potential threats, such as air defenses, enemy aircraft, geography, and more. Overcoming security barriers remains a challenge—even in NATO.

“It’s bureaucratic for a reason because the mission data files are extraordinarily important to the F-35,” said Maj. Gen. Paul D. Moga, commander of the 3rd Air Force, the umbrella command over USAFE-AFA’s wings. “A lot of it is intelligence and information-sharing barriers that we need to get past.”

What the F-35 brings to the fight is more than meets the eye, he said. “They talk about survivability because of stealth, primarily lethality, because of systems and avionics and integration thereof, and advanced weapons,” Moga said. Yet “the F-35 is very much also about interoperability. And that’s just not interoperability when you’re flying in formation on a mission together.”



Chris Gordon/staff

A U.S. Air Force maintainer works inside the air intake of a Norwegian air force F-35 at Ramstein Air Base, Germany. NATO countries are now integrating to be ready for future conflicts.

Ultimately, more than 600 F-35s will be operating in Europe in the 2030s—and only about 10 percent will be American.

ACE OPERATIONS

As the U.S. and its allies are doing in the Pacific, Hecker said NATO allies are implementing the Air Force’s Agile Combat Employment (ACE), in which Airmen would disperse in time of conflict to multiple smaller air bases, complicating targeting for adversaries. At this exercise in May, Airmen from the 52nd Fighter Wing dispersed as if Spangdahlem was under attack, relocating to a makeshift tent city at NATO’s Geilenkirchen Air Base in Germany.

“It’s almost back to the future,” Hecker said. “If you go back 35 years ago, a lot of the ACE concepts were alive and well, here in Europe with a smaller alliance at the time. But it’s still a big alliance, where you could take off with any aircraft and land in pretty much any of the NATO countries, be able to get gas, fill up your tires, and in some cases, get

Eighteen-wheeler refueling trucks trundle down the flight line at Ramstein Air Base, Germany, pumping 160,000 gallons of jet fuel in one day during a NATO fighter exercise.



Chris Gordon/staff



Chris Gordon/staff

A U.S. Air Force maintainer prepares a Norwegian air force F-35 for launch during an exercise at Ramstein Air Base, Germany. "If you're fighting with someone, it helps to know them," said Norwegian Air Force Col. Martin Tesli, seen here in the cockpit of his F-35.

munitions and those kinds of things. And that's what we're building to try to get back to that construct."

Improved air base defense and air and missile defense is a top USAFE priority, Hecker said. He has a team of experts devoted to those issues at his headquarters, but he noted that no active defense is bulletproof.

"We will never have enough base defense assets that I can protect every single base 24/7 here," Hecker said. "It only works to move the assets inside of their targeting cycle. We've got to make sure that we move them quite often. And then, you know, with everything coming in, something's going to get through eventually."

So you have to make sure you have an adequate rapid runway repair model so that you can repair airfields when you do have a leaker that gets through. And then you have to do some passive things, as well; decoys and those kinds of things used to keep them off balance, so they don't know exactly where everything is all the time. There's a lot that goes into it."

Spreading the footprint out more permanently requires more legwork. On Poland's eastern flank, the 52nd Operations Group's Detachment 1 is headquartered at Lask Air Base, a small team that it coordinates and supports fighters, tankers, and airlift operations, in and out of the country.

The air operations across Europe and Africa are monitored at the 603rd Air Operations Center at Ramstein, where the commander can watch the action from behind a mirrored glass wall, on a raised area that looks like the bridge of a futuristic spacecraft. USAFE conducts so many exercises that its two massive screens are often divided between one depicting real-world events while the other is used to control the exercise. To protect classified information, Airmen displayed open-source flight tracking websites on the large screens during this reporter's visit—providing rare insight into its nerve center and how densely populated the airspace over Europe is.

Developing the capacity to work from common bases is also part of NATO's long-term vision. "We do not do that often enough," said Luftwaffe Col. Michael Trautermann,

the senior German national representative to NATO Allied Air Command. "These are things that need to be regained for NATO as an alliance to be able to be successful."

During a one-on-one fighter competition at Ramstein Air Base in early June, 37 NATO fighters from nine countries flew onto the base, where Ramstein personnel helped marshal aircraft, pumped them full of 160,000 gallons of jet fuel, and kept everyone safe in the skies through its air traffic control. The competition practiced the Air Force's push toward building Airmen who can conduct a variety of tasks to complete a mission.

"Rapid launch and recovery, ground ops ... they did all those skill sets that we're trying to exercise," said Maj. Gen. Christopher F. Yancy, mobilization assistant to the commander of U.S. Air Forces Europe-Air Forces Africa. "They're used to working on heavies. They hadn't worked on fighters."

But heavy bombers are still a key asset for NATO, with the U.S. Air Force the only partner country to field such aircraft. Air Force Global Strike Command's bomber task force missions continue to expose European allies to the benefits of having America's B-52, B-2, and B-1 bombers on their side.

"Virtually everyone is hungry for interaction with bombers," said Maj. Gen. Jason R. Armagost, who runs America's bomber force as commander of the 8th Air Force. "Say you're a country in Central Europe, and you don't have tankers, you don't have bombers. Nobody has bombers but us. That's an important thing to remember. But when you integrate in a way that brings a joint and complex force presentation, you've taken your sovereign airpower, which is defense of your homeland or defense of NATO, and you've now aggregated to the ability to project power, essentially through integration."

For the Airmen of U.S. Air Force in Europe and NATO Allied Air Command, whether pilots or commanders or even political leaders, the new reality is that only by working together will they be able to provide for the common defense.

"If you're fighting with someone, it helps to know them," said Norwegian Air Force Col. Martin Tesli, wing commander of Ørland Air Base, Norway, the country's main F-35 base. ★

SmallSats: Answering the Call for Space Superiority

Small satellites lend themselves to many more applications than simply low-Earth orbit resilience.



Mike Tsukamoto/staff; NASA; PIR04D/Pixabay

An illustration depicts a fictional constellation of SmallSats in orbit above the Earth. Building a new hybrid architecture with SmallSats—typically under 1,000 kg and the size of a mini-fridge or smaller—are anchored in the tenets of Competitive Endurance, the operating theory advanced by Chief of Space Operations Gen. B. Chance Saltzman.

By Col. Charles S. Galbreath, USSF (Ret.), with Aidan Poling

Russian and Chinese offensive spacepower ambitions are making headlines and are intent on erasing the vital advantage the United States has in space. U.S. defense leadership now publicly recognizes the need to gain and maintain space superiority—an essential change given the current threat environment and the incredible pace at which our adversaries are advancing their space capabilities.

To achieve the needed level of space superiority, the Department of Defense and Congress must provide the United States Space Force with the resources and authorities necessary to realize the full potential of small satellites, or “SmallSats.” This means looking beyond proliferating large numbers of SmallSats to increase space architecture resilience to “deny a first-mover advantage.” While this objective remains valid, achieving space superiority requires harnessing the potential of SmallSats in multiple ways.



