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# AIR FORCE

MAGAZINE

## AGE OF AIR POWER

### USAF Turns 75



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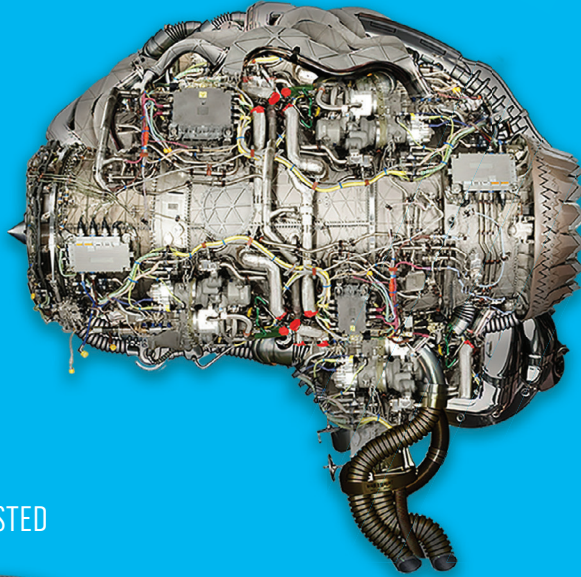
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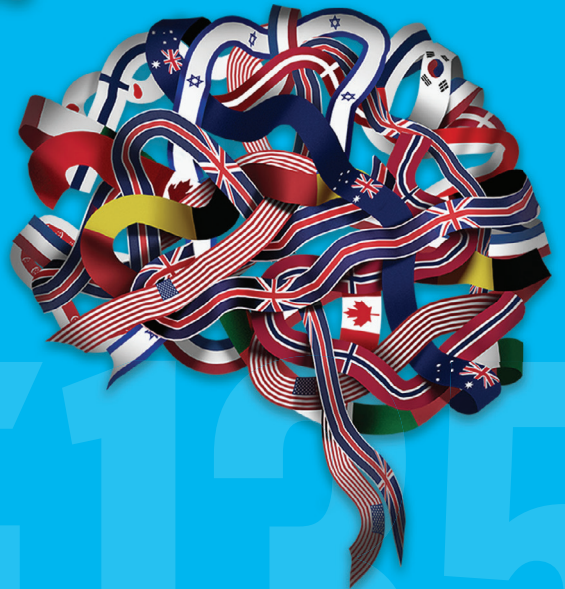
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Mike Tsukamoto/staff; Lockheed Martin

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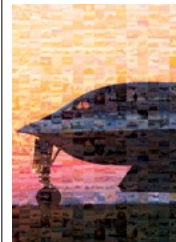
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An artist illustration of a U.S. Air Force's Space Based Infrared System (SBIRS) satellite built by Lockheed Martin provides a continuous view of the Earth's surface. SBIRS collects and transmits infrared (IR) data that is vital for early missile warning and defense.

## ON THE COVER



Eric Lee/staff

A photo of a B-2 on the flight line is re-crafted as a mosaic using hundreds of Air and Space Force photographs.

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By Tobias Naegle

# Milestones

**T**he Air Force turns 75 on Sept. 18, a momentous three-quarters of a century.

Riding the wave of victory coming out of World War II, the Air Force symbolized American ingenuity, industrial might, and sheer audacity. The Air Force produced the world's fastest airplanes and its most lethal and intimidating weapons.

The Berlin Airlift answered Soviet brute force with daring, sophistication, and persistence. High-flying surveillance, within and beyond the atmosphere, unshrouded the activities of America's adversaries, lessening the risk of war. The Air Force broke into space and undergirded NASA's victorious race to the moon.

In Vietnam, the likelihood that Airmen would return home safely after a mission increased dramatically, the loss rate dropping by 80 percent compared to Korea and by 400 percent versus World War II. But the Air Force came out of that war, in which a smaller, weaker foe held and tortured more than 300 Airmen, determined to alter those odds even more dramatically.

It succeeded. The technology that emerged in the aftermath of Vietnam changed the nature of war as much as the advent of air power in the first place. Radar-defeating stealth could render a fighter aircraft all but invisible to enemy air defenses. Precision bombs and missiles, whether enabled by airborne lasers or satellite navigation, provided a new means of strategic, systematic, and progressive warfare.

Between Operation Desert Storm, to expel Iraq from Kuwait in 1991, and Operation Allied Force, to stop the Serb's slaughter of ethnic Albanians in Kosovo in 1999, the Air Force's prowess, capability, and capacity to affect the outcome of conflicts was beyond question. America was the world's lone remaining superpower, and air and space power was its not-so-secret weapon.

Were this the story of one man's life it would be an unparalleled success. He could sit back and live out his days knowing, to quote St. Paul to Timothy, that "I have fought the good fight. I have finished the race. I have kept the faith."

Of course, the Air Force is not a person who can live out the golden years in quiet satisfaction. It is a necessary institution of national power, vital to the preservation of American interests at home and abroad. As such, it must continually reinvent itself, anticipate the threats of tomorrow and invent new ways to challenge, confound, and deter rivals in the future.

As we celebrate the wonders of air and space power and the dominance the Air Force demonstrated in both air and space over these past 75 years, remember that there are more fights to come. The race is not over. And the time is now to rekindle the faith in air and space power that made America's the greatest military on Earth.

Preserving and ensuring that title must be our collective goal. It is the surest way to preserve peace in a world where tyrants and despots seek to amass wealth and resources by trampling on the rights of others. This will come at a cost. It takes effort—investment, invention, and arduous work—to reach elite status in anything. It takes even more to become the elite force USAF is today.

About 17 years ago, then-Air Force Chief Gen. T. Michael Moseley offered a plan to modernize the Air Force at a cost of an extra \$20 billion a year. His vision would have delivered the actual military requirement for F-22s—double the number the Air Force would ultimately acquire—and it would have done so at reduced cost through multi-year agreements. It also would have secured a new tanker, accelerated the F-35, and lined

up investment for a new search-and-rescue helicopter, a new trainer, and new AWACS and JSTARS replacements.

In other words, it would have staved off all the problems the Air Force is suffering today. But Moseley was talking about the future at a time when the present was particularly grim. Poor decisions had left the United States trapped. Iraq had descended into a protracted civil war, and there was no clear way out. The Army was too small, the Pentagon was hemorrhaging money.

"Kids were dying," recalls Gen. Norton A. Schwartz, who succeeded Moseley in 2008. Defense Secretary Robert Gates, brought in to replace Donald H. Rumsfeld and fix the broken war strategy, "was writing letters to the families of the fallen every day."

Gates viewed the Air Force's focus on the future as shrill and off-key. More to the point, he saw the Air Force as a convenient bill payer for up-arming the Army in that ill-fated war.

Time proved Moseley right. Cutting the F-22 program after 187 aircraft would cost the Air Force scale and efficiency, making the planes and squadrons more expensive to sustain, and leaving the service with too few combat jets by the late 2010s. Having failed to get its programs in order 15 years ago, the Air Force is now struggling to pay, all at once, for the KC-46 tanker, the F-35, the B-21 bomber, the T-7 trainer, the new Sentinel ICBM, next generation air dominance, and soon the E-7 Wedgetail.


Gates saw himself as a wartime Secretary but missed the wider context of his job, leading the Pentagon in the midst of a global strategic shift. He ignored indicators of China's growing ambition and squandered the opportunity to get ahead of that threat.

Now, perhaps, the world is waking up to what the visionaries saw so clearly. Russia's war in Ukraine has finally rekindled a sense of purpose among our NATO allies, awakening them to the

need to invest in a unified defense, rather than put that off for another day. In the Indo-Pacific, China's tantrum over the visit of House Speaker Nancy Pelosi to Taiwan makes clear its true ambitions there. In launching exercises that simulated a naval blockade, China aims to intimidate—Taiwan, its neighbors, and the United States.

China already has a larger navy than the U.S., and hopes to outsize the U.S. Air Force, as well. To deter China from fulfilling its territorial and political ambitions, the U.S. will have to compete on both capability and capacity. An arms race is at once economic, technological, and military in nature. To maximize effectiveness, the most valuable new weapons are those that will impose the greatest cost on China to counter.

As the Air Force enters its fourth quarter-century, it desperately needs more resources to match the demands of our defense strategy: Cutting edge technology that imposes new costs, such as integrated satellite targeting, dynamic new weapons like the B-21 bomber and the Next Generation Air Dominance systems to challenge existing capabilities, and scale. The capacity to sustain the force through prolonged combat is as important to deterring future conflict as new capabilities like swarms, lasers, manned-unmanned teaming, and more mobile and resilient satellites.

The lessons of the past 75 years are clear enough. Our Air Force needs both new capabilities and capacity sufficient to execute the Nation's military strategy. For the past 30 years, Americans invested less in their Air Force than in either their Army or Navy. As a result, the Air Force is the oldest, smallest, and least ready in its history. Americans must invest to make our Air Force whole again. 

## **The Air Force is not a person who can live out the golden years in quiet satisfaction.**

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

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**Full Stop**

Stop pretending we're going to be buying F-35s in 15 years. The early, virtually artisanal, copies are already obsolete and it's not inconceivable that the whole fleet will be by 2040. If you really believe in the platform, upgrade the ones we have and buy as many as you can, as quickly as you can, and move on.

Stop pussyfooting around the A-10 issue. If anyone besides the Tucson Chamber of Commerce believes these antiques are relevant, let them have 'em. Maybe the Army wants them for organic close air support and believes we will be fighting folks whose air defense is throwing rocks. Otherwise, shut that operation down and shift the resources to the F-35.

Stop mollycoddling Boeing on the tankers. You keep adding bells and whistles to an aircraft that still cannot perform its basic function. Make them finally fix their screw-ups and maybe consider buying some Airbus tankers off the shelf. We don't need the most exquisite Swiss Army knife of an airplane but we do need workable 21st century tankers to replace the KC-135s, which are actually older than the A-10s.

Stop trying to invent everything yourselves and sending out RFPs to the usual suspects. Instead, let's figure out the effects we want to accomplish and turn the brightest minds in academia and the commercial world loose on the problem. Then take the risk of giving them some real dough quickly so that we might actually get the jump on our competitors.

Richard A. Holt  
San Antonio

**Name Change**

The summary presented regarding the logo and name change to our association was well written, "Editorial: The Air Force

Association is No More, but AFA Lives On," May, p. 2]. As we move forward in our mission scope and duty performance we must welcome such advancements as being reflective of what we are truly all about. Air & Space Forces Association really says it all, however, shouldn't our logo capture this movement and the significance of our progress?

Should we consider altering the letters from AFA and use ASFA as being all inclusive? This logo variant will serve us with great distinction for another 70-plus years and still be "in style" with the combined missions! Please 'Aim High' on this one!

Col. Joseph L. Cordina,  
USAF (Ret.)  
Parker, Texas

**Holy Engines, Batman**

Enjoyed the articles on the CERP for the B-52 ["New Power for the B-5s," April, p. 38].

Why eight vs. four engines? Was eight a frozen holy number as seems the case?

For example, the Rolls-Royce engines, pylon and nacelles from a 757, would have a cleaner solution, with fewer parts, proven design, less weight, and benefits of increased power available. Changes or upgrades to that combination would provide a much quicker answer. The same with Pratt & Whitney or GE Aviation engines.

If the F130 were truly a "plug and play" for TF 33, the choice might make sense but [not with] 60 years of technology, different companies, different engine controls, etc. The need for new nacelles indicates that isn't true.

Charlie McCormack  
Danville, Conn.

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**WRITE TO US**

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## Diversity in the Ranks

In the 2022 Air and Space Force Almanac issue, Lt. Col. (USAF, Ret.) Marshall Miller basically states that “diversity for diversity’s sake” is not necessarily a good thing, because the overarching goal is a more capable military force. He goes on to say that a continued diversity push without any indication (derived from metrics) of positive impact to the mission would be a shame. After reading the letter multiple times, the only logical conclusion I could reach from his article is that leaders should develop a metric to determine if diversity (i.e., minorities and women) is helping to meet the mission; and if metrics do not show a positive mission impact, we should drop the diversity push ... and just stick with the White men majority. I sincerely hope that military and private sector leaders in positions to really make a difference do not subscribe to Lt. Col. Miller’s position. I can’t think of any circumstances in which pushing for diversity by pursuing very capable minorities is a bad thing.

CMSgt. Allen R. Cherry,  
USAF (Ret.)  
Universal City, Texas

I am an ‘old’ Air Force, Vietnam/Cold War-era veteran, and I consider myself a stakeholder in the Air Force and the

United States of America. After reading my January/February Air Force Magazine, specifically the editorial statement, “Russia, China, and Air Power Politics” and several articles in “World: USAF Aircraft Availability On Long Downward Trend,” “Unapproved Religious Exemptions Could Force Out Up to 10,000,” and “Pentagon Releases New Rules to Control ‘Extremist’ Activity,” I became increasingly upset.

