

The Future of Flight Test 28 | The Power of Quantum 36 | Airmen Who Ran for President—and Lost 42

AIR & SPACE FORCES

airandspaceforces.com

Q&A:
Insight from
Air Force
Futures 6

AIRPOWER'S GROUND TRUTH

Inside Special Reconnaissance, USAF's Newest
SOF Career Field. 32



Published by the
Air & Space Forces
Association

December 2023

\$8



0 74470 29757 4

MORE AGILE. UNMATCHED ACCESS.



The KC-46A tanker enables the U.S. Air Force to deploy from more airfields. It can operate from shorter runways and takes up less space on ramps—meaning more booms in the air, faster refueling and dispersed operations for force projection. When winning won't wait, it's time for the KC-46A tanker.

AIR & SPACE FORCES

December 2023, Vol. 106, No. 12 airandspaceforces.com



Northrop Grumman

DEPARTMENTS

- 2 Editorial:**
Follow Through
By Tobias Naegele

- 4 Letters**

- 4 Index to Advertisers**

- 8 Airframes**

- 14 Faces of the Force**

- 15 Verbatim**

- 16 World:** New Chief, Gen. David Allvin; B-21 Raider takes flight; T-7A Red Hawk testing; C2 in the Cloud; U.S. air strikes in Syria; Ukrainians start F-16 training; and more.

- 46 AFA in Action:**
Tuskegee Airman Harvey promoted to Colonel

- 47 Heroes/Leaders:**
Robin Olds

FEATURES

- 6 Q&A: Thomas Lawhead, Air Force Futures**
Looking Into the Future.

- 28 Getting Ready for the New Test Surge**
By John A. Tirpak
Edwards Air Force Base might not have been this busy since the 1960s.

- 32 Ground Truth: Special Recon**
Inside the Air Force's Newest SOF Career.
By David Roza

- 36 Disentangling Quantum**
By Heather Penney
Understanding the science to make the right choices.

- 42 Three Airmen Who Sought—But Never Won—the Presidency**
By Daniel L. Haulman
Veterans of the Army Air Forces ran for President in 1964, 1968, and 1972. None came close to winning.

The B-21 Raider bomber is among at least 10 major weapons programs beginning flight tests at Edwards Air Force Base, Calif., where test engineers are ramping up for one of their busiest periods in decades. The B-21 Raider will serve as the backbone of America's bomber fleet. See "Getting Ready for the New Test Surge" p. 28.

ON THE COVER



Miriam Thurber/USAF

Combat controller and special tactics officer students carry out their mission plan during Tactics Field Week this past in the North Carolina forests.

STAFF

Publisher
Bruce A. Wright
Editor in Chief
Tobias Naegele

Acting Managing Editor
Chequita Wood
Editorial Director
John A. Tirpak
Senior Designer
Dashton Parham
News Editor
Greg Hadley
Pentagon Editor
Chris Gordon

Production Manager
Eric Chang Lee
Photo Editor
Mike Tsukamoto
Senior Editor
David Roza
AFA in Action Editor
Patrick Reardon
Staff Writer
Unshin Lee Harpley

Contributors
Daniel L. Haulman,
Col. Phillip S. Meilinger, USAF (Ret.),
Heather Penney,
Christopher Prawdzik



ADVERTISING

Christy Sitter
Director of Sales
703.247.5837
csitter@afa.org

SUBSCRIBE & SAVE
Subscribe to *Air & Space Forces Magazine* and save big off the cover price, plus get a free membership to the Air & Space Forces Association.
1-800-727-3337

Air & Space Forces Magazine (ISSN 0730-6784) December 2023 (Vol. 106, No. 12) is published monthly, except for two double issues in January/February and June/July, by the Air & Space Forces Association, 1501 Langston Blvd, Arlington, VA 22209-1198. Phone (703) 247-5800. Periodical postage paid at Arlington, Va., and additional mailing offices. **Membership Rate:** \$50 per year; \$35 e-Membership; \$125 for three-year membership. **Subscription Rate:** \$50 per year; \$29 per year additional for postage to foreign addresses (except Canada and Mexico, which are \$10 per year additional). Regular issues \$8 each. USAF Almanac issue \$18 each. **Change of address** requires four weeks' notice. Please include mailing label. **POSTMASTER:** Send changes of address to Air & Space Forces Association, 1501 Langston Blvd, Arlington, VA 22209-1198. Publisher assumes no responsibility for unsolicited material. Trademark registered by Air & Space Forces Association. Copyright 2023 by Air & Space Forces Association.

By Tobias Naegele

Follow Through

Sometimes, a singular event so stuns the world that we are instantly, palpably aware that nothing will ever be quite the same again. Pearl Harbor. 9/11. COVID-19. At other times, the world shifts and it's only later that, looking back, the scope of change grows clear.

And sometimes these two phenomena converge, and you see not just the changes aligning in the rearview mirror but a clear path to a better future ahead. Now is one of those moments.

When Gen. Charles Q. Brown Jr. became the 22nd Air Force Chief of Staff in the COVID-infected summer of 2020, his signature challenge—"Accelerate Change ... or Lose"—was a cry for urgency. Brown didn't unveil a new strategy or organizing principle. He was sounding an alarm. Stop admiring the problem and get on with solving it. Push decision-making down the chain. Come up with your own solutions. Get on with it.

Teaming Brown with Frank Kendall, who arrived as Secretary one year later, proved fortuitous: Kendall, the consummate Pentagon insider and old Cold Warrior matched well with the fighter pilot warrior, whose scant Pentagon experience might otherwise have been a handicap. But Kendall's focus was well aligned: He wanted to move on from conceptual experiments to "delivering meaningful operational capability." He too wanted to accelerate change.

That brings us to today. Brown became Chairman of the Joint Chiefs of Staff on Oct. 1. A month later, his former deputy, Gen. David W. Allvin, was finally confirmed and sworn in as the 23rd Air Force Chief of Staff. A new era arrives.

Like Brown and Gens. David Goldfein (Chief No. 21) and Mark Welsh (No. 20), Allvin inherits the smallest, oldest Air Force in American history. Each Chief took over a smaller and older force than his predecessor, and the Air Force continues to shrink, jettisoning by the hundreds older aircraft that long ago exceeded their "best-by" date.

But unlike his predecessors, Allvin may well be able to hand off a growing Air Force to his successor.

Over the next few years, the Air Force will begin to test and field a whole new generation of aircraft and weapons, the most fundamental rejuvenation of the force since the 1970s when it delivered the F-15, F-16, F-117, B-1, B-2, C-17, AWACS, and JSTARS.

In his week as Chief, the T-7A Red Tail, the first jet trainer in nearly 40 years, and the B-21 Raider, the first new bomber since the B-2 more than 30 years ago, arrived at Edwards Air Force Base, Calif., for testing. They join F-35s already proving out new upgrades in the California Desert and a host of new air-to-air and air-to-surface missiles. Also coming soon: B-52s with new engines and flight systems, the E-7 Wedgetail AWACS replacement, the Next-Generation Air Dominance family of systems, and a cast of uncrewed Collaborative Combat Aircraft.

There hasn't been so much "new" coming down the pike in generations. How fitting, then, that the new Chief should be a former test pilot and that his challenge to the force is "follow through."

It's time to complete the picture. Turn concept to reality. The future to now.

The world is at a far more dangerous precipice today than it was three years ago. During COVID, we experienced fear of the unknown, unprecedented impacts on our lives and the economy, reactions and counterreactions. COVID left the world a less stable place. It undermined globalization, exposed overdependence on foreign supply chains and just-in-time delivery processes that leave little margin

for error or disruption. COVID also deepened political divisions and undermined trust in institutions.

Russian President Vladimir Putin sought to exploit those divisions when he invaded Ukraine. He bet—wrongly it turned out—that Europeans would give up Ukraine as long as they were assured a steady supply of Russian gas.

COVID broke economies, but some came back faster and stronger than others. China has proven less resilient. Its president, Xi Jinping, continues to consolidate power. Having publicly dispatched his predecessor, Hu Jintao, into obscurity last year, Xi disposed this year of both his defense and foreign ministers. Business leaders have also been made to disappear.

Iran's audacious instigation of the Oct. 7 Hamas attacks in Israel is another symptom of a more dangerous world. Its proxy forces in Lebanon, Syria, Yemen, and elsewhere continue to try to draw the U.S. into a wider conflict.

Russia, China, and Iran all benefit from a less stable world. The U.S. must be steadfast in deterring their worst instincts.

At his coming-out speech at JB Andrews, Md., Nov. 17, Allvin acknowledged the tense world situation.

"The current environment is one in which our national interests are threatened in a way we have not seen in decades," he said. The job of the Air Force and the military in general, "is to ensure that when other international actors consider reaching into that toolbox for a device labeled 'military conflict,' they rightfully consider that an unwise choice."

Rebuilding the Air Force, as a more modern, more flexible, and more lethal opponent is the key to deterring—and to fighting and winning if needed.

"The evolving character of war is one that privileges speed and tempo, range, agility, flexibility, resilience, and precise lethality," he said. "These elements run deep in the DNA of airpower, and it is our responsibility to the joint force and the nation to bring these to bear to meet our pacing challenge."

Speed has always been key to victory in war. David was smaller than Goliath, but his slingshot was quicker than the giant's sword. The great Roman Legions lost the Battle of the Teutoburg Forest to far-less sophisticated but more nimble German tribes. Speed crushed Iraq in Desert Storm.

Speed creates confusion and information advantage. It ramps up the pressure on an overwhelmed foe. It creates surprise, and surprise wins.

Yet, speed has not been a defining characteristic of Air Force modernization over the past 20 years. Inconsistent funding, inconsistent support from Congress, inconsistent messaging from the Pentagon, and inconsistent performance by suppliers have all contributed to that fact. The KC-46, the T-7A, and the F-35 programs are all years behind schedule.

Yet it now seems we are at a turning point. The reviews of those aircraft are universally high; their troubles finally nearing a close. The B-21, among USAF's best-run efforts, is pretty much on target. The organizational discipline that Kendall and Brown imposed is working.

Allvin's challenge is to rally his Airmen to the call. "Follow through" doesn't have the ring of "Charge!" or even "Accelerate Change ... or Lose." It's not poetry. But it's important. Sustaining change is as hard—maybe harder—than initiating it. Achieving transformation is another challenge all together.

Time is short. The clock is ticking. Take your swing—and follow through.



**Time is short.
The clock is ticking.**

Register Now!



AFA WARFARE SYMPOSIUM

A Professional Development Event

FEBRUARY 12-14, 2024 | AURORA, CO | AFA.org

**PREPARING
FOR GREAT POWER CONFLICT**





Air & Space Forces Association

1501 Langston Blvd • Arlington, VA 22209-1198

afa.org

Telephone: **703.247.5800**

Toll-free: **800.727.3337**

Fax: **703.247.5853**

AFA's Mission

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.
- **Advocate** for aerospace power, and promote aerospace and STEM education and professional development.
- **Support** readiness for the Total Air and Space Forces, including Active Duty, National Guard, Reserve, civilians, families and members of the Civil Air Patrol.

Contacts

CyberPatriot info@uscypatriot.org
 Field Services. field@afa.org
 Government Relations. grl@afa.org
 Insurance. afa.service@mercer.com
 Membership. membership@afa.org
 News Media. communications@afa.org
 StellarXplorers STLX_info@afa.org

Magazine

Advertising. sales@afa.org
 Editorial Offices. afmag@afa.org
 Letters to Editor Column. letters@afa.org

Change of Address/Email

In an effort to stay connected with AFA and your local chapter, please update your mailing and email addresses. Change of address requires four weeks' notice.

To update your contact information:

- **Email:** membership@afa.org
- **Visit:** The Members Only area of our website, afa.org
- **Call:** Our Membership Department at 1-800-727-3337

Mail your magazine label, including your first and last name, to our Membership Department at 1501 Langston Blvd., Arlington, VA 22209-1198.

Due Credit

Until I read the article from the October edition titled "Credit Where It's Due" [p. 47], I had not before seen any requirement specifying that an aerial victory had to be achieved while operating as an "aircrew flying manned aircraft." I have no doubt that this additional discriminator was included rather recently as an effort to exclude any tally of aerial victories scored by pilots flying remotely piloted aircraft.

Then, I read the incorporated article titled "Deciding Victory Credits," and the narration included this statement: "In my opinion, ground-based pilots who shoot down unmanned enemy aircraft deserve credit, but in a different category from those who risked their lives flying in combat." In terms of risk to life, one has to ask the question. What is a greater risk to life, flying from a ground station under threat of artillery fire, or shooting a beyond-visual-sight missile from 30 to 50 miles away while being undetected?

This reminds me of the foolish notion that medals that would be awarded to aircrew who encountered enemy fire would have those medals denied if they flew the same mission with such skill as to go undetected and avoid enemy fire. Efforts to apply such a discriminator then logically would deny credit for a BVR [beyond-visual-range] missile shot, but award it for a cannon shot, or deny credit for shooting down an unarmed transport aircraft, based upon some notion of risk to life. In truth, such an effort is rightly ridiculed.

The Air Force keeps tweaking their rules for aerial victory credit, and the

result is each time there are new technologies, the Air Force is required to reconsider the rules. The solution to this perpetual problem is simplification, and it's long overdue. Simplicity states that when an aerial vehicle is destroyed, then victory credit is earned for destroying it.

If it took multiple people to actually detect the target, then fire and guide the weapon causing the destruction, then the credit is shared equally, and so on and so forth. That concept was properly applied during World War II, as pilots who attacked enemy airfields got proper credit for destroying aircraft on the ground. These missions were very dangerous, with a far-higher loss rate than air-to-air encounters with enemy aircraft.

Yet, many years later, these victory credits were rescinded. So much for the idea that victory credits should carry with them a risk of loss of life!

It should not matter if the target is a balloon, or fixed wing, rotary wing, or remotely piloted aircraft, or even autonomous aircraft. Pilots who from an F-15 shoot down an enemy RPA deserve as much credit as one who shot down a MiG-21 over Vietnam. With the advent of remotely piloted combat aircraft, capable of detecting and shooting down aerial vehicles, the time is quickly approaching when that discriminator about "flying from manned aircraft" is going to look very questionable. Get rid of it now.

Whether you're inside the aircraft, or flying it from a ground station, truth remains the aircrew detecting the target, firing the weapon, and guiding the weapon all earn equal victory credit. And while we're on that subject, perhaps that would finally

WRITE TO US

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

INDEX TO ADVERTISERS

Boeing	Cover II
Pratt & Whitney	Cover IV
USAA	Cover III

AFA Warfare Symposium.	3
Shop AFA	47

include the notion of AWACS radar operators getting due credit for their role in shooting down enemy aircraft, starting in Vietnam.

All that would mean we had no actual aces in Vietnam, as Charles DeBellevue would only have about two victories, with an equal share of those six going to his pilots, and the AWACS controllers, who detected and tracked the enemy aircraft and vectored the F-4 to its firing solution.

If you destroy an aircraft, then the credit is recognized and awarded. If it took a crew to do it, then the entire crew shares the single destruction in equal percentage. If you do it by yourself, then the credit is singular.

Maj. Ken Stallings,
USAF (Ret.)
Douglasville, Ga.

I was really looking forward to reading "Credit Where It's Due" in the October issue. Unfortunately, after reading through all of the twists and turns in the kill credit process, I'm not sure what the conclusion is.

Has the Air Force reached an agreed on basis that harmonizes all of the different era standards into a single cohesive listing? Has the kill credit process been harmonized among the Air Force, Navy and Marine Corps services or are there still multiple standards?

Where is the official repository of the agreed-on kill credits? I feel the article has no conclusion and the title remains unanswered. Even more intriguing, will the Space Force count kills and of what? Will there be a Space Ace?

Hank Caruso
California, Md.

China, China, China

In my opinion, the editorial "China Syndrome" [September, p. 2] is right on target. I think China's housing stock is overbuilt. This is an important economic fact because new housing construction accounts for at least 25 percent GDP. If new housing construction were to stop, the GDP would drop by 25 percent. If housing construction even slowed by 20 percent, it would mean a 5 percent drop in GDP.

China's urbanization is at 65 percent for 2021 and has been increasing at 1.5 percent per year. With an end-

point of 80 percent urbanization, it would appear that China has 10 more years of housing construction at the present rate. However, estimates for vacant housing range from 7 to 13 percent of the urbanization rate which means maybe only one to five years of construction left. This is why housing construction companies such as Evergrande are having such problems.

China has been trying to project that it is going to overtake the U.S. economically. For example, since 2000 its steel industry doubled and then doubled again and again, ... but today China produces 57 percent of the world's steel. The steel industry can't double again to increase China's GDP. China is hitting market saturation.

If China's economic growth slows dramatically or even contracts this decade, this could lead Xi to try and divert the attention of the people of China to something other than the economy. In 1905, Czar Nicholas thought a war with Japan would divert the attention of the people of Russia from their domestic problems and unify the country. Let's hope Xi doesn't go down the same path, but let's be prepared.

William Thayer
San Diego

Rules Are Rules

Regarding the two letters on recruiting in your October issue [p. 5], I agree with both writers that the Air Force is sacrificing discipline for diversity by lowering recruiting standards. Permitting longer hair length and more visible tattoos, while easing drug testing criteria and grooming requirements, dilutes the discipline necessary to mold an effective fighting force.

During my Air Force Officer Training School stint in 1964, I was taught that the military runs on rules that apply to everyone, with no exceptions. Because if everyone in uniform did their own thing, you'd have a mob, not a military. Nearly 60 years later, that seems to be happening.

Richard Reif
Flushing, N.Y.

William Tell

I enjoyed your October article regarding William Tell 23 [p. 32] which brought back great memories. In the summer of 1986 I was the new com-

mander of the 4484th TEST Sq. at Tyndall Air Force Base, Fla. We were a tenant and assigned to the Tactical Air Warfare Center at Eglin Air Force Base, Fla.

In the first week of my new assignment I was asked to the office of the 475th Weapons Evaluation Group Commander Col. "Lucky" Ekman. The WEG was in charge of William Tell, the Weapons System Evaluation Program, drone targets, and other activities at Tyndall. Colonel Ekman asked me if my squadron could produce real-time videos of live missile firings from the Gulf of Mexico for WT 86 scheduled for October.

As an Eagle driver with zero engineering expertise I respectfully said, "I'll have to get back to you." He'd asked me the question based on my squadron's reputation. We had a few fighter pilots, numerous junior officer engineers straight out of the Academy, and numerous senior NCOs with vast radar, electronic countermeasure, weapon/radar interface, design, and construction experience. In fact we were the only squadron in Tactical Air Command authorized to modify an aircraft.

When I brought this before these young engineers and senior NCOs their eyes lit up. After procuring an old video transmitter for a guided weapon off a dusty shelf at Eglin courtesy of Systems Command, they got authorization to modify a two-seat Eagle from the 325th Fighter Training Wing.

After weeks of effort they had an antenna on the beach, cables from the beach to a makeshift video facility, and with my in-house USAF photographer in the back seat, the task was complete. Somewhat crude but totally operational and for the first time the WEG had live video from WT 86 contestants that could be observed 50 miles away in an air-conditioned building.

Two years later I was a member of the 475th WEG for WT 88. By now much improved video could be watched by participants and spectators in a large auditorium as it happened, just like in the movies. What a blessing for me to have been surrounded by these superb young officers and senior enlisted.

"Can't" was not a word they understood.

Col. Robert A. Corson,
USAF (Ret.)
Spring, Texas

Looking Into the Future

Thomas J. Lawhead is the Assistant Deputy Chief of Staff, Strategy, Integration and Requirements, commonly called Air Force Futures. The office is responsible for developing Air Force strategy and concepts, assessing the future operating environment through wargames and workshops, and developing future force design, using a 30-year horizon. That means Air Force Futures focuses on the 2050 time frame. This interview is adapted from an Aerospace Nation event held by AFA's Mitchell Institute for Aerospace Studies. It has been edited for length and clarity.

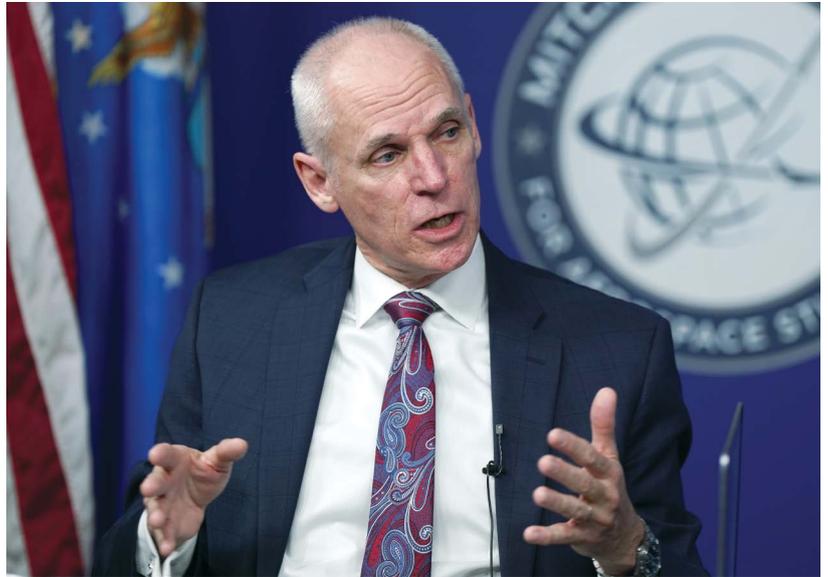
Q. Your organization looks to develop concepts for the future, yet, there are threats out there that we can't ignore today. How do you balance these two time horizons? Or are you specifically concerned with the future and you let the rest of your staff worry about today?