Col. Charles Galbreath, USSF (Ret.), is a Senior Fellow for Space Studies at the Mitchell Institute Spacepower Advantage Center of Excellence. Download the entire report at <http://MitchellAerospacePower.org>

Building a new hybrid architecture with SmallSats—typically under 1,000 kilograms (kg) and the size of a mini-fridge or smaller—are anchored in the tenets of Competitive Endurance, the operating theory advanced by Chief of Space Operations Gen. B. Chance Saltzman. SmallSats seek to increase operational flexibility, deliver enhanced capabilities, and increase mission capacity to ensure a continued space advantage for the United States and our allies.

SmallSats can improve domain awareness to “avoid operational surprise” because they can rapidly launch and broadly proliferate a variety of sensors to monitor emerging situations. These systems are also ideal for “responsible counter-space campaigning,” given that SmallSats can host a range of kinetic and non-kinetic capabilities to defend friendly space assets and deny an adversary the ability to use space to defeat our air, land, and maritime forces.

SmallSats can create these desired effects in ways legacy systems cannot, which is why the increased adoption of SmallSats will need to be a key element in our future architecture—one that empowers the

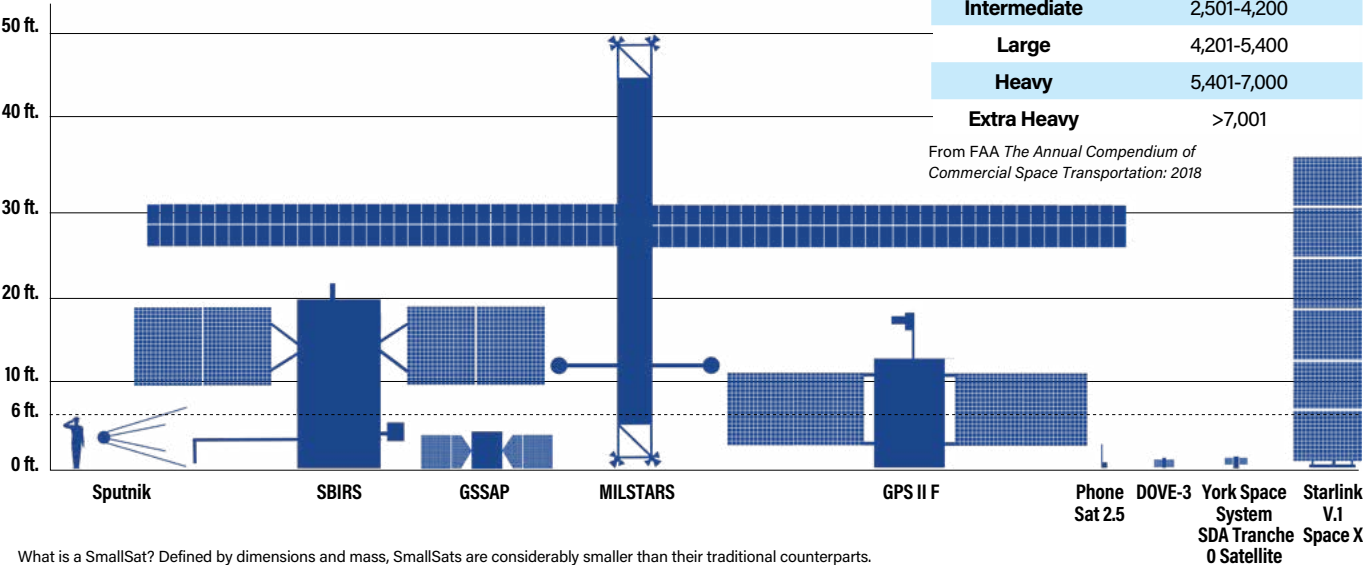
Relative Size of SmallSats to Traditional Satellites

SmallSats typically weigh between 100-200 kg. They range in size from a credit card to a mini-refrigerator. Common types include CubeSats based on 10x10x10 cm units and ESPA-class satellites weighing up to 180 kg.

The standardized shape of SmallSats allows them to be boutique legacy satellites. Increasing standardization among satellite types also allow for faster development and integration of SmallSats.

	Mass Class	Kilograms (kg)
SmallSats	Femto	0.01-0.09
	Pico	0.1-1
	Nano	1.1-10
	Micro	11-200
	Mini	201-600
	Small	601-1,200
	Medium	1,200-2,500
	Intermediate	2,501-4,200
	Large	4,201-5,400
	Heavy	5,401-7,000
	Extra Heavy	>7,001

From FAA The Annual Compendium of Commercial Space Transportation: 2018



What is a SmallSat? Defined by dimensions and mass, SmallSats are considerably smaller than their traditional counterparts.

Mike Tsukamoto and Dash Parham/Air & Space Forces Magazine

Space Force to evolve at the pace, scale, and scope necessary to maintain space superiority and achieve the objectives of Competitive Endurance. With the understanding that our adversaries are pressing hard to contest space, this is a “must do,” not a “nice-to-do.”

“The need to gain and maintain space superiority over peer adversaries is the distinguishing characteristic of a transformed Space Force and it is a top priority,” according to the Department of the Air Force Posture Statement.

The recent revelation that Russia is pursuing a new anti-satellite (ASAT) system is just the latest in an increasing list of weapons targeting U.S. space systems. The proliferation of these threats in the past two decades highlights the efforts adversaries like Russia and China are taking to counter U.S. advantages in space. The risks are not just to our space systems. It also extends to our fielded forces in the air, at sea, and on the ground that are not targeted by the growing use of space capabilities by our adversaries. In the past two years, China has placed over 200 surveillance and reconnaissance satellites in orbit. As Maj. Gen. Gregory Gagnon, the lead Space Force intelligence officer stated, the PLA’s “breakout pace in space is profound.”

Competitive Endurance is a strategy to control escalation and, if needed, prevail if conflict arises. While space superiority and Competitive Endurance are not synonymous, the actions and capabilities needed to achieve each are similar—the distinction lies with whether the situation is considered competition or conflict. In either case, SmallSats must play an important role in the U.S. theory of victory. Deterring conflict, especially one extending to space, is central to the posture of the United States. Making clear to adversaries that the USSF can and will achieve space superiority is central to keeping competition from escalating.

A HISTORICAL PERSPECTIVE

During the Cold War, the nuclear mission's no-fail requirement drove the need for satellites with high mission assurance and system redundancy. That relegated SmallSats to experimental missions, while operational satellites grew in size, complexity, and capability. What followed was a self-compounding cycle of increasing cost and lengthening development time. It could take years to integrate new capabilities into the final satellite—so long that by the time a satellite launched, some of its payloads were no longer at technology’s cutting edge.

The MILSTAR 2 NC3 communications satellite is a prime example. The first MILSTAR 2 contract was awarded in 1982, but the first satellite was not delivered until 1993. Weighing 10,000 pounds, it cost \$800 million and required a \$433 million Titan IV rocket to launch it into space.

However, the success of space-based capabilities during Operation Desert Storm demonstrated the undeniable asymmetric advantage that space assets could provide in conventional warfare. The First Gulf War would come to be known as “The First Space War.”

In the decades since, these highly engineered, very capable, and extremely reliable satellites proved indispensable across multiple operations. Enabled by a highly permissive space environment, they fostered a revolution in military thinking, contributing to precision strike, which allowed U.S. and allied combat aircraft to attack multiple targets per sortie rather than needing multiple sorties to attack a single target.