How can the Air Force (and other military services) afford to undertake a ‘Great (mandated woke ideological) transformation’ and departure from its heritage, traditions, and martial values when we are confronted by peer-to-peer, superpower competition and potential armed conflict with Russia (the former Soviet Union) and Communist China? What is the point of focusing on notional, ‘feel good’ stuff like diversity, inclusion, and equality and hyper-vigilance to root out military extremists, when the No. 1 priority should be preparation for a war that promises to be radically different from the “sandboxes” of Iraq and Afghanistan?

As far as I recall, during the 45-year Cold War, our armed forces were on their A-game as the defense of the United States and preservation of our way of life was paramount because of the ever-present threat of a nuclear exchange with the Soviet Union. “Fly, Fight, Win” was the

mission and focus of the Air Force. This became more clear when I was assigned to SAC; the legacy of Gen. Curtis LeMay lived on in terms of standards, discipline, uniformity, and cohesion. There was no forgetting that “Peace was our Profession” and that it was a byproduct of “Peace Through Strength.”

I visited [www.af.mil](http://www.af.mil) and saw where the Air Force “unveiled a new mission statement in April 2021. The addition of “Airpower, Anytime, Anywhere” to the original “Fly, Fight, and Win” statement will likely not deter Russian or Communist Chinese aggression if they don’t believe that a ‘balance of power’ really exists.

MSgt. Mark A. Bernhardt,  
USAF (Ret.)  
Orlando, Fla.

## Editor’s Notes:

### In the June/July 2022 issue:

On p. 40, the aircraft flown by Lt. Col Harry Goldsworthy should have been the B-36.

On p. 59, the Sample Housing Allowances with dependants/without dependants headings were reversed.

## Reunion Notice:

**B-52 Stratofortress Association Rendezvous**, Sept. 8-11, 2022. All members and interested parties welcome. For details go to [www.stratofortress.org](http://www.stratofortress.org).



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# PACAF Readies for New Threats

*Gen. Kenneth S. Wilsbach, Pacific Air Forces Commander, has delivered two decades of experience to lead the Air Force's most geographically dispersed major command. Wilsbach sat down with Air Force Magazine at his office at Joint Base Pearl Harbor-Hickam, Hawaii, in a building whose pockmarked outer walls from Imperial Japanese air attack are a constant reminder of the vital importance of air power and readiness.*

## **Q. What is PACAF's role in great power competition?**

A. Our forces need to be ready for any eventual conflict or crisis that we might have. There's a broad range of missions that we can do, from humanitarian assistance all the way up to full-spectrum conflict. The PACAF requirement is to provide those capabilities to the INDOPACOM commander Adm. [John C.] Aquilino, and so, on a day-to-day basis, we have our folks training to be able to accomplish those objectives.

The strategic objective for the United States is a free and open Indo-Pacific, ... through working with allies and partners in the region, working with our joint partners, every single day. I've been in PACAF for a lot of my career, and it hasn't always been that way. But I can tell you that we're about as jointly integrated as I've ever seen, right now.

We're also competing with some folks in the region that don't necessarily want a free and open Indo-Pacific, like China. ... And then Russia, while they are pretty well preoccupied with what's happening in Ukraine, they haven't stopped operating in this theater. So, we pay attention to them as well.

## **Q. How has INDOPACOM developed plans for a joint fight in the Pacific? What is working and what is not working?**

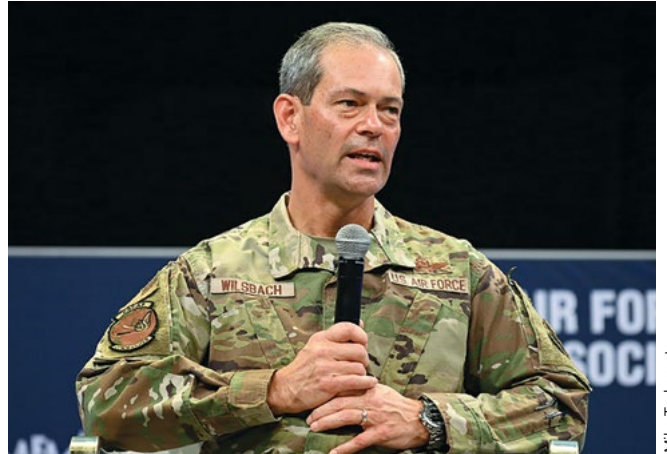
A. The good news story is a lot is working ... we just demonstrated this to Admiral Aquilino [June 3] by putting together a completely joint exercise where we integrated simulated joint fires in our air operations center.

What we're working on is this notion of joint, all-domain command and control, JADC2, and being able to pull that together so that the fires are integrated on a scale and at a pace that makes the response very difficult for your adversary. All of the services are working on technology to be able to realize JADC2. But in the meantime, none of the components out here are waiting on that, we're going ahead and frankly, executing JADC2 with the technology that we already have, knowing that there'll be future technology that will help us to do this better.

## **Q. What resources do you need for ACE and pre-positioning to execute your mission?**

A. With respect to ACE and why we do ACE, I think it's important for the readers to understand that because it's not efficient. It's expensive. .... The reason why we need this is because heretofore we would build up these very large bases, albeit a small number of them.

China has really built up their surface-to-surface capability, and they have the capability of shutting down that [small number] of very large bases. And so, ... in order to create a targeting problem for them, we disperse. That's what agile combat employment is about, creating a targeting problem so that even if you get



Mike Tsukamoto

Pacific Air Forces Commander Gen. Kenneth Wilsbach takes part in the panel "China: The Pacing Challenge" during the AFA Warfare Symposium in Orlando, Fla., March 3, 2022.

attacked at one of your bases, your other bases are able to continue.

In the budget for 2022, and what we think we're going to get for a budget in 2023, we're getting a decent amount of funds to be able to do things like pre-positioning. ... We're beginning to buy those kits, we're beginning to put that stuff out in the field. And we're also doing some construction this year, mostly in the way of runway and ramp extensions, fuel storage, munitions storage.

## **Q. How do you plan to disperse ACE exercises more broadly?**

A. We've actually been doing quite a bit of ACE in Japan, in other parts of Japan like our folks at Yokota and Misawa and Kadena have been doing. And even the Japanese have been doing ACE.

Even in Korea, our forces are practicing ACE. Not in the full spectrum of ACE, like you've seen around the Marianas Islands, but at least part task trainers. The ACE aspect of perhaps taking off out of Osan, landing at another base, getting a quick turn, and getting airborne again; some multi-capable Airmen skill sets in Korea, in Japan. ACE for the entire Air Force [was] started in Alaska. Our forces in Alaska have been doing ACE now for coming up on five years.

Really, all the bases in the Pacific are doing ACE as a component of their day-to-day training. When we first started this, we'd set out, 'Okay, we're going to do ACE for two weeks.' That's not how it works anymore. Now ... we're doing something about ACE every week

We've also had some ACE-like operations in Australia. We've had some ACE operations in the Philippines and Palau. So, there's been quite an expansion of where we do this.

## **Q. What ACE lessons have been learned so far with command-and-control and hub-and-spoke operations?**

A. The command-and-control aspect of ACE is also something that all the wings in PACAF are working through, and finding out what the challenges are, and tackling those challenges with new



innovations and new communication kits, and ways of making sure that, for example, an aircraft that needs maintenance comes back to the hub where the main maintenance is. If you've got one that's good to go, you might send that one out to a spoke, so it can do a quick turn and launch again. That command and control while ACE is happening in multiple places is another thing that everybody's working on.

**Q. Has PACAF declared IOC yet for ACE?**

A. We haven't. But I mean, we're in a good spot, we're in a good spot. And I'm very confident that ACE is something that we can do if the wings get called to do ACE right now. We're working, we're continuing to expand that ACE envelope every single day.

What we've been working on pretty aggressively over the last few years is providing every single wing some foundation of ACE capability. Every wing is a little bit different as to where they go, how they disperse, how much multi-capable Airmen capability they actually have. Certainly, Korea is a little bit different because they're very focused on the North Korean threat [when] everybody else [is] primarily focused on the Chinese challenge. Everybody's also got a little bit of Russia in the back of their minds as well. Every wing applies how they employ ACE just slightly different, but everybody's got a foundation.

**Q. Can you talk about the timeline shift for China's capability to take Taiwan from 2030 to 2027, and what lessons might China be gleaning from the ongoing war in Ukraine?**

A. We detect the shift. You know, there wasn't any magic. That's Xi Jinping in public telling his commanders to be ready to take Taiwan by force by 2027. That's what he said in public. So that seems completely unacceptable to me and to a lot of the region.

"What I think that China should take away as parallels from the Russia-Ukraine fight, there's a couple of things I think that they should pay attention to: The tactical/operational problem that Russia had with Ukraine, which was, in the big scheme of things, a relatively easy problem. Drive across the border and take territory. The terrain is not that tough. It's not a long distance ... it's right there. Yet, they struggled. And why? Well, one of the reasons they struggled is because they didn't really have a good sense of their own capabilities. What I think, and what China should probably pay attention to, is in authoritarian systems, the senior leadership—in this case Putin—didn't get the truth from his generals. And I suspect there's a similar problem in China. So, they might not actually know what their actual capabilities are. That's one parallel.

Another one is ... the simple tactical problem. China trying to invade and take Taiwan by force is the most difficult military problem there is, which is an amphibious landing, and/or an air assault. And the amphibious landing isn't crossing a river, it's a 100-mile strait. That's dangerous waters, so that's not a freebie. You don't just get to sail across, there'll be some combat in that strait. That's a very difficult task to accomplish.

The other thing that's a parallel is you have a nation that, in Ukraine, that's very motivated to defend themselves. And you also saw an international community who did not take kindly to an aggressor nation attacking ... unprovoked. Russia has talking points, predominantly made-up talking points to give them [a] rationale to do the invasion. But, frankly, [they] were complete bunk. The world realized that, and they supported Ukraine, and started sanctions. I would think that China should expect massive sanctions if they were to ever do a similar attack against Taiwan. You have quite a bit of military aid going into Ukraine, from all over the world. I think China should expect something like that for Taiwan. And Taiwan is a fairly well-equipped military. They're

[also] fairly well-trained.

**Q. There has been some talk of a NATO of the Pacific. Do you think this is necessary?**

A. You know who's talking about NATO in the Pacific? The Chinese. Nobody else is talking about NATO in the Pacific, and the Chinese talk about it because they think that it'll create a wedge with our allies and partners. I certainly pick up on that. In my discussions with fellow air chiefs around, they're all picking up on that. They're considering it chaff by the Chinese.

Many countries say to me, 'You are our partner of choice, we want to train with you, we want to be interoperable with you, we want you to come to our country and fly with us, we want to come to your country and fly with you, and we want to go to a third country and fly with all three of us. So, that's constantly happening, day after day after day.

They see China as a challenge and could possibly be threatening their way of life, and their objective to have a free and open Indo-Pacific, and so that's why they want to train with us, and that's why they want to interoperate with us.

**Q. How are bomber task force missions going? How will B-21 long-range strike capability fit into PACAF plans?**

A. The B-21 will be a much larger fleet. Having the ability to have more tails that can be in more places at the same time and create a lot more effects. ... It will give us a tremendous capability to get to places that perhaps we can't get today. And to have effects that can be created by that platform.

The bomber missions have been going pretty well. We can do the bomber task force missions from Guam, .. we can do them from other places, like Australia.

I'm very happy about the joint training that we get done mostly with the Navy, but also with allies and partners. We do a lot of bomber missions with the Japanese. We've done some bomber missions with other countries, and we're trying to expand that.

**Q. What is being done to promote information sharing, and what needs to be done for better interoperability with U.S. F-35s?**

A. We're constantly exchanging information on F-35, with both Korea and Japan as well as Australia. We're flying together regularly with all three of those countries. ... That's sharing the best way, ... in training where you're working, almost interoperably so that you can refine your tactics, techniques, and procedures.

**Q. Can you tell me about an artifact here in your office?**


A. I absolutely love Alaska. The last time I was there, I got to be really close with the Alaska Federation of Natives, ... and we actually collaborate on a lot of things. They gave me some of these. This is a petrified orca tooth, and this is an eardrum of a bowhead whale, and this is the cross section of the spine. I got to go on a whale hunt. I wasn't able to be on the boat where they harpooned, like Captain Ahab-style, harpooning. The boat's barely bigger than my table, and they harpoon this 30-foot-long whale and then they tie it to the boat.

They killed this whale, and they bring it in, and they butchered it. They use every bit of that. All the soft tissue they consume.

**Q. Did you have any of it?**

A. I did.

**Q. What's it taste like?**

A. Wasn't good. Wasn't good [laughing]. I didn't care for it, maybe it was an acquired taste. 

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# Decades of greatness

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**BAE SYSTEMS**

# BAE Systems: A Trusted Partner in Aircraft Survivability



BAE Systems

BAE Systems will re-host the EC-130H Compass Call's mission equipment on the higher performing Gulfstream G550, the baseline airframe familiar to Airmen as the EC-37B.