A. No one organization is doing all of the work. Between the national security strategy, the National Defense Strategy, the Joint Warfighting Concept—from which we derived the Air Force Future Operating Concept—the joint force, the Office of the Secretary of Defense, and Congress, we are very well aligned on where we think we need to go. That helps a lot. We spend a lot of time collaborating and communicating to ensure that the requirements piece that Air Force Futures is responsible for is aligned with the acquisition strategies to get after those capabilities and with the resourcing side of that defense acquisition enterprise [for] how we get from here today to tomorrow's force. I think there will always be conversations about balance. What's more important, the weapon or the platform? What's more important, the network or the platform or the weapon? You're going to have those vertical conversations. There's also at that temporal conversation on mitigating risk near term versus mitigating risk [longer] term.

Q. How do you engage to ensure that there are a balanced set of voices and that you are getting all the inputs you need in context?

A. We work with each of the majcoms ... It's all well and good to have great platforms—fighters and bombers and the weapons for them—but if I can't communicate between them, and do the command and control, I might as well not have them. ... I think we tend to focus when we talk future force design and future capabilities on the capability aspect of what we need, and there is also certainly a capacity aspect. [But] there are about four other parts of future force design, which we are chugging through: the organization that most efficiently and effectively gets us to that combat capability; there's posture, there's presentation, and then probably most important, there's Airman development. [It's all] part of the future force design.

Q. You mentioned capacity. We all know that the Air Force is the oldest and smallest in its history. How do we go about



Mike Tsukamoto/staff

Acting Deputy Chief of Staff for Air Force Futures Thomas Lawhead says his organization seeks to align “the voice of tomorrow's Airmen” to the future operating concepts and then define how to organize, train, and equip that future force.

regaining the capacity that we need to execute our national defense strategy?

A. Regaining of capacity is defining what capacity is needed. This week we're doing a sprint effort on stand-in and stand-out [requirements]. And where is there a knee in the curve of the ratio of our ability to stand outside the highly contested environment and shoot into it? How much do we need penetrating capabilities to go into that highly contested environment? And what weapons does that penetrating capability need? What sensor capabilities are needed inside the highly contested environment versus outside? And as we get to that balance, that [will] point to the capabilities we need and the capacity that we need. And then what's our path toward growth? That gives us the analytic rigor that allows us to go downstairs to OSD and the joint staff to fight for what we need in terms of platforms, weapons, and Airmen, as well as to the Hill to plead our case with Congress.

Q. So all that demands adequate resources. How is the Air Force doing at advocating for and gaining these resources?

A: I think we're doing great. And the reason we're doing great, relative to other services, is that we've got that analytic rigor behind what it is we need and why we need it, both in terms of capability and capacity. Do we have enough? We never have enough. But we are looking at how can we be more efficient and effective both in terms of organization and what is absolutely essential to tomorrow's warfighting capability. So from that perspective, we're doing okay. I think, as I gaze into my crystal ball of future resources, that bite will by necessity continue. We are aligned as a joint force and what we need. And every conversation we have, both with the Joint Staff, with the combatant commanders, with the major commands, and with

OSD points toward the joint force need for what the Air Force brings to the fight.

Q. How does the Air Force's future force design prioritize air base defense?

A: For Secretary Kendall, probably the one thing that keeps him up at night is base defense of our forces in a deployed environment. And I 100 percent agree with you that, yeah, we learned how to fight through those base attacks, but the scale and capability of the attacks that the force will see in the near- to long- to midterm future, are unimaginably worse than what we experienced during the Cold War. So the way we're attacking that capability need is really a triumvirate of base defense itself, logistics under attack, and agile combat employment. And those three—which all need to be orchestrated, and commanded and controlled together—are what's going to enable us to actually generate the combat sorties that we need.

We have put a good amount of money into repositioning and setting the theaters, not just in the Indo-Pacific, but also in the European theater. So that will enable agile combat employment and logistics under attack, and to generate the sorties. We're [also] having a lot of conversation with the Army about roles and responsibilities and who is going to protect our bases.

Those have been fairly fruitful. The Army was given a pretty good slug of money in the last budget to get after sector and regional air defense. We are currently working with the Army in an Integrated Air and Missile Defense Mix study. In addition, in a parallel effort, we're also working with the Army, NORAD, and NORTHCOM on an Air and Missile Defense of the Homeland analysis of alternatives. There's also the Defense of Guam study. So we are looking at this holistically at the best way to protect—not just the Air Force—but the joint deployed force [against the threats] we're going to face, which is unlike anything we have ever seen.

Q. Agile combat employment is an important element of the Air Force's strategy. Where does the Air Force stand in its attempts to make ACE a reality?

A: The way we will fight in the future is significantly different from the way we fought in the past from fixed bases. We're not going to have the luxury of a six-month Desert Shield, where we're able to build up forces and materiel in significant main operating bases, and then, at a time and place of our choosing, initiate conflict and win. Where we see the future, we will be fighting to get out of CONUS, fighting to get into theater, fighting to get sorties airborne, fighting to get into the area of operations, and then actually preventing—whether it's a cross-strait invasion or a Russian incursion—preventing and denying enemy objectives. And then maybe the most important, hardest, and biggest fight of all is sustaining that fight over time.

As you look at agile combat employment, the thought that we have and working with the combatant commands is a hub-and-spoke model, where as many spokes as I can operate out of complicates the enemy's targeting capability. And with the assumption that with mission command, we're able to continue to fight the fight out of those spokes. This is logistically hard to sustain. So we'll need to work our way through that. ACE is inextricable from logistics under attack and inextricable from base defense because it all has to happen. So where we see that coming to some fruition is the ability to get into shorter and shorter runways. As we get into runway-flexible, runway-independent capabilities, that starts to expand the number of spokes that we can do.

Q. Collaborative combat aircraft are among the Secretary of the Air Force's priorities, and that's clearly a move into the future. Where is that in your vision?

A. One of the critical needs that we have is to bring affordable mass to the battlespace, and we'll do that at first with collaborative combat aircraft in the air-to-air role initially and then we will seek to expand to other mission sets. We will hopefully get a 2024 budget sometime soon, because we've got a lot of money that we've put into it for CCA development, and we think it's a critical force multiplier and enabler of the joint force.

Q. How does your Futures work integrate space power capabilities and concepts into your vision?

A. To actually figure out what the joint force needs out of space, we're in a transition point from where space was a capability provider—think GPS and precision navigation and timing, think MILSATCOM—to where we are collaboratively seeking to use capabilities from space, particularly in the moving target indicator realm ... to hold targets in custody and hold them at risk at a time and place of our choosing.

Q. The Air Force finds itself pursuing multiple solution paths for the GMTI mission. How do you balance space-based GMTI versus what we expect to see with the E-7? Could you elaborate a little bit on how you balance these two different approaches?

A. First and foremost, the E-3 needs to be replaced, and it needs to be replaced as quickly as possible. We see the E-7 as a significant upgrade to the E-3's capabilities. In a perfect world, I would be able to go to a moving target indicator from space capability immediately, but that capability is still in development and won't be ready to field for some time. So we see the E-7 both as a gap filler, but more importantly, as a resilient piece that will remain part of the joint force for a long time to come. Even as we go to space for a lot of these capabilities, the ability [adversaries have] to target our assets in space show us that we can't throw all our coins into one hat. We need an organic capability when it's necessary, as well as a beyond-line-of-sight capability from space when able.

Q. When you look at the cost of CCAs, it looks like it's going to be roughly \$20 million. Are there platforms you're exploring, or perhaps already working on, that are cheaper than CCA? And are you working on things that might be more survivable in the Pacific, such as runway-independent platforms?

A. On our CCA effort, we'll have an Increment 1 and start up an experimental ops unit beginning next year that really paws into how do we go about operating our CCAs. Our Increment 2, which will be a follow on, will explore the trade space in terms of runway length required versus runway independence, and what that gets us from a payload and range capability standpoint. In terms of what's cheaper than CCAs? We will continue to fight to keep the cost of CCA and its mission equipment as low as possible. Obviously, once a CCA gets up toward the cost of an F-35, you might as well buy an F-35. So we will keep that cost down by using that trade space between what it needs to do, what we need it to do, and how elaborate it needs to be. The other side of that coin then is what are the other things we want uncrewed aircraft to do, whether that's coming out of palletized effects, whether it's being launched off of fighters, bombers, or whether it's special ops forces inserted into the battlespace. We will want sensors, we will want comm nodes, we will want nonkinetic effectors out in the battlespace. All of those could be potentially supplied by autonomous platforms. 



Students in the 312th Training Squadron extinguished a simulated kitchen fire at the Louis F. Garland Department of Defense Fire Academy on Goodfellow Air Force Base, Texas, in October. The Air Force has about 5,575 enlisted Fire Protection Airmen across the Total Force—and not a single officer. They must be ready to respond to everything from a small kitchen fire to an engine fire on a runway to wildfires threatening base operations.



A KC-46 Pegasus joins an F-16 Fighting Falcon from the U.S. Air Force's 80th Fighter Squadron soaring high over the Indo-Pacific in October during the first-ever trilateral exercise joining U.S., Japanese, and South Korean air forces. Bilateral exercises between the U.S. and Japan and the U.S. and South Korea have been staples of allied training for decades, but a single exercise involving all three had been impossible until now due to residual tensions stemming from Japan's occupation of Korea from 1910 to 1945.



Maintainers with the 18th Equipment Maintenance Squadron open a hatch in the radar dome of an E-3 Sentry AWACS from the 961st Airborne Air Control Squadron at Kadena Air Base, Japan. The Air Force retired 13 E-3s in 2023, paring its fleet to just 18 aircraft. Most of those are at Tinker Air Force Base, Okla., long the main hub for USAF E-3s, with the others at Kadena and Joint Base Elmendorf-Richardson, Alaska. In the years to come, the Air Force will acquire a new fleet of E-7 Wedgetails which will replace the distinctive E-3s with a newer, more capable aircraft.

FACES OF THE FORCE



Senior Master Sgt. Dan Heaton/ANG

Staff Sgt. James Watson, a member of the Michigan Air National Guard's 127th Logistics Readiness Squadron, appreciates the order and the organization of a warehouse. As a material management technician, his job—along with a small team of fellow Airmen—is to manage the inventory of parts, equipment, and gear that it takes to operate an air wing. "Everything is in its place. I appreciate the process," said Watson, who has about 11 years of combined Active-duty and Air National Guard service. "When I can see the task list, and I know where everything is, I know that I can succeed," he said.



Tech. Sgt. Lucas Weber

Chief Master Sgt. Suzane M. Buttery of the 911th Aeromedical Staging Squadron at Pittsburgh Air Reserve Station, was promoted during a ceremony Oct. 14. "I am devoted to my family, I am devoted to my country, and I am devoted to the men and women of the 911th ASTS," Buttery said. "I thank you so much for the honor and privilege of being able to serve you." Prior to her current position, Buttery was stationed at bases in Germany, Texas, Ohio, Washington, D.C., New York, and New Mexico. She also deployed in support of operations Enduring Freedom, Inherent Resolve, Freedom's Sentinel, and Allies Welcome.



USAF

Eglin Air Force Base, Fla., welcomed **Chief Master Sgt. Kelvin Hatcher** as the 33rd Fighter Wing command chief in June. An adviser to the wing commander, Hatcher is originally from Georgia and joined the Air Force in September 2000. "[W]hen I walked through the door, I saw the etched layout of the F-35 into the granite tile, and everything surrounding it. I look at how an organization presents itself, so what I saw was professionalism and pride," Hatcher said. "I want to continue to grow that across all of our formations so people know they belong to a professional organization, and they can be proud of it."



Senior Master Sgt. Dan Heaton/ANG

Airman 1st Class Chloe Morgan, a member of the 127th Medical Group at Selfridge Air National Guard Base, Mich., has her sights set on a medical career. A two-year member of the Air National Guard, she took a full-time position with the group as a health technician after her initial training as a pharmacy technician. "I joined initially for the education benefits," Morgan said. "When I started working in the career field, I realized how much I was learning being a part of the organization. And it's a good feeling too, knowing that I can play a role in helping others."



Courtesy photo

Four Air Commandos from the **27th Special Operations Security Forces Squadron** and the **27th Special Operations Civil Engineer Squadron** took first place at the Western Regional Esports Invitational Tournament at Hill Air Force Base, Utah, in September. In the first-ever Air Force base-versus-base Esports tournament, approximately 40 Airmen and Guardians competed to showcase their virtual gaming skills. Staff Sgt. Cameron Chaviers, 27th SOSFS quality control evaluator said, "It gets you out of your shell to talk to other individuals because in gaming there is no rank structure."



AFRL courtesy photo

A novel idea to revolutionize capability development through optimized digital engineering won the Air Force Materiel Command Spark Tank Integrated Capabilities challenge. **Douglas Szczublewski**, Next Gen Capabilities Lead and aerospace engineer, Aerospace Systems Directorate, Air Force Research Laboratory, presented his team's winning concept for Digital Effectiveness Based Design during the AFMC Senior Leader Conference Oct. 19. The concept will now go on to receive support and funding for implementation to combine air vehicle design and mission analysis into one digital ecosystem.

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



Tech. Sgt. Richard Mekki

Senior Airman Emily Sorrell, a security forces defender with the Vermont Air National Guard's 158th Fighter Wing, turned a knitting hobby into a rewarding business. It started when she was recovering from a tonsillectomy in high school and needed something to do. At a local craft store, she and her mother went through a variety of options before Sorrell decided to try her hand, literally, at fiber crafts. Today, her business, Red Mills Handmade Crochet, specializes in amigurumi, the Japanese art of knitting or crocheting small stuffed yarn creatures, gaining her thousands of social media followers.



Airman 1st Class Mason Hargrove

The 56th Fighter Wing welcomed **Isaac "Axe-Man" Salinas** from Make-A-Wish Arizona to become a pilot for a day Oct. 13 at Luke Air Force Base, Ariz. He received a guided tour of the 61st Fighter Squadron including an up-close F-35A Lightning II tour, and he even sat in the cockpit. Salinas also visited the air traffic control tower, enjoyed an F-16 Fighting Falcon training simulator immersion, and completed a tour of aircrew flight equipment, showcasing the technical aspects of a pilot's gear and safety equipment. He ended the day meeting Col. Keagan McLeese, 56th Fighter Wing deputy commander.



Courtesy photo

Space Force **Master Sgt. Gary Meiman**, Space Launch Delta 45 Intelligence flight chief, became part of Hurricane Idalia relief efforts in August. Meiman went to secure his family in Citrus County on Florida's central west coast as the storm approached. "We organized a small group that could get in there and assist people out of homes that were flooded," said Meiman, whose family has air boats that can access places where other vehicles can't go. "We were able to go in and get them out of their homes, and then move them back up to dry land or get them in touch with support agencies," he said.



Courtesy photo

While some have anxiety about Air Force fitness standards, Olympic hopeful **Airman 1st Class Daniel Michalski** thrives in this environment. A member of the Air Force's World Class Athlete Program, Michalski competes nationally and abroad in the 3,000-meter steeplechase, a track and field event consisting of 75 laps and 35 barrier hurdles, seven of which include a 12-by-12-foot water pit. Inspired by his disabled grandfather, "a kind, insightful and spiritual man," Michalski's ultimate goal is qualifying for the 2024 Olympics in Paris.



Vadim Savitsky/Russia Ministry of Defense

CLEAN SWEEP

"Xi's anti-corruption campaign in the PLA is nowhere near done. It's impossible to completely root out corruption in the PLA. They are a singular power structure within a monopolistic governance structure (CCP). Like the Corleone family, you can selectively remove actors whose corrupt practices become too large to ignore to 'kill the chicken to scare the monkey' and hope the message gets through. But the organized crime system stays intact."

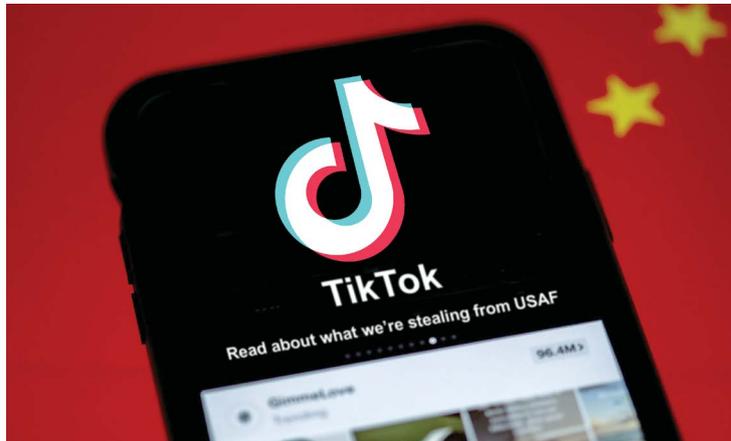
—**Lyle J. Morris**, Senior Fellow for Foreign Policy and National Security at the Asia Society Policy Institute's (ASPI) Center for China Analysis, on the quiet dismissal of China's Defense Minister Gen. Li Shangfu.

Airpower ... About Time

"What the F-16 does allows the Ukrainians to leverage multidomain operations in a way that they simply don't have the ability to do today."

—**Retired Lt. Gen. David A. Deptula**, dean of the Mitchell Institute for Aerospace Studies, on the beginning of F-16 training for Ukrainian pilots in the U.S. [Oct. 25].

Curated by China



Mike Tsukamoto/staff; Solenfeiyissa and Sayyid96/Pixabay

"The grabbing of data from TikTok isn't my biggest concern. It's the manipulation of our perceptions ... to shape our behavior. ... If your first reaction when you see something is an emotional one, you're being manipulated. Just realize, your social media feeds, especially on TikTok, are being curated by the PRC or those aligned to the PRC in ways that are pushing certain narratives and certain information and trying to foment dissent within our population as well as to push the narrative that's advantageous to the PRC."

Lt. Gen. Kevin B. Kennedy Jr., commander of the 16th Air Force, on information warfare, at the Mitchell Institute for Aerospace Studies [Nov. 13].



Courtesy photo

Driven to Distraction

"The [Asia-Pacific] region is concerned about the focus of the United States. We're involved in two wars, ... our presidential election next year, and whether this emphasis on the Indo-Pacific and [whether] an emphasis on cooperating with allies—building these coalitions—is really going to be sustained."

Bonnie Glaser, an Asia expert at the German Marshall Fund of the United States [Reuters, Nov. 13].

"Putin sees Hamas as a way to distract us and to weaken the coalition that we have built against him. His unwillingness to vote to condemn what Hamas did Oct. 7 ... is a sign that he prefers to see us distracted by this fight and to see Hamas as a sort of second front against us"

James O'Brien, assistant Secretary of State for European and Eurasian affairs [Nov. 8].

Career Change

"We're looking at things like dedicated career tracks focused on technical areas, where people who are specialists stay in their specialty through what is a good career track for them, as opposed to the traditional [paths]...up through the ... ranks to higher levels of responsibility and management. ... We do this with other fields. We do it with medicine, for example, right? But we're going to need that technical expertise. And in some of these fields, continuity is really important to us. So all of that is going to be considered and how we attract and retain people as part of that process as well"

—**Air Force Secretary Frank Kendall**, speaking on a Center for New American Security webcast, on some of the personnel changes coming in his "re-optimization" of the Air Force, set to be unveiled in January.

Israel-Hamas



Al Quassam Brigade via Mehr News Agency

"I think the longer this goes, the harder it can become. ... The faster you can get to a point where you stop the hostilities, [the sooner] you have less strife for the civilian population."

—**JCS Chairman Gen. Charles Q. Brown Jr.**, speaking about the conflict in Gaza [Nov. 9].



Staff Sgt. Stuart Bright

Gen. David Allvin became the Air Force's 23rd Chief of Staff Nov. 1. In his first message to the force, he emphasized that USAF's course had been well set by his three most recent predecessors who had already set the right plans in motion.

Message From the Chief

Course is Set, Allvin Tells Airmen: Now USAF Must Follow Through.

By Christopher Gordon

New Air Force Chief of Staff Gen. David W. Allvin's first message to Airmen praised his three most recent predecessors for modernizing the force, its strategies, and organization to the force, then challenged every Airman to help "follow through" to turn those changes and initiatives into airpower and capability.

On his first official Monday as USAF's 23rd Chief of Staff, Allvin spelled out his priorities Nov. 6, emphasizing the essential role the Air Force will play in future conflict. "The attributes of the changing character of war are ones well suited for our service," he wrote. "Speed, tempo, range, agility, flexibility, precise lethality, and resilience have been the hallmarks of airpower since our inception. The future holds ambiguity, but our task is clear: We must now follow through."

Allvin was Vice Chief for the past two years and had been acting as Chief since his predecessor, Gen. Charles Q. Brown Jr., became JCS Chairman Oct. 1. A week later, the Oct. 7 attack by Hamas on Israel triggered a regional war. With Russia and Ukraine still locked in a brutal fight in Europe and a new Middle East conflict bubbling in the Middle East, military leaders are worried China or North Korea could try to take

advantage of the moment while the U.S. is distracted in those other regions.