China saw the undeniable asymmetric advantage space systems afforded and launched its own concerted effort to field systems that could attack the “soft underbelly” of the United States military. In 2001, the congressionally mandated Space Commission warned of the growing risk of a “Space

Pearl Harbor." Its recommendations included improving satellite survivability, organizational consolidation, and budgetary alignment—but the commission was largely ignored.

Over the next 20 years, China and Russia fielded multiple non-kinetic anti-satellite (ASAT) weapons; kinetic ASATs including ground-based direct-ascent weapons to destroy satellites, as demonstrated by China in 2007 and by Russia in 2021; and electronic warfare, cyber, and on-orbit threats.

Space was clearly transitioning from a “sanctuary” to a contested warfighting domain. The recognition of this reality led to the standup of the Space Force in 2019. Over the past five years, the U.S. defense community has begun to leverage new opportunities provided by lower launch costs and smaller, more powerful satellites to prepare for conflict in space.

TECHNOLOGY CREATES NEW OPPORTUNITY

The combination of decreasing launch and satellite development costs coupled with advancements in technology have enabled the operational use of SmallSats. In 2015, SpaceX achieved a game-changing milestone with its first successful vertical landing and recovery of a rocket's first-stage booster. Today, reusable Falcon 9 rockets can deliver payloads into LEO for about \$1,200 a pound, compared to \$30,000 per pound in 2011 when the space shuttle was still operating. Decreased cost and increased launch cadence mean that large constellations of small, affordable satellites are now economically feasible.

The increasing power and decreasing size of both satellite components and computer processors made smaller and smaller satellites more technically feasible as well. In 1968, the Corona KH-4B spy satellite was fitted with a camera measuring 172.7-by-157.5-by-165.1 centimeters (cm). Weighing 514.8 kg, it had a ground imaging resolution of 6 feet and delivered its images back to Earth by physically dropping film canisters that would be captured before they fell to Earth. Processors aboard contained perhaps 5,000 transistors, compared to more than 60 billion transistors on a modern processor chip today.

Now consider Planet Labs' first “Dove” satellite, a 3U CubeSat measuring 10-by-10-by-30 cm and weighing 5.6 kg. It's resolution is comparable to that produced by Corona. There are currently over 150 satellites similar to the original Dove on orbit today.

The opportunities presented by SmallSats are crucially important to realizing Gen. Saltzman's Competitive Endurance approach. This theory of success aims to bolster U.S. forces' ability to deter offensive actions in space and, if necessary, enable U.S. space superiority during a conflict. The theory of Competitive Endurance encompasses three overarching core tenets: deny first-mover advantage, avoid operational surprise, and conduct responsible counterspace campaigning.

The Competitive Endurance tenet to “deny first-mover advantage” centers around the need to change the legacy U.S. space architecture

to one that is more resilient and, therefore, a less attractive target. The Space Force is currently making great strides to improve the resilience of its space architecture.

The most discussed approach is the use of a large constellation of lower-cost SmallSats in low-Earth orbit (LEO)—what the Space Development Agency has coined the Proliferated Warfighting Space Architecture (PWSA).

By increasing the number of satellites, the impact of losing one or two to attack is greatly diminished. The transition from large to small satellites shifts the risk-reward calculus in favor of defense by eliminating single points of failure and making it more costly for adversaries to degrade U.S. space capabilities. Instead of being able to shoot down a single “fat juicy target,” adversaries would instead need to disable dozens to substantially degrade U.S. space capabilities.

Dr. Derek Tournear, Director of the Space Development Agency, noted that using cheaper small satellites means “it will cost more to shoot down a single satellite than it will cost to build that single satellite. We just completely changed that value equation.”

Current military use cases for SmallSats have focused on proliferating sensors and communications links in LEO, denying first-mover advantage to an adversary by vastly expanding the number of targets that must be destroyed to knock out space connectivity. However, being able to absorb the first punch is not enough to achieve space superiority. To harness the full potential of SmallSats and answer the demands of today's threat environment, SmallSats must be applied to all three tenets of Competitive Endurance.

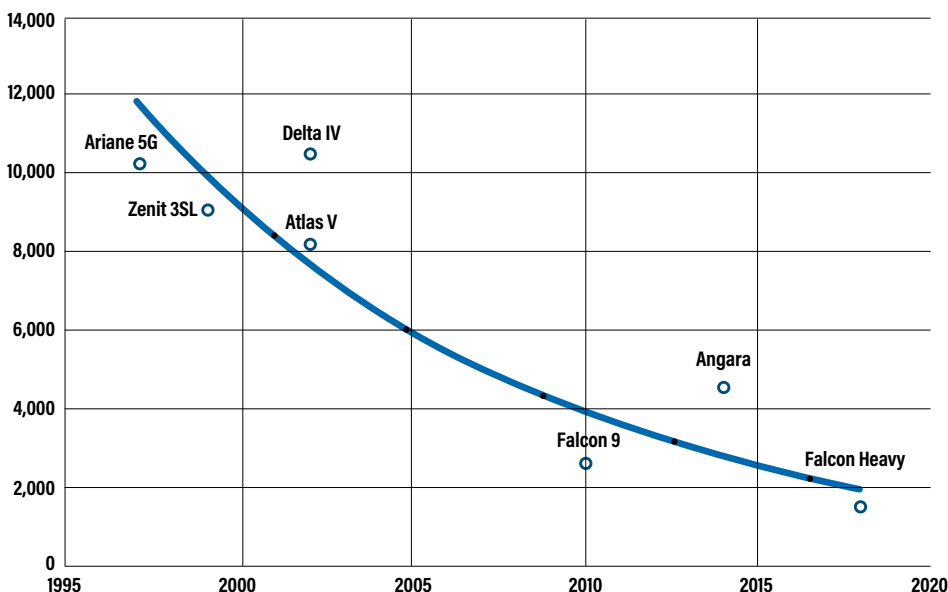
DENY FIRST-MOVER ADVANTAGE

SmallSats lend themselves to an array of tactics, including camouflage, concealment, and deception; maneuver; and multi-orbit diversification, to degrade and delay adversaries' decision-making ability and prevent them from accurately targeting elements of the U.S. space architecture.

The size of small satellites relative to large legacy designs inherently makes it harder to find, fix, track, and target them

Launch Cost (FY 21 \$ Per KG)

Decreasing launch costs over the past 20 years have enabled increased launch opportunity for SmallSats.



for destruction. Smaller satellites simply have smaller optical and radar signatures, and CCD tactics can further reduce signatures or mask them by emitting deceptive signals to make it even harder for adversaries to close their kill chains.

Such techniques to decrease signature have already been demonstrated. SpaceX, under pressure from astronomers to reduce Starlink's impact on ground-based astronomy, has demonstrated the feasibility of reducing the visible signature of its small satellites, using a SpaceX-designed "Low Reflectivity Black" paint and darker solar panel materials to decrease reflectivity. SpaceX also employs techniques to adjust orientation and positioning as the satellites orbit the Earth to minimize their brightness. Building on such approaches could prove as game-changing in space as stealth of the F-117 and B-2 were to airpower at the end of the Cold War.