**B**AE Systems, Inc. has formed a unique relationship with the U.S. Air Force over the service's 75-year history. As one of the world's largest aerospace and defense technology companies, BAE Systems is trusted by the Air Force with highly classified work, particularly in the field of electronic warfare (EW).

BAE Systems' EW partnership with the U.S. Air Force dates to the 1950s, when it was known by its legacy company name, Sanders. Today, the company delivers superior situational awareness, even in the most complex battlespaces, with fifth-generation electronic support, electronic protection, and electronic attack capabilities.

"Our company's EW heritage began in the 1950s with signals intelligence," said Nick Myers, director of strategy and growth for BAE Systems' Electronic Combat Solutions business area, and a retired U.S. Air Force Colonel. "Once you understand sig-

nals intelligence, providing countermeasures is the next step, and the Air Force's U-2 programs are really what got us involved in the countermeasures business for electronic warfare and protecting aircraft."

By continually providing EW hardware, BAE Systems has been building off the legacy of Sanders and the U-2 program by adapting to rapid technological advancements.

"Our systems are designed for today's and tomorrow's evolving threats," said Myers. "When it first started, the U-2 flew so high that there weren't any threats capable of reaching it. But over time, threats advanced and so we used our signal intelligence background to develop a countermeasure. It's a cat and mouse game that continues today, only it's become extremely complex with today's technological advancements."

BAE Systems provides EW capabilities for unique mission sets, such as the EC-

130H Compass Call and the future EC-37B platform.

"Radios use the electromagnetic spectrum (EMS) to transmit voice, data, and other communications, so an enemies' radio provides information to their system that in turn make them a target for our countermeasures," Myers said. "For the EC-130H that is transitioning to the EC-37B, that's a unique mission because it's protecting other aircraft by providing blanket and surgical electronic attack coverage so they can successfully get to and from the target."

But the EW systems BAE Systems provides can be found across a variety of Air Force platforms including the F-35, F-15, F-22, and others, enabling Airmen to effectively complete their missions.

"Pilots can better avoid threat systems to perform their missions, which would be extremely more difficult if they didn't have one of our systems on board," Myers said. 🌟



Mike Freer/Touchdown Aviation

## One Team, One Fight

"Not too long ago we were celebrating 75 years of peace in Europe, and now we have war in Europe. We have war at the eastern edges of the alliance, and I think it's upon all of us to be able to counter future threats as one fighting force."

—**Dutch Maj. Gen. Andre Steur** after the U.S., Netherlands, Italy, France, Germany, Greece, and the United Kingdom agreed to jointly invest in Next-Generation Rotocraft Capability [Defense News, July 20].



Mike Tsukamoto/staff; Lucio Alfonsi/Pixabay

## Land Grab?

"Decency is not a weakness we always have. To answer America, let it always remember there's a piece of territory, Alaska. When they try to manage our resources abroad, let them think before they act that we, too, have something to take back."

—**Vyacheslav Volodin**, the chairman of the Russian State Duma (parliament), speaking to lawmakers about possible Russian responses to U.S. sanctions [July 6].



Senior Airman Zachary Rufus

## They Have a Dream

"F-16s are still something that our pilots dream about. F-16s are a global symbol of aviation might and force. ... We really hope that our pilots will be able to fly some of them to protect our country and show the world that Ukraine is a modern Army capable of protecting the whole of Europe."

—**Yuriy Sak**, adviser to Ukraine's minister of defense, in a phone interview from Kyiv with Air Force Magazine.



Lucio Alfonsi/Pixabay; Mike Tsukamoto/staff

## Ante Up

"I'm always reluctant to put a whole lot of chips in the middle of the table ... and the NGAD seems like a whole lot of chips going in the middle of the table ... maybe you've got to do it. Maybe it's a technology that, if somebody else gets there first, and you haven't gotten there, then you're in a really bad place."

—**Rep. Adam Smith**, Chair, House Armed Services Committee, Defense Writers Group, commenting on the Next-Generation Air Dominance system [June 15].

## SOONER OR LATER

"There is a lot of attention being paid [to how China views the war in Ukraine]. And one school of thought is that the lesson is 'Go early and go strong,' before there is time to strengthen Taiwan's defenses. We may be heading to an earlier confrontation—more a squeeze than an invasion—than we thought."

—**Sen. Chris Coons** (D-Del.), in an interview with The New York Times.

## DEEP SPACE



NASA

"Today, we present humanity with a groundbreaking new view of the cosmos from the James Webb Space Telescope—a view the world has never seen before. ... Webb will help to uncover the answers to questions we don't even yet know to ask; questions that will help us better understand our universe and humanity's place within it."

—**NASA Administrator Bill Nelson** on images from NASA's James Webb Space Telescope [July 12].

## DOLLARS AND SENSE

"In purchasing power parity, [China] spend about \$1 to our \$20 to get to the same capability. ... We are going to lose if we can't figure out how to drop the cost and increase the speed in our defense supply chains. ... In this environment today, it is absolutely going to kill us."

—**USAF Maj. Gen. Cameron G. Holt**, deputy assistant secretary to the Air Force for contracting, at a federal contractor event, quoted in The War Zone.

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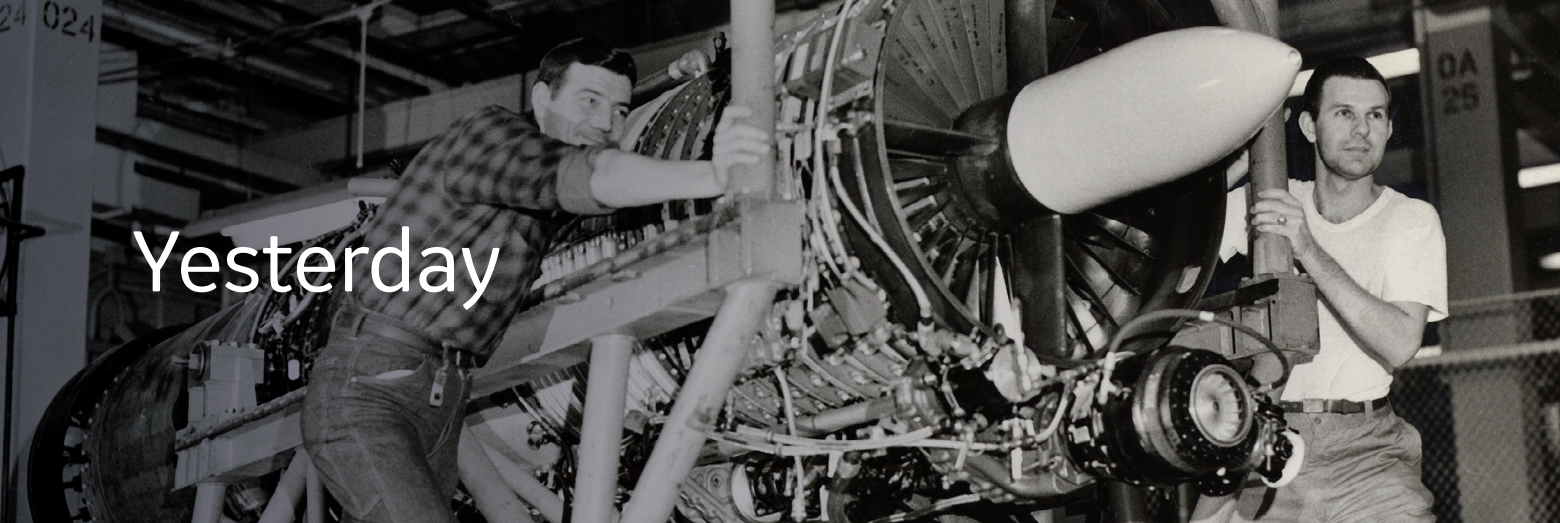




Staff Sgt. Devyous Barlow spreads concrete during a runway overrun repair project at an undisclosed location in Southwest Asia in June. The quality and maintenance of runways has a major operational impact, affecting everything from safety to maintenance and is critical to ensuring that future Agile Combat Employment operations are successful. The lack of runways proved disastrous during the Korean War (see "Air War Over Korea," p. 86).



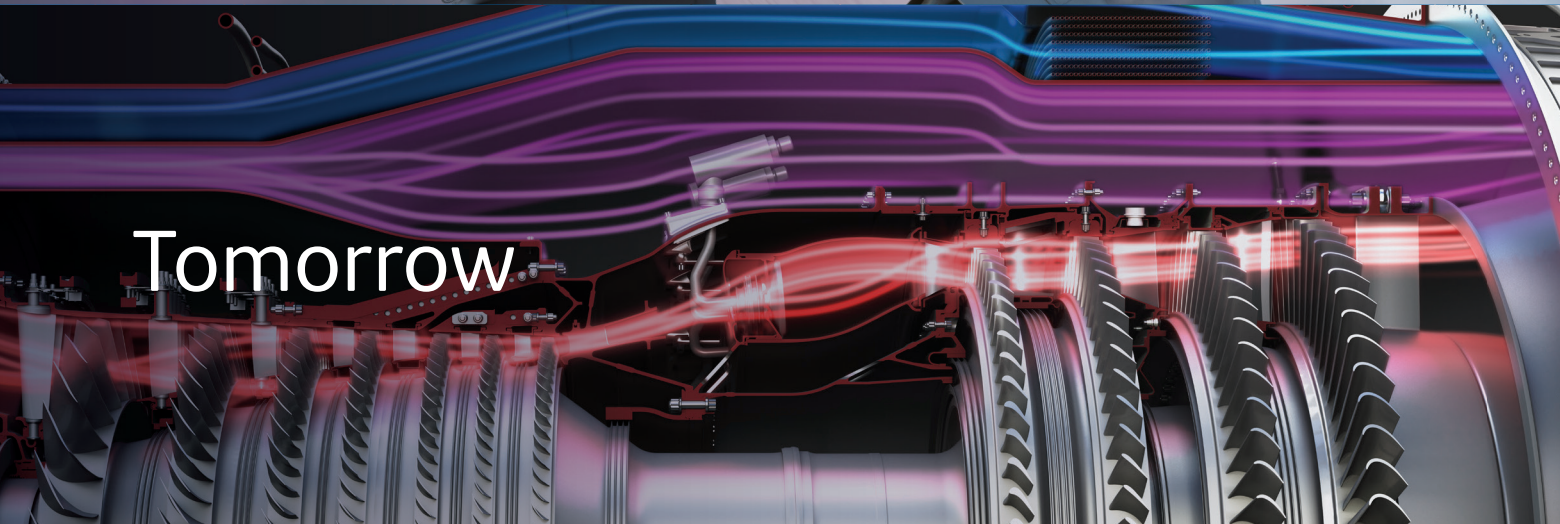
Behold the pilot's view of a KC-135 from his F-15D cockpit somewhere near Kadena Air Base, Japan. Refueling capacity is a key to meeting operational needs in a vast region where routine operational distances extend into the thousands of miles. The Air Force's 340 KC-135s average more than 60 years of age and will eventually be replaced by more capable KC-46s that combine greater fuel capacity, greater range, and the ability to transfer fuel by both boom and drogue, as well as to move fuel to and from other tankers. Once fully operational, the Pegasus will be able to operate closer to the fight and enhance fighter effectiveness in ways not possible by the venerable KC-135.



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# General Electric—A Reliable Partner from the Very Beginning

In 1941, Gen. Henry H. “Hap” Arnold of the then-U.S. Army Air Corps, personally reviewed a jet engine patented by Sir Frank Whittle flying on a Gloster E.28/39 aircraft. Impressed by its design, Arnold arranged for a Whittle engine to be brought back to the U.S. and tasked General Electric (GE), known for its work on turbosuperchargers, to use the Whittle design as the foundation for developing the first U.S. jet engine. Arnold’s request for a new jet engine launched a partnership that continues today, with the ongoing development of GE’s XA100 designed for the F-35, along with thousands of GE engines that power the current Air Force fleet.

“The primary challenge of the day was that engines lose power at higher altitudes where air density decreases,” said Darin DiTommaso, vice president of engineering for GE Edison Works, GE’s advanced military products organization. “GE had developed a turbosupercharger that demonstrated the ability to reduce the amount of power loss at higher altitudes, so the U.S. Army Air Corps selected GE to develop an engine we called the I-A.”

At the time, GE’s development of the I-A engine was a secret program. So secret, in fact, that the engineers tasked with the project became known at GE’s Lynn, Mass., plant as the “Hush-Hush Boys.” The engineers succeeded, as the I-A engine first ran on April 18, 1942, and flew six months later in October 1942, powering the Bell XP-59.

The rapid development of the I-A engine put GE on its trajectory to becoming a world leader in jet propulsion technology. The investments made into the I-A’s research and development laid the foundation for the future success of several engines, including the J47, the world’s most-produced engine.