The 2022 National Defense Strategy identifies China as the pacing threat due to its aggressive military buildup, the scale of its economy, and its great technical prowess, while noting the challenges posed by Russia, Iran, North Korea, and radical extremism. But each of these threats has a connection to the region. Iran is the instigator behind Hamas in Gaza, Hezbollah in Lebanon, and the Houthi rebels in Yemen, all of whom have launched attacks since Oct. 7, including a Nov. 9 shoot-down of a USAF MQ-9 Reaper drone by the Houthis. The Pentagon is grappling with the possibility that multiple conflicts could break out simultaneously in different parts of the globe.

Allvin, a former test pilot with more than 4,600 flight hours in more than 30 aircraft—including 800 flight test hours and 100 combat hours—is familiar with those challenges, having held key roles in Europe, Afghanistan, and the Pentagon on both the Air Staff and Joint Staff. He helped write "America's Air Force: A Call to the Future" in 2014 and the "Air Force Future Operating Concept" in 2015, documents that laid the groundwork for what was initially termed "multidomain operations" and later evolved to become combined joint all-domain command and control (CJADC2).

As Vice Chief, Allvin was a member of the Joint Requirements Oversight Council, and he now finds several of his former colleagues on that panel as fellow members of the Joint Chiefs. He also played a lead role in tackling recruiting and retention as the senior member of Brown's Barriers to Service Cross-Functional Team, which worked to eliminate processes and rules that were keeping otherwise-qualified civilians from joining the force.

"We have formidable challenges ahead," Allvin wrote. "Many of the solutions to these challenges are not a mystery" and the Air Force has been working to address those challenges "for some time."

The answer is not a handful of new initiatives, but rather follow-through in delivering new capability. Repeating "follow through" seven times, he admonished Airmen to follow through on:

- "Airmen and their families expect and deserve changes worthy of their commitment and sacrifice, and suited to fulfill the oaths we take on service of this Nation."

- Transforming "the products of our Operational Imperatives into actual meaningful operational capability. This requires thoughtful consideration and integration, with the ultimate aim of maximizing combat effectiveness."

- Ensuring "our force presentation and force generation models are aligned to the way we intend to fight as articulated in our current Air Force Future Operating Concept. This means adapting many of our current paradigms for units of action, and orienting toward team preparation for deployment to be combat effective more rapidly."

- Defining and refining "the force design that provides the optimum size, shape, and composition of our force. This entails not only incorporation of currently unfielded classes of capabilities" such as collaborative combat aircraft and "also new competencies and skill sets for which we must organize and train future Airmen."

- Adapting "our organizational structure to optimize for great power competition. This entails applying 'integrated by design' to capability development. This organizational design should focus on ensuring designated commanders can focus on training, readiness, and warfighting—with both the requisite authority and accountability. Meanwhile, other commanders will focus on supporting capability development and sustainment. However, all will be oriented on providing well trained, equipped, and ready forces for deterrence and conflict."

- Transforming and modernizing training, which will require "continued focus on learner-centric training and education to optimize individual human performance. We have demonstrated new ways to leverage technology to not only improve information absorption and application for specific skill sets, but also ways to tailor training to individual Airmen and enable them to learn and apply skills more rapidly and effectively throughout their years of service."

- Harnessing "the innovative talent and spirit that exists in every corner of our Air Force by vectoring that energy toward solving our key Air Force challenges. We must continue to connect and empower the innovation ecosystem so the brilliance of individuals can better serve the entire Air Force team."

- Ensuring "our commitment to the success of the team. This includes demanding and protecting an environment in which all Airmen can reach their full potential. It means uplifting our wingmen, while holding ourselves accountable for our actions. It means removing barriers while maintaining and enforcing standards. It means all-axis leadership—top-down, peer-to-peer, and even 'leading up.'"

Allvin's nomination had been among hundreds held up in the Senate by Sen. Tommy Tuberville (R-Ala.), who has blocked general officer promotions over concerns about DOD funding travel for troops and family members seeking abortions or other reproductive health services unavailable in their duty locations.

After making no inroads with Tuberville, despite his drawing increasing ire—and in some cases outright vitriol—of fellow Republicans, Senate Majority Leader Chuck Schumer (D-N.Y.) called individual roll-call votes for the leaders of the military services.

Despite the Senate's political gridlock, the upper chamber had little objection to Allvin himself, swiftly confirming him in a 95-1 vote on Nov. 2 once his nomination reached the floor. Allvin was sworn in soon after the vote by Air Force Secretary Frank Kendall at Falcon Stadium at the Air Force Academy, his alma mater. Allvin took his oath for perhaps the last time at the same location where he graduated 37 years before. Both men were attending Corona, a conference of senior Air Force leaders that Kendall and now Allvin lead.

"We know each of us is serving in a place of importance in this great Air Force, and in a time of extraordinary consequence," Allvin concluded. "I can think of no cause more honorable than this, and I could not be more proud to serve as your Chief of Staff. We know the challenges. ... Let's follow through and meet them head on!"

Allvin is only the second Chief to have been neither a fighter nor bomber pilot; the other was Gen. Norton A. Schwartz, CSAF No. 19, who spent much of his career in the Special Operations world. Allvin has extensive operational and staff background and has commanded at the squadron, wing, and operations center levels. He spent much of the past decade in the Pentagon either on the Air Staff or Joint Staff.

"In today's dynamic environment, our service faces both significant challenges and tremendous opportunities—the world's greatest Air Force will meet them head-on just as innovative Airmen have done for generations," Allvin said in a statement. "My wife, Gina, and I are humbled by this opportunity, and we are eager to continue to serve our Air Force, our Airmen, and their families."

As an Air Staff leader, Allvin was a visionary who helped to craft the joint force operating concepts advanced by three successive Chiefs: Gen. Mark Welsh, No. 20; Gen. David Goldfein, No. 21; and Brown, No. 22.

Under Senate rules, senators may place such holds on individuals or groups. The Senate can force votes on individual nominees, but Senate Democrats, who hold the majority, declined to do so for months, arguing that giving in to Tuberville would set a dangerous precedent. The number of general officer nominations affected has grown steadily and now numbers more than 400.

In September, Tuberville tried to force an individual vote on Gen. Eric Smith to be the next Commandant of the Marine Corps in an unusual procedural motion. Schumer responded by calling up the nominations for Brown, Smith, and Gen. Randy George, to be the next Chief of Staff of the Army, for individual votes.

A similar process unfolded in late October, as Sen. Dan Sullivan (R-Alaska) sought votes on Allvin and Adm. Lisa Franchetti, nominated to be the next Chief of Naval Operations.

The moves gained added urgency after Smith, having been confirmed as Commandant but still without a No. 2, suffered a medical emergency and was hospitalized Oct. 30. That left the Marine Corps with a three-star acting leader. Along with Allvin, the Senate confirmed another service head in Franchetti, also

in a 95-1 vote, and Lt. Gen. Christopher Mahoney as Assistant Commandant of the Marine Corps, who will temporarily head the USMC in Smith's absence as the service's newest four-star general.

"They are outstanding leaders who have faithfully served their country for decades, and I know they will continue to be great leaders of our force as they continue to tackle the crucial national security issues of these challenging times," said Secretary of Defense Lloyd J. Austin III.

OTHERS ALSO JOINED IN THE PRAISE

"The long wait for General Allvin to be confirmed is thankfully over, and now the Air Force can get on with its important modernization and readiness initiatives," said Bernie Skoch, Chair of the Air & Space Forces Association. "General Allvin is

a gifted senior leader whose operational, staff, and test experience make him ideally suited to build on the outstanding work of his predecessor. The unprecedented global threats facing our military today pose challenges for which airpower is, in many cases, the only answer and most effective deterrent. His leadership will be crucial in the years ahead."

With Allvin's confirmation, however, the Air Force now has no Vice Chief of Staff. Deputy Chief of Staff for Operations Lt. Gen. James C. "Jim" Slife has been nominated to succeed Allvin as Vice Chief, but his nomination is among those on hold. An Air Force spokesperson confirmed to Air & Space Forces Magazine that there will be no acting VCSAF; Allvin, like Smith, will serve functionally as both Chief and Vice Chief until Slife can be confirmed. ★

MODERNIZATION

#BREAKING

B-21 RAIDER FIRST FLIGHT #RAIDER33 #B21Raider 11-10-23

Images of the first flight of the B-21 Raider posted by aviation photographer Matt Hartman on X, the platform formerly known as Twitter, offered the first glimpses of the new bomber in flight showing off a variety of previously unseen characteristics.



Matt Hartman @ShorealoneFilms via X

1st Flight of the B-21 Raider

By John A. Tirpak

The first B-21 Raider bomber took off from Air Force Plant 42 in Palmdale, Calif., just after dawn on Nov. 10, en route to Edwards Air Force Base, Calif. That first 90-minute flight, decades in the making, paves the way for months of testing.

Plane spotters filmed the aircraft from near Plant 42, heading eastbound with an F-16 chase plane after climbing to about 500 feet. The landing gear had yet to be retracted in video and photos that appeared on social media, and a lengthy cable appeared to be trailing from the upper surface of the tail on the port side, near the exhausts.

An Air Force spokesperson confirmed the plane took off

at approximately 7 a.m. local time and landed safely at Edwards about 8:30 a.m., fulfilling promises by manufacturer Northrop Grumman and the Air Force that the new stealth bomber would fly before the end of 2023.

The duration of the flight suggests that pilots did more than a ferry hop to Edwards and that they likely conducted tests to evaluate flying qualities. Flight-tracking websites indicated a roundabout pattern between Palmdale and Edwards. The flight was not announced beforehand.

"As confirmed by the U.S. Air Force, the B-21 Raider is in flight-test," a Northrop Grumman spokesperson said. "The robust flight test campaign is being executed by a Combined Test Force comprised of Northrop Grumman and Air Force personnel that will validate our digital models and moves

us another step closer to reaching operational capability."

An Air Force spokesperson said flight-testing "is a critical first step in the test campaign managed by the Air Force Test Center and 412th Test Wing's B-21 Combined Test Force to provide survivable, long-range penetrating strike capabilities to deter aggression and strategic attacks against the United States, allies, and partners."

The first operational B-21s will be based at Ellsworth Air Force Base, S.D. Maintenance will be managed at Tinker Air Force Base, Okla.

Six test aircraft are being produced now, all on the same production line, using the tools, processes, and technicians that will be used for production aircraft.

The Air Force has previously said that B-21 test aircraft will be "usable assets" as soon as they are airworthy, and that the test aircraft will be converted to the operational configuration after developmental and operational testing is complete.

The contract for the B-21, originally called the Long-Range Strike Bomber, was awarded in 2015, and the aircraft is expected to cost around \$700 million each in current dollars.

The B-21 was officially named the "Raider" in 2016, to honor the Doolittle Raiders of World War II that carried out the first airstrikes against Japan.

Northrop Grumman President and Chief Executive Officer Kathy Warden has acknowledged that, due to the fixed-price nature of the program, inflation, and labor costs in recent years, the company will earn "zero" profit on the initial production contract. However, the company has said it expects to receive a \$60 million adjustment from the Air Force to mitigate those additional expenses.

NEW FEATURES EMERGE

Plane spotter photos taken during runway taxi tests show vertical features that left many industry observers curious. A photo posted on Reddit by user "Folding_White Table" showed two vertical armatures rise from just above the wing root of the blended wing body on both the port and starboard sides, just above where the engine core or cores are likely placed. It's unclear from the photo whether they are symmetrically positioned on the aircraft.

Based on previous photos, the vertical features seem to be retractable.

At least one of the armatures was visible in an earlier, first view of the B-21's aft deck, which circulated online in October. However, the angle of that photo made it hard to determine

whether it was part of the aircraft or a background object.

In a Reddit post, u/Folding_White Table said the photos were taken from the intersection of 40th Avenue East and Avenue N in Palmdale, right at the fence line of Northrop Grumman's end of Air Force Plant 42. The photographer said the spot offers a "perfect view of runway 25/7, 22/4 and Site 4," on the closest public road to Northrop's facilities.

Some industry experts speaking on background, given the sensitive nature of the B-21, suggested the vertical armatures could be coverings for auxiliary air intakes in the open position, and may be extended to allow more air into the engines for ground operations. But others disputed that theory, suggesting the armatures may be too far back and too slender to serve that purpose efficiently. One also noted that the armatures are "unusually tall" for such a purpose and so thin that the opening they putatively cover might not be big enough to supply the necessary air.

The verticals also appear to be triangular and pylon-shaped, rather than flat. But experts discounted the idea that the verticals could be antennas or sensors, as they would ruin the B-21's stealthy shape if extended during an operational mission, and not positioned correctly for them to be fuel vents, which are typically positioned at the aircraft's tail.

One possibility: The features are there simply to disrupt a ground-based sensor from learning too much about the B-21's radar cross-section. The stealthy F-117 and F-35 both have a removable, faceted device that makes them more visible to air traffic controllers and increases their radar cross-section, but that can be removed for combat operations.

On the B-2, which was manifestly the design basis for the B-21, the auxiliary air intakes are set just above and aft of the intake and give the appearance of four curved paddles, with two above each intake.

The B-21's vertical armatures are also near—but outboard of—an unexplained dark feature on the surface of the aircraft on both sides of the central hump or spine. This feature is also visible in the forward-quarter of an image of the aircraft released by the Air Force. It is inboard of the engine inlets in that image—not in line with them—on the side of the spine.

One expert suggested the dark feature is a mechanism to disperse the large quantity of heat likely generated by the B-21's avionics; another speculated that it could be a bleed air vent necessitated by the B-21's serpentine inlets—the air tunnels that conceal the engine fan blades. ★

Tests Finally Begin for T-7A Red Hawk

By David Roza

The first T-7A Red Hawk landed at Edwards Air Force Base, Calif., on Nov. 8, marking the start of developmental flight tests for the two-seat jet. The T-7A is the planned replacement for the T-38 trainer for fighter and bomber pilots.

Designated APT 2, the Boeing jet was the first production representative T-7 to be built, and the same aircraft that Maj. Bryce Turner flew on June 28, in the first official test flight by an Air Force pilot. A joint Boeing and Air Force crew flew the jet from the Boeing facilities at St. Louis to Vance Air Force Base, Okla., Kirtland Air Force Base, N.M., and Luke Air Force Base, Ariz., before finally arriving at Edwards.

"This arrival marks an exciting transition into the next

phase of developmental flight," said Maj. Jonathan "Gremlin" Aronoff, T-7A test pilot, in an Air Force release. "The T-7A gives immense capability updates that will allow the Air Force to train the next generation of combat aviators. Success of first delivery is truly a testament to the joint USAF-industry team we have in place."

The aircraft was piloted by Aronoff and Boeing test pilot Steve "Bull" Schmidt.

The goal of developmental flight testing is to evaluate changes made earlier in the development process and determine how and whether to refine the aircraft further. Boeing and Air Force officials told reporters in September that another T-7 designated APT 1 will join APT 2 at Edwards while APT 3 will undergo weather testing at the McKinley

Climatic Laboratory at Eglin Air Force Base, Fla., before being used as a mission systems testing platform. APT 4 and 5 are due later this year.

According to the press release, test pilots have been rehearsing missions in a simulator and will now start flying up to three times a day as they try expanding APT-2's flight envelope—the maximum altitude and airspeed in certain conditions—before testing mission systems.

The Air Force needs the T-7 to replace the 1960s-era T-38 fleet, which is increasingly difficult to maintain. The Red Hawk was originally due to reach initial operational capacity in 2024, but has been held up by problems with flight stability, flight control software, and its ejection seats.

The Air Force has been cagey about other uses for the Red Hawk, which could also be adapted to become a light fighter once properly equipped. ★



Patrick Young/USAF

The first T-7A Red Hawk, piloted by USAF test pilot Maj. Jonathan "Gremlin" Aronoff and Boeing test pilot Steve "Bull" Schmidt, soars over Edwards Air Force Base, Calif., Nov. 8.

NORAD Puts C2 in the Cloud

By Chris Gordon

The U.S. is modernizing its air defenses with a new Cloud-Based Command and Control (CBC2) system that came online last month.

The Eastern Air Defense Sector, one of NORAD's regional commands, reported its initial operating capability of CBC2 uses of artificial intelligence to help personnel monitor more information more simply.

"Instead of an air battle manager having to consult different screens or systems for different sensor inputs or data, CBC2 brings together those inputs," a North American Aerospace Defense Command official explained to Air & Space Forces Magazine. "The effect is a more streamlined connection between sensors, systems, and decision-makers."

The advance marks a "pivotal milestone in the service's modernization of tactical command and control capabilities," NORAD said.

The new system is part of the Air Force's push toward greater connectivity as part of the Advanced Battle Management System (ABMS). The Air Force plans to expand CBC2 to the Pacific and other locations, using a model known as agile development, security, and operations (DevSecOps)—software that will continually receive updates.

NORAD and U.S. Northern Command, which is responsible for the defense of North America, are the first to receive the capability. Starting with EADS, which covers the eastern United States, is a priority because the region includes Washington, D.C.

"We didn't do an overall CBC2 contract and hand it off to somebody that kind of did all the typical integration kinds of things," Brig. Gen. Luke C.G. Cropsey, who is in charge of the Department of the Air Force's ambitious ABMS efforts, said at AFA's Air, Space & Cyber Conference in September. "We actually went directly to the experts in their respective layer of



Patrick Young/USAF

"Advancing our command and control capabilities is instrumental in achieving the department's Second Operational Imperative—achieving operationally optimized Advanced Battle Management Systems," said Air Force Secretary Frank Kendall.

the stack, and we said, 'Hey, who's the best at 'fill in the blank,' and we went and we got them on contract."

CBC2 will aggregate and integrate military and commercial air defense data sources into one common picture to support homeland defense, the service says.

EADS headquarters is located at Griffiss Business and Technology Park in Rome, N.Y., and is largely staffed by the Air National Guard. Despite its nondescript location, the rollout was attended by senior military officials, including Secretary of the Air Force Frank Kendall, Cropsey, and high-level representatives from the Royal Canadian Air Force, the Office of the Secretary of Defense, and USAF Lt. Gen. Dagvin R.M. Anderson the Joint Staff Director for Force Development (J7).

"Advancing our command and control capabilities is instrumental in achieving the department's Second Operational imperative—achieving operationally optimized Advanced

Battle Management Systems—while maintaining technological superiority in a rapidly evolving threat landscape,” Kendall said in remarks at the ceremony.

CBC2 is a multinational effort. “CBC2 incorporates a large number of tactically relevant data feeds as well as artificial intelligence and machine learning to assist decision makers with maintaining detailed situational awareness of the battlespace,” EADS said in its news release. “The platform uses this data to develop courses of action from which leaders can make higher quality and faster decisions that improve operational outcomes.”

Next to get CBC2 will be the Canadian Air Defense Sector

(CADS), which is expected to field the new technology by mid-2024. NORAD expects to roll out CBC2 to the air defense sectors in Alaska, Hawaii, and Washington throughout 2024.

“NORAD will apply CBC2 in our air defense sectors to modernize air battle management software interfaces,” the official from the command said.

CBC2 is expected to be upgraded to fit in with hardware updates as they are fielded, such as NORAD’s planned new over-the-horizon radar, the NORAD official said.

“We’re deploying capability starting now,” Cropsey said in September. “It will obviously continue to happen in the future. But this isn’t something that’s five years away. This is today.” ✨



Senior Airman Olivia Gibson

U.S. Air Force F-15Es attacked Iran-backed militias in retaliation for strikes on U.S. forces in the region. Attacks by Iranian proxies have increased since Israel declared war against Hamas.

OPERATIONS

USAF Hits Back in Mid-East

By Chris Gordon

When the U.S. launched airstrikes in eastern Syria on Nov. 12, it was the third bombing raid against Iranian-linked targets there in less than three weeks. Iranian-backed militias have increased their attacks on U.S. forces, systems, and facilities since Israel invaded Gaza following the Oct. 7 Hamas attacks on Israeli civilians.

U.S. counterstrikes are intended to deter further attacks, but militias and rebel groups in Syria, Iraq, Yemen, and Lebanon continue to instigate. The U.S. counterstrikes sought to destroy a training facility in Abu Kamal and safe house in Mayadin used by Iran’s Islamic Revolutionary Guard Corps (IRGC) and Iranian-backed militias.

“The President has no higher priority than the safety of U.S. personnel, and he directed today’s action to make clear that the United States will defend itself, its personnel, and its interests,” said Defense Secretary Lloyd Austin III in a statement.

U.S. Mission Support Site Green Village, and Mission Support Site Euphrates, both in Syria, were each attacked Nov. 8, as was Al Asad Air Base in Iraq. Separately, a one-way enemy drone was shot down on the morning of Nov. 10 before reaching its target at Al Tanf Garrison, Syria, a U.S. military official said. Three U.S. service members were injured in the attack on Green Village outpost in eastern Syria, though they have since returned to duty, a military official said.

In response, two F-15Es struck an Iranian supported weapons storage facility at Maysulun, Syria. Multiple secondary explosions sent debris high into the air amid large plumes of smoke.