The sheer number of SmallSats also creates opportunities to confuse potential adversaries. Ridesharing launch missions and ESPA (Evolved Expendable Launch Vehicle Secondary Payload Adapter) rings able to operate and deploy small satellites means that operators can play an increasingly sophisticated "shell game" by hiding high-priority payloads within larger satellite constellations.

The rapidly improving technical capability of SmallSats also enables greater use of orbits previously dominated by larger satellites. By diversifying orbits across low, medium and geosynchronous orbit, the Space Force can improve survivability while continuing to provide a range of services to warfighters.

The Space Force is exploring ways to leverage multi-orbit architectures, with plans to expand assets in medium-Earth orbit (MEO) and geosynchronous-Earth orbit to augment existing constellations and enhance capabilities for target tracking and other missions. "I'm an advocate of proliferation everywhere," said Frank Calvelli, Assistant Secretary of the Air Force for Space Acquisition and Integration in spring

2024. "I think we should be proliferating more at MEO and GEO as well."

Doing so enhances deterrence by complicating an adversary's targeting calculus and ensures the delivery of critical space services, even if adversaries compromise individual satellites or orbits.

AVOID OPERATIONAL SURPRISE

SmallSats can also bolster space domain awareness to deter potential attacks, offering improved revisit rates and data collection capabilities, which are crucial for monitoring high-value assets and potential threats.

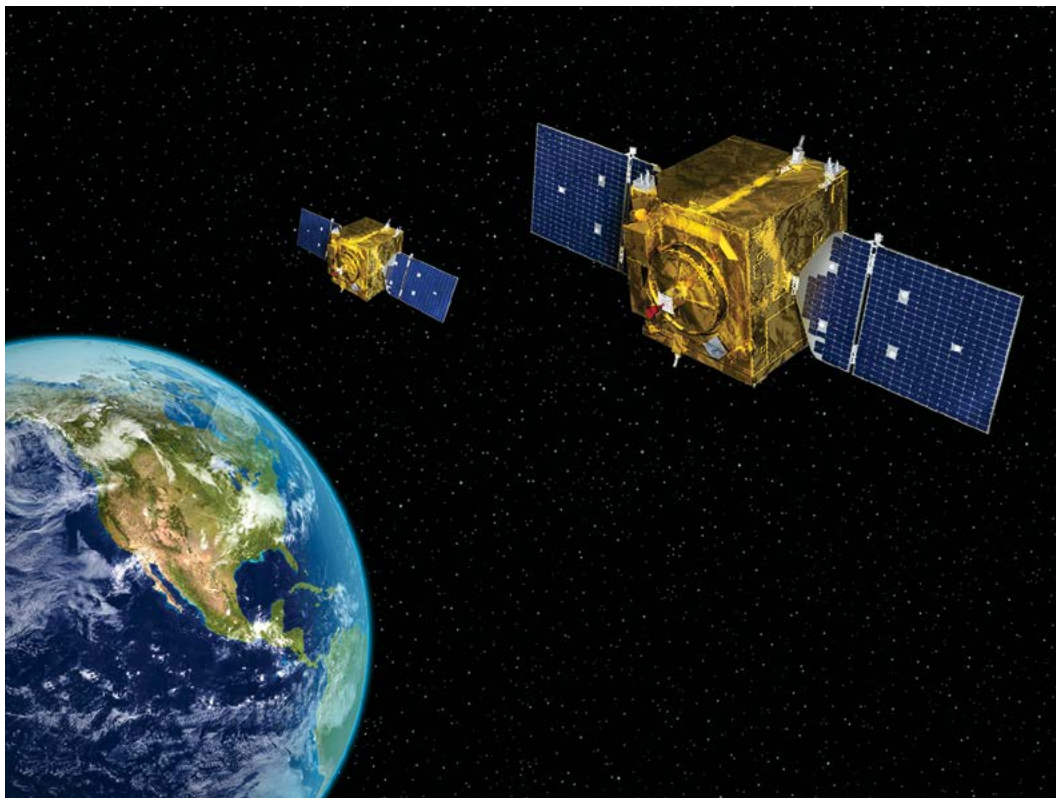
The five Geosynchronous Space Situational Awareness Program (GSSAP) SmallSats currently on orbit provide crucial capabilities to the Space Force, but their small number and inherent fuel constraints limit their overall utility. A larger fleet of SmallSats, however, would allow for "maneuvering without regret," expanding coverage from LEO to cislunar space.

Rapid responsiveness to emerging space threats will be a crucial capability as space's warfighting nature becomes more apparent. In February 2024, news revealed that Russia may be developing an on-orbit nuclear ASAT. The incident underlines the importance of the Space Force's ability to rapidly deploy new space domain awareness capabilities to monitor emerging threats. According to Gen. Michael Guetlein, Vice Chief of Space Operations, the Space Force's upcoming Victus Haze demonstration will showcase the ability to "rapidly put up space domain awareness and operate it in real-time against a threat."

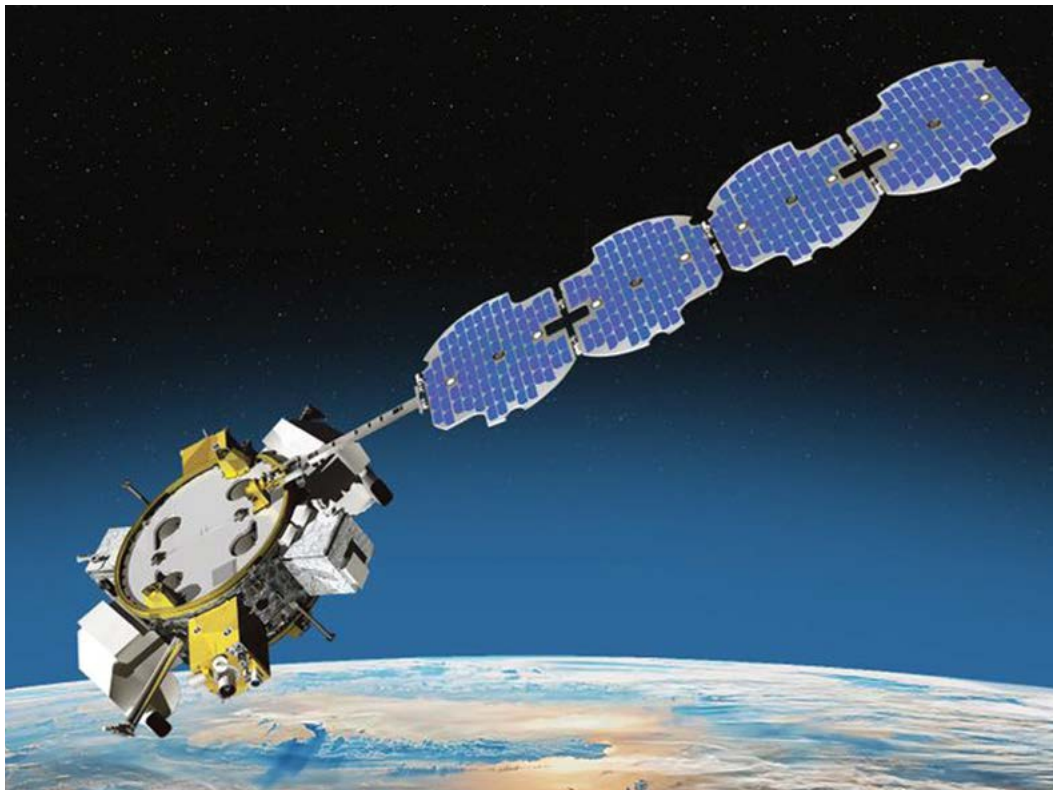
By establishing the capacity to rapidly launch and operate new satellites in response to urgent needs, the Space Force aims to improve its ability to counter unexpected adversary actions and maintain an edge in space.