“Jet engine development is one thing, but it’s another to mass produce it on a regular basis,” DiTommaso said. “We developed a supply chain and cultivated the relationship between our engineering and manufacturing organizations, en-

abling the J47 program to produce more than 35,000 engines, primarily for the F-86 and B-47.”

General Electric employees work on the J47 engine at the company’s Lockland plant in 1950. General Electric photo.

Longevity soon became a trademark of GE’s engines.

By 1959, GE’s J85 engine powered the first flights of the T-38 trainer, an aircraft that remains in service today. Another GE engine, the J79, famously powered the F-4 Phantom for the Air Force, a handful of which still fly today internationally.

“That longevity validates the quality of the J85 and J79 designs, which reflects on the quality of our engineers, product support team, supply chain, and operators on the manufacturing and assembly lines,” said DiTommaso. “Technology continually improves, and key deliverables and requirements change. We’ve adapted our designs as requirements asked for much more fuel efficiency and thrust, but the true value of an engine like the J85 is really in its simplicity and low cost.”

GE further benefited from its participation in the 10-year “Great Engine War” competition with Pratt & Whitney from 1984-1994.

“Competition forces you to collaborate with the customer in order to fully meet their needs across a variety of challenging requirements,” DiTommaso said. “As a manufacturer, you have to listen to the customer—in this case the Air Force—to deliver what they want at the time they want it. Our collaborative relationship builds trust so that when things don’t always go perfectly, you can still work through issues together.”

GE’s advanced F110-129 engine has been significantly improved to adapt to the unique demands of the F-15EX, with increased airflow, jet engine efficiency, a three-stage chord blisk fan, and an advanced radial augmentor to reduce complexity, improve maintainability, and increase the life span of parts.

The trust developed between GE and the Air Force directly empowers pilot

success in major military air campaigns, such as Operation Desert Storm.

“About 80 percent of the U.S. and Allied aircraft in Operation Desert Storm were powered by GE, more than 5,000 engines in all,” DiTommaso said. “We supported the F-16s, F-117s, F-18s, A-10s, Blackhawks, and Apaches as well as military transports. No matter the aircraft, our goal is for the pilot to never have to think about the engine so they can focus on their mission.”

GE is continuing that mission today, innovating to develop the world’s first-ever flight-weight three stream adaptive cycle engine—the XA100—to bring next generation technology to the cornerstone of the Air Force fleet, the F-35.

“The Air Force expressed the need for better fuel efficiency, more thrust and thermal management, and the XA100 delivers, bringing 25 percent better fuel efficiency, 10 percent more thrust, and twice the thermal management capability,” DiTommaso said. “The first engine-to-test campaign is complete and we’re now in the second phase of our second engine-to-test campaign at Arnold Engineering Development Complex. We’re very pleased with how it’s performing and looking forward to an opportunity to bring that capability to the field.”

DiTommaso is confident that GE’s military business, because of the relationship it has cultivated with the Air Force over its 75-year history, will continue to flourish into the future.

“Our relationship with the Air Force is built on a series of successes and close collaboration,” DiTommaso said. “Today, GE and its joint venture partners power around 40 percent of U.S. Air Force aircraft, and we continue to be a key strategic partner in improving their existing fleet’s sustainment and readiness. We’re going to continue listening, collaborating, and delivering innovative technologies and products that will keep our Air Force leading the world. GE is honored to play our part and looking forward the next 75 years.”

By John A. Tirpak

# The Chinese-Russian Axis After Ukraine

**C**hina and Russia form an “axis” working against the interests of the U.S., and that relationship is likely to strengthen in the wake of Russia’s invasion of Ukraine, despite economic sanctions on Moscow. China is learning damning military lessons from the Ukraine conflict that may drive it to engage in a small war for “practice” before tackling the one that really matters to it: Taiwan. In response, the U.S. should continue with its successful—so far—strategy of building a united front against aggression and authoritarianism.

So said scholars in a Center for New American Security online seminar, “The China-Russia Nexus: How Should the U.S. Compete?” held in June.

“I think it is accurate to call this an ‘authoritarian axis,’ CNAS senior fellow Andrea Kendall-Taylor said of the China-Russia alliance, which she dated back to 2014. Russia’s invasion of eastern Ukraine “was a critical catalyst” driving Russia and China together because, with sanctions applied, Moscow “really no longer saw any opportunities in the West” and sought partners elsewhere. The two countries have since “leaned in’ to this relationship,” she said.

Both countries fear democracy and view the U.S. “as their primary threat.” They both seek to undermine U.S. power and influence and believe the U.S. “weaponizes” democracy to “spread America’s own influence and to undermine their own regimes.”

Vladimir Putin and Xi Jinping also have a personal relationship, Kendall-Taylor said. China has invested in Russia, and there have been actual—not just figurative—bridges built between the two countries in recent years. Both feel they are best served by having a stable border and relationship at their backs so they can direct their efforts outward, she said.

China and Russia are close for “purely practical” reasons, she said, noting their complementary capabilities and interests. Russia has sophisticated weapons to sell to China—although that factor is diminishing as China independently improves its military technology—and China has been willing to invest financially in Russia’s economy. There’s a “practicality and a complementarity that just naturally feeds the relationship,” she added.

Kendall-Taylor cautioned that Russia and China are “not aligned on every issue” and have some diverging interests. But the value of cooperation for now outweighs those other considerations.

While “Beijing has been very cautious” about being too vocal in its support for Moscow since the invasion, “as soon as that international spotlight starts to dim” and the world turns its attention to other crises, Xi will “lean in” with “efforts to support his closest strategic partner,” she said. This is “what we saw in 2014. ... As soon as the world moves on,” the two will be “in this together.”

## A WARM-UP WAR BEFORE TAIWAN?

The lessons from Russia’s uncoordinated and frequently ineffective operations in Ukraine should be “really sobering for China,” said Jennifer Lind, associate professor of government at Dartmouth University. They have similar military equipment and logistical systems, and both lack modern experience in ground war and combined arms operations, she pointed out.

They also lack “the innovative learning culture that leads to high-quality performance” on the battlefield, she added.



CGTN

Chinese President Xi Jinping presented the first Friendship Medal of the People’s Republic of China to Russian President Vladimir Putin, calling him his “best friend” and “confidant.”

“Any sensible observer” in China, looking at Russia’s debacle in the first few months in Ukraine, “should feel pretty sick to their stomach,” because China “ticks all these [same] boxes.”

China and Russia recently tried to enact military reforms, and Ukraine may be a barometer of “how effective those reforms have been, how committed these institutions are to them ... and to what extent.” The two countries are “transforming antiquated, bloated organizations” that are traditionally “very much focused on ground forces.”

China’s lack of recent, real-world experience in modern war is also a danger signal, Lind warned.

“The Chinese are probably realizing ... that if they want to fight the war over Taiwan, [it] ... shouldn’t be their first” modern conflict, she said. “If they want to play in the Superbowl, they’re going to have to play a few games beforehand.”

“That’s a pretty sobering thing when we think about the number of ... territorial disputes” China is engaged in around the Indo-Pacific, “and the various ways in which it might be tempted to use force in East Asia.” China perceives its inexperience as a “key vulnerability” and “frankly, we should probably be expecting China to engage in military force toward the goal of getting better at war.”

The idea that Russia’s invasion of Ukraine opens the door for an invasion of Taiwan misses the mark, though, according to Lind. China has its own interests, its own timelines, and “strategic calculations,” not driven by what Russia does.

“I think we can overstate whether China’s calculus toward Taiwan has anything to do with what’s going on in Europe,” she said. China has long-term goals regarding Taiwan, and it likely wants to accomplish those goals without armed conflict.

“China ... uses ‘salami tactics,’” Lind explained, by “changing facts on the ground ... using interventions that are nonkinetic” and gradually achieving its goals in small increments. The West shouldn’t assume China is resolved to invade Taiwan if it can achieve its ends in other ways.

The increased fear that China will take advantage of the invasion of Ukraine to carry out its own invasion of Taiwan could help propel such an event toward reality, according to James Steinberg,

Dean of Advanced International Affairs at Johns Hopkins University. If Taiwan believes the timetable for a Chinese invasion has accelerated, “it will start to strengthen its military capacity, its ability to resist, and move closer to the United States militarily and politically. That may well influence Beijing’s calculations. So it’s sort of a second-order consequence” of the Ukraine aggression.

China is probably unconcerned that it will be economically sanctioned as a consequence of supporting Russia during the Ukraine invasion, said Richard Fontaine, chief executive officer of CNAS, who has worked on the National Security Council and the staff of the Senate Foreign Relations committee. China recognizes that since Russia is so excluded from the European economy—except for energy—imposing sanctions on it wasn’t a huge cost for the West.

Western countries “have so much less” to lose in sanctioning Russia than they do China, with whom there is a robust economic relationship, he said, and China knows it.

Taylor offered, though, that Russia is “not as isolated as we would like to think on the international stage.” She said, “We can collectively pat ourselves on the back because the transatlantic response [to the invasion] has been outstanding, as it has been from countries in the Indo-Pacific that are onboard.” However, “that has not been the response from the rest of the world,” and India, South Africa, and others have not followed suit.

“Not one African country has levied sanctions on Russia,” she mentioned.

## CHINA’S INFLUENCE IN EUROPE

China has probably lost influence in Europe as a result of its backing of Russia in Ukraine, but not seriously enough to cause it to scale back its friendship with Moscow, Fontaine said.

Sentiment in Europe has turned against China, he said, “because at the time of Europe’s peril, Beijing has sided with the aggressor.” China has “taken the Russian position,” echoing Russian charges of American chemical weapons labs in Ukraine, and “how NATO expansion should have stopped a long time ago.” It would be “hard to overstate” the antipathy Europeans feel toward China as a result, he said, comparing it to that in the U.S. toward the Middle East after the 9/11 attacks. The invasion has fundamentally changed the way Europe perceives threats to its collective security, what defenses it needs to have, and “the kind of relationships [it] needs,” including with China.

“At this point, Russia has got to look like a less-valuable quasi-ally than it did in January,” Kendall-Taylor said. “Its military looks much less capable than everyone—including the Chinese—probably thought. Its economy will be smaller because of sanctions “and that will continue indefinitely. It is more diplomatically isolated.”

Even so, “I don’t think that’s nearly enough to sever, or even set back, the drive the Chinese leadership has for a closer relationship with Russia,” Fontaine said.

## RUSSIA’S AND CHINA’S NARRATIVES

Much depends on whether Xi buys Russia’s “current narrative” about Ukraine, Lind said.

The Russian military was “exposed for being far less capable than we ever imagined,” she said. “But if they do turn the corner and start to generate more momentum in the Donbas,” Russia will push the idea that it can, “on a peacetime footing, beat Ukraine, acting all on [its] own, while Ukraine has the backing of every single NATO member state,” and that makes it a more valuable ally.

Steinberg said there is also a receptive domestic audience in Russia for the narrative that “this is not really a war about Ukraine

but a proxy conflict between Russia and the United States.” He said this is a point of view “you hear ... even in India.”

Lind warned that the U.S. probably thinks too highly of its “soft power” and assumes that it has a sympathetic ear around the world, which she said is not necessarily so.

China portrays itself as having “clawed its way up to the economic pinnacle of the world,” after being exploited by the imperialist West in the 19th century, she said. It paints itself as a country “that understands economic development and is standing up to the United States, which has been using force all around the world ... in very dangerous ways for the past several decades.” There’s “strong sympathy for that,” she said. While America does have soft power, particularly with its cultural exports, “there’s a lot of places that view [it] with distrust and skepticism.” Countries are “very interested in China’s growth model and in what China has to say,” and other authoritarian countries are “deeply interested” in how China has grown and prospered, “and what it might do for them,” she said.

Underestimating China’s soft power “is something we do at our peril,” she added.

## NIXON’S APPROACH WON’T FLY

Steinberg said the U.S. approach to the modern China-Russia axis can’t follow previous models. Harking back to Richard Nixon’s efforts to “open up” dialog with Beijing, he noted that Nixon’s idea wasn’t to side with China against Russia, or even to “play both across the other ... but to be closer to ... each of them than they were to each other.” The situation today is very different, he said.

China and Russia have an “extraordinarily asymmetric” relationship, he noted. “Russia needs China badly, for all kinds of reasons” and while China “welcomes the partnership, it doesn’t need Russia.” Consequently, “China can pretty much dictate the terms” of the alliance. China’s need for technology from Russia is “declining over time ... 20 years ago, they didn’t know how to build a fighter. Now they do.” The same applies to aircraft carriers and air defense systems, “and now they’re ahead of Russia in some areas, probably hypersonics.”

It’s hard to find an opening that would relax tensions with either state, he said.