“If the attacks against our forces don’t decrease or stop, we will take additional measures,” Austin said Nov. 9. “We’re going to do everything we can to protect our troops, and we are absolutely serious about that.”

Few experts expect Iran to comply. More than 50 attacks since Oct. 17 have produced more than 56 injuries, according to the Pentagon, most of them traumatic brain injuries (TBI). “Thankfully, none of our troops have been injured seriously,” Deputy Pentagon Press Secretary Sabrina Singh told reporters Nov. 9.

That same day, Houthi rebels in Yemen shot down an Air Force MQ-9 over the Red Sea. It was the third MQ-9 shot down by the Houthis in the past six years.

WHEN IS AN ATTACK ... AN ATTACK?

As attacks mount, so do discrepancies between official and unofficial counts. Pentagon Press Secretary Air Force Brig. Gen. Patrick S. Ryder acknowledged the difficulty and said the issue amounts to definitions. “It’s going to be an art, not a science, depending on a situation,” he said.

The Pentagon measures only those attacks in which U.S. personnel were “threatened.” The Pentagon, U.S. Central Command, and Joint Task Force Operation Inherent Resolve, which is charged with helping partner forces in Iraq and Syria fight against ISIS, are all involved in the calculus, according to U.S. officials.

But U.S. figures and those maintained by outside experts differ. Claims by militias can also muddy the waters. Both suggest the number of attacks may be greater than the Pentagon is acknowledging. The Islamic Resistance in Iraq, an umbrella title for multiple militias, claims it has carried out almost 60 attacks.

“Official claims of responsibility from the Islamic Resistance

in Iraq are—in my experience—reliable indicators that an attack was launched,” said Charles Lister of the Middle East Institute.

Lister added that a likely explanation for the lower U.S. government number is due to attacks that land farther afield from the U.S. forces.

What is not in dispute is that the threats against U.S. forces have grown dramatically. Before Hamas’ Oct. 7 attack on Israel and the Israeli military’s forceful response that followed, U.S. forces in Iraq and Syria had been attacked about 80 times by Iranian-aligned militias since the start of the Biden administration. Not one of those took place in Iraq for at least the past year. Now, however, the militias are making repeated attacks in Iraq and have executed scores of strikes overall.

Some of those have been close calls. The Wall Street Journal reported that one drone landed on top of a barracks in Iraq but failed to explode. At Al Asad, a hangar was destroyed and, with it, a small aircraft inside, according to a U.S. military official.

Complicating the tallying of attacks is the possibility that some attacks may not have been intended for U.S. targets, but rather for the Syrian Democratic Forces (SDF), a U.S. partner in the fight against Islamic State militants, according to an analysis from the Washington Institute for Near East Policy.

Militia estimates may be inflated, as well. Whether the groups are merely trying to harass U.S. forces or are attempting to inflict serious casualties can be a complex undertaking. Michael Knights of the Washington Institute notes that even “performative attacks” can be dangerous because some militias’ rockets are inaccurate and could pose a threat to U.S. forces even if the group intends to miss.

“For me, it’s about intent,” said Knights. “It’s about the fact that they’re risking hitting and killing our troops.” 

Ukrainians Begin F-16 Training in US

By Chris Gordon

A “small number” of Ukrainian pilots began training with the 162nd Wing of the Arizona Air National Guard in October in “F-16 fundamentals,” according to a service spokesperson.

“The training curriculum will align with the foundational knowledge and skills of each pilot and is expected to last several months,” a U.S. Air Force spokesperson said in a statement provided to Air & Space Forces Magazine.

The 162nd Wing trains pilots at Morris Air National Guard Base, at Tucson International Airport. It is the only unit in the U.S. Air Force tasked with training foreign pilots on F-16s as part of its day-to-day mission. The wing has trained pilots from over two dozen countries in how to operate the F-16.

“They’re very intimately familiar on how we do training of foreign military pilots,” Lt. Gen. Michael A. Loh, the director of the Air National Guard, said in September.

A typical F-16 training course takes around six months. However, U.S. officials have indicated Ukrainian pilots are unlikely to follow a standard model as the course will be suited to Ukraine’s need to protect its skies from Russian aircraft, drones, and missiles. European nations are also training Ukrainian pilots in how to operate the F-16.

Training of F-16 pilots typically includes significant classroom and simulator time in addition to training in the air. Foreign F-16 pilots also have to undergo English language

training, which Ukrainians began recently at Joint Base San Antonio-Lackland Air Force Base, Texas.

“For Ukraine, it is going to be tailored for exactly what they need to do, which is multirole, both air-to-air and air-to-ground,” Loh said. “We will train them to do the full multirole spectrum of what we can expect in their theory of conflict.”

Ukrainian pilots are not expected to start flying F-16s in combat until 2024. European nations have pledged to provide Ukraine with used F-16s. The U.S. has committed to training some pilots and maintainers to supplement the coalition of countries working to provide Ukraine with F-16s.

Gen. James B. Hecker, commander of U.S. Air Forces in Europe, said in an interview in September that “up to about 10 pilots” would be trained by the U.S. The Pentagon has said the U.S. will also train “dozens” of maintainers, though the U.S. has not revealed whether that training has begun.

“One of the reasons why the F-16 is such a good match for the Ukrainian Air Force is because of the multiple roles that it can conduct,” said retired Lt. Gen. David A. Deptula, a former fighter pilot and dean of the Mitchell Institute for Aerospace Studies. “It can perform air-to-air combat, which is a role that is critical in providing air defense for the cities and military areas that require protection from Russian attack in Ukraine.”

The F-16 can also be used to employ air-to-surface weapons and to suppress enemy air defenses. Such capabilities would enhance Ukraine’s ability to retake its territory by providing

capabilities that ground forces alone cannot, Deptula said. “What the F-16 does allows the Ukrainians to leverage multi-domain operations in a way that they simply don’t have the ability to do today,” he added.

Though the U.S. has not pledged to provide any American-owned F-16s, transferring the stalwart multirole fighter—around 3,000 of which are in service around the world—

requires approval by the American government to be given to Ukraine, which the Biden administration signaled it would sign off on in the summer.

The training by the 162nd Wing “follows President [Joe] Biden and Secretary [Lloyd] Austin’s decision to train Ukrainian pilots on F-16s as part of the United States’ contribution to Ukraine,” the Air Force spokesperson said. 

SPACE

USSF Plans 21 Launches in FY24

Fiscal 2024 Launches

Launch Vendor	Program	Mission
United Launch Alliance	SDA T2TL-B	One of the Tranche 2 Transport Layer launches for the Space Development Agency (SDA)
	NROL-73, -56, -100, -109	Reconnaissance and intelligence missions conducted in partnership with the National Reconnaissance Office (NRO)
	STP-5	Supports SSC’s Space Test Program
	SILENTBARKER 2/NROL-118	Joint NRO and SSC space domain awareness mission
	USSF-57	Next Generation Overhead Persistent Infrared GEO (NGG) satellites for survivable missile warning, tracking, and defense
	USSF-25	Defense Advanced Research Projects Agency’s (DARPA) DRACO to demonstrate a nuclear thermal rocket in orbit.
	USSF-95	Missile Track Custody (MTC) prototype satellite to evaluate future requirements
SpaceX	GPS III-9	Part of GPS modernization
	SDA T1TL-F, SDA T1TR-A, SDA T1TR-E	Tranche 1 of SDA’s planned Transport Layer for global military data connectivity
	SDA T2TL-A, SDA T2TL-C	First three Tranche 2 satellites in SDA’s Transport Layer
	USSF-75, USSF-70	Undisclosed Space Force missions
	NROL-77	A reconnaissance and intelligence mission in partnership with NRO
	GPS III F-1	First launch in GPS III Follow-on program
	GPS III-10	GPS Modernization

By Unshin Lee Harpley

The Space Force aims to boost its National Security Space Launch (NSSL) program from 12 launches in fiscal 2023 to 21 missions in 2024, with United Launch Alliance (ULA) responsible for 11 missions and SpaceX handling 10.

Nailing down all the contracting will come in phases, however, as the 2024 budget has yet to pass Congress and be signed into law. Fiscal 2024 began on Oct. 1, but the government is operating under a continuing resolution as lawmakers wrangle over differences.

“The government is only ordering eight missions now, due to continuing resolution,” said Col. Doug Pentecost, deputy program executive officer for Space Systems Command’s Assured Access to Space (SSC/AATS).

If the full program is executed, the launches and associated activities will pay \$1.3 billion to ULA and \$1.2 billion to SpaceX, Pentecost said.

Pentecost said the Space Force initially planned more ULA launches, but after evaluating readiness, production capacity,

and the ability to meet demands, the split was adjusted. Over the entire 48 planned launches in the National Security Space Launch Phase 2 plan, ULA is now expected to be responsible for 26 launch assignments versus 22 for SpaceX. In all, Phase 2 will be substantially larger than the original estimate of 34 launches.

The 48 planned launches, to be executed within the next two to three years, encompass missions ranging from GPS to missile warning and space research and reconnaissance, according to SSC’s announcement.

ULA and SpaceX secured their contracts for Phase 2 in August 2020, outperforming competitors including Northrop Grumman and Blue Origin. After this fifth and final Phase 2 award, the launch program will again be open to competition for Phase 3, which will cover the period from 2025 to 2034. That program is to be split into two segments, or “lanes.”

In Lane 1, SSC will award multiple indefinite delivery/indefinite quantity contracts. These five-year, renewable agreements are intended to increase the Space Force’s launch options and, through competition, to drive down costs. In Lane 2, USSF will award two contractors launch agreements to manage launches into all orbits with comprehensive mission-specific services. 



U.S. Space Force Lt. Gen. Stephen Whiting, Space Operations Command commander, right, receives a NATO Space Centre mission brief from Lt. Col. John Patrick, Director of the NATO Space Centre, left, at the NATO Allied Air Command at Ramstein Air Base, Germany, in September.

Staff Sgt. Emmeline James

Space Force Readies Europe-Africa Unit

By Chris Gordon

The U.S. Space Force will officially activate its component for Europe and Africa in just over a month, U.S. European Command said Oct. 31.

U.S. Space Forces Europe and Africa, which will be dubbed SPACE-EURAF, will stand up Dec. 8, U.S. European Command (EUCOM) said in a news release. It will become the fourth Space Force component embedded in one of the U.S. military's regional commands, joining U.S. Central Command, U.S. Indo-Pacific Command, and U.S. Forces Korea.

As things stand now, America's space capabilities in Europe are nestled under the air component, U.S. Air Forces in Europe-Air Forces Africa (USAFE-AFAFRICA). That model dates back to before the Space Force became an independent service.

Giving the Space Force its own components elevates the service to put it on par with other branches and allows the USSF to better provide space capabilities to combatant commanders, service officials say.

"The activation of Space Forces Europe and Africa is a significant milestone in the journey to fortify joint space capabilities within Europe and Africa," EUCOM said in a statement.

SPACE-EURAF "will support a wide range of missions, including deterring potential adversaries, responding to crises, and strengthening our alliances and partnerships," EUCOM added in its release. Many nations in Europe already have a long history of civilian space operations and have put a focus on building up their military space capabilities.

Space Force Col. Max Lantz, who already heads up the space portfolio in USAFE-AFAFRICA, will become SPACE-EURAF's inaugural commander. Both U.S. European Command and U.S. Africa Command are in Germany, and SPACE-EURAF will not solely focus on Europe.

"In the case of Europe, we're just taking advantage of the fact that USAFE is also the Africa Command support," Chief of Space Operations Gen. B. Chance Saltzman explained at AFA's Air, Space & Cyber Conference in September. "Because it's all done from the same location, it's easy for us to leverage that same construct and really get a two-for-one, to some degree."

Despite the immediate concern surrounding the Middle East in the wake of the Israel-Hamas conflict and attacks on U.S. troops by Iranian proxy groups, the U.S. military's long-term focus is on the Pacific and Europe. The Space Force set up its Indo-Pacific component last year as its first step toward creating geographic commands.

Plans to establish a European component for the Space Force were announced around the same time in November 2022. Throughout 2023, senior U.S. military space leaders traveled to Europe to strengthen military space alliances—not an easy task for an often highly classified domain that conventional wisdom held was a safe harbor from military action until a few years ago.

Formally establishing the component, however, took time. "When you have to work with host nations, there's an extra few steps," Saltzman said. "So just going through all those normal coordination processes just took a little bit longer."

The Space Force is looking forward to having a more vocal role in key decisions in combatant commands in the future, service officials say.

"That detailed integration is much harder to do when you're thousands of miles separate," Saltzman said. "What these components require is pretty senior people that understand the business."

After SPACE-EURAF is established, the Space Force will likely consider other components for combatant commands. Top possibilities include U.S. Cyber Command, U.S. Special Operations Command, and U.S. Forces Japan. 

Frank Borman, Apollo 8 Commander and USAF Pilot, Dies at 95

By John A. Tirpak

Frank Borman, Air Force fighter and test pilot, the American astronaut who commanded Gemini 7 and Apollo 8, and later head of Eastern Air Lines, died Nov. 7. He was 95.

The Apollo 8 mission, in December 1968, the first manned mission for the Saturn V rocket, marked the first time human beings traveled to and orbited the moon. The successful flight paved the way for the six U.S. moon landings that followed.

Borman learned to fly at 15, graduated West Point near the top of his class in 1950, and joined the Air Force, where he became an instructor and fighter pilot. He flew F-80s, T-33s, and F-84s. After earning a master's degree in aeronautical engineering at the California Institute of Technology in 1957, he taught thermal dynamics and fluid dynamics at West Point for three years. He then attended the Air Force's test pilot school and was involved in testing a number of new aircraft, including the F-104 in a series of "zoom" to high-altitude test flights.

In 1962, Borman was picked for the second group of astronauts, and went into rotation for the Gemini and Apollo flights.

As commander of Gemini 7, his first space mission, he shared for 14 days the cramped Gemini capsule with fellow astronaut Jim Lovell in 1965. That flight proved human beings could function in space—at least long enough to make it to the moon. In addition, the craft rendezvoused with Gemini 6, validating procedures needed for future space rendezvous and docking activities.

Less than two years later, the crew of Apollo 1—Gus Grissom, Edward White, and Roger Chaffee—were killed in a capsule fire while performing a launchpad "plugs out" check of their spacecraft. Borman was the sole astronaut on the review board formed to determine the root causes of the fire, which proved deadly because the design did not allow for the crew to escape on their own.

Borman helped persuade Congress to resume support for the Apollo program, testifying on the review's findings and expressing confidence in the enterprise and its leadership. The fire, he said, was due to a "failure of imagination," in which engineers had not fully anticipated every potential problem. He said NASA would learn from the tragedy.

Borman was then chosen to work with North American Aviation to correct the deficiencies and defects in the Apollo spacecraft and to help redesign the hatch so that future crews could escape quickly if necessary.

Picked to command Apollo 8, Borman accepted the challenge when the 1968 mission was changed. It was originally intended to be a deep-space test of the Apollo command and service modules with the lunar module. But the Soviet Union had achieved a lunar circumnavigation with a "Zond" unmanned craft earlier in the year, and intelligence indicated Russia might try to declare victory in the moon race by sending two cosmonauts on a similar flight in a Soyuz craft before the end of the year.

Viewing the situation as virtually a military battle, Borman took on the retooled mission, which allowed only a few months



National Archives

Frank Borman commanded the Apollo 8 mission, the first human space travel to reach and orbit the moon.

of training. Apollo 8, which made 10 lunar orbits, came off with virtually no technical glitches and confirmed the navigation techniques and computer software needed to go to the moon.

It was during that mission—flown by Borman, Lovell, and William Anders—that the famous "Earthrise" photo was taken of the small and fragile-looking Earth emerging over the lunar horizon, providing inspiration for the environmental movement and the creation of a national "Earth Day" less than two years later. The flight was also memorable for the crew's reading from the Book of Genesis during a live broadcast from the spacecraft on Christmas Eve.

Borman was NASA's liaison with the White House for Apollo 11 in 1969, and he coached President Richard Nixon to shorten his congratulatory message to the moon landing crew and a playing of the National Anthem, as it would consume precious extra minutes of the crew's air.

Though offered command of a moon landing mission, Borman declined, saying he had no interest in lunar exploration and that he had simply viewed the moon race as a necessary military contest with the Soviet Union that the U.S. had to win.

He told an interviewer in 1999 that "as far as I was concerned, when Apollo 11 was over, the mission was over." The science obtained on the five subsequent landings was "frosting on the cake."

After leaving NASA, Borman visited 25 countries in 25 days as a special presidential envoy, seeking help from countries to pressure North Vietnam to release American prisoners of war. Borman returned with good wishes but no practical results. Invited to address a joint meeting of Congress to discuss the effort, he described the hardships of the captives, and urged

lawmakers “not to forsake your countrymen who have given so much for you.”

He retired from the Air Force in 1970 as a colonel and soon joined Eastern Air Lines, becoming its senior vice president for operations. Five years later he became chief executive officer and the following year, chairman.

After Eastern, Borman operated an auto dealership with his son, and then became a cattle rancher in Montana. In 1996, with co-writer Robert J. Serling, he published his autobiography, “Countdown.” In retirement, he served on a number of corporate boards, including Home Depot and National Geographic.

NASA Administrator Bill Nelson said Borman “knew the

power exploration held in uniting humanity when he said, ‘Exploration is really the essence of the human spirit.’ His service to NASA and our nation will undoubtedly fuel the Artemis Generation to reach new cosmic shores.”

Borman’s lengthy list of awards included the Harmon Trophy—twice, for Gemini 7 and Apollo 8—and the Collier Trophy for the Apollo 8 mission, along with Lovell and Anders; the U.S. Air Force Space Trophy; the Robert H. Goddard Memorial Trophy; the Congressional Space Medal of Honor and the Society of Experimental Test Pilots James H. Doolittle Award, as well as honorary doctorates from eight institutions of higher learning, including Air University. 

Ken Mattingly, Apollo and Space Shuttle Astronaut, Dies at 87

By John A. Tirpak

Thomas Kenneth Mattingly II, command module pilot of Apollo 16, commander of two space shuttle missions, and an aerospace industry executive, died in Arlington, Va., on Oct. 31 at 87. He was one of only two astronauts to fly both an Apollo and shuttle mission in space.

Mattingly was commissioned in the Navy in 1958 and served as a pilot aboard aircraft carriers from 1960 to 1965. After completing the Air Force Aerospace Research Test Pilot School, he was one of 19 pilots selected in 1966 to be a NASA astronaut.

During his first five years with NASA, Mattingly supported the Apollo 8 and 11 missions and was the astronaut liaison to the industry/government team developing the Apollo spacesuit and backpack.

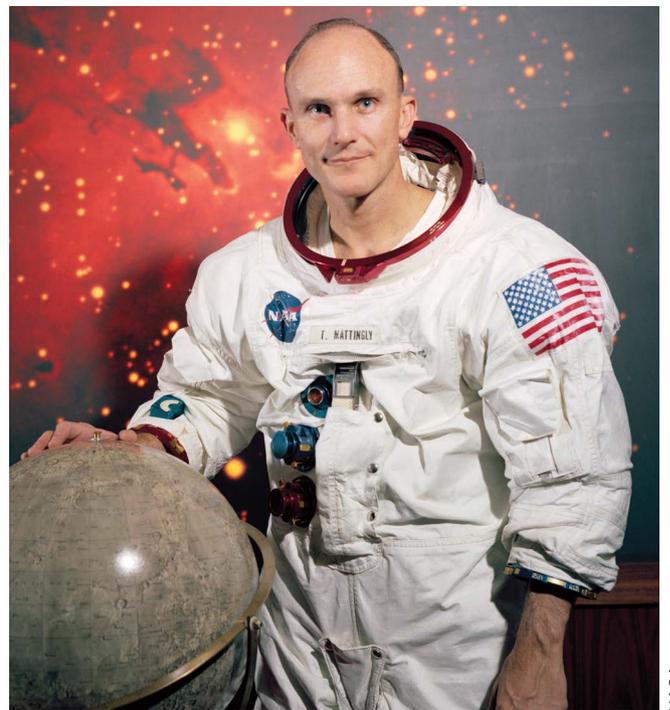
He was selected for and trained as command module pilot of Apollo 13, but due to exposure to Rubella, was removed from the mission three days before launch. Replaced by backup astronaut Jack Swigert, he was on the ground when Apollo 13, en route to the moon, suffered an oxygen tank explosion in its service module, decimating the command and service modules’ power supply. Mattingly helped develop workarounds that allowed the service module to be used as a lifeboat so that the command module could conserve power for re-entry. Despite his exposure, Mattingly did not become sick with Rubella.

Mattingly’s contributions to the ill-fated mission were recounted in the 1995 film “Apollo 13,” nominated for an Academy Award as Best Picture, in which he was played by actor Gary Sinise.

In a Nov. 1 statement, NASA Administrator Bill Nelson said Mattingly “stayed behind and provided key real-time decisions to successfully bring home the wounded spacecraft and the crew of Apollo 13.”

Back in the Apollo flight rotation, Mattingly was named command module pilot for Apollo 16, the penultimate moon mission, which sent astronauts John Young and Charles Duke to the lunar surface for three days in April 1972. Mattingly remained alone in the command module while they descended for the landing, conducting 36 experiments and mapping large swaths of the lunar surface.