The Space Force's eventual ground-based moving target indicator (GMTI) satellites, used to characterize vehicles and ships, and the Space Development Agency's growing number

Geosynchronous Space Situational Awareness Program (GSSAP) satellites are a space-based capability operating in the near-geosynchronous orbit regime supporting U.S. Space Command space surveillance operations as a dedicated Space Surveillance Network (SSN) sensor.



USSF



Northrop Grumman illustration

A Northrop Grumman rendering depicts the ESPASat platform which can accommodate up to six payloads with independent mission objectives. The Space Force has nicknamed this platform “the freight train to space” that can insert SmallSats into geosynchronous orbit or host dedicated payloads on the ring itself until test completion.

of missile warning and tracking satellites could, for instance, help track the deployment, emplacement, and launch of a road-mobile ASAT.

Commercial SmallSat operators are already contributing to this effort; the Navy has contracted Planet and HawkEye 360 for help with maritime surveillance, data that could inform U.S. Space Command about potential ship- and ground-based threats to space assets.

A proliferated U.S. satellite architecture means that adversaries would need to conduct larger-scale, more visible attacks to degrade or destroy a satellite constellation. This increased visibility would make distinguishing between isolated incidents and coordinated strikes easier, providing clearer indications of hostile intent.

RESPONSIBLE COUNTERSPACE CAMPAIGNING

Responsible counterspace campaigning tactics can be accomplished by capitalizing on the full range of benefits that SmallSats represent.

SmallSats increase the feasibility of using satellites to conduct defensive and offensive missions. Small “bodyguard” satellites, equipped with nondebris-generating kinetic or non-kinetic capabilities, could be stationed beside high-value satellites to protect against attack. In effect, such satellites would be analogous to fighter escorts protecting tankers or airborne radar. They could also support communications, missile warning satellites, or GPS functions.

The Space Force also could employ SmallSats as “hunter-killer” satellites, co-orbital weapons designed to disable adversary satellites using localized kinetic, EW, lasing, spoofing, or jamming techniques. These weapons could patrol near adversary assets, hide in less monitored orbits, or remain with a larger bus or an upper-stage vehicle waiting for activation. The ability to provide offensive counterspace capabilities at a moment’s notice would credibly add to the deterrent posture of the United States.

CONCLUSION

Adversary space-enabled kill chains pose an active and increasing threat to U.S. and allied forces around the world. To achieve space superiority and deliver on the tenets of Competitive Endurance—Avoid Operational Surprise, Deny First-Mover Advantage, and Conduct Responsible Counterspace Campaigning—the United States should leverage a fleeting window of opportunity to field a modern space architecture built around SmallSats to provide the necessary capabilities to gain and maintain space superiority.

The Space Force, Congress, and the U.S. space industrial base should consider the following steps to fully capitalize on the opportunities offered by SmallSats (a more comprehensive list is available in the full report):

- Scale up SmallSat procurement, including large block buys to protect funding streams, and continue trends that reduce costs and increase employment flexibility and technology refresh rates. This includes removing the harmful budget caps imposed by the Fiscal Responsibility Act of 2023.

- Grow funding tied to the theory of Competitive Endurance to meet the requirements needed to address each tenet.

- Support the industrial base in ramping up SmallSat production to shore up its supply chains and streamline production for large-scale procurement.

- Continue to develop and scale launch to improve affordability and frequency.

- Adopt tactics, techniques, and procedures for SmallSats associated with their operating requirements, which are unique and distinct from operations for legacy systems that accomplished fewer missions with less risk.

- Increase cybersecurity and sensing capabilities for greater resiliency and situational awareness.

- Prioritize architecture sustainability and make management, disposal, and reconstitution part of the strategy for the U.S. space architecture.



OUTSTANDING AIRMEN OF THE YEAR

The Outstanding Airman Program annually recognizes 12 enlisted members for superior leadership, job performance, community involvement, and personal achievements.



The Air Force Association drove the creation of the Outstanding Airmen of the Year program, which debuted at AFA's 10th annual convention in 1956. Airmen selected receive the Outstanding Airman of the Year ribbon with bronze service star device; they also wear the Outstanding Airman badge for a full year. This year's honorees were chosen by a selection board from among nominees advanced by commands in the Air Force and Space Force.

SMSgt. Sarah Buckley

Duty Title: International Affairs Specialist

Organization: Headquarters Pacific Air Forces, Joint Base Pearl Harbor-Hickam, Hawaii

Home of Record: San Diego

Senior Master Sergeant Sarah Buckley led the Pacific Air Forces enlisted regional security cooperation program, directing 36 country portfolios valued at \$10.9 billion. She led an 11-month planning effort, executing the largest Pacific Air Chiefs' Symposium in history by



managing a \$1.2 million budget, 122 volunteers, and over 300 engagements among key leaders from 23 allies and partner nations, fortifying a free and open Indo-Pacific. Moreover, she drove policy change to Air University's International Honor Roll program by capturing the benefits that United States professional military education has generated for foreign militaries, resulting in the induction

of three Chief Master Sergeants of the Air Force from Indo-Pacific partner nations in 2024. Furthermore, Buckley established an enlisted international academy, securing \$175,000 in funding, onboarding 19 students from eight nations, and developing the first-ever Royal Australian Air Force Commandant position in the Pacific Air Forces.

MSgt. Genevieve M. Villela

Duty Title: Financial Operations Superintendent

Organization: 502nd Comptroller Squadron, Joint Base San Antonio, Texas

Home of Record: San Leandro, Calif.

Master Sergeant Genevieve M. Villela executed a customer scheduling and queuing pilot system at seven bases in support of the Assistant Secretary of the Air Force in Financial Management's effort to standardize customer service, also preparing an implementation blueprint for the remaining 71 squadrons. She led 150 joint-service personnel and sourced over 27 security contracts worth over \$9 million. Additionally, she co-chaired Joint Special Operations Command's Program Budget Advisory Committee, helping secure \$2 million for 213 missions. She solved a four-star-level congressional Inquiry and discovered two LeaveWeb system flaws, driving fixes and resolving 7,000 unreconciled leaves. Furthermore, Villela developed nine of the first-ever real-time analytics dashboards for 78 installations, reaching 20,000 users and reducing the 33,000 existing pay cases by 42 percent in the first month. Finally, she led an eight-member team to revamp the accession process for Basic Military Trainees and purged six workflows, eliminating \$1.8 million in debts for 9,000 graduates.



MSgt. Haley L. Kallisto

Duty Title: Weapons Director

Organization: 225th Air Defense Squadron, Joint Base Lewis-McChord, Wash.

Home of Record: Sausalito, Calif.