Today, “there isn’t much we can do to get closer to Russia,” Steinberg said, because “we can never offer Russia what China can offer.” So there’s not much to the idea that “we can drive a wedge between them.” And, if the U.S. sees both as high-end competitors—and promotes that view among its allies—“that will inevitably ... drive them together.”

The best strategy for now is to “continue this momentum” of the unified international response to the Ukraine invasion, Kendall-Taylor said, “because the weakness of these authoritarian regimes is that they make mistakes,” among which Ukraine was a “colossal” one for Putin. That makes it important for America and its allies to “be united, be working together so that we can take advantage of these mistakes and shape the world” in a democratic way.

Fontaine noted that the Ukraine invasion has backfired on Putin, with Sweden and Finland joining NATO and the other members “wanting to work together more closely,” stepping up their military investment, and stiffening their military posture. Allies in Asia that have signed on to the sanctions are trying to show China “what aggression can be met with in a consolidated response.”

All this “does create some opportunities for us to work together,” he added; that the democratic nations “are allied and stronger still.”



Airman 1st Class William Rio Rosado

An MQ-9 Reaper flies a training mission over the Nevada Test and Training Range. Unmanned aerial systems such as the Reaper changed air warfare for good.

# Revolutionary Partnership

## Early vision and sustained support enabled the Air Force and General Atomics to change warfare forever

**O**ne extraordinary thing about the U.S. Air Force's unmanned aircraft revolution was that it almost didn't happen.

True believers couldn't always make others see the vision, and had to overcome "opposition from many in the service," as retired Gen. John Jumper, a former chief of staff, told Congress earlier this year. Once the Air Force committed in the mid-1990s to the RQ-1 Predator, the challenges only began.

"Introduction into the Air Force was not easy," Jumper said.

But the service remained committed, and so did the aerospace pioneers at General Atomics Aeronautical Systems, Inc., builder of the aircraft. Together they forged a partnership that went on to change warfare forever.

Initially, Air Force leaders focused on enhanced reconnaissance: With no hu-

man crew on board, the Predator could stay on station, orbiting areas of interest for many hours longer than conventional combat aircraft.

Commanders quickly warmed to the quantity and quality of real-time situational awareness these unmanned systems produced, more than had ever before been possible. During the air war over Kosovo in 1999, for example, officers were able to watch a Yugoslav target before, during, and after it was struck by munitions dropped from a B-52, as Air Force Magazine described. Commanders could conduct immediate bomb damage assessments from their op center.

Soon the issues shifted to new questions: How best to use a Predator's view of a target to cue a strike aircraft quickly; how to operate the aircraft at greater distances via satellite; how to upgrade what the aircraft could do itself with its own

sensors and—maybe someday—even its own weapons.

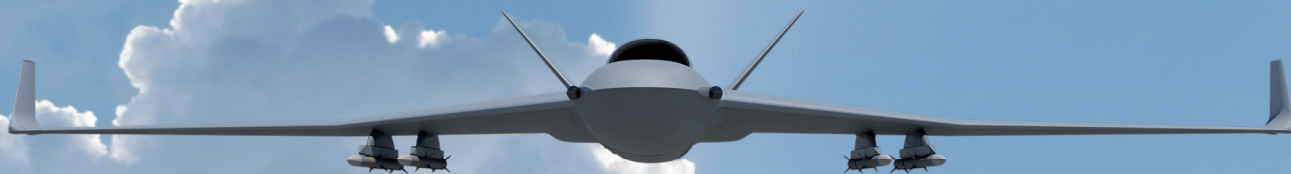
Those problems were solved.

"We were done crawling. We were walking, and we were getting ready to run," says Dave Alexander, president of GA-ASI, who as a company aerospace engineer at the time was a central part of the process. "We knew then how much more this platform could deliver and we stayed focused in supporting the Air Force in getting it there."

That phase of the story has passed into lore along with the names of leaders like Jumper; his predecessor as Chief of Staff Gen. Michael Ryan; retired Col. James "Snake" Clark, who later headed intelligence, surveillance, and reconnaissance innovations as a civilian—and the team at Air Force Materiel Command's Big Safari office, led by William Grimes. Once they and other Air Force leaders saw the Predator in action in the Balkans, they



*NextGen*



*Defender*



*Ghost Reaper*



*Sparrowhawk*

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knew what unmanned systems could do in future applications.

**TEETH OF THE PREDATOR**

The Air Force, GA-ASI and its partners began addressing the needs: The Predator got better sensors and a laser designator so that it could spotlight targets for armed aircraft to strike with precision-guided munitions. Then, it got weapons of its own: a pair of AGM-114 Hellfire anti-tank missiles. All that work was well underway by Sept. 11, 2001, when the use case for armed UAS stopped being theoretical.

Suddenly American officials needed more, ever more, sustained, high-quality intelligence about activities on the ground in Afghanistan, which sheltered the al Qaeda conspirators of the 9/11 terrorist attacks. And U.S. counterterrorism strategy began to rely heavily on the ability to find, pursue and eliminate individual terrorists or small groups, knitting together all sources of intelligence available and then relying on the Predator to conclude the operation.

The aircraft, the Air Force and other U.S. government teams that operated it had their rendezvous with destiny. The Predator changed the battlefield in Af-

ghanistan, and later Iraq and elsewhere. It became an icon, nominated as the one of the top 10 aircraft that changed the world. One important early aircraft hangs in the National Air and Space Museum and another Predator is on display at the National Museum of the United States Air Force.

Before long, GA-ASI and the Air Force both recognized that the success of the Predator also revealed its endless possibilities. So even as GA-ASI workers were proving out and perfecting the Predator's capabilities, they also developed a larger, more capable successor: the MQ-9A Reaper.

**ENTER THE REAPER**

Nine feet longer than the Predator, with a wingspan 11 feet greater, the Reaper's takeoff weight is 12,000 pounds, more than 4.5 times that of the earlier aircraft. Its speed, altitude, endurance, and payload are likewise greater, and its a Honeywell-built turboprop engine gives it the voice and power of a modern aircraft.

"Reaper defined what medium-altitude, long-endurance ISR could be, based on what the Air Force and the joint force needed," Alexander says. "It still

does, and it will for a long time."

Aircraft followed for other services—including the U.S. Army's Predator cousin, the MQ-1C Gray Eagle. Friendly nations followed the trend, including the United Kingdom, France, Italy and more. The mission envelope, which began as tactical ISR, expanded into border security, humanitarian assistance, disaster response, customs enforcement, infrastructure security, wildlife monitoring, and beyond.

Hardware, software, and other innovations only have grown as well, company officials say. In partnership with the Air Force, GA-ASI is redrafting the very same UAS handbook they wrote together with new practices that will transform military operations and air dominance again.

**THE FUTURE FORCE**

One example is with artificial intelligence and autonomy, and a new generation of aircraft that will do much of their work on their own, without constant, real-time attention by human pilots.

"We won't need stick-and-throttle flying anymore unless we want it, and we won't need to have human eyeballs watching the sensor feed every minute," says Patrick Shortsleeve, a retired Air

**A General Atomics MQ-20 Avenger unmanned vehicle returns to El Mirage Airfield, Calif. in 2021, during Orange Flag 21-2. The mission helped test the Skyborg Autonomy Core System.**



General Atomics

Force colonel who served as a director of intelligence at NATO and director of ISR operations for coalition forces in Afghanistan. Shortsleeve now works as GA-ASI's vice president for DOD strategic development.

"You'll push a button," he says, "the airplane will take off and fly its mission, and if it sees something interesting it'll tap you on the shoulder and say, 'Hey, take a look at this.'"

Shortsleeve refers to this as a form of "supervised autonomy"—humans in command, but at a layer above unmanned systems working independently or collectively to perform ISR or support

other operations. The aircraft could sortie in autonomous-only flights or team with crewed aircraft. In addition to ISR roles, future uncrewed systems might be the lead element in a fighter sweep, or defend tankers, early warning platforms, or larger surveillance aircraft.

Autonomy promises to reduce personnel costs and eliminate dependence on datalinks that adversaries try to jam and hack. With resilient new networks and other novel capabilities, the aircraft can fly, work, and burst-communicate only when needed.

GA-ASI's combat-proven, jet-powered MQ-20A Avenger UAS regularly

notches new milestones in integrated autonomous operations when flying in support of Air Force exercises at Nellis AFB, Nev. The Air Force Life Cycle Management Center (AFLCMC) is supporting the Skyborg Vanguard Program, and new bigger, more sophisticated unmanned jets are in the works, promising more endurance, higher-quality ISR, and increased lethality.

The partnership between the Air Force and GA-ASI will continue to make history, Alexander vows.

"Supporting the women and men of the U.S. Air Force is our honor," he says. "And we're just getting started." ✪

**History of Innovation**

The partnership between the U.S. Air Force and General Atomics Aeronautical Systems, Inc., not only pushed the boundaries of technologies and aviation, but also changed the world.

**1994:** The first Predator unmanned aerial system takes flight from a GA-ASI test facility in El Mirage, Calif., within six months of a Defense Department contract requesting a demonstration aircraft with potential military and intelligence applications.

**February 2001:** A Predator aircraft laser-designates a target at a test range in Nevada and then destroys it by releasing an AGM-114 Hellfire missile. This historic demonstration is possible thanks to sustained support by the U.S. Air Force.

**December 2002:** Eager to expand on the capabilities being demonstrated by Predator, the U.S. Air Force orders its first four "Predator B" UAS. Designated the MQ-9 Reaper, this aircraft would go on to become a mainstay of the U.S. Air Force.

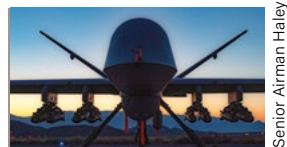
**March 2002:** The Battle of Roberts Ridge: Predator releases ordnance against hostile al Qaeda combatants as they battle American special operations forces. This history-making battlefield employment of a UAS helps turn the tide and preserve the American forces in the field.

**2004:** The active fleet of Predator aircraft records 100,000 operational hours—many of them in combat.

**2007:** The active fleet of Predator, Reaper, and other UAS records 300,000 operational hours, reflecting heavy combat use around the world.

**2013:** The U.S. Air Force awards GA-ASI a contract for the Reaper Extended Range kit, which includes additional fuel storage permitting even greater on-station time for the already long-enduring aircraft.

**2020:** The airmen of the 556th Test and Evaluation Squadron at Creech AFB, Nev., fly an MQ-9 loaded with eight Hellfire missiles—a greater combat load made possible as the result of the Air Force's willingness to experiment and innovate and GA-ASI's ability to support new applications for a proven fleet of aircraft.



**An MQ-9A carrying eight Hellfire missiles.**

Senior Airman Haley Stevens

**1999:** The Air Force takes the Predator to war in the Balkans. The UAS permits long-endurance surveillance and reconnaissance as no aircraft ever had. Air Force crews request upgrades, including to networking, sensing, and to enable the Predator to deliver ordnance of its own.

**February 2001:** First flight of a larger, more capable UAS derived from the early success of the Predator, dubbed the "Predator B."



**An MQ-1B Predator**

432nd Wing/432nd Air Expeditionary Wing

**September 2001:** U.S. military forces enter combat in Afghanistan following the 9/11 terrorist attacks. Predator flies in support of coalition operations, making possible a new kind of highly precise, responsive, networked warfare.

**March 2003:** U.S. Air Force crews operating a Predator destroy an Iraqi anti-aircraft gun emplacement near Basra in one of the early missions following the invasion of Iraq. Predator would serve a role in Iraq as essential as that it played in Afghanistan and elsewhere, if not more.

**2005:** Testifying before Congress, Air Force Chief of Staff Gen. John Jumper tells senators he intends to buy as many UAS as GA-ASI can produce, given the important role they are playing in the Air Force's new network-centric warfare.

**2011:** The U.S. Air Force accepts its final Predator. The type will continue to serve, but the bulk of the fleet will be MQ-9A Reapers.

**2015:** MQ-9A Reaper records one million flight hours, with nearly 90 percent of that spent in combat.

**2019:** Major coalition air operations against the Islamic State conclude. Predator and Reaper are indispensable to the conflict, providing long-persisting surveillance that makes possible the delivery of precise ordnance. Air element commanders mandate a certain number of hours of full-motion video in order to validate potential targets—evidence that only the UAS can provide. These aircraft become the keys that unlock the doors to action in the air war.

**2021:** GA-ASI's MQ-20 Avenger jet-powered UAS flies using the U.S. Air Force's "Skyborg" autonomous core system software, which successfully operates the aircraft without any human pilot in control. The Air Force and GA-ASI continue to work closely in pioneering new applications for existing UAS and to develop new aircraft that will revolutionize air warfare—again.

U.S. Airmen assigned to the 354th Air Expeditionary Wing set up a small shelter system in support of the exercise Valiant Shield 22 at Palau International Airport.