On the return flight to Earth, Mattingly conducted a 73-minute extra-vehicular activity (EVA) to retrieve film canisters from the craft’s service module. To date, it is one of only three deep-space



NASA

NASA astronaut Ken Mattingly in his Apollo spacesuit was one of two astronauts to fly both the Apollo and shuttle in space.

spacewalks conducted beyond geostationary orbit.

After the Apollo program, Mattingly became a key figure in the development, test, and operation of the space shuttle. From 1973 to 1978, he was head of the astronaut office to support the Space Transportation System (STS), at which point he became technical assistant for flight test of the program.

From December 1979 to April 1981, he headed the astronaut office ascent/entry group. Mattingly was the backup commander for the STS-2 and STS-3 missions, the second and third orbital test flights of the shuttle Columbia.

He commanded STS-4 in July 1982. The Columbia mission was the last of four test flights of the shuttle system, which completed 112 orbits of the Earth. It landed on July 4 at Edwards Air Force Base, Calif., where President Ronald Reagan greeted the returning Mattingly and pilot Henry Hartsfield. From June 1983 through May 1984, Mattingly headed the Astronaut Office

DOD Support Group

In January 1985, Mattingly commanded STS-51C aboard Discovery, with a crew of five, the first dedicated military mission for the shuttle. The mission launched a secret payload using the Inertial Upper Stage booster from the payload bay. The mission remains largely classified.

During his years as an astronaut, Mattingly logged over 504 hours in space. He retired from NASA in 1985, but returned to the Navy, retiring as a two-star admiral the following year. He went on to be director of Grumman's Space Station Support Division, headed the Atlas booster program for General Dynamics, and

was a vice president at Lockheed, where he ran the X-33 space shuttle successor program later canceled by the Pentagon and NASA in 2001.

Mattingly held an aeronautical engineering degree from Auburn University, and received numerous aerospace awards and honors, including the Department of Defense and NASA Distinguished Service Medals, the Society of Experimental Test Pilots Ivan Kincheloe Award, the Navy Distinguished Service Medal, and the Johnson Space Center Certificate of Commendation and Group Achievement Award. He had accumulated over 7,200 flying hours, including more than 5,000 in jets. ★

PERSONNEL

WAPS Tests to Go All-Digital

By David Roza

The Air Force is set to roll out its digital Weighted Airman Promotion System (WAPS) in February 2024, in time for the technical sergeant testing cycle. The new system, eWAPS, replaces the paper-and-pencil method, which is a headache for administrators and has often been lost in the mail. Digitizing the system has been on the to-do list for branch senior leaders for years.

"When it comes to the Force of the Future, it is essential we modernize the IT systems our Airmen use—to include how we test for promotion," Chief Master Sgt. of the Air Force JoAnne Bass told Air & Space Forces Magazine in a statement.

WAPS is a standardized test which helps the service identify Airmen worthy of promotion to the ranks of staff sergeant (E5) and technical sergeant (E6). Test-takers are quizzed on topics such as career field information, Air Force history, and customs and courtesies. In 2021, the test was modified to include situational judgment questions to assess leadership qualities.

Officials expressed frustration with the paper WAPS method, which in 2021 Lt. Gen. Brian Kelly, then-deputy chief of staff for manpower, personnel and services, said was "embarrassing" and "makes all of us as senior leaders absolutely crazy." Bass shared his opinion.

"It is 2022, if we can't get out of taking a No. 2 pencil into promotion tests, something is wrong," Bass said last year.

2022 came and went without digitization, which the senior leader attributed in part to not all locations having the systems in place to perform digital testing. But that appears to have changed. Bass said pilot tests were conducted across 61 bases from July to September, with more pilots scheduled through December to make sure the installations can support eWAPS.

Laying the groundwork for digital testing proved to be a difficult task. A Nov. 6 press release from the 18th Wing at Kadena Air Base, Japan, explained that the education center there required funding from Air Force headquarters to order individual test stations and "advanced computer systems" to meet the new requirements. Engineers on the base then renovated the testing area before it was declared fully operational in September.

Air Force Times reported in September that the rollout would begin in January. An Air Force spokesperson explained that Airmen will begin registering for eWAPS in January, but the testing itself has always been set to coincide with the E-6



Tech. Sgt. Dan Heaton/ANG

After years of No. 2 pencils and paper tests, the Air Force's Weighted Airman Promotion System tests will move in 2024 to an all-digital format.

testing cycle starting in February.

The digital test sits at the intersection of two ongoing issues for the Air Force: personnel development and digital modernization. On the personnel side, Bass is pursuing a number of changes to better retain and educate Airmen, such as reforming developmental special duties, increasing commissioning opportunities for enlisted Airmen, offering better incentives to keep technical experts, and reforming how Airmen are assigned to duty locations.

On the digital side, the slow pace of setting up eWAPS is one of several frustrations Airmen feel about the IT systems they depend on to work, arrange travel, and process important paperwork. Many of those systems are outdated and struggle to perform basic tasks.

"Our Airmen always say, 'I wonder if our leaders know, I wonder if our leaders understand the challenges we have.' And I'm like, 'Yes, we do, and we share those challenges, right?'" Bass said last year. "Like, we're frustrated with the IT systems that we have, I mean, beyond belief. As many times as you have to add in your PIN, I have to do that too. I mean, I send stuff home to my phone or my whatever so that I can actually watch whatever I need to watch, because I can't do it on my work [computer]."

If successful, eWAPS may represent progress on both issues.

"I look forward to hearing the feedback from our Airmen and appreciate the work by all to get us here," Bass said about the upcoming rollout. ★



Northrop Grumman

The B-21 Raider bomber is among at least 10 major weapons programs beginning flight tests at Edwards Air Force Base, where test engineers are ramping up for one of their busiest periods in decades. The B-21 Raider will serve as the backbone of America's bomber fleet.

Getting Ready for the New Test Surge

Edwards Air Force Base might not have been this busy since the 1960s.

By John A. Tirpak

The first B-21 Raider took off at dawn from Palmdale, Calif., Nov. 10 on its premier flight, touching down at nearby Edwards Air Force base more than 90 minutes later, after using a circuitous route to check out basic handling qualities. Edwards will be the bomber's home for the next several years, as pilots and engineers test and assess its performance.

The Raider is one among a surge of test projects for which Edwards has been preparing, ensuring a pace of operations there not seen since the test heyday of the 1960s. Among the new arrivals and other imminent test programs:

- The B-21 Raider bomber.
- The T-7A advanced jet trainer, which arrived at Edwards only a day before the B-21 from St. Louis. It's the first of five dedicated T-7A test aircraft that will be put through its paces over the next two years.

"It's an awesome time to work in the test enterprise ... there's cool stuff going on!"

—Maj. Gen. Evan Dertien, commander, Air Force Test Center

■ The B-52 test force will grow to eight or more aircraft, as Stratofortresses on loan from Air Force Global Strike Command (AFGSC) arrive to evaluate its new radar, engines, weapons, and a series of navigation and communications upgrades.

■ The X-62A, a highly modified F-16 that will test autonomy functions.

■ The new F-15EX fighter.

■ Collaborative Combat Aircraft (CCAs), intended to be autonomous or semi-autonomous partners for crewed fighters.

■ The AIM-260 Joint Advanced Tactical Missile, the next-generation, long-range dogfight missile for Air Force fighters.

■ The Next-Generation Air Dominance (NGAD) fighter, a super-stealthy fighter to succeed the F-22

■ The F-35 and its Block 4 upgrades, as well as a new version of its F135 engine.

■ The Hypersonic Attack Cruise Missile, an air-breathing, Mach 5-plus weapon.

That list doesn't include ongoing test projects to evaluate aircraft upgrades or other new munitions, most of which will be evaluated at Eglin Air Force Base, Fla. Many of the new programs are the result of Air Force Secretary Frank Kendall's Operational Imperatives initiative, which seeks to put new, more relevant hardware in the hands of Airmen as quickly as possible.

"We're busy," acknowledged Maj. Gen. Evan C. Dertien, commander of the Air Force Test Center, in an October interview. Without significant new financial or human resources, the Air Force Test Center is training its workforce for new kinds of testing and applying new technologies to the task.

Dertien's enterprise comprises test aircraft, ground test facilities, test ranges, the data infrastructure, and people. Asked if his resources are robust, stressed or overwhelmed, he said "it depends on the program." Some "are stressing our fleet a little bit more, some programs are stressing the technical capabilities of our people. Other programs are obviously stressing our facilities," he noted.

But stress is not necessarily all bad. "It's an awesome time to work inside the test enterprise," he said. "Most people are very excited to show up to work because there's cool stuff going on."

Dertien's test aircraft fleet is being modernized. The existing F-35 test fleet, for example, is "getting pretty long in the tooth" and will be upgraded with as many as nine factory-fresh aircraft dedicated to the test mission.

"It's one thing to get an aircraft, but it's another thing to get the right instrumentation in there," Dertien said. "So we're making sure that we have the instrumentation needed."

The aircraft will be outfitted with specialized test gear right on the production line at Lockheed Martin, he said. For other kinds of F-35 testing, Edwards will use operationally representative aircraft from Air Combat Command or the Navy, borrowing planes as needed. The F-35 test fleet on the ramp now is "very diverse," he continued, and comes from all the U.S. services as well as partner countries.

F-35 testing is currently focused on the Tech Refresh 3 upgrade, which swaps out the F-35's processor with a much more powerful unit that makes possible the capabilities in-

herent to the coming Block 4 upgrade. That will deliver more powerful electronic warfare capabilities among more than 50 improvements.

TR-3 is "our No. 1 focus right now," Dertien asserted.

But it is the bomber test contingent that is "probably where our fleet is stressed the most," he said. "The most loaner aircraft that we have right now is in the bomber fleet. ... We're supporting bomber modernization, with B-52 engine upgrades, the cockpit upgrades, and also all the hypersonic [weapons] development."

As a result, the bombers represent "our biggest workload," Dertien said. "The Air Force has done a great job of providing us extra resources for what is ... a couple of years of surge. ... Once we get through some of these programs, we'll go back to our normal size."

Boeing is developing a new "agnostic" pylon assembly for the B-1 called the Load-Adaptable Modular (LAM) pylon, which can accept a variety of new munitions. The Test Center and AFGSC are interested in the hardware and the Air Force has provided some money to evaluate it, because the test demands on the B-52 are also stressing GSC. With eight B-52s in testing, and another 10 to 12 in depot or repair most of the time, only 56 to 58 of the 76 B-62s will be available for operations. And while the B-52 has a nuclear deterrence mission, the B-1 doesn't.

CCAS

Brand new in the pipeline is the Collaborative Combat Aircraft (CCA) initiative, which poses a new kind of test effort, Dertien said. Autonomous aircraft have been tested before, but the scale and intensity of the effort is new, as are the challenges of operating crewed and uncrewed aircraft together.

"We're still learning" how to test CCAs, he said. "My focus right now is making sure that the test enterprise is ready to test autonomy."

That will change workforce training and ensure that ranges, policies and procedures are ready for challenges posed by CCAs.

As ACC Commander Gen. Mark D. Kelly has pointed out consistently since CCAs first appeared in the Operational Imperatives, the FAA has yet to develop rules and policies which



An F-35A took off from Edwards Air Force Base, Calif., in January, conducting the first flight of an F-35 with the complete Technology Refresh 3 (TR-3) suite of updates. The upgrade adds the computer and electrical power to support a range of long-promised Block 4 capabilities.

F-35 Joint Program Office



Air Force testers will manage tests for the Hermeus Quarterhorse, shown here in a concept illustration, which is to be capable of flying at Mach 4. Quarterhorse will validate the company's proprietary turbine-based combined cycle (TBCC) engine, based on the GE J85 turbojet.

would allow CCAs to transit civilian airspace, and that has to happen if they are to be truly integrated with the combat air forces.

Kendall has posited a force of at least 1,000 CCAs, with the first ones ready for duty within the next six years. That timeline demands a robust and fast-paced test program.

While Dertien said he has all the necessary specialists for CCA testing, the challenge will be integrating their efforts.

"I have people who know" how to test uncrewed air vehicles, autonomy, and fighter tactics, he said. "But now we're going to have to bring [those capabilities] all together to test something like the CCA."

In preparation, the Test Center is pulling together all the work done in recent years on the Kratos XQ-58 Valkyrie and the Air Force Research Lab's "Skyborg" aircraft-agnostic autonomous flight algorithm. It's also set up a program called VENOM (Viper Experimentation and Next-gen Operations Model), a half-dozen F-16s that will explore how to tactically and operationally integrate uncrewed and crewed fighters working in close proximity.

The X-62 Variable In-flight Simulation Test Aircraft (VISTA) is "helping us advance autonomy" and define the needed workforce, Dertien said. It is the ground floor of fighter integration, he added.

The test enterprise will be ready "when that first CCA lands or is brought here," he said, such that "we're ready to test the autonomy and integrate it with existing systems like the F-22 and the F-35."

Col. Douglas P. Wickert, commander of the 412th Test Wing at Edwards, noted that CCAs will also be nodes in a wider network, which means integrating them with the nascent joint all-domain command and control (JADC2) system. They cannot be comprehensively tested in isolation, he commented.

"Increasingly, these are all interactive systems," he observed. "One of the things that we've done in the test enterprise is create recurring opportunities to bring a lot of things together." Edwards is setting a "stage" on which the Air Force can integrate CCAs with crewed aircraft and the Advanced Battle Management System (ABMS), and allow testing in "a very complex,

realistic environment."

Preparing for the influx of many new programs means Dertien's team must work smarter and get better utility out of the assets on hand.

MISSION CONTROL

A manpower-intensive aspect of most test flights is the control room—think Mission Control at NASA—with a score of experts monitoring everything from dynamic loads on the test article to chase aircraft, telemetry links, and watching for stray aircraft or vessels entering the test area which could interfere with the activity.

"Two [or]... three years ago, I would have really highlighted control rooms as being the constraints" on testing, Dertien said.

"That was really due to all the different classifications that were built up and driven from the program office," he said. It was time-consuming to run a highly secretive test and then reconfigure the control room for the next program.

"We made a lot of investments to ... be able to turn the control rooms much faster," he stated.

"We've also made a lot of investments that are allowing us to do distributed test operations. So I can have a control room here at Edwards supporting a test in St. Louis," where the F-15EX is built, "or a control room here at Edwards supporting a test down in Eglin. So I think we're making much more efficient use of our existing control rooms."

They are no longer a limiting factor, Dertien said.

Wickert said Air Force testing is going through "the most significant modernization I think that maybe the Air Force has ever ... lived through" and if the test enterprise is going to manage "the tsunami of programs in the future," it can't do business as it has.

"We would need about three times as many people. And although we're going to get a modest increase, we will never get that much," according to Wickert.

Consequently, the enterprise is using "some of the modern data analytic tools" that the younger workforce is already comfortable with "and they're hungry to do it."

When it comes to “taking data and turning that data into information and information into knowledge, there are some modern practices that I think are ... going to make us much more efficient, much faster.”

The Test Center has “decades” of data that can be used to train an artificial intelligence to evaluate new systems more rapidly and deeply, Wickert noted. “In the past, we’d deliver a ... 500-page test report and that took people a lot of time to type.” But now the system can “deliver integrated data products. Because, when you create the test report,” it’s answering the question “you thought the program office was asking.” Now, with an integrated data report, “they can always come back and ask ... different questions and the data is there to go do that.”

Across the Test Center, “we’re looking at creative new ways to provide products that are really less work, and also more valuable to the program offices and the customers we support.” It’s doing more “with the existing data that we already have.”

Edwards has a chase fleet of mostly F-16s. Crews in chase aircraft watch the test article for problems or changing conditions; sometimes they photograph or film the test, and they can also watch for stray aircraft in the area. Dertien said the chase fleet is “pretty well resourced,” and not a limiting factor, but “with the B-21, with T-7s and all the bomber modernization, the hypersonics ... it does stress that fleet.”

The Test Resource Management Center (TRMC) is moving to repurpose RQ-4 Global Hawks retiring from the intelligence, surveillance and reconnaissance mission and turn them into high-flying telemetry capture and relay platforms, Dertien said.

This will “provide more instrumentation on our ... larger ranges that are over the water, where we test hypersonics,” he noted. The effort will increase “our airborne and space-based instrumentation capabilities. So that’s a program that continues to evolve, but primarily that’s led by TRMC right now, that are making those investments in the Global Hawks to instrument and operate those vehicles to support hypersonic test.”

The concept of operations calls for three or four Global Hawks to collect data over the large areas covered by hypersonic systems, which typically fly over sea ranges because of their speed, sonic booms and the fact that they usually are not recoverable once their fuel or momentum run out.

The innovation will add great new flexibility, Wickert said.

“When we used to rely on the Navy for telemetry... we would have to actually start [deploying] the ships two weeks ... prior to a test and just have them on station” to establish the telemetry capture across the range.

“And of course, if something happens to the system under test in those 14 days,” then the test opportunity is lost, Wickert said. With the Global Hawks, “in 12 hours you can have them on station” with the telemetry ready to go.

Just as the Air Force is migrating its air and ground moving target system to space, the test enterprise is looking at the same kind of thing, which “gives you a 24-hour range if you have the space assets in the right place,” Dertien said. Such investments “can really support the hypersonic side” of testing.

HYPERSONICS

With the pace of hypersonics testing increasing, Dertien said the push is to “improve instrumentation over our water ranges” both off the East and West coasts of the U.S.

“We’re starting to link some ranges together and do some hypersonic testing across ranges right now, but more to follow as far as which corridors are approved. ... The FAA and other folks are working on those, but right now we’re satisfying most of the need on the overwater ranges.”

Overland routes will be needed eventually, but it is tougher to overcome concerns about sonic booms and potential conflict with airliner traffic and make the case for over land versus over water, Dertien said. In the meantime, “we can break up our testing into multiple parts” of the flight profile. But “we have some work to do.”

Under the AUKUS agreement, the U.S. is working with Australia to use the large Woomera Range in Australia for overland hypersonic testing, which can mitigate some of the challenges in that area, Wickert noted. It will also allow for “impact on land” evaluations.

Another way to reduce the burden on the test enterprise is to do more ground testing, particularly where it involves hypersonics, Dertien said. More investment is being made in wind tunnels to reduce the need for open-air testing, he said.

“You’re never going to have one facility that can test the entire profile,” he said, so various tunnels and ground test assets are being developed to evaluate hypersonic designs in more manageable pieces.

Since 2014, more than \$1 billion has been invested at Arnold Engineering Development Complex in Tennessee to develop a clean-air high-Mach tunnel system as well as the Dragon Fire system, which adds capacity in arc heater systems, in high demand because of the thermal testing needs of any hypersonic system.

“That’s really to test our thermal protection systems,” Dertien said. “So this is more of a capacity increase.”

The high-Mach system, called J-5, will test scramjet engines.

“What’s unique about this is it will probably be the only one in the world that’s a clean-air, tru-temp test facility.” Simply heating the air can create particulates that can interfere with the test, Dertien said, but the J-5 “allows us to get much more accurate measurements of the conditions that a hypersonic weapon would experience in flight.” The J-5 will also be able to shift between high-Mach speeds without the need for “massive reconfiguration” between tests. That will speed up the process. Capacity will also increase because the J-5 allows longer test runtimes than possible with existing equipment.

Wickert also noted that commercial entities like Strato-launch—which operate “up the road, in Mojave”—are creating hypersonic-friendly launch platforms and reusable hypersonic platforms such as the Talon series. Others include Hermeus, with its Quarterhorse—a Mach 4 vehicle—and Dark Horse, a Mach 5, hypersonic vehicle, both privately developed. Academic institutions such as Purdue University “are making significant investments in hypersonic facilities,” and the Air Force likely will “be able to leverage” or partner with these efforts, he said.

The Defense Department has also set up the University Consortium for Applied Hypersonics—which includes Purdue, Notre Dame, and Texas A&M—to further add to the national infrastructure and attract more experts to the field, important because “a lot of [the current experts] are retiring.”

“Hypersonics is sexy again,” Wickert said. The consortium aims to create “the next generation of experts.”

“All of this goes back to the heyday of hypersonic testing in the ‘60s,” he said, “where we had ... 199 high-speed flights, where we could do materials and sensors and windows and controls.”

“To have now, a recurring testbed that, every two weeks, you can try something new out, that’s a great capability.”

Dertien agreed that “it is a tsunami ... but that just makes it incredibly exciting and ... easier for us to recruit people to come to test. ... They’re actually really, really excited to have a lot of cutting-edge work to do.”





Miriam Thurber/USAF

In the North Carolina forests in July, Tactics Field Week prepares students within the Special Warfare Training Wing's 352nd Training Squadron for careers as combat controllers, special tactics officers, and special reconnaissance Airmen.

Inside the Air Force's Newest SOF Career: Special Reconnaissance

By David Roza

FORT LIBERTY N.C.

In most professions, the path of least resistance is the best. Not so for the Air Force's newest special warfare field: special reconnaissance (SR).

"Going through sniper school, you try to walk through the worst terrain that you can find because that's where nobody else wants to go," said "Tech Sgt. J," a senior Airman whose full name was withheld for security reasons. "Vines and sticks grabbing onto your ghillie suit [camouflage] ... it can be a pretty humbling experience."