As the sole air defense liaison at the Asia-Pacific Economic Conference, Master Sergeant Haley L. Kallisto relayed information among 17 government agencies, guaranteeing protection for the President of the United States, China's President, 3,500 foreign delegates, and over 100 corporate leaders. She championed the multinational



Noble Skywave radio competition, placing her sector in the top 12 percent of 374 units and strengthening radio communications with 20 partner nations. Kallisto updated cruise missile academics for a large-scale wartime exercise, arming instructors with leading-edge tactics and enabling the training of five students managing ACE activities. She briefed 40 Air Force senior leaders

on tactical C2 and NORAD NORTHCOM for homeland defense mission sets. As a certified crisis counselor, she mentored 11 youth experiencing suicidal ideation, de-escalating deadly situations. She became one of three 194th Wing Victim Advocates, facilitating 25 annual SAPR trainings while supporting victims.

TSgt. Cory Green

Duty Title: NCOIC, Weapons and Tactics

Organization: 60th Security Forces Squadron, Travis Air Force Base, Calif.

Home of Record: Bakersfield, Calif.

Technical Sergeant Cory Green developed a flight-run, small arms training plan to enhance gunfighter capabilities and was also chosen to develop Air Mobility Command's sustainment fire concept of



operations. This initiative aimed to bolster security forces marksmanship capabilities across AMC's 14 wings. Additionally, he led a 16-member search team that successfully rescued an Airman who had been missing for hours in the Department of Defense's largest training area.

Lastly, Green commanded an armed response to an active shooter threat at the Air Force's largest medical center. Through his decisive actions, he secured the subject, seized the loaded firearm, and effectively prevented a mass casualty event, ensuring the safety of nearly 3,000 staff members and patients.

TSgt. Jose Lucero IV

Duty Title: Flight Sergeant

Organization: Air Force Security Forces Headquarters Det. 3, Fort Bliss, Texas

Home of Record: El Paso, Texas

Technical Sergeant Jose Lucero IV led the Air Force Combatives Program at Fort Bliss, Texas. His actions encompassed joint training of 82 Army, Navy, Air Force, Department of Defense and Veteran Affairs Instructors. As the first and only Air Force Reserve Master Combatives Instructor, Lucero engineered a three-day Active Shooter



Combatives Event for the 2023 Defender Challenge where he battle-tested 11 hand-selected competitors across all Majcoms in order to produce a readiness baseline for the Security Force's enterprise. He also led a team of instructors for 2,500 Security Force members tasked to deploy. Tactics taught include mounted, dismounted operations, shoot-move-communicate, close-quarter combat, tactical

vehicles, and air base recapture and recovery skills. Lucero provides guidance, character development and leadership traits to all his students with an emphasis on life-saving skills.



TSgt. Geraldine Schwartz

Duty Title: Airman Leadership School Instructor

Organization: Royal Air Force Feltwell, U.K.

Home of Record: Harlem, New York City

Technical Sergeant Geraldine Schwartz serves as an Airman Leadership School Instructor where she directed 960 academic hours of professional military education (PME) across five wings, 74 squadrons, six Majcoms and 68 Air Force Specialty Codes. Additionally, she created the first-ever combined U.S. and U.K. PME course by collaborating with the Royal Air Force PME Command Team for three months, synthesizing 120 hours of joint instruction. Her initiative enabled a new course for 57 students, strengthening NATO joint interoperability and allied educational relationships. Furthermore, Schwartz led a USAFE-AFAFRICA/A1-directed manpower review. She solved a three-year staffing shortage resulting in a \$140,000 savings in student funding allocations. Finally, she was selected by the Department of State to serve as a Spanish translator and instructor for 16 diplomats, driving her selection to the Language Enabled Airman Program.

TSgt. Joseph Mazure

Duty Title: NCOIC, Survival, Evasion, Resistance, and Escape (SERE)

Organization: 609th Air Operations Center, Al Udeid AB, Qatar

Home of Record: Grand Rapids, Mich.

Technical Sergeant Joseph Mazure was by name requested to fill an E-7 billet for 270 days, coauthoring Air Force Special Operations Command's first Master Training Plan for SERE. He also spearheaded the largest wing personnel recovery kit revamp in two decades—a three-year project—executing a \$165,000 budget



and fabricating 450 kits utilized by 2,500 personnel. Mazure directed the Air Force's largest operational SERE flight, executing 52 group training events for 14 squadrons, supporting six commands. Additionally, he collaborated

with the United States Space Force and the National Reconnaissance Office to rectify a critical flaw in survival radios that affected 13 partner nations, revitalizing secure satellite communications for emergencies coalition-wide. At the Central Command Joint Personnel Recovery Center, Mazure coordinated personnel recovery for four downed aircraft across three combatant commands, activating 15 Air Force and Navy rescue assets, culminating in the recovery of 15 personnel.

SrA. Jacob Cummings

Duty Title: CV-22B Electrical and Environmental Systems Journeyman

Organization: 7th Special Operations Aircraft Maintenance Squadron (SOAMXS), RAF Mildenhall, U.K.

Home of Record: Hitchcock, Texas

Senior Airman Jacob Cummings has made a major impact in his role as a CV-22 Electrical and Environmental Systems Technician. He maintained nine CV-22B aircraft valued at \$1.2 billion for the 7th SO-AMXS. He also qualified in tasks outside his career field and earned the title of Dedicated Crew Chief to a highly decorated aircraft. He demonstrated leadership by guiding his shop's maintenance and training efforts, solving 2,100 discrepancies, enabling 987 sorties and 3,400 flight hours. Cummings deployed for two NATO exercises, resulting in 103 sorties for Naval Special Warfare training. As Shift Lead, he executed 27 mission-limiting repairs, enabling five CV-22 sorties to support the movement of the President of the United States in Europe. Finally, Cummings executed 192 maintenance actions that ensured the safe evacuation of 100 U.S. citizens from an active conflict area.





USAF

SrA. Mariah Hayden

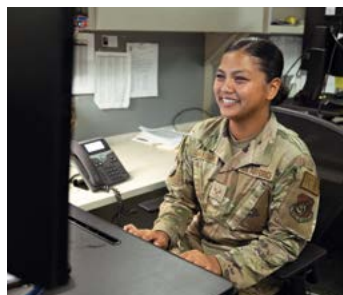
Duty Title: Emergency Management Operations Journeyman
Organization: Space Base Delta 1, Peterson Space Force Base, Colo.
Home of Record: Indianapolis

Senior Airman Mariah Hayden filled a Noncommissioned Officer in Charge role for five months and steered a three-base mitigation program shielding \$67 billion in mission assets, 111 joint partners, and ensuring global effects for 11 combatant commanders. She served as a Department of the Air Force subject-matter expert for the first update to Chemical, Biological, Radiological & Nuclear protective equipment in 18 years. Her efforts synchronized Army, Department of the Air Force, and United States Special Operations Command requirements to generate future-focused protection standards for 1.5 million joint warfighters. Hayden revived a nearly canceled Air Force Emergency Management Worldwide event, averting a two-year delay in functional professional military education for 200 Total Force Air Force Emergency Managers. Finally, she guided relocation of Peterson Space Force Base's primary emergency command and control node to enable the beddown of seven new squadrons and 500 Guardians.