THE PACIFIC



Senior Airman Jose-Miguel Tamondong

# PACAF Competes With China Over Pacific Partnerships

By Abraham Mahshie

ANDERSEN AIR FORCE BASE, GUAM

**A** metaphorical chess match is playing out across the Pacific, with China and the United States offering military assistance and training to build strategic partnerships across the region in a competition for friends and access across the region.

While China offers big-ticket items such as aircraft, ships and port construction, the U.S. floats less expensive gear with the promise of interoperability and the training to make that useful, as well as long-term financial and military assistance, a Pacific Air Forces air liaison explained to Air Force Magazine.

“It is definitely a chess match,” said Lt. Col. Michael Ellis, a PACAF air adviser and commander of the 36th Contingency Response Support Squadron, in an interview at Andersen Air Force Base, Guam. “The 36th CRSS is aligned for INDOPACOM AOR, which is a pretty hot and heavy topic right now,” Ellis said. “From our position within air advising, we are asked to provide them with equipment and then train them on it.”

In fiscal 2022, air advisers in the Indo-Pacific helped execute 50 missions with 15 different partner nations, delivering \$32 million worth of equipment. Three funding streams provided assistance in theater: the Air Force’s BA04 [Budget Authority 04] funding for support to other nations; INDOPACOM Commander Adm. John C. Aquilino’s Asia-Pacific Regional Initiative funds; and congressionally authorized Title 10, Section 333, funds for

building partnership capacity.

That’s small potatoes compared to what China seems to be doing. From 2013 to 2018, China provided \$1.5 billion in development assistance to Pacific island nations. The total could be higher.

Ellis said the different U.S. funding streams and types of security assistance give INDOPACOM flexibility.

“It could look like 11 fuel trucks; it could look like backup generators for their airport; it could end up looking like forklifts so they can download cargo,” he said. “We train them in their country on this equipment that they’ve just received.”

Ellis cited Palau, where Exercise Valiant Shield concluded in June, and Timor-Leste as two countries in the theater receiving such assistance. Timor-Leste, a nation north of Australia that gained independence from Indonesia in 2002, is deepening ties; fiscal 2023 Pacific Deterrence Initiative funds slated for military construction there could benefit future U.S. operations.

“We hope, obviously, that it can end up being used for good in the future,” Ellis added. “And, possibly if America needs to partner with them, they have interoperable equipment now.”

Yet Ellis downplayed competition with China in defense assistance.

“When [the] cards are on the table, what we show is, even though there might not necessarily be a hospital, maybe there’s not necessarily a ship, [but] there is a support alliance, regional partnership,” he said.

## U.S. AS 'PARTNER OF CHOICE'

Michael Collat, a retired Air Force intelligence officer who leads Booz Allen Hamilton's defense contracting work with INDOPA-COM in Honolulu, said countries in the region are often forced to split their allegiance between China and the United States.

"China is their backdoor neighbor," Collat said by video conference from Hawaii. "A lot of them look for China as economic partner of choice, but the U.S. as kind of the security partner."

When China and the United States compete for access, it can be challenging, as is the case now in the Philippines. "There have been cycles throughout their history of turning west and east, kind of back-and-forth, as they try and strike that balance, depending on the administration, the party that's in charge," he said.

Newly elected Philippine President Ferdinand Marcos Jr. recently stated his desire for closer relations with Beijing, including possible military exchanges.

"China has been on this charm offensive for a relatively short period, but I think there's a lot of countries already seeing what happens in that," said Collat, referring to China's predatory lending practices. "They look very attractive in the short term, but there's a lot of strings that come attached to the offer."

Ellis visited the Philippines prior to the May 9 presidential election to guide an ongoing security assistance program.

"The Philippines is one of those that will be receiving equipment in the future to support their airfield ops," he said prior to Marcos's comments. "Everything that I've seen, at least from a [political-military] standpoint, looks like it is favorable for the U.S. military cooperation with the Philippine government. I think time will tell, to be quite honest."

In a June 9 interview at PACAF headquarters in Hawaii, commander Gen. Kenneth S. Wilsbach said countries indicate to him that they prefer working with the United States, which shares their desire for a free and open Indo-Pacific.

"As I go around the region and I talk to air chiefs and other senior military leaders, we're the partner of choice," Wilsbach said.

Wilsbach said countries in the region are worried about China's aggressive behavior, including by Chinese flagged ships where it has maritime disputes with Vietnam, the Philippines, and Japan.

China also exhibits "some very bad behavior" in the skies, the commander said, citing a June 4 example of China ejecting chaff in close proximity to Australian and Canadian aircraft that caused damage to one of the engines.

"This is the environment," Wilsbach said. "Air chiefs go, 'Yeah, we want to train with you more. We want to come and train with you in your place. We want you to come to our place and train, etc, etc, etc. So, they are seeking interoperability.'"

## THE BUSINESS IS GROWING

China's largesse across the Pacific led to a new defense agreement with the Solomon Islands in April, but Ellis said the United States is stepping up, too, with budget increases in coming years.

Some examples include further security cooperation with Mongolia and new partnerships with the Marshall Islands and Papua New Guinea in fiscal 2024.

"The business is growing," he said.

Defense Department projections for fiscal 2024 use of congressional Section 333 funding have just been finalized, Ellis said, and INDOPACOM is expected to get 37 percent of the \$1.16 billion allotted to the geographic combatant commands. Ellis said PACAF will be allowed to divvy up 50 percent of that total, or about \$215 million.

"The signal is going up that there needs to be more of an investment when it comes to security cooperation—that building partnership capacity in the Indo-Pacific," Ellis said.

The air liaison referred again to Palau as a success story. After first receiving security assistance from the Defense Department two years ago, Palau has hosted PACAF exercises Cope North 21, Pacific Iron 21, Cope North 22, and Valiant Shield 22.

"When we talk about getting after a pacing threat," said Ellis—a reference to DOD's preferred designation for China—working with the Pacific countries is how "they will end up trusting us."

"There's a lot of partnership that's taking place," he added. "I don't think I can intelligently answer whether that's going to result in actual, tangible results in the future, but what I can say is, it's working toward the policy that needs to be done within the Indo-Pacific." ✪

# B-2 Bomber Task Force Deploys to Australia

By Greg Hadley

A pair of B-2 bombers from Whiteman Air Force Base, Mo., arrived in Australia on July 10, starting a new bomber task force mission in the Indo-Pacific just days after the Air Force completed its last one.

The B-2s from the 509th Bomb Wing landed at Royal Australian Air Force (RAAF) Base Amberley, according to a service press release, and will take part in "training missions and strategic deterrence missions with allies, partners, and joint forces."

"This deployment of the B-2 to Australia demonstrates and enhances the readiness and lethality of our long-range penetrating strike force," Lt. Col. Andrew Kousgaard, 393rd Expeditionary Bomb Squadron commander, said in a statement. "We look forward to training and enhancing our interoperability with our RAAF teammates, as well as partners and allies across the Indo-Pacific as we meet PACAF objectives."

The bombers' deployment will also support the Enhanced Cooperation Initiative under the Force Posture Agreement first signed more than a decade ago by the U.S. and Australia.

Collaboration between the two nations has increased even

more recently, with the announcement of the AUKUS agreement, which will include enhanced air and space cooperation, as the allies look to challenge Chinese influence in the region.

More concretely, recent bomber missions in the Indo-Pacific have included training with the Royal Australian Air Force.

In 2020, Whiteman B-2s deployed to Naval Support Facility Diego Garcia then flew over Australian training areas while Marines and Australian troops trained together to control the strikes. In 2016, a B-2 from Whiteman landed at RAAF Base Tindal. Most recently, B-1s that deployed to Guam conducted hot-pit refueling operations with the RAAF in Australia.

Those B-1B Lancers arrived home to Ellsworth Air Force Base, S.D., on July 4 to finish their bomber task force rotation. Less than a week later, the B-2s from Whiteman arrived in Australia.

This past March, a B-2 from the 509th Bomb Wing became the first bomber of its kind to land at RAAF Base Amberley, part of a quick turnaround amid more than 50 hours of flying. During that mission, the B-2 operated with Australian F-35s, EA-18 Growlers, and F/A-18F Super Hornets, as well as American F-16s and F-22s. ✪



# Alaska Command Girds for Threats

Alaska Command's Lt. Gen. David Krumm says Russia's invasion of Ukraine has not diminished "their commitment to the Arctic." Alaska has emerged as increasingly important location for air power projection globally.



*Lt. Gen. David A. Krumm wears multiple hats as the commander of Alaskan Command, United States Northern Command, of 11th Air Force, and of North American Aerospace Defense Command Region, North American Aerospace Defense Command, Joint Base Elmendorf-Richardson, Alaska. Krumm, who is set to retire in August, has served as the senior military leader in Alaska since April 2020. In a July interview with Air Force Magazine News Editor Amy Hudson, Krumm discussed Arctic training and operations, infrastructure, and the region's growing importance to the U.S. military, as well as potential adversaries.*

**Q: With its new F-35s, Alaska now has more fifth-generation combat power than anywhere else in the world. What does this mean for the region, and what changes are you planning for the Joint Pacific Alaskan Range Complex (JPARC) to better train with these more advanced aircraft?**

A: The addition of the F-35s ... is a mind-meld step in our ... nation's ability to project power all over the Northern Hemisphere. When we look at Alaska from a globe, ... what you see is [that from] ... anywhere in the Northern Hemisphere, you can get from Alaska really, really quickly. ... The location here just creates an ability for our nation to be able to respond almost anywhere in the world, and these aircraft are the most advanced in the world.

The airplanes are very complex. They have incredible sensors. They can shoot weapons that go further faster, and we need an airspace training area that allows our operators to exercise those aircraft to their fullest capabilities. So, we need to continue to build up the JPARC, ... [including] increasing the size of the airspace to reflect those better sensors and longer-range weapons as well as improving the threats.

**Q: Can you elaborate on the threat updates that you're looking at with regards to the range?**

A: What we're looking at primarily are the ground threats that our operators can train against. ... What are the systems that we can buy that can replicate what our operators will

face in conflict? ... Technology is moving at an incredibly rapid rate. Our adversaries, potential adversaries at least, are looking at some incredible technological advancements across the electromagnetic spectrum. We just need to not be locked into the past.

... The threat doesn't have ones or twos of these systems. They have dozens, if not hundreds. So, we need to be able to replicate that. We need an environment that is densely packed with electromagnetic signals and systems that can provide feedback to our operators about when they're targeted, when they're vulnerable, and ... if the tactics they were doing were correct. I'm pleased with the progress. You always want to go faster, but we are moving at it.

**Q: Prior to Russia's invasion of Ukraine, it was busy forming new military units focused on the Arctic, refurbishing old infrastructure, and building new bases. Where does that stand now?**

A: Certainly, the focus of their military operations has been on the invasion of Ukraine. I don't think there's any doubt of that, but we haven't seen them, ... take assets or people out of those ... areas ... [they were] building up, and I think that that's expected because the Arctic is very, very important to Russia. Depending upon what number you look at, it generates a significant portion of their GDP from materials like petrochemicals and hydrocarbons. ... They are committed to securing their interests in the Arctic.

**Q: Are you still intercepting the same number of Russian aircraft entering the U.S. Air Defense Identification Zone (ADIZ)? A few years ago that was a record high.**

A: We don't talk specific numbers because of operational security, but certainly we also do message when we are tracking and or intercepting aircraft that come into our ADIZ, and those have been few and far between of late.

... What I would say is we don't see any change in their commitment to the Arctic. But it is reasonable to assume that some of the operations that they've done in the past have not been conducted of late. And I think it's important

to note, ... operations in the Arctic are pretty circular, right? So, ... we'll see increases [in exercises or training] and then we'll see some lulls. I think it's too early to tell if this is just one of those standard lulls or if it's something new.

**Q: China obviously is not geographically close to the Arctic but considers itself an Arctic nation. Have you seen any changes there?**

A: China, ... has proclaimed themselves a near-Arctic nation. ... If you're familiar with Google Maps, you might find some disparities with that statement. Here's what we know: China continues to have an interest in the Arctic. They use research vessels, which ... most likely have a dual civilian and military purpose in the Arctic. They are keenly involved in the Arctic Council, even though they're only an observer, because they are not an Arctic nation despite what they might want to proclaim. They obviously understand that the Arctic is going to be important to them and to the world in the upcoming future and they want, I believe, to try to influence the governance of the Arctic and how it's managed.

**Q: Last year, Gen. Glen D. VanHerck, commander of U.S. Northern Command, told Congress Arctic funding was "inching" along. Has there has been progress in this area in FY23?**

A: The FY 23 budget isn't finalized yet, so ... it's too early to declare victory, stalemate, or defeat when it comes to Arctic funding. But I would say that people are recognizing the importance of the Arctic. There are just some incredible competing demands right now, and ... funding is not unlimited. It's going to have to be apportioned to the priorities of our nation. ... In order to make different strategies work, you're going to have to resource them, and if you want to resource those strategies, you're going to have to take from other areas, and I think that's the discussion we continue to have.