Sneaking through swamps is another. The goal is to provide timely and accurate intelligence to enhance the effectiveness of airpower from the ground. These Airmen must master the full range of reconnaissance skills, from silently inching their way through brush in a ghillie suit to zeroing in on a target through a sniper scope to flying small drones or employing technical

"It sounds silly, but it is a skill just knowing how to walk through the woods in a tactical manner."

—Special Tactics Officer, Capt. Max Krasnov, 352nd Special Warfare Training Squadron

equipment to achieve cyber or spectrum effects.

"All the other sister services have their own reconnaissance assets," J said. "The Air Force was looking at a more niche capability, specifically for what kind of problems pilots are going to have."

SR evolved in 2019 to replace special operations weather teams (SOWT), whose mission had been to gather weather and environmental intelligence in hostile territory. In the years before that shift, SOWT Airmen started adopting some of the skills that make up the core of SR today. Though SR training still includes some weather elements, the main purpose now is to provide air-minded reconnaissance to open up routes for aerial attack against sophisticated air defenses.

"Basically we are looking at solving the integrated air defense problem that China, Russia, or Iran is going to have," J said. "We'd be looking at opening airways for follow-on forces. The Air Force doesn't want to have to rely on Army assets to open up those airways."

In a future conflict, SR Airmen will be tasked with observing enemy anti-air defenses, gathering intelligence on enemy troop movements, conducting real-time battle damage assessments after airstrikes, and scouting landing zones. Satellites or aerial reconnaissance may be unavailable at times, making old-school intel a crucial alternative.

"We weren't doing that in Afghanistan because there was no reason to accept that risk—we could just put an MQ-9 over the target for a week," said Capt. Max Krasnov, a special tactics officer and training flight commander with the 352nd Special Warfare Training Squadron at Pope Army Airfield, N.C. That's not possible against better-equipped nation-states. So SR "ensures that the Air Force has a way to get the ground truth under any situation," Krasnov said. "That's why they are trained to the full gamut of reconnaissance techniques that are currently available."

In terms of cyber and electronic warfare, Tech. Sgt. J said SR provides "the link between the big computers and the target," but stopped short of detailing specific capabilities for security reasons. But Krasnov hinted at what that might look like with an example: "If I were to walk into a hotel lobby, log onto the guest Wi-Fi on my cellphone, and get the IP address that my phone connected to, I am gathering information about that hotel," he said. "Play with your imagination as to where that can go."

The wide range of skill sets involved in SR means there are plenty of rabbit holes for Airmen to dive down.

"What I think is a cool thing about the career field is there are certain vectors that guys can really nerd out about," J said. "Maybe a dude just really wants to deep dive into drones, you can do that. Guys want to go cyber warfare or higher-level intelligence gathering, we have avenues for that."

The Air Force counts just 50 SR Airmen in its ranks today, with hopes to double that in the coming years. Among them could be Airman 1st Class S, a trainee in the SR Apprentice Course at Pope, who was attracted by the newness of the field.

"It was new and there are only a few people doing it ... so I was curious to see what it was like," he said.

SR is also attracting former special forces troops from other services, among them at least three prior Marines and a prior

Green Beret Soldier.

"There has actually been, in my opinion, a surprising amount of cross-trainees or prior service people coming through," said Tech. Sgt. J, who listed long-range-shooting and cyber warfare as two reasons why some of them sought out SR.

Being so new, SR Airmen often have to explain what they do when they arrive downrange, but J considers that a strength rather than a weakness.

"I honestly think that it is a benefit for the kind of people we attract, because then they are forced to go out and prove themselves and their capabilities," said the former SOWT

J was attached to a team of Green Berets in Afghanistan a few years ago. "I showed up and I said, 'Hey, this is my little drone, this is what I can provide for you guys. I've got this training up into this shooting school, I'm a jumpmaster, I can do all this,'" he said. "And then the next step is to go to the range of that team and outshoot them."

SPECIAL RECONNAISSANCE COMMANDOS

Two Airmen hid in the dark, in a small hole by the side of the road running through a pine forest. Across the road, just 80 yards away, was their target: a train station they had to monitor for 24 hours for signs of enemy movement. It was bold to creep up so close, but the small ridge line into which they had dug their hide site blocked the sight lines from deeper in the woods.

The Airmen were eventually caught by the "enemy" in this training exercise, but the inconvenient ridge helped illustrate why SR Airmen are needed.

"Even if you have satellite imagery, you're not going to pick up this little hill that makes a very big difference," said Krasnov, the special tactics officer. "If you're back 200 yards, you can see cars drive by, but that's about the level of fidelity you can get. ... If we need them to positively identify a guy with a mustache and a limp in his left leg, that is going to drive how bold they are about where they need to be."

Sneaking up on a target requires its own set of skills, especially in this part of North Carolina, where the ground cover is sparse and a carpet of pine needles crunches underfoot.

"It sounds silly, but it is a skill just knowing how to walk through the woods in a tactical manner," Krasnov said. "If you



1st Lt. Xiaofan Liu

A trainee from the 352nd Special Warfare Training Squadron fast ropes out of a civilian H225 Super Puma helicopter on Mackall Army Airfield, N.C., in October. The 352nd SWTS is responsible for executing the combat control, special reconnaissance, and special tactics officer apprentice courses.

go hunting and sit in a tree for hours, and all of a sudden a deer appears, you're like, 'How did that just get there? I didn't hear it, I didn't see it walking up.' Someone who's really good, it's almost like they can do that."

CRAWL, WALK, RUN

By the time Airmen arrive at Pope for the SR and Combat Control Apprentice courses, they already have been training to join special tactics for months. The pipeline starts with the Special Warfare Candidate Course, followed by the grueling Special Warfare Assessment and Selection Course, both at Joint Base San Antonio-Lackland, Tex. Part of the goal of those courses is to put candidates through intense physical training to see if they can handle the demands of the profession.

Those who pass through assessment and selection go on to a series of schools across the country such as pre-dive swimming and water confidence, static line parachuting, freefall parachuting, and survival, evasion, resistance, and escape (SERE) training. The journey continues at the four-month apprentice course.

"The diving and jumping, that gets you to work," Krasnov said. "This course is what you do when you get there."

Crawl, walk, run is the name of the game. Students learn how to read a map and compass, then start navigating through the woods, a change of pace for many who have relied on GPS-enabled smartphones all their lives. They learn how to safely handle a firearm and how to shoot accurately, how to move on a battlefield, and how to position themselves in a team fight. Later, they master small-unit tactics, like bounding movements and ambush maneuvers.

After-action reviews are intense. "If you're doing an L [-shaped ambush], you've got to make it an L, it can't be, I don't know, whatever the [blank] that was," one instructor said, bluntly criticizing his charges after a drill. "While you're making these big flanking movements, you've got to make sure you're keeping track of where you are geographically in relation to your support-by-fire, so they can effectively support you."

Easier said than done. Students had to yell commands through gas masks as fake artillery rounds went off around them and smoke grenades tinted the air pink and purple. An untrained observer could barely identify the camo-clad students amid the leaves. But learning how to operate in such confusing and stressful conditions is among the objectives of this course.

"Anyone can learn to program a radio—it's not hard," said Krasnov. "We need people who can reprogram a radio when they are cold, hungry, haven't slept in two or three days, and are in the middle of a firefight."

BREAD-AND-BUTTER

Usually about a quarter of the students at Pope aim to join SR, while the rest hope to become combat controllers (CCTs), who are experts at coordinating aircraft with ground operations. The students train on many skills together, such as land navigation and small-unit tactics, but they split up for skills specific to each career field. The SR Airmen learn the basics of weather observation, intelligence processing and reporting, surveillance and reconnaissance equipment and techniques, long-range shooting with the M110 rifle, and stalking lanes, where Airmen build ghillie suits, using grass or other forms of ground cover camouflage, and learn to move around undetected.

"It looks super cool," said Tech. Sgt. J, a SR instructor. "And then you do it for the first time and you realize that it is miser-

able, especially if it's really hot out. People don't realize how hot ghillie suits are."

In the stalking lanes, J explained, students have to sneak up to a truck full of instructors, close enough so they can identify the letter on a placard one of them is holding up—all while evading the trained eyes of the instructors. It is a difficult task, but an essential step in training to sneak deep into enemy territory.

"Even if SR Airmen use cyber or electronic warfare, they still have to get to a location the enemy doesn't want them to be, without them knowing," Krasnov pointed out.

The SR students learn the basics of operating small unmanned aerial systems, starting with quadcopters about the size of a dinner plate. Though easy to fly, operating them effectively in an undercover military operation requires deep understanding, such as how high to fly to remain undetected, counter-drone techniques adversaries might use to evade drones' thermal sensors, safe operating ranges and timelines, and how many spare batteries to bring for a mission.

Still, the apprentice course is only a starting point. Graduates continue honing their skills for six more months at a special tactics training squadron when they're finished. Advanced SR skills include operating fixed-wing drones and top-secret cyber and electronic warfare tools.

BEST FRIENDS

The apprentice course ends with a weeklong final training exercise where CCT and SR students demonstrate the skills they learned over the past four months. The exercise often begins with students parachuting into a simulated contested environment, after which they must establish a forward operating base and pursue follow-on missions, like striking a target or capturing an airfield to land a C-130 or to airdrop troops and supplies.

The exercise gives the students a chance to practice the basics of their respective career fields: CCT students may establish and operate an airfield or call in air support, while SR students may have to sneak up on a target and gather intelligence for an ambush. The exercise ends with a 15-mile ruck march back to base.

Graduation is a hard-won moment for both students and instructors. "These students, within a year they're going to be on teams with all of the instructors' best friends," Krasnov said. Instructors are incentivized to do a good job. "One, the instructors want to make sure they're not going to get their friends killed. And two, all their friends know that we are responsible for the quality of the students. So they don't want their buddies to rag on them for producing bad students."

WHAT'S NEXT FOR AIR FORCE SPECIAL TACTICS?

SR Airmen are trained to infiltrate deep into enemy territory to gather information on enemy air defenses. That mission is part of a larger shift as the military prepares for conflicts with near-peer adversaries such as China and Russia.

Older special tactics career fields are also feeling the shift as they focus on skills not often utilized during the past 20 years of the Global War on Terror (GWOT). For example, CCTs are certified Federal Aviation Administration air traffic controllers who can establish airfields in hostile environments. But during the GWOT, they often served as joint terminal attack controllers, calling in airstrikes to support ground troops.

"For us, GWOT was the JTAC mission," said Krasnov. "We were doing some airfield missions, but I would say 95 percent of what we were doing was JTAC."

As the Air Force prepares to operate from small islands in the Pacific, CCTs may find themselves helping guide aircraft to austere airfields more often than they did in GWOT.

“Historically, the air mobility mission is one of our bread-and-butters,” he said.

In May, CCTs with the Kentucky Air National Guard’s 123rd Special Tactics Squadron guided MC-130J transport aircraft, A-10 attack jets, MH-6M helicopters, and MQ-9 drones in for a landing on two highways in Wyoming, an exercise meant to practice generating airpower in austere locations. A new CCT recruiting ad also emphasized that role with the line “we turn hell into an airstrip ... and clear the way for others to follow.”

Meanwhile, the JTAC mission could take a different form in a near-peer conflict, where enemy air defenses may force friendly aircraft to use longer-range munitions dropped farther from the target. In that situation, SR Airmen, who specialize in deep reconnaissance, may serve as remote spotting scopes for CCTs farther away.

“There are a lot of scenarios where the JTAC is back at the base and a team is passing the relevant information of what’s going on,” Krasnov said. “They know the ground truth, but I am trained to process that and explain it to aircraft.”

PARARESCUE

In the GWOT, pararescue jumpers [PJs] often rode helicopters out to injured troops and cared for them on the flight back to a large base with robust medical facilities. But in a near-peer conflict, operators may be much farther from medical facilities, and there may be no flights due to distance and enemy air defenses.

“There was no chance a mission was getting approved if there was not a specific plan that anyone on that mission could get transported to a high level of surgical care within an hour,” Krasnov recalled about his GWOT deployments. “To go from that to ‘we’re probably not going to hear from you for a week’ is a much different mindset and a much different level of risk that you need to plan for.”

PJs are now training to provide care for more patients for longer periods than they typically did during the GWOT. In a recent exercise off the coast of California, PJs practiced caring for injured patients amid missile strikes, contested airspace, limited supplies, and other challenges meant to simulate what they may face in a war in the Pacific. In one scenario, Airmen treated about two dozen patients after a missile strike on an airfield, then moved them to a contingency location via helicopter.

“This simulates one of the most likely mission sets we could respond to: mass casualties caused by a missile strike at a forward operating site,” Master Sgt. Trevor Runyan, the instructor flight chief at the 68th Rescue Squadron, a formal training unit for PJs, previously told *Air & Space Forces Magazine*.

Later on, the PJs rescued simulated pilots who had been shot down and landed in the water. Some had drifted into contested airspace, so the PJs jumped out of fixed-wing aircraft with parachute-configured Zodiac boats to pick them up, then bring them back to friendly airspace where a helicopter could carry them to shore. Throughout the exercise, the PJs juggled multiple missions and limited resources.

“As a 10-man element, they must prioritize missions and determine if and when they should operate as a split team, and the risks associated with that,” Runyan said.

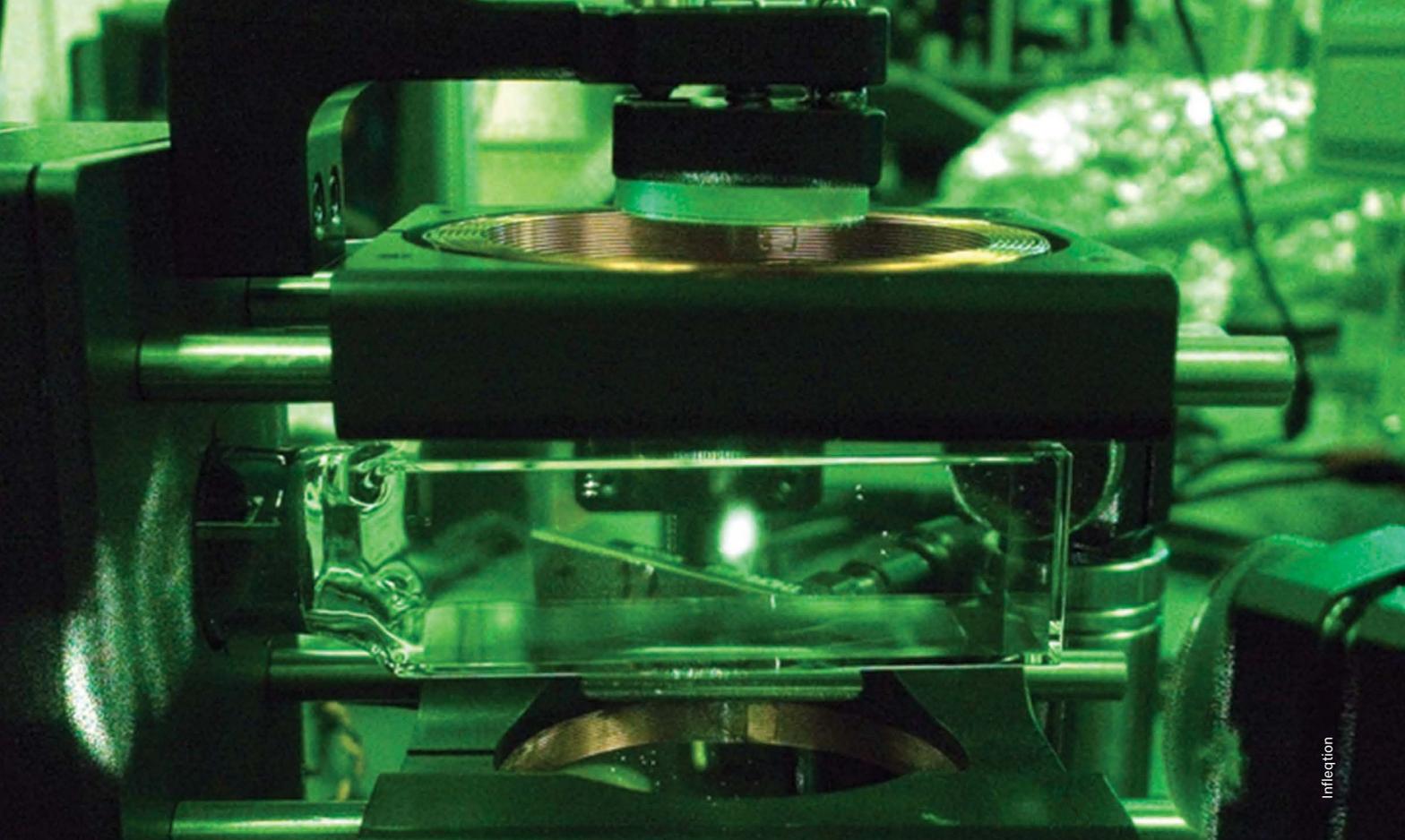
While counterterrorism missions continue in the Middle East and Africa, special operations forces across the military are reassessing their approach to risk in preparation for near-peer conflict.

“For U.S. ground special operations leaders, attitudes toward risk tolerance remain shaped by the last two decades of war in the Middle East and Africa,” special operations expert Spencer Reed wrote in January for *War on the Rocks*. “But if these leaders are to offer utility to the joint force or their parent services in the future fight, they should reframe and reassess how they view risk now, ahead of a future armed conflict with a great power adversary.”



Candidates in a pool compete against their own desire to quit in the Special Warfare Training Wing Assessment & Selection Course at Joint Base San Antonio-Lackland, Texas, in January. The Special Warfare Training Wing prepares candidates physically, mentally, emotionally and cognitively for demanding careers as special warfare operators.

Miriam Thurber/USAF



Inflection

A Rubidium cold-atom cloud, visible as the central bright spot in this infrared image, is captured at the intersection of laser beams in a trapped atom vacuum system. Laser cooling plays a crucial role in quantum applications.

DISENTANGLING QUANTUM

Understanding the Science to Make the Right Choices.

By Heather Penney

Since World War II and the birth of atomic power, the United States has established military dominance by exploiting technologically advanced capabilities to achieve overmatch against numerically superior adversaries. The explicit pursuit of a technological superiority over the Soviet Union was the premise of the “Second Offset” strategy of the 1970s and 1980s, in which the Department of Defense accelerated the development of stealth, precision navigation and timing, precision weapons, improved datalinks and communications, advanced sensors, and greater computer processing to yield competitive overmatch against rivals. Ensuring such a technological advantage is even more important today, yet the United States no longer maintains the scientific and manufacturing primacy it enjoyed during the Cold War.

To regain a technological lead and secure a military advantage, DOD has identified quantum information science and technology (QIST) as among the core technologies in need of “Third Offset” investment. The United States and China are intense competitors in this pursuit. The value of “leap ahead” technologies



Heather Penney is a senior resident fellow at the Mitchell Institute for Aerospace Studies. Download the entire report at <http://MitchellAerospacePower.org>.

is clear. In the Second Offset, advanced sensing and tactical datalinks enabled forces to share situational awareness across the battlespace, delivering an information advantage to battle managers and mission commanders. That, in turn, helped them make better decisions and employ forces more effectively. Stealth enabled aircraft to evade detection, changing the traditional attrition calculus and seizing the ability to surprise. GPS and precision-guided munitions decreased the number of weapons necessary to achieve desired effects against targets. It’s precisely this technological overmatch that proved so decisive in Operation Desert Storm and subsequent operations.

Quantum technology could constitute similar leap-ahead capability, introducing a new regime for competition, subverting adversary countermeasures, and introducing new strategies. Quantum sensors promise accuracy, stability, sensitivity, and precision far exceeding existing technologies. Quantum computers promise unparalleled computing power, enabling encryption-breaking and problem-solving on a scale and speed not possible today. Because these capabilities are sought by adversaries as well as the U.S., it is critical that DOD understand and shape the development of this technology. As the Congressional

Research Service notes, quantum technologies “could hold significant implications for the future of international security writ large.”

DOD leadership realizes the value of successfully fielding quantum applications both before adversaries can and also before they can develop countermeasures. Like stealth and precision strike, QIST could deliver a lasting military primacy to bolster U.S. deterrence. Quantum timing and navigation could replace dependencies on space-based GPS; quantum sensing could enhance ISR and kill chains; and quantum computation could decrypt encoded messages and enhance machine learning.

Failure to invest and ceding that capability advantage to an adversary, on the other hand, would have grave implications. This risk is particularly relevant for the Department of the Air Force given the criticality of navigation, timing, sensing, and spectrum control to Air Force and Space Force missions.

EMERGING FIELD

It may not yet be possible to fully anticipate all the potential use cases for QIST. When the first general-use digital computers came about in 1945, the electronic numerical integrator and computer’s (ENIAC) initial purpose was to solve cumbersome mathematical equations, such as ballistic trajectories, in laboratory settings. Back then, few would have predicted a future in which smartphones, modeling and simulation, or computer-generated graphics became ubiquitous. QIST may prove to be similarly transformative.