SrA. Leanne Jayoma

Duty Title: Career Development Technician
Organization: 647th Force Support Squadron, Joint Base Pearl Harbor-Hickam, Hawaii
Home of Record: Arlington, Va.

Senior Airman Leanne Jayoma excelled in an E-6 role for three months, leading eight Airmen and executing nine A1 programs valued at \$11 billion in support of 53,000 personnel. Additionally, she overcame a manning deficit by coordinating an Exception to Policy to merge two sections and developed a 34-hour training



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plan that slashed customer wait times by 37 percent, resulting in 459 hours being repurposed to tackle other priorities. Jayoma authored myEval training that was instituted by seven Military Personnel Flights across four Majcoms. Moreover, she coordinated with A1 and the Air Force Personnel

Center to mitigate myEval system discrepancies by developing new procedures for 83 commander's support staff teams, resolving 3,000 rejected evaluations and saving 780 hours annually. Finally, Jayoma developed an automated solution for special duty pay notifications, reducing a labor-intensive process from 864 to 48 hours and enabling rapid processing of \$92.2 million in entitlements.

SrA. Rachel Heath

Duty Title: Resource Advisor
Organization: 377th Healthcare Operations Squadron, Kirtland Air Force Base, N.M.
Home of Record: Lakeland, Fla.

Senior Airman Rachel Heath filled a GS-11 position for nine months, completing 46 finance trainings and liaising with Higher Headquarters to allocate a \$20 million budget, supporting 48,000 visits and raising Active-duty access to care from 26 percent to the top 1 percent of military treatment facilities. She served as Flight Chief for four months, leading seven staff members and 12 programs, securing 11 new hires, handling \$347,000 in insurance claims, and securing \$103,000 in bonuses for 68 civilian employ-



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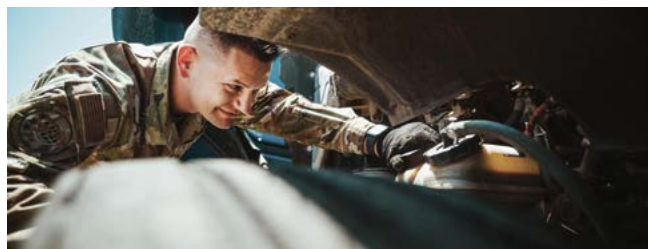
ees. Heath utilized her Accounting Degree to develop her Medical Group's budget cost performance index, enhancing spending forecast accuracy by 65 percent, certifying 32 spend plans, and developing the group's FY24 financial plan. She led her group's end-of-year closeout, guiding 12 flights, vetting \$4 million in requirements,

and securing \$3.4 million in equipment to modernize 15 units and a \$609,000 four-person contract to execute 15 new personnel reliability program standards for 820 Airmen.

SrA. Mykhailo Khromiak

Duty Title: Ground Transportation Support Operator
Organization: 56th Logistics Readiness Squadron, Luke Air Force Base, Ariz.
Home of Record: Peoria, Ariz.

Senior Airman Mykhailo Khromiak deployed in support of defense assistance efforts to Ukraine as a critical command and control liaison for the Air Domain Awareness Cell, alerting forces to 2,000 air threats and 1,500 ballistic missiles and safeguarding 43 million lives. Furthermore, he crafted translation aids, arming pilots with enhanced situational awareness and improving sortie rates for unmanned aerial vehicles. Khromiak provided translation support during three meetings of the Ukraine Defense Contact Group, helping secure \$7.6 billion in aid for Ukraine. Additionally, he executed the Presidential Drawdown Authority's aim by enabling the implementation of four new air capabilities, increasing the survivability of 40 aircraft worth \$1.7 billion. Additionally, Khromiak hauled 16 tons of equipment to Gila Bend Auxiliary Field, standing up a divert airfield for in-flight emergencies for 20 joint units across five airframes and three Majcoms, supporting 23,000 sorties and 239 pilot graduates.



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By Patrick Reardon

2024 National AFA Thompson/Mallett Teacher of the Year

The Air & Space Forces Association named Ty White the 2024 Teacher of the Year. David Tyrel "Ty" White, a high school chemistry teacher at Willcox High School in Willcox, Ariz., guides his students toward their own authentic STEM experiences. As a rural teacher, he believes there are opportunities for students to be engaged in STEM learning experiences wherever they live, and he continuously identifies and provides myriad opportunities to expand student possibilities.

Due to his extraordinary work for students in his rural school and community, as well as students across the country, White was named the 2023 National Rural Teacher of the Year, the 2023 AZ State Teacher of the Year, and the 2023 National 2nd Place AFA Teacher of the Year. Additionally, in 2023, he received an Honorary Doctoral Degree in Humane Letters from Northern Arizona University.

In 2019, White became the Southwestern Space Settlement Design Competition regional coordinator and continues running the qualifying program today in the University of Arizona's research facility in Oracle, Ariz., Biosphere 2—a significant upgrade from the Willcox High School gymnasium where it was previously held.

"He has continued his leadership role in the Borderlands Rural Teachers Caucus where he works with rural teachers across Arizona to collect data from a variety of educators (including administration and support staff) to identify the most pressing rural challenges. He developed a white paper to share with state legislators and educational leaders based on his research on those challenges. The goal of the initiative is to develop content and training to both support and grow young teachers while creating a stronger support network and resources across the southeastern Arizona region," said Wally Saeger, Arizona AFA president.

"He has worked with the Arizona Science Center, the Arizona STEM Acceleration Project, the Society for Science, and Arizona Game & Fish to raise awareness of local resources and develop PD for isolated rural and small school teachers. Ty co-hosts a podcast with Dr. Melissa Sadorf from the Arizona Rural Schools Association, highlighting some of the amazing things rural teachers do to help their schools flourish," added Saeger.

Congratulations to Ty White, AFA's National Teacher of the Year. Ty is dedicated to fostering his students' ambitions and creating new STEM opportunities for them regardless of where they live. He has not only touched the lives of his students but played an important role in shaping the next generation of leaders in aerospace," said John Shade, Executive Vice President for Business Development and Future Programs at Rolls-Royce Defense. "At Rolls-Royce, we are proud to sponsor AFA's Aerospace Education program and support all the excellent educators recognized across the country in the Teacher of the Year Program."

White's students perform authentic research during the Biosphere experience in his classroom and in extracurricular STEM clubs. He sponsored the Racing the Sun Solar Go-Kart challenge, a Rocketry camp, as well as other initiatives above and beyond his chemistry classroom.

White co-founded the nonprofit, Industry Simulation Education (InSimEd), which brings in aerospace engineers to work directly with



Courtesy photo

2024 AFA National Teacher of the Year David White.

students at engineering hackathon competitions across North America.

"When asked about my proudest moments as a teacher, there are several that come to mind. Laura D., as a freshman, was not interested in science—it didn't relate to her life. However, when she was a junior, I was able to connect her love for cosmetology to chemistry. By her senior year, she created a successful research project, building and coding an Arduino-powered calorimeter."

White's former student, Laura Dunham, graduated with a chemical engineering degree and now works at the National Renewable Energy Lab.