... What I always like to emphasize is what happens in our Arctic, ... we want to be by choice, not by consequence. So, we need to make the right choices about funding the right things in our Arctic strategy, so that we're not trying to play catch up later on.

**Q: This spring you had multiple simultaneous Arctic exercises going on where Agile Combat Employment played a big role. What unique challenges, if any, does ACE present in the Arctic? What have you learned so far?**

A: The concept of agile combat employment isn't only for the Pacific region. The threat is real, and essential bases that are consolidated, are vulnerable now to different types of attack. ... Dispersal is going to be a key part for us in future conflict, ... and being able to move assets, ... to keep your assets protected by surprise, by concealment—you know complicating the enemies' targeting—that's going to be a fundamental concept of conflict in the future. ...

We've learned that organizing, training, and equipping on a regular and consistent basis is going to be key, because you just don't show up in January in the Arctic and thrive. You're pretty much just trying to survive, much less thrive. ... We know that we need a regular drumbeat of exercising, training, and equipping our forces to work up here. The environment itself is challenging. The cold, the snow, the wind, the weather, are just things that our service members need to experience. ... It's also the equipment because we bring equipment that's never seen below freezing to Alaska, different things happen, so understanding hydraulics, under-

standing seals, understanding all the things that the cold weather affects is important for not just the human body but also for the equipment that we use.

**Q: Clear Space Force Station, Alaska, received its first Long Range Discrimination Radar in December. Can you talk about the capabilities that brings to the region and where that stands in terms of operational capability?**

A: Clear is an important improvement in both domain awareness as well as missile defenses, and I'm excited about what that capability brings for us. The Space Force is running that location, we're obviously providing support where we can. ... Much like real estate, it's all about location, location, location. Where Alaska sits provides an incredible place for you to be able to detect, track, and engage threats to our homeland. And a Clear provides us those capabilities.

**Q: How is climate change impacting all these things that we've talked about?**

A: The warming rate is two to four time faster [in the Arctic] than the rest of the globe, and what that's doing is creating a different environment. ... It's really affecting the permafrost, so the ground in which we built and utilize all of our systems ... is changing. So it's going to change the way that we build in the future, and it's going to probably require us to make modifications to the things that were built in the past. The warmer temperatures are creating less sea ice and that gives us a couple of challenges. ... Do you know how when a hurricane comes up from the Caribbean and ... goes on the East Coast, and ... it's got like 75 mile an hour winds and everyone's freaking out in New Jersey and New York? We call that a Thursday up here in the Arctic. When you have less sea ice, now you have the wind and the storms, causing some incredible erosion patterns that we just never really anticipated. Because the open water is there longer, ... we're seeing some erosion rates on the coast of Alaska that are decades further than we thought. ... At one of our sites the erosion is already up to what we predicted it would be in 2040. ...

A lack of sea ice also is creating opportunities. ... If you think about a route from East Asia to Europe, you can save somewhere in the order of seven to 12 days in travel time with a ship sailing from East Asia to Europe. That's an incredible cost savings for transportation companies, and just one of the reasons that we believe that a few countries like China are looking very closely at the Arctic. The ... lack of sea ice ... doesn't make the environment less formidable, but it allows you to have access to some of the resources, ... in the form of hydrocarbons, ... rare earth metals, minerals, and ... fish, ... which again, is why I think you see Russia very steadfastly building up this Arctic presence to safeguard what it believes are its national interests.

**Q: If erosion is happening so much faster than you anticipated, what does that mean for the radars located along the coast?**

A: We've already built a number of sea walls and fortified the structures around those radars. ... The radars themselves are vitally important to us, but in the future, we're looking at different technologies, like over-the-horizon radars—those wouldn't necessarily be built on the coast—to provide us that domain awareness. ... We're not planning on moving any of our radar sites at this time. I think we understand how to protect them with those sea walls ... and fortifying them. ❄️

# Ukraine Needs U.S. Aircraft

By John A. Tirpak

**T**he weapons the U.S. and NATO have provided Ukraine aren't enough to reverse Russia's invasion, and the process of providing F-16s from U.S. stocks should begin as soon as possible, analysts said in an AFA Mitchell Institute online seminar.

Panelists also said the U.S. shouldn't fear Russia's nuclear threats and that Vladimir Putin will invade more countries if not stopped in Ukraine.

"Time is not on our side," said Evelyn Farkas, former assistant secretary of defense for Russia, Ukraine, and Eurasia.

"The battle for Ukraine is ... not just for Ukraine ... but it's for the international order," she said. If Russia isn't defeated in Ukraine, "we are going to have a whole lot of trouble politically and militarily all around the world."

Farkas noted that "winter is coming. The Russians are regrouping, and ... the only way to get back at them is to use air power and to provide more assistance" to Kiev.

Panelists said Ukraine's best chance for reversing Russia's advances will come through air-launched standoff missile strikes on Russian rear areas and supply lines, as well as command and control centers and air power working in concert with Ukrainian ground forces.

Retired Lt. Gen. David A. Deptula, dean of AFA's Mitchell Institute for Aerospace Studies, said the Russia-Ukraine war, underway since 2014, won't be over quickly, so "there's time" to provide Ukraine with F-16s and train some of its experienced pilots to fly them.

Ukrainian pilots have boasted that they could learn to fly F-16s in a couple of weeks, and Deptula said that's not too far off the mark.

Because they are already skilled aviators, Ukrainian MiG-29 and Su-27 pilots are "looking at more of a transition course from four to six weeks," he said. This would be enough time to get them "up to speed" on the F-16.

While no countries have offered their own F-16s for Ukraine, and Lockheed Martin has a waiting list of several years for new ones, Deptula said Congress has agreed to let the Air Force retire 48 F-16s this year. "So clearly those are surplus to U.S. needs" and could let the Ukrainians "reconstitute their air force" by the end of the year.

Mitchell scholar Heather Penney, a former F-16 pilot, said that beyond the transition training, learning to employ the fighter's systems would take Ukrainian pilots a few months.

Until then, the U.S. could provide MQ-1C Gray Eagles or even MQ-9 Reapers to give Ukraine more airstrike capability and persistent watch over the battlefield for target spotting and "actionable intelligence," Deptula said.

Absent fresh air power, though, panelists said weapons being supplied to Ukraine—such as artillery—don't deliver a decisive capability to beat the Russians "at their own game," he added.

Farkas noted that Slovakia has said it would consider giving Ukraine its MiG-29s, which Ukraine already knows how to employ.

She said Vladimir Putin "does not want war with NATO

or the United States" and that his threats of going nuclear shouldn't overly worry them. Putin knows that use of a tactical nuclear weapon "would be the quickest way to get us directly involved" in the war, she said.

While Putin doesn't want a second front with NATO, "if he prevails ... and gets some kind of compromise with Ukraine, some kind of stalemate ... he will turn to the Baltic States next," she said. "He will use as an excuse access to Kaliningrad, and he will definitely press and probe our defenses."

Putin is paying a heavy cost in troops, equipment, and sanctions, but doesn't yet face strong domestic opposition over Ukraine, Farkas pointed out. That could change if he must order a nationwide draft and his people face a wave of body bags returning from the West.

"They might then say, 'This is not our war,'" Farkas asserted, and Russian leaders would face domestic unrest such as during its own Afghanistan War.

Ukraine also needs more naval capability to keep its remaining ports open, and panelists urged providing more aircraft that can launch anti-ship missiles, such as U.S. Harpoons already given.

Seth Jones of the Center for Strategic and International Studies said the U.S. should have a clearly defined goal for the outcomes it wants from the Ukraine crisis.

"There have been ... vague comments about weakening the Russians," he said, but the U.S. and its allies should provide enough military assistance to "blunt Russian advances, retake territory, and bog the Russians down in a campaign much like what they faced in Afghanistan," which would cause them a loss "domestically."

The weapons already provided—such as Stingers, Javelin anti-tank missiles, artillery, and old vehicles—won't achieve those objectives, Jones said. Instead, Ukraine "needs systems to target dug-in Russian ground forces." Besides higher-end unmanned aircraft, Jones said main battle tanks and medium- to long-range standoff missiles are needed.

"I see too much reticence right now" on the part of NATO leaders about Russian escalation, he added. "Those concerns have been exaggerated."

Jones said Russia's strategy so far requires that "they put their ground forces in vulnerable positions." Those forces have shown that "they're not very good, with significant problems of corruption, morale, training, leadership, [and] logistics" and so would be vulnerable to air attack. "So a much more significant ... sustained air campaign" is in order for Ukraine.

Clark said Russia has an advantage in that it has developed "rungs on the escalation ladder" from use of mercenaries all the way up to nuclear weapons. The West should emulate that to blunt Russia's seeming veto power over greater Western involvement in Ukraine.

"We must accept more risk," Farkas said. "History shows ... if you can't stop a leader like Hitler in the first phase, you're going to face worse" later. Putin has shown that he will back down when confronted by resolve and "firmness," she said.

But "we're playing it too safe," she said. "We are too worried about Russian escalation, and we shouldn't be." ❖



Courtesy

The X-37B Orbital Test Vehicle Mission 5 spaceplane conducted on-orbit experiments for 780 days, breaking its own record by being in orbit for more than two years. The uncrewed platform is a testbed for mostly classified space experiments.

# X-37B Space Plane Eclipses Its Record for Longest Flight

By Amanda Miller

**A** Space Force X-37B reusable space plane surpassed 780 days in space July 7, eclipsing its prior endurance record.

The Space Force's Space Delta 9 operates the uncrewed, Boeing-built X-37B Orbital Test Vehicle (OTV), which belongs to the 3rd Space Experimentation Squadron. Space Force officials did not immediately respond to queries.

The Space Force has never disclosed how many X-37B Orbital Test Vehicles it owns and does not publicize the classified program's mission itineraries. However, Boeing Space announced the new record on social media.

The Space Force says the uncrewed X-37B is a testbed for technologies associated with reusable space vehicles and largely classified space experiments. The spacecraft is 29 feet long, one-quarter the length of the Space Shuttle. Taking off from Cape Canaveral Space Force Station, Fla., the first three OTV missions landed at Vandenberg Space Force Base, Calif. The past two returned at Kennedy Space Center, Fla., close to

the Cape Canaveral launch site.

X-37B missions have grown progressively longer over time. OTV-1 lasted 224 days in 2010. OTV-5 set the prior record of 780 days, remaining in space from September 2017 to October 2019.

OTV-6 launched from Cape Canaveral on May 17, 2020. Two publicly revealed payloads included the Air Force Academy's FalconSAT-8, which the X-37B deployed into orbit with five experiments and technology demonstrations aboard; and the Naval Research Laboratory's experimental Photovoltaic Radio-frequency Antenna Module, intended to convert solar energy into RF microwave energy.

Secrecy surrounding the X-37B fueled suspicions in China and Russia that the X-37B is "secretly an offensive weapon," according to a report by the Secure World Foundation updated in May 2022. That report called such fears unfounded, noting that observed from the ground, the X-37B appears to be "exactly what the Space Force claims it is."

The U.S. government will start missions on a new uncrewed space plane, Sierra Space's Dream Chaser, in 2023. NASA has contracted flights on Dream Chaser to resupply the International Space Station. ✪

# 'Eye-Watering' Intel From Space

By Amanda Miller

Space Force operators and intelligence specialists will work side by side in the future to deliver the full “TPED” intelligence cycle—“tasking, processing, exploitation, and dissemination”—said Space Force Lt. Gen. Stephen N. Whiting.

Whiting commands the Space Force’s Space Operations Command, or SpOC. In the July 7 episode of the Aerospace Corp’s Space Policy Show, Whiting said intelligence is one of SpOC’s four “core competencies,” alongside cyber, operations, and combat support. Intelligence is an area where he said the service has made the most progress so far.

SpOC’s Space Delta 7—organizationally similar to an Air Force wing—sends intelligence detachments to other deltas around the service. This helps tailor intelligence assets to the given mission, delivering intel “right into their ops floor,” Whiting said. “So if you are at Space Delta 4”—the missile warning delta at Buckley Space Force Base, Colo.—“all of that intel is about missile warning, missile defense, and the threats to those systems.”

The Space Force will add three more intelligence squadrons “over the next couple years,” enabling the command to carry out the full “TPED” cycle, “all focused on space,” Whiting said.

Now that there is a Space Force, intelligence Guardians can be space specialists “instead of bouncing in and out and going and doing other things.” Space operators and cyber specialists will “grow up together” with their counterparts who specialize in intelligence, Whiting noted.

“In fact, we talk about a left-seat, right-seat model, where—when our space operators or cyber operators are ‘executing mission’—there’s an intel operator sitting right next to them bringing them that intel that they need,” Whiting said. “And they’re going to figure out new ways of operating that I think are going to be eye-watering as we move forward.”



Techn. Sgt. JT Armstrong/USSF

**The 2nd Space Warning Squadron Det. 1 operates the Space Based Infrared System satellite constellation from the Mission Control Station at Schriever Space Force Base, Colo.**

The Space Force in June stood up a second intelligence-focused delta, Space Delta 18, at Wright-Patterson Air Force Base, Ohio, to operate the new National Space Intelligence Center. Its 1st Space Analysis Squadron and 2nd Space Analysis Squadron date back to 2008, originally the Space Analysis Squadron and Counterspace Analysis Squadron of the Air Force’s Space and Missiles Analysis Group.

In an interview with AFA’s Mitchell Institute for Aerospace Studies in May, Whiting said governments such as China’s and Russia’s can attack satellites in orbit, but that cyberattacks offer a “lower bar to entry” to lesser powers, such as Iran or North Korea. Space systems’ cyber vulnerabilities represent the “soft underbelly” of the U.S. satellite infrastructure, he said.

“So everything we do has to be relative to the threat,” Whiting said July 7. “In fact, the threat is the reason we have a U.S. Space Force.”

## Whiting: USSF Plans to Add 3 New Intelligence Squadrons

By Amanda Miller

The Space Force plans to add three new intelligence squadrons in the next two years, doubling the number of squadrons in Space Delta 7, said Lt. Gen. Stephen N. Whiting, commander of the service’s Space Operations Command.

In an online discussion hosted by the Mitchell Institute for Aerospace Studies, Whiting described the advances the Space Force has made in intelligence since becoming an independent military service. The Space Operations Command sits “at the nexus” of the Space Force and the newly re-created U.S. Space Command, Whiting explained. Known as “SpOC,” the command possesses “all the operational capability in the Space Force.”

SpOC leads missions “like space domain awareness, electromagnetic warfare, missile warning, operational-level command and control, defensive cyber capabilities, intelligence, surveillance and reconnaissance, satellite communications, precision, navigation and timing, and orbital warfare,” he said. Adding more intelligence activities would contribute to the command’s priority of being “ISR-led and cyber secure.”

Whiting said intelligence is the area in which the Space Force has made the most progress since its creation in December 2019. “When we stood up the Space Force, we went all around the

U.S. Air Force to find all the places that intelligence was being done, either for space or from space, and we brought all of that in, in partnership with the Air Force, and it all transferred over to the Space Force,” Whiting said. The result was Space Delta 7, the command’s intelligence, surveillance, and reconnaissance delta, which has detachments that embed within each of the command’s other numbered deltas.

“So if you’re the Delta 4 commander at Buckley [Space Force Base] outside of Denver and you have the global missile warning responsibility, your S-2 function—your intel function—is actually a detachment of that Delta 7. And that major who runs that detachment? ... They take their day-to-day direction from Delta 4,” Whiting said.

He said the plan to add three more intelligence squadrons is “all fully funded—all the billets are already in place.” The new squadrons will include a threat-analysis squadron, a targeting squadron, and a PED squadron, short for processing, exploitation, and dissemination.

“So we are really getting after the intel requirements that our space warfighters need, and those intel Guardians are just leading the way for us, and we’re very, very proud of what they’ve done.”

# Saltzman Picked to Succeed Raymond as CSO

By Amanda Miller

President Joe Biden has nominated Space Force Lt. Gen. B. Chance Saltzman to be the Space Force's next Chief of Space Operations. Saltzman currently serves as the deputy CSO for operations, intelligence, sustainment, cyber, and nuclear.

The Pentagon announced Saltzman's nomination July 28. Chief of Space Operations Gen. John W. "Jay" Raymond, the first person to serve in Space Force, is retiring.

Saltzman holds a bachelor's degree in history from Boston University and a master of strategic management from George Washington University, D.C., according to his official bio. He went from Air Force Space Command in 2016 to the Pentagon, where he served as director of future operations at Headquarters Air Force. After that, he was director of current operations.

A year as deputy commander of U.S. Air Forces Central preceded his return to D.C., where he took up his current post in August 2020. In that same month he transferred into the Space Force and received his third star.

Speaking with AFA president retired Lt. Gen. Bruce Wright at the AFA Warfare Symposium in March, Saltzman said he wasn't confident in today's "space status quo" in the event of a "high-end fight" with China's military "if all sides of a fight are using space the way they currently do now."

"I don't like our advantages there—the complexity of synchronizing in the Indo-Pacific, the distances we have to cover," Saltzman said. China is "going to have targeting capability. They've got advanced weapons. ... I don't like to win 51 to 50. That's not the way I want to go to war with these guys."

This shift from the "benign space environment" the U.S. military enjoyed in the past means it now will "operate against a



Mike Tsukamoto/Air Force Magazine

**Lt. Gen. B. Chance Saltzman, Deputy Chief of Space Operations for Operations, Cyber, and Nuclear, is nominated to replace Gen. John Raymond as CSO. Raymond is retiring.**

thinking adversary that is committed to denying us those space capabilities," Saltzman stated.

Instead, he said that presenting "a formidable force" to deny any benefits of an attack in space could be "one of the cornerstones of deterrence," along with being able to "impose costs" on an adversary as punishment for "aggressive behavior in space."

A strategy for doing so, he said, requires not just new equipment for a more resilient space architecture but also training and investing "to make sure that our operators, whether they're providing ISR, SATCOM, missile warning, electronic warfare, any of those capabilities" are "the best trained in the world." ✪

## Smaller Sats, More Orbits Can Boost Resilience

By Abraham Mahshie

The Department of the Air Force's new space acquisition chief said he will seek to expand the types of orbits used by the Space Force's future satellite constellations in the interest of improving their resilience. At the same time, he would aim to acquire smaller satellites that can be produced more quickly.

Frank Calvelli worked for 30 years at the National Reconnaissance Office (NRO), including eight years as its principal deputy director, before his confirmation to the long-vacant DAF position of assistant secretary of the Air Force for space acquisition and integration in April.

"You get the sense that we really, really need to do something with our architecture," Calvelli said at a media roundtable discussion June 28.

"I think the day without space is a horrible day for the nation, right?" he said, reflecting on the threats posed by Russia and China in space. "The nation depends on space," he said.

A week prior, the new space acquisition chief spoke at an AFA Mitchell Institute for Aerospace Studies webinar, describing how he would apply his NRO experiences to program management to the Space Force.

At the Pentagon, Calvelli commended the work of the Space Development Agency for proposing its constellation of proliferated low-Earth orbit (LEO) satellites for added resiliency.

"For too long, the DOD side of the house has just predominantly worried about [geosynchronous] orbits ... I think you've got to shake things up," he said. "From a resiliency perspective, I think we get it by proliferating the architecture more."

"I think orbit diversification, getting into LEO, getting into [medium-Earth orbit], getting into elliptical orbits, like a polar orbit or a halo orbit—even trying some crazy things on other orbits that are available—I think is really going to add a lot of resiliency," according to Calvelli.

Achieving space architecture resiliency will also require faster production of satellites. Calvelli believes that can be done by producing smaller satellites.

"We want to build as fast as we can and launch them as fast as we can," he said in response to a question from Air Force Magazine. "To go a little bit faster, you got to build a smaller-sized spacecraft."

Calvelli learned at the NRO that building large systems takes years, from sourcing the materials to developing the physics and constructing the system. In turn, those large systems are designed to last more than five years.

Small spacecraft can be constructed faster and used for shorter periods of time.

"You could actually just do a two-year design life or a three-year design life and use more readily available components," he said. "Launch has gotten so inexpensive that it's cheaper to replenish than it is to keep building." ✪

# Boeing and USAF Mark More than 75 Years of Innovation, Collaboration



Staff Sgt. Nathan Eckert

The KC-46A Pegasus Tanker is the latest in a long line of U.S. Air Force aircraft built by Boeing. The multirole cargo tanker is a heavily a modified 767-200 ER airliner, equipped with the 787 Dreamliner cockpit and able to fly 7,350 miles (or longer with aerial refueling).

By Adam Stone

For more than 75 years the U.S. Air Force and Boeing have shared an intertwined history of supporting the highest priority national defense missions. Today, Boeing leads industry investment in pioneering next-generation technology and innovation as the company looks to the future to provide the most digitally advanced, simply and efficiently produced, and intelligently supported solutions to the U.S. Air Force.

Boeing's industry partnership with the U.S. Air Force dates back to the earliest days of aviation, and continues today in the form of some of the most sophisticated and formidable flying machines on the planet. With an eye toward the future, Boeing continues to develop the cutting-edge capabilities the Air Force needs to maintain its strategic advantage across space and air domains.

To illustrate the depth and breadth of this key national security relationship,

we'll take a look back in time; explore current programs; and look ahead to what the future may hold.

## INNOVATING FROM THE START

Boeing's ties to the Air Force began in the wake of World War I and the design in 1919 of the GA-1 attack plane, an armored triplane powered by a pair of modified Liberty engines driving pusher propellers.

"Our history has been intertwined with the Air Force, and it's been a remarkable story," said Steve Parker, vice president and general manager for Bombers & Fighters at Boeing Defense, Space & Security.

Lethality and survivability have been the watchwords for both since those earliest days. From the start, "the relationship was built on a foundation of trust," Parker said. Airmen were climbing into dangerous, experimental machines. Flight was a high-risk endeavor. Trust was essential.

"We've always focused on making sure we are able to provide solutions

that meet the Air Force's needs for mission effectiveness," Parker said.

Boeing has long looked to Air Force veterans for their expertise, and today, more than 15 percent of its workforce are veterans, many of them Air Force vets. The mutual experience ensures Boeing's workforce understands inherently who their customers really are and what is at stake each time an airplane rolls out for a mission.

Over the years, Air Force and Boeing programs have also been recognized by the whole of the aerospace industry. Boeing-Air Force partnered programs yielded nine Collier Trophies to date, an award that recognizes the greatest achievement in aeronautics and astronautics for the given year from the National Aeronautic Association, Parker noted. "That's proof of our shared partnership doing revolutionary things together," he said.

## BUILDING THE FUTURE

Today, Boeing's Air Force program portfolio bulges with new developments:

KC-46A TANKER

# 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.

[boeing.com/kc-46](http://boeing.com/kc-46)





## A Century of Partnership

Boeing delivered its first military aircraft, two trainers, in 1917; some 101 years later, in 2018, Boeing won the competition to build USAF's newest jet trainer, the T-7A. Few companies can match its extensive history.

**Jan. 1917:** Boeing delivers its first airplanes, two EA trainers, to the US Army Signal Corps.

**Nov. 1919:** Boeing Airplane Co. begins its first major contract for the U.S. Army Air Service modernizing de Havilland DH-4s. Between 1919 and 1924, Boeing will rebuild over 300 of the light bombers for the US Army Air Service.

**March 20, 1932:** The Boeing P-26 Peashooter makes its first flight. It soon establishes a reputation as the fastest air-cooled pursuit fighter in the world and the first all metal monoplane fighter in the U.S.

**July 28, 1935:** The Boeing Model 299 XB-17 experimental bomber, prototype of the B-17, makes its first flight at Boeing Field in Seattle. Newspaper reporters nickname it "The Flying Fortress."

**Dec. 23, 1941:** The Douglas C-47 Skytrain, a military transport version of the company's famous DC-3, makes its first flight. The transport is also produced in the C-53 Skytrooper troop transport version.

**Sept. 21, 1942:** The Boeing Model 345 bomber, prototype of the B-29 Superfortress, makes its first flight.

**Dec. 17, 1947:** The XB-47 Stratojet makes its first flight from Boeing Field, Seattle. The revolutionary Stratojet is the U.S. Air Force's first swept-wing jet bomber.

**July 18, 1956:** The first of more than 800 KC-135 Stratotankers rolls out from the Boeing plant in Renton, Wash., followed a few minutes later by the last KC-97 Stratofreighter. The KC-135 makes its first flight on Aug. 31, 1956.

**May 3, 1959:** The first Boeing-built VC-137 transport is delivered to the U.S. Air Force for presidential use.

**July 27, 1972:** The McDonnell Douglas F-15 Eagle air superiority jet fighter makes its first flight successfully and on schedule. On Dec. 11, 1986, the long-range strike version of the F-15; the F-15E Strike Eagle, makes its first flight.

**May 25, 1976:** The Boeing E-3 AWACS, a modified 707-320B jet, makes its first flight with full mission avionics.

**Oct. 18, 1984:** The Rockwell B-1B Lancer bomber makes its first flight.

**Sept. 19, 2005:** The U.S. Air Force takes delivery of the first production CV-22 Osprey, the Air Force Special Operations variant of the V-22 tilt-rotor aircraft.

**April 16, 2008:** The first Wideband Global SATCOM satellite is placed into operation.

**Sept. 24, 2018:** The U.S. Air Force selects the MH-139 helicopter to replace the more than 40-year-old UH-1N "Huey" helicopters used to protect America's ICBM bases. In Dec. 2019, the U.S. Air Force