Congress passed the National Quantum Initiative (NQI) in 2018, recognizing that QIST was on the cusp of transitioning from promising academic theory to real-world applications. The intent was to shepherd a “whole-of-government approach to ensure the continued leadership of the U.S. in QIS [quantum information science] and its technology applications.” The legislation directed creation of a National Quantum Coordination Office (NQCO) to develop a 10-year plan to accelerate QIST applications across multiple sectors. NQCO activities and oversight include coordinating efforts among federal agencies,

providing funding to basic research in universities and federal laboratories, developing the workforce, and establishing standards. The NQCO also established the Quantum Economic Development Consortium (QED-C), a membership organization whose mission is to grow the commercial quantum industry and supply chain. Subsequent National Defense Authorization Acts and the 2022 CHIPS and Science Act further buttressed support for the QIST development.

These starter initiatives, however, may not be sufficient. China is investing heavily in QIST R&D, and the Chinese Communist Party (CCP) has the power to move more rapidly than the U.S. government.

What it will take to achieve a “quantum advantage” remains hard to define. To quantum scientists, “quantum supremacy,” “quantum advantage,” and “quantum primacy” simply mean the ability of a quantum computer to solve a problem that no traditional computer could do. For DOD, a more useful working definition of “quantum advantage” in relation to China and its QIST efforts might include the scientific research base resident in universities and laboratories; the industrial base and manufacturing workforce needed to realize QIST potential; the intellectual workforce for quantum design, engineering, and programming; and the ability to deploy meaningful capability and the readiness of warfighters to employ it. This comparative assessment, unlike the more academic one, also recognizes that quantum advantage is not a “zero-day” event, but rather a marathon.

UNDERSTANDING QUANTUM SCIENCE

Even for leaders with technical backgrounds, quantum science can be confounding. Yet without a basic knowledge of QIST, leaders cannot judge for themselves whether or not proposed projects have real value to the warfighter. Senior leaders must have their own understanding to make informed requirements, resourcing, and programmatic decisions. This does not mean that they need to become quantum scientists or solve complex mathematical equations, but they should be sufficiently literate to ask the right questions, match the tech-



Researchers at the Air Force Research Laboratory Information Directorate in Rome, N.Y., are advancing quantum technologies from the individual quantum bit (or qubit) level to the system level, where different qubit types must interface for future capabilities for the U.S. Air Force.

Albert Santacroce/AFRL

Quantum's Benefits and Challenges

The physics and principles of quantum science are universal, but the means of achieving effects varies. Scientists have developed multiple methods—or modalities—to achieve desired effects. Each has its own strengths and challenges.

Modality Type	Benefits	Challenges
Superconducting Chips	<ul style="list-style-type: none"> Can leverage existing microchip fabrication Small form/fit of chips similar to current chip High gate speeds = faster processing times Circuit logic similar to classical computing 	<ul style="list-style-type: none"> Requires cryogenic cooling Large infrastructure Large power requirements Short coherence times Scalability of individual quantum processors is limited—must be networked to increase processing
Silicon Spin/ Quantum Dots	<ul style="list-style-type: none"> Strong gate fidelity Can leverage existing semiconductor technology High gate speeds = faster processing times 	<ul style="list-style-type: none"> Requires cryogenic cooling Large infrastructure Large power requirements Short coherence times Limited demonstrated gate entanglement may imply inability to scale Vulnerable to interference/cross-talk
Neutral Atom	<ul style="list-style-type: none"> Application versatility High controllability of individual qubits Stable, identical, and consistent qubits Strong connectivity across qubits Long coherence times (5") Room temperature Excellent scalability 	<ul style="list-style-type: none"> Low gate fidelity Slow gate speeds = slower processing times Need to miniaturize laser hardware Need to improve laser precision Need to increase vacuum cell quality
Trapped Ion	<ul style="list-style-type: none"> Application versatility Stable, identical, and consistent qubits Strong connectivity across qubits Long coherence times (10") Room temperature Excellent scalability High gate fidelity 	<ul style="list-style-type: none"> Slow gate speeds = slower processing times Need to miniaturize laser hardware Need to improve laser precision Need to increase vacuum cell quality Ion charge may restrict scalability
Photonic	<ul style="list-style-type: none"> Application versatility Promising qubit fidelity Long coherence times Can leverage existing microchip fabrication technologies Room temperature Are often used in conjunction with atom-based modalities Can be used to convey quantum information ("flying qubits") from one physical location to another 	<ul style="list-style-type: none"> Massless photons are difficult to control Photons do not naturally interact, resulting in poor gate operations High qubit (photon) loss rates (signal loss) Poor qubit connectivity Difficult to entangle Difficult to scale

nology to high-value use cases, and identify key technological challenges. Unfortunately, the Defense Science Board recently concluded that when it comes to DOD and quantum, "there is a notable lack of rigorous analysis tying performance to mission specifications and/or novel capability." More work is required to understand how the foundational principles of quantum science can address capability gaps and vulnerabilities for the warfighter.

The leadership perspective is crucial because the scientists and engineers seeking to transition QIST from the laboratory to the real world may not fully understand the demands of the operational environment or how quantum capability could or should be integrated with other systems. Technological optimism may lead program managers to overestimate the value of a proposed application or underestimate the challenges in maturing quantum tech into a combat capability. Innovators approach QIST from mathematical, scientific, and even theoretical vantages; warfighters must provide the operational perspective.

UNDERSTANDING QUANTUM SCIENCE BASICS

Recent advances in quantum mechanics, material sciences, and other technologies have created the potential to use QIST in

new ways. Long-established applications of quantum phenomena include atomic clocks, lasers, solid-state semiconductors, solar cells, LEDs, and digital cameras and optical sensors. In today's second quantum revolution, researchers apply advances in the underlying quantum sciences to deliberately isolate, control, and manipulate subatomic particles to capitalize on principles like superposition or entanglement to engineer radically new technologies.

A quantum bit, or qubit, is the most basic unit of quantum information. In conventional computing, a bit is binary in nature: either a 1 or 0. These two states relate to the physical property of a transistor, which is either powered on (a state of 1) or off (a state of 0). A qubit, on the other hand, can be in any of three states: powered, off, or superposition, which is a combination state between 1 and 0.

While quantum principles and properties are universal, the physical methods and hardware—or modalities—that physicists use to isolate, control, and measure quantum matter are not. Scientists use different modalities to build quantum bits and access quantum properties. Some modalities use cryostats to chill materials to near absolute zero to enable unique physical properties at those frigid temperatures. There



CGTN/China Media Group

Quantum technology promises dramatically faster communications links than are possible today. China has claimed to have set a long-distance transmission record between two ground stations set more than 1,200 kilometers (745 miles) apart.

is no single best modality or qubit type for all applications. One modality may be more effective at large-scale computing, while another modality may be better at sensing. Each has different strengths and challenges and must be matched to the particular use case. As with any technical design, there are trade-offs between capability, cost, complexity, size, and operational utility. Policymakers should probe these considerations to better understand the strengths and limitations of each and to best match research and development to warfighter needs.

All quantum systems are built on qubits, and how technologists build qubits can vary widely, as can qubit performance. Quantum states are very sensitive, making them both very useful and very fragile. Because of their inherent sensitivity, qubits are prone to error due to radiation, heat, impacts from other particles, or even the machine's control systems.

A logical qubit is one or a grouping of qubits with a longer coherence that corrects for the faults induced by noise. Rather than shielding and striving for perfect qubits, a fault-tolerant system seeks to implement a sort of quality control to compensate for qubit errors. A common means of doing this is to entangle many different qubits together to achieve one "noise-free" or "idealized" logical qubit. Not all qubits are equal, and not all error correction techniques require the same volume of extra qubits.

Quantum companies are often formed around specific technological choices. A QIST company's modality, design, and engineering, however, will have a direct impact on the quality of its qubits and ability to manipulate quantum particles and behavior. A company based on superconducting chips, for example, is unlikely to be able to develop a sensor appropriate to integrate on a fighter aircraft due to cryogenic cooling, power, and space requirements.

A working knowledge of quantum science, therefore, can be significant in evaluating appropriate solutions and use cases.

CHINA SEEKS QUANTUM ADVANTAGE

Experts now estimate that China has invested upward of \$15 billion across all of its QIST research and development efforts to date, a figure that far outpaces the United States and other countries. China holds twice as many quantum patents as the

United States and is aggressively pursuing QIST for military applications.

China launched its Quantum Experiments at Space Scale (QUESS) in 2011, an ongoing yearslong effort by the Chinese Academy of Sciences (CAS) to harness the potential of QIST. QUESS seeks to tackle the many difficult problems of quantum communication, including a new kind of encryption protocol. The 2016 Micius satellite launch demonstrated China's ability to deploy quantum key distribution (QKD), a form of quantum-based encryption, between Beijing and a ground station in western China. The CAS team also used Micius to perform other experiments notable for the distances involved, and in 2017, they conducted the "world's first quantum-encrypted virtual teleconference" with the Austrian Institute for Quantum Optics and Quantum Information (IQOQI), bridging a distance of over 4,600 miles. CAS has since continued to develop and demonstrate novel experiments designed to further secure quantum communications across "untrusted" nodes.

While the National Security Agency (NSA) discourages U.S. entities from using QKD for encryption, China's successful demonstration proves its ability to produce and encode on-demand photonic qubits, maintain signal strength and avoid meaningful qubit loss across thousands of miles of free-space and fiber-optic transmission, and develop secure and accurate quantum repeater stations.

The QUESS program is just one of many lines of effort the CCP is pursuing. China has also made significant strides in quantum computation. In 2021, the University of Science and Technology of China (USTC) revealed an advanced superconducting computer, named the Zuchongzhi 2 after a famous Chinese mathematician and inventor, which utilized 56 qubits out of a total of 66. What was remarkable was that the Zuchongzhi 2 reportedly "cracked a problem three times tougher" than Google's Sycamore computer could solve. The Google Sycamore computer is a 53-qubit superconducting computer that had marked the first point of "quantum supremacy" in 2019. China also demonstrated Jiuzhang 2, a photonic qubit computer whose computational speed and power far exceeds those other efforts by factors thought to be in the billions—at least in highly controlled laboratory settings.

Aside from the construction of prototype quantum com-

puters, Chinese researchers have been developing techniques to solve fundamental quantum challenges, such as error correction and code-breaking. A late-2022 paper by Chinese university researchers proposes a method for breaking standard RSA encryption with a 372-qubit computer. RSA decryption, which could be used for a “harvest now, decrypt later” intelligence strategy, was previously estimated to require hundreds of thousands of qubits. While the paper is controversial in the scientific community and has not yet passed peer review, the research exemplifies China’s sustained effort.

China has made other quantum claims that warrant scrutiny. Public announcements regarding quantum radar, for example, have met with skepticism from international scientists. Quantum radar sends out one particle of an entangled pair, keeping the other in storage. If the entangled particle returns, it represents a positive detection of a target. China suggests this quantum radar is a jam-resistant counter-stealth capability, even marketing a prototype by the China Electronics Technology Group Corp. at the 2018 Zhuhai Air Show. A more recent 2021 paper from Tsinghua University claimed an improved quantum radar design that increased the probability of detection of a stealth object from 10 percent to 95 percent. Other scientists, however, remain skeptical.

The idea behind a quantum radar is that a photon changes when it bounces off a stealth aircraft, and therefore changes the stored partner photon. But quantum storage is still early in development, you cannot monitor the status of the stored photon for change or you’d collapse it, and while you might know the azimuth of the detected contact, you would have no idea of the range because you receive very few particles back. French physicist Fabrice Boust’s comments are representative: “I am convinced that when they announced their quantum radar it was not working ... but they knew they would get a reaction.”

Even if RSA decryption and quantum radar are primarily CCP propaganda, China has no intention of being left behind in quantum science or technologies. In 2008, China established the “Thousand Talents Plan,” a government-led program to recruit and employ foreign scientific researchers in Chinese industry

and academia. According to a U.S. Senate committee report, it is among over 200 talent recruitment programs the CCP is cultivating to accelerate domestic Chinese scientific innovation. These programs go well beyond job postings: Documented activities include conducting undisclosed scientific collaborations, obscuring Chinese institutional affiliations, academic and economic espionage, stealing intellectual property and technical data, and facilitating clandestine relationships with the People’s Liberation Army (PLA).

China’s 14th Five-Year Special Plan for Science and Technology Military-Civil Fusion, its newest strategic-economic plan, specifically highlights QIST, among other technologies such as artificial intelligence and machine learning, as a national imperative. This accounts in part for the Chinese government’s investment of an estimated \$15.3 billion in quantum research to date. Although there is some debate regarding the veracity of these financial assertions, if accurate it would mean that the CCP’s investment is more than double that of the European Union (\$8.4 billion) and triple that of the U.S. government (\$3.7 billion) in quantum research. Even the most conservative estimates of Chinese investment— \$4 billion—would have China easily outpacing U.S. government investment.

China’s experiments also represent practical military applications, even if they are not yet fieldable. Secretary of the Air Force Frank Kendall acknowledged, “It is quite clear to me that we are in a race for technological superiority with China as far as conventional warfighting is concerned.” The director of the China Aerospace Studies Institute concurred, warning that hypersonics and quantum computing stand as “niche fields,” where China is rapidly closing the gap between its capabilities and those of the U.S. Some in industry, including Booz Allen Hamilton’s head of Strategic Cyber Threat, believe China may be on track to surpass the United States.

KEY TAKEAWAYS FOR SENIOR DECISION-MAKERS

I. A sound understanding of the basics of quantum science is crucial to empower U.S. defense leaders to evaluate proposed QIST applications. This does not mean that they need to become quantum scientists or solve complex mathematical



An image from China’s government-funded television network CGTN shows a quantum radar system developed by China Electronics Technology Group, which claims the device can detect stealth aircraft and see through the radar jamming used to hide warplanes.



Airman 1st Class Carl Good

U.S. Air Force Capt. Rob Simmons, center, Joint Base Charleston, S.C., Spark Tank Director of Innovation, briefs SandboxAQ, an Alphabet spin-off that aims to master AQ—the combination of artificial intelligence and quantum science.

equations, but they should be sufficiently literate to ask the right questions, match the technology to high-value use cases, and identify key technological challenges. Understanding the principles of entanglement, interference, non-locality, teleportation, no-cloning, and so forth may seem highly esoteric, but it is vital to ensure that the discussions surrounding QIST programs do not leave senior leaders in the dark. Senior leaders must be equipped to press engineers on everything, including qubit coherence times; qubit overhead; logical qubits; power, size, and cooling requirements; and the overall ruggedness of the quantum system. When it comes to quantum technologies, the details matter.

2. Defense leaders must have a solid foundation in quantum science to appropriately contextualize the operational and strategic implications of Chinese technology demonstrations. China is aggressively pursuing quantum applications, including computation, quantum key distribution, and radar. While some of this is strategic peacocking, other quantum demonstrations are indicative of a clear commitment to solving the difficult problems of fielding useful quantum applications. A knowledge of the science can help policymakers evaluate Chinese developments. For example, some claims, such as quantum radar, appear intimidating and worrisome but are most likely empty bluster. Other very public demonstrations, such as QKD, may not have apparent use cases but clearly prove that China is dedicated to working through many of the scientific and engineering challenges to fielding a broad array of quantum capabilities. Senior leaders must take Chinese developments in quantum computing seriously and consider their potential strategic consequences.

3. U.S. defense leaders should establish a working definition of a quantum advantage that is not purely academic and recognizes the global strategic nature of the competition. A “quantum advantage” for DOD would evaluate the comparative technological positions of the United States and adversaries like China with respect to their QIST efforts. This comparative assessment offers a far more practical understanding of “quantum advantage” because it honors the global strategic nature of the competition. This

definition, unlike the more academic one, also recognizes that quantum advantage is not a “zero-day” event but rather a marathon.

4. Policymakers should understand and consider the benefits and drawbacks of each modality and its qubits so that they may make informed decisions regarding how to best match modalities to their use cases. While some modalities may be more flexible and have benefits across a variety of applications, there is no single best modality. This means that senior leaders must be discerning when evaluating which modalities best match operational use cases. For example, the superconducting modality is probably not ideal for fighter aircraft applications. As with any technical design, policymakers must understand the trade-offs between capability, cost, complexity, size, and operational utility of quantum modalities.

5. U.S. defense leaders should identify high-payoff, near-term quantum applications that are matched to warfighter needs, and establish a quantum-based program of record to deliver that capability. To stimulate the advancement of QIST applications and deliver impactful capabilities to the warfighter, the Department of the Air Force should establish a quantum program of record. QIST must progress out of the basic research phase, and only a program of record will stimulate private equity and focus engineering and design in a way that can deliver capability to the warfighter. Establishing a program of record is key to ensure that warfighters have what they need to secure not just a quantum advantage but an operational advantage.

The nature of the strategic quantum competition with China does not give U.S. defense officials the luxury of time. DOD must accelerate the maturation of critical quantum technologies for defense—China will gladly surpass the U.S. quantum enterprise if we slow down. The DAF must take action now to help its leaders understand the underlying science needed to make choices that deliberately build up a robust and innovative quantum industrial base. Senior leaders must be able to make informed decisions on high-potential, high-payoff QIST applications if they are to provide future warfighters with the combat edge they need. ★



Sen. Barry Goldwater remained in the Air Force Reserve well after his disappointed rout in the 1964 presidential race. Then-Maj. Gen. Goldwater sat in the cockpit of a Convair F-106B Delta Dart in 1967.

3 Airmen Who Sought —But Never Won— the Presidency

**Army Air Forces Vets ran for President in 1964, 1968, and 1972.
None came close to winning.**

By Daniel L. Haulman

Political historians would see little in common among the politics of Republican Barry Goldwater, the Arizona senator who ran and lost to Lyndon Johnson in 1964; George Wallace, the Alabama governor, whose American Independent Party candidacy in 1968 split the Democratic ticket and sent Richard Nixon to the White House; and Democrat George McGovern, the South Dakota senator who lost to Richard Nixon in 1972. All three ran under different party banners, but what they had in common was that all three were veterans of the U.S. Army Air Forces in World War II.

Goldwater flew military transports on long-range transoceanic flights from the United States to the China-Burma-India theater. Wallace was a flight engineer on B-29s on combat missions from Tinian to Japan and back in the Pacific theater. McGovern flew B-24 bombers on combat missions from Italy against Nazi targets in Europe. These military experiences were

Every President of the United States from the end of World War II in 1945 to the end of the Cold War in the early 1990s was a military veteran.

defining moments for each.

Every President of the United States from the end of World War II in 1945 to the end of the Cold War in the early 1990s was a military veteran. Besides Harry S. Truman, an Army National Guard artillery officer in World War I, the others were all World War II veterans: Dwight D. Eisenhower, John F. Kennedy, Lyndon B. Johnson, Richard Nixon, Gerald Ford, Jimmy Carter (who was at the U.S. Naval Academy during the war), Ronald Reagan, and George H. W. Bush. Among them, only Ronald Reagan was an Army Air Forces vet. Except for U.S. Army Gen. Dwight D. Eisenhower, the rest were Navy veterans.

Among the five Presidents since 1992, only George W. Bush, who was a pilot in the Air National Guard, served in the military. Bill Clinton, Barack Obama, Donald Trump, and Joe Biden did not.

The United States Air Force was not created as an independent service until 1947, two years after World War II ended. Before then, the Army Air Forces was subordinate to the Army, and it was a distinctive part

of that service and crucial to the victory of Allied forces over Germany and Japan.

BARRY GOLDWATER

Barry Goldwater's service in the Army Air Forces as a transport pilot was global and heroic. Having attended Staunton Military Academy in Virginia, Goldwater started attending the University of Arizona in 1928, but had to drop out when his father died to run his father's store. The next year, he soloed as a civilian pilot, and obtained a commercial pilot's license. He applied to train as a military pilot in the Air Corps but was rejected because of poor vision. In 1930, he joined the Army as an infantryman in the Reserve, serving in the 25th Infantry Division. During the 1930s, he continued flying private airplanes, accumulating 400 flying hours. In 1934, he married Margaret Johnson, whom he called Peggy.

In 1941, Goldwater visited Lt. Col. Ennis Whitehead at Luke Field, Ariz., and asked for a commission in the regular Army to serve in the Army Air Forces. Whitehead obliged, and Goldwater became the public relations director at Luke Field, with the rank of first lieutenant. He also coordinated the base supply system.

In July 1942, eight months after the bombing of Pearl Harbor and the U.S. entry into the war, Goldwater was assigned to flight training school at Yuma, Ariz., as an aerial gunnery instructor. He also photographed pilot cadets in exchange for their allowing him to fly some of the AT-6 advanced trainer aircraft, accumulating 200 hours of unofficial flying time.

In May 1943, Goldwater finally achieved his goal of becoming a military pilot. The Air Transport Command took pilots with poor vision, such as Goldwater, to help transport planes, equipment, and supplies to various airfields around the world. Goldwater, now a captain, became the operations officer of the 27th Ferrying Squadron. He was stationed at New Castle, just outside Wilmington, Del.

Five months later, Goldwater and nine other pilots joined in an operation known as "Snowball Run," the first aerial ferrying of P-47 single-engine fighters from the United States to England, via

Newfoundland, Greenland, Iceland, and Scotland. Goldwater informally named the P-47 he flew across the Atlantic the "Peggy G" after his wife. The flight covered more than 3,700 miles.

After returning from England on a C-87, Goldwater, as a chief pilot, ferried multi-engine aircraft, including medium bombers, from the United States to India, a distance of 10,000 miles—almost halfway around the world. The Crescent route went from the eastern United States to the Azores, then across northern Africa and the Middle East; the Fireball route went from Miami to Brazil, then across the Atlantic to Nigeria, and from there across Central Africa to India.

In one operation, Goldwater flew a four-engine C-54 loaded with two B-29 engines to a base in India. There he met Gen. Curtis E. LeMay, who helped direct forklifts to unload Goldwater's plane. Goldwater and LeMay became friends at that time.

By February 1944, Goldwater was stationed in India, taking part in "Hump" flights over the Himalaya Mountains from India to China, transporting arms, ammunition, and other equipment and supplies to the forces of Generalissimo Chiang Kai-shek. On these missions, Goldwater flew C-46 twin-engine aircraft, usually landing at Kunming, China, from whence shuttle flights carried the cargo to other bases. Goldwater earned a promotion to major and not long after, to lieutenant colonel. In Burma, Goldwater helped train Chinese pilots to fly P-40 fighters.

In August 1944, after six months in the China-Burma-India theater, Goldwater returned to the United States. He was assigned to a flying training school in Southern California to train future fighter pilots and was there when the Japanese agreed to surrender in August 1945. Goldwater received an honorable discharge that November and returned to civilian life. He eventually went from the retail store business into Arizona politics, and soon helped found the Arizona Air National Guard.

GEORGE WALLACE

George Wallace was never a pilot but, unlike Goldwater, he flew combat missions. Wallace enlisted in the Army Air Forces at Tuscaloosa, Ala., on Oct. 20, 1942, but was not required to



George Wallace, right, chose retired Air Force Gen. Curtis LeMay as his running mate in his 1968 run for the presidency. Running on the American Independent Party ticket, they shared the stage at a 1968 campaign rally at New York City's Madison Square Garden.

1st Lt. George McGovern, in front of his B-24 in Italy during World War II, flew 35 combat missions and earned the Distinguished Flying Cross. His 1972 presidential run ended in overwhelming defeat.



McGovern Library via the Dakota Wesleyan University Archives

report for induction until January 1943. He did his basic training at Miami Beach, Fla., and was sent to Arkadelphia, Ark., for preliminary flight training, including academic courses, despite his already having obtained a law degree from the University of Alabama. But Wallace came down with spinal meningitis and was treated with sulfadiazine, a sulfa drug, to which he suffered an allergic reaction. While on temporary leave, Wallace returned to Tuscaloosa and married Lurleen Burns in May 1943, and then requested he be relieved from pilot training. He reported to Amarillo, Texas, for reassignment as an enlisted man and was transitioned to training as a flight engineer as a member of a B-29 bomber crew. The B-29 Superfortress was the largest, fastest, highest-flying, and longest-range bomber of World War II, with the largest bomb capacity. Wallace completed most of his training at Alamogordo, N.M., but also trained in Denver, and elsewhere. During this time, Wallace was promoted to sergeant.

In mid-June 1945, Wallace and his 11-man B-29 crew picked up a B-29 called “Sentimental Journey” at Topeka, Kan., and flew it via California and the Pacific Islands to the Mariana Islands, where he came under the command of LeMay in the XXI Bomber Command of the 20th Air Force. In Guam, Wallace and his crew transferred to another B-29, called the “Little Yutz,” and flew it on to the nearby island of Tinian, arriving on June 20. Wallace and his crew served in the 795th Bombardment Squadron, 468th Bombardment Group, of the 58th Wing of the 20th Air Force.

By the time Wallace arrived on Tinian, bombardment operations from there to Japan and back had become routine. LeMay had abandoned attempted high-level daylight precision attacks on Japanese military targets, which proved largely unsuccessful because of cloud cover and the jet stream and the extreme altitudes. Instead, he pursued a strategy of lower-level nighttime raids on Japanese cities, using incendiary bombs. The B-29s flew in huge formations on round-trip missions that sometimes lasted up to 18 hours, flying over the island of Iwo Jima on the way. As flight engineer, Wallace was responsible for controlling

the fuel consumption of his Superfortress, to make sure the big plane retained enough fuel to make it all the way back to Tinian after a combat mission.

Wallace flew at least nine combat missions from Tinian in the “Little Yutz”—some of them harrowing and dangerous. They faced flak, enemy fighters, updrafts from huge fires, bad weather, and fatigue. All but one of the missions was a nighttime incendiary raid. Conscious of the massive fires these B-29 missions ignited, the men who flew them suffered a psychological toll. On one mission, two of the aircraft’s four engines quit, but Wallace was able to restart them. On another, one of the engines caught fire, but Wallace was able to extinguish the blaze. “Little Yutz” returned to Tinian on three engines, largely thanks to its flight engineer.

Wallace’s B-29 returned to Tinian from an overnight mission early on Aug. 6, 1945, unaware that another B-29, also based on Tinian, would drop an atomic bomb on Hiroshima, that day. He found out soon enough.

After returning from his final mission on Aug. 6, Wallace and his crew were ordered to embark on an air transport plane to California, landing at Mather Army Airfield. Granted leave, he took a train to Mobile to be with his wife and young daughter, where he was on Aug. 14—“Victory over Japan Day” or “V-J Day”—when it was announced that Japan had agreed to surrender.

With World War II over, Wallace was eager to return to civilian life. He had lost weight and had become anxious, perhaps depressed. Ordered to report for additional flight crew training, he refused, and his commanding colonel sent him for medical evaluation. Doctors determined Wallace was not fit to fly, and he spent a month in a hospital. He received an honorable discharge on Dec. 8, 1945, at El Paso, Texas; the Veterans Administration eventually granted him a 10 percent disability rating.

Among his honors and decorations were credit for the Air Offensive, Japan campaign, an Air Medal, a Good Conduct Medal, and ribbons for the American theater and the Asiatic

Pacific theater. He also received, along with tens of thousands of others, the World War II Victory medal.

In 1958, George Wallace ran but lost the race to be the Democratic candidate for governor of Alabama. Four years later, however, he won the governorship and soon set his sights higher. In 1963, having gained notoriety by challenging federal Civil Rights enforcement, he announced his intention to challenge President John F. Kennedy in the 1964 Democratic primaries. Wallace became a national symbol of Southern resistance to federal civil rights law. Although he later withdrew, it set the stage for his 1968 campaign, not as a Democrat, but as the candidate of the American Independent Party. His choice for running mate was his old superior in the Marianas, Curtis LeMay, who by then was a former Chief of Staff of the United States Air Force.

Precluded from running again for governor by Alabama law, Wallace backed his wife's successful bid for the office in 1966, and then when that term ended, ran and won again in 1970. Two years later, he again sought the presidency, this time as a Democrat, his candidacy ending after he was shot in an assassination attempt while campaigning. He tried and failed a fourth time in 1976.

GEORGE MCGOVERN

George McGovern was a bomber pilot in the Army Air Forces during World War II. McGovern flew B-24 Liberators and was a combat veteran.

Having already trained as a civilian pilot, McGovern completed primary flight training at Muscogee, Okla., basic at Coffeyville, Kan., and advanced flight training at Pampa, Texas, where he received his wings and commission as a second lieutenant in April 1944. McGovern then trained on the B-24 pilot at Liberal, Kan., and Mountain Home, Idaho. He met and married Eleanor Stegeberg during his early flight training.

In October 1944, McGovern voyaged to Italy and in November began flying combat missions, as a co-pilot on his first five missions, and later as pilot in charge for 30 missions more, all with the 741st Bombardment Squadron, 455th Bombardment Group, stationed at Cerignola, Italy. The 455th was one of 21 heavy bombardment groups of the Fifteenth Air Force in the Mediterranean theater.

Among McGovern's 35 combat missions, most were long-range bombing raids against Nazi targets, including railroad yards, fuel refineries, airfields, bridges, and factories in Germany, Austria, Hungary, Italy, Czechoslovakia, and Poland. Two of those missions sought to damage a synthetic oil refinery near the Auschwitz death camp.

He had to overcome anti-aircraft artillery, enemy fighters, and bad weather. On one mission, McGovern's B-24 blew a tire on takeoff, and he had to take extraordinary steps to land the plane safely on return; on another, an engine failure forced McGovern to make an emergency landing on the island of Vis in the Adriatic Sea, putting down on a small runway designed for fighters. His most challenging mission was his last, on April 25, 1945, when McGovern's plane was peppered with flak during a raid on the railroad marshalling yards at Linz, Austria, but despite the plane's heavy damage, McGovern managed to land it safely, saving the lives of everyone on board.

McGovern earned a Distinguished Flying Cross with three oak leaf clusters for his combat flying. According to Thomas J. Knock's biography, "among presidential candidates of the 20th century, none save Eisenhower could boast a more impressive record" of military service. McGovern concluded his service in June 1945, flying a B-24 from Italy across the Atlantic Ocean to the United States, with stops at Morocco, the Azores, and Newfoundland, before landing at Boston.

Additional Reading

BARRY GOLDWATER

■ Lee Edwards, *Goldwater: The Man Who Made a Revolution* (Washington, D.C.: Regnery Publishing Inc., 1995); Robert Alan Goldberg, *Barry Goldwater* (New Haven, Conn.: Yale University Press, 1995)

■ Barry Goldwater, *With No Apologies: The Personal and Political Memoirs of United States Senator Barry M. Goldwater* (New York, N.Y.: William Morrow and Co. Inc., 1979)

■ Barry Goldwater and Jack Casserly, *Goldwater* (New York, N.Y.: Doubleday, 1988)

GEORGE WALLACE

■ Stephan Leshner, *George Wallace: American Populist* (Reading, Mass.: Addison-Wesley, 1994)

■ Dan T. Carter, *The Politics of Rage: George Wallace, The Origins of the New Conservatism and The Transformation of American Politics* (New York, N.Y.: Simon and Schuster, 1995)

■ Mary S. Palmer, *George Wallace: An Enigma* (Point Clear, Ala.: Intellect Publishing, 2016)

■ George C. Wallace, War Department AGO form 53-55 at Alabama Department of Archives and History

GEORGE MCGOVERN

■ Thomas J. Knock, *The Rise of a Prairie Statesman: The Life and Times of George McGovern* (Princeton, N.J.: Princeton University Press, 2016)

■ George McGovern, *Grassroots: The Autobiography of George McGovern* (New York, N.Y.: Random House, 1977)

■ George McGovern, *My Life in the Service: The World War II Diary of George McGovern* (New York, N.Y.: Franklin Square Press, 2016)

He would go on to serve as a senator from South Dakota and to win the Democratic nomination for President in 1972, when he lost by a landslide to Richard Nixon. McGovern would try again for the nomination in 1984, but his campaign did not resonate, and he dropped out.

Since World War II, the United States has had 14 Presidents. Ten of these were veterans, including the first nine in a row. Eight of them were veterans of World War II. For a generation, from 1953 to 1989, Presidents of the United States were World War II veterans. The United States benefited from having had commanders in chief who had also served their country in the armed forces. The only Presidents since Franklin D. Roosevelt who were not veterans were Presidents Clinton, Obama, Trump, and Biden.

Goldwater, Wallace, and McGovern reflect the diversity of views of the nation during and following World War II. Having all served honorably, Goldwater, Wallace and McGovern, regardless of their political defeats in the three sequential presidential elections of 1964, 1968, and 1972 and their strongly contrasting political philosophies, can be remembered for their common courage and heroism in serving their nation and for risking their lives to help the Allies win the war.

Daniel L. Haulman is a former head of the organizational histories branch of the Air Force Historical Research Agency. The author of several books, his most recent article for Air & Space Forces Magazine was "Credit Where It's Due," which appeared in the October 2023 edition.



100-Year-Old Tuskegee Airman Promoted to Colonel

Lt. Col. James H. Harvey III, a Tuskegee Airman and one of the nation's first African American fighter pilots, stands by as his wife and daughter pin on his colonel insignia at his honorary promotion on Nov. 4.



Trevor Cokley/USAF

Storied Tuskegee Airman James Harvey III was honorarily promoted to colonel during halftime of the Air Force vs. Army game on Nov. 4 before tens of thousands of spectators at Empower Field at Mile High in Denver.

Harvey, who turned 100 years of age in July, is among the few World War II Tuskegee Airmen still surviving today.

Wearing a crisp new service dress uniform provided by the Air & Space Forces Association, Harvey stood in the south end zone alongside the Chairman of the Joint Chiefs of Staff Gen. Charles Q. Brown Jr., Sen. Michael Bennett (D-Colo.), and Air Force Secretary Frank Kendall. His two daughters, Alysyn Green and Kathy Harvey, and his niece, Karen Jackson, pinned colonel on his shoulders.

"Because of his work breaking barriers, I can stand here today as the Chairman of the Joint Chiefs of Staff" Brown said during the ceremony. Brown, the former Chief of Staff of the Air Force, was the first Black service Chief in U.S. history. He is only the second Black Chairman of the Joint Chiefs. "James, I want to thank you for your service. I want to thank you for breaking barriers, and it's my distinct honor to promote you to colonel today."

Following the pinning ceremony, two historic aircraft conducted a stadium flyover: a P-47 Thunderbolt, like those flown by Tuskegee Airmen from Harvey's 332nd Fighter Wing, which won the propeller-class segment of the first-ever Air Force gunnery meet in 1949, and a P-51 Mustang, flown by the Tuskegee Airmen during World War II.

"It was a magnificent honor to watch thousands of Airmen, Guardians, and Soldiers cheer on Colonel Harvey when our Chairman of the Joint Chiefs, Gen. C.Q. Brown, promoted him from being the Air Force's oldest lieutenant colonel to the newest colonel in the U.S. Air Force," said AFA's Executive Vice President Maj. Gen. Doug



Joint Chiefs of Staff/@thejointstaff

As one of the last living members of the Tuskegee Airmen, Lt. Col. James Harvey III was honorarily promoted to colonel by Chairman of the Joint Chiefs of Staff Gen. Charles Brown Jr.

Raaberg, USAF (Ret.), who took part in the end-zone ceremony as a distinguished guest. "The Air & Space Forces Association is proud to 'issue' him a uniform fitting of his senior rank and stature as a Tuskegee Airman, combat fighter pilot, and leader."

Also present during the ceremony were the Chairman's wife, Sharene Brown, newly sworn-in Air Force Chief of Staff Gen. David Allvin, Gen. Mark Kelly, Commander at Air Combat Command, and Lt. Gen. Richard M. Clark, Superintendent of the U.S. Air Force Academy.

To learn more about Harvey's magnificent career, read Air & Space Forces Magazine's online July 10, 2023, article, "Attitude is Still Altitude for this Tuskegee Airmen As He Turns 100 Years Old."



SHOP AFA

Shop Gifts for the
Holidays!



SHOPAFA.ORG

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

Robin Olds

Larger-than-life legend on the battlefield and the football field.

Olds was a legend in the Air Force. He had been an All-American football player at West Point (tackle), was an ace in World War II with 13 victories, and married the glamorous movie actress Ella Raines. He was the quintessential fighter pilot. As he put it: “Bombers drop bombs. Fighter pilots fight. It was simply the way it was meant to be.”

Robin's father was Air Corps pioneer Robert Olds, a charismatic and dedicated Airman as well as highly capable commander. During World War II he led Ferry Command and was in line to take over a bomber unit in England but died of heart problems in April 1943, thus cutting short a very promising career.

Robin was then a cadet, where he did all right academically and militarily, but it was athletic prowess that won him collegiate fame. He was big, muscular, and rugged. He graduated a year early due to the war, won his wings, and went to Europe where he flew P-38s and P-51s, soon becoming an ace—in both aircraft.

He spent the Korean War stateside, made colonel in 1953, and continued to fly fighters. In September 1966 he went to Southeast Asia and took command of the 8th Tactical Fighter Wing at Ubon Air Base in Thailand. His vice wing commander and good friend was Daniel “Chappie” James, who would become the first Black four-star general in U.S. history. As a team, they were known as “Blackman and Robin.”

When bomb-laden F-105s went north they were usually escorted by F-4s and Wild Weasels—two-seat F-105Fs that would jam and attack enemy radars. If MiGs showed up, the Thuds would continue to the target while the Phantoms engaged the MiGs. The North Vietnamese were aware of these tactics, so they avoided the Phantoms when possible.

Olds' plan, Operation Bolo, proposed that F-4s mimic an F-105 strike package. The Phantoms would be loaded with air-to-air missiles instead of bombs; they would use standard Thud routing, altitudes, speeds, tactics, and call signs. It was hoped North Vietnamese radar operators would paint the incoming aircraft and assume they were unescorted F-105s. They would then scramble MiGs from the five airfields ringing Hanoi and direct them to the incoming bombers. Not until sighting the Phantoms would the MiGs realize they had been duped. It was expected they would then peel off and head for home. Olds was prepared for that: F-4s stationed at Da Nang in South Vietnam, also mimicking F-105s, would head toward Hanoi from the east. Enemy radar would assume these aircraft were also bombers intending to strike targets near the capital. Instead, the Da Nang fighters would head for the MiG bases and orbit overhead. When the MiGs fled from the Thailand-based F-4s to recover at their airfields, the Da Nang F-4s would be there waiting.

Unfortunately, the mission did not go as planned. Bad weather prevented the Da Nang aircraft from arriving over the MiG bases.



Then-Col. Robin Olds with his F-4C Phantom II. Olds named all his aircraft after his West Point roommate, Scat Davis, whose poor eyesight barred him from becoming a pilot.

Nonetheless, Olds led his wing as scheduled; the North Vietnamese were tricked; 12 MiG-21s scrambled to intercept what they supposed were unescorted F-105s; and they did run into a buzz saw. Without a single loss, seven MiGs were downed, one by Olds—he had four during the Vietnam War. Unfortunately, the lack of the Da Nang force meant the remaining MiGs were able to recover safely.

Olds later claimed that he could have gotten his fifth MiG on a number of occasions, but knew that if he did so, he would be grounded and brought home for public affairs purposes. He would rather fly.

Always outspoken, he was often criticized for speaking his mind. He complained about air-to-air missile technology, for example, noting that the missiles were unreliable. He, like many other fighter pilots, thought the F-4 needed an internal gun.

Upon leaving Vietnam, he was promoted to brigadier general and became Commandant of Cadets at the Air Force Academy; most cadets both adored and feared him. He was gruff, hard drinking, and famous. And he took no nonsense. When a cadet complained after being hammered for making a mistake, Olds said simply he should consider himself lucky: If he had been an officer his career would be over. Cadets could recover from mistakes, he said. So learn.

Upon leaving the Academy, Olds had a tour as Chief of Aerospace Safety and then retired to the Colorado mountains. He died in 2007 and was buried at the Academy cemetery. On his grave, invariably, is a partially full bottle of scotch—old friends stopping by to say hello and have a drink in his memory. 

*Robin Olds' memoirs were published after his death with the help of his daughter Christina Olds and Ed Rasimus, **Fighter Pilot** (St. Martin's, 2010). Of interest, Walt Kross, who flew with Olds in Thailand and later rose to four stars, wrote a fictional account of his tour at Ubon, **Splash One** (Brassey's, 1991), which is excellent.*



Medicare Annual Enrollment? You got this.

And we've got you. Our USAA Licensed Insurance Agents can help you review plans we offer so you can take charge of your Medicare Annual Enrollment.

Plans become available starting Oct. 1.

USAA offers a variety of Medicare Advantage and Prescription Drug Plans through our trusted providers.



Don't wait. Medicare Annual Enrollment Period concludes Dec. 7. Visit usaa.com/aep or call 800-515-8687 to talk to a USAA Licensed Insurance Agent today.

TTY users, dial 711.
Weekdays, 7:30 a.m. – 8 p.m. CT.
When you call, you'll be directed to a USAA Licensed Insurance agent.

Medicare solutions provided by USAA Life Insurance Company, San Antonio, TX, and through USAA Life General Agency, Inc. (LGA) (known in CA and NY as USAA Health and Life Insurance Agency), which acts as an agent for select insurance companies to provide products to USAA members. LGA representatives are salaried and receive no commissions. However, LGA receives commissions from those companies, which can include compensation based on the total quantity and quality of insurance coverage purchased through LGA. Plans not available in all states. Each company has sole financial responsibility for its own products.

It is important that we treat you fairly. Discrimination is against the law. The plans we represent, and their subsidiaries, do not discriminate or exclude people because of their race, color, national origin, age, disability, sex, sexual orientation, gender identity, or religion. USAA complies with all applicable Federal and State Civil Rights laws.

ATTENTION: Language assistance services, free of charge, are available to you. Call 800-515-8687 (TTY: 711).
Español: Llame al número arriba indicado para recibir servicios gratuitos de asistencia lingüística. 繁體中文: 撥打上面的電話號碼即可獲得免費語言援助服務

This advertisement brought to you by USAA, 9800 Fredericksburg Rd., San Antonio, TX 78288.

©2023 USAA. 5827256.1.1023



ALL THREE F-35 VARIANTS
ENABLES BEYOND BLOCK 4

SUPPORTING 55K JOBS

PRATT & WHITNEY | F135
ENGINE CORE UPGRADE



The F135 Engine Core Upgrade (ECU) – directly supporting nearly 55,000 domestic jobs in the United States. The F135 ECU is the proven, faster and more cost-effective option. And it's the only solution that leverages the deep expertise and broad capabilities of RTX. With meaningful capability by the end of the decade, the F135 Engine Core Upgrade is the smart decision for the F-35. Learn more at prattwhitney.com/F135ECU