"What truly left a lasting impression on me was Ty's ability to make lectures not only educational but also captivating. He instilled our learning with a sense of excitement by exploring captivating scientific occurrences, such as the intriguing double-slit experiment. His approach to teaching not only engaged us but also fostered a genuine appreciation for the wonders of science," Dunham said. "I have observed his students involved in his programs today, and they are enthusiastic about sharing their projects with others and readily seek out Ty White for guidance whenever they encounter obstacles. The growth I have seen in WHS due to Ty's significant role as an educator has been inspiring. His commitment to becoming an engaged and knowledgeable individual extends far beyond the classroom, making him a prime example of motivation and dedication."

White is involved in numerous professional organizations as a leader, mentor, and presenter, including:

- Data Science Planning Committee and Teacher Recruitment and Retention Task Force for the Arizona Department of Education;
- Co-planner for the first (2024) AFA Teacher Air STEM Camp; partnering with AFA and Davis-Monthan Air Force Base; and
- Lead team member in creating Professional Development models for STEM teachers, developing Rural Community of Practice for STEM teachers, working with the launch team to start a STEM Ecosystem in Cochise County.

"He possesses a rare blend of passion, creativity, and expertise that has profoundly impacted the educational experiences of his students," said Kevin Davis, Superintendent, Willcox Unified School District #13. "Ty's approach to teaching and integrating aerospace-related STEM topics into his lessons is nothing short of exemplary. He has developed innovative curricula and hands-on learning experiences that not only engage students but also empower them to explore and apply STEM concepts in meaningful ways."

AFA Cochise Chapter 107 President George Castle said White is "one of the most consequential teachers" he's met, noting he regularly collaborates with other teachers, local businesses, and industry leaders to prepare students to join the future workforce.

"Ty can identify with and understand the students' different abilities, likes, and dreams. He helps them understand concepts in science and how they relate to the students' everyday lives by being involved in and consistently improving many of the extracurricular science activities for the students," Castle said. "The students are very motivated to do well and continue their studies due to Mr. White's ability to instill a love of learning science."



By Col. Phillip S. Meilinger, USAF (Ret.)

Claire L. Chennault

A 'Tiger' who showed his teeth without biting his tongue.

Chennault was a well-known and heroic figure in America during World War II, due largely to his command of the Flying Tigers in China. The American Volunteer Group—its official name—suited Chennault and his personality.

Raised in Louisiana, Chennault attended LSU for a year but dropped out due to lack of money. When the U.S. went to war in 1917, he enlisted in the Army, went to officer school, and then flying training. He did not fly in France, but over the next 17 years he earned a reputation as an outstanding pursuiter—fighter pilot—as well as an irascible and difficult officer. In 1930 he was sent to the Air Corps Tactical School to head the Pursuit Section.

Chennault's ideas on the superiority of pursuit aircraft were contrary to those of his colleagues at the Tactical School. There, the theory of strategic bombing was taking hold, and this theory assumed that nothing could stop a well-organized bomber attack from penetrating enemy airspace and destroying a nation's key manufacturing, transportation, and military targets. Chennault begged to differ. He argued, strenuously, that fighters could intercept a bomber formation and decimate it before it could reach its targets—and this was before the invention of radar, which would make his argument even stronger.

His personality was both his greatest strength and greatest weakness—not unusual for original thinkers—and his abrasive and aggressive attitude alienated his coworkers. This was unfortunate because his warnings should have been heeded—the war would show the theory of unescorted bomber formations was wrong.

Surprisingly, however, although Chennault was convinced his planes could find, intercept and stop an attacking bomber formation, he refused to take the next step. He rejected the idea of providing escort to the bombers. To him, that smacked of a passive and defensive mindset. A fighter pilot's primary trait was aggressiveness, and he did not want it wasted on the reactive mission of escort. He was not alone in this attitude—many other pursuit pilots thought similarly. This too was a shortcoming that would soon become evident in combat.

Plagued with a variety of physical ailments, besides being burdened with a difficult personality, it was obvious to Chennault that he had no future in the Air Corps. In 1937 he retired as a major. Fate then intervened.

China had been invaded by Japan and was in desperate straits. Chiang Kai-Shek reached out to America for help. President Franklin Roosevelt was reluctant to buck the prevailing isolationist sentiments across the U.S., but did extend some assistance. He agreed to sell the Chinese 100 fighter aircraft, Curtiss P-40 Warhawks. Chiang had already hired Chennault to head his nascent air force, and Roosevelt allowed military pilots to be recruited to fly in this air arm. Those attracted to the Soldier-of-fortune job of flying for China, under the command of Chennault, were of a type.

Like Chennault himself, most of those recruited for his Volunteer Group were hard, aggressive men who did not get along and whose units were happy to be rid of them.

The P-40 was inferior to the front line Japanese fighter, the Zero, and Chennault knew it. He flew dozens of combat missions against the Japanese himself, reputedly shooting down dozens of enemy



U.S. War Department

Gen. Claire Chennault was a big supporter of fighter-interceptor aircraft during the 1930s, when the U.S. Army Air Corps was primarily focused on high-altitude bombardment.

aircraft, and quickly learned the tactics needed to fight the Zeros and survive: "always look around, stay together, hit and get out so you can recover speed and come back, withdraw erratically so the enemy cannot anticipate your vulnerable moments. Concentrate your force where the enemy is weakest; do not let him use his strength against you and make the most of every advantage you have. Use your wits; know your ship and your enemy."

The results were exceptional. The Flying Tigers—named because the pilots painted graphic shark teeth and eyes on their aircraft noses—proved a match for the Japanese. During their limited time in action they shot down nearly 300 Japanese aircraft for a loss of only 12 of their own. When the U.S. entered the war, the Tigers were inducted into the new 14th Air Force, and Chennault, brought back on Active duty and promoted to major general, became its commander.

Chennault did not get along with his superior, Lt. Gen. Joe Stillwell, nor with his air superiors either, in theater or in Washington—Henry "Hap" Arnold thought him a "crackpot." When the war ended, he was quickly hustled back into retirement. He remained in China and formed Civil Air Transport—it would soon be bought by the CIA and renamed Air America. Chennault was belatedly promoted to lieutenant general nine days before he died in July 1958. ★

Chennault's memoirs, "Way of a Fighter" (Putnam's, 1949) are like the man himself, egotistical and contentious, but always interesting. There are several biographies of the general, but the two best are "Chennault: Giving Wings to the Tiger" (University of Alabama Press, 1987), and "Jack Sampson's Chennault" (Doubleday, 1987).

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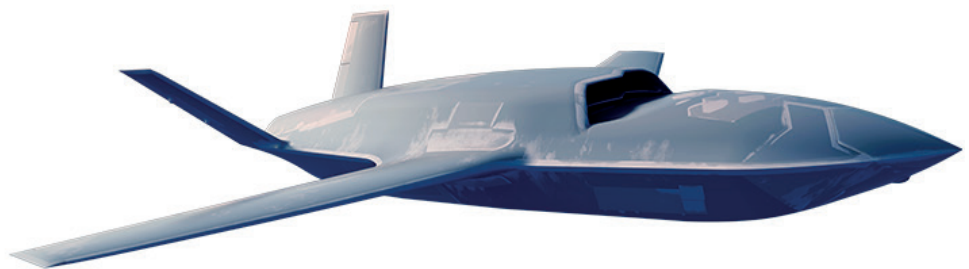
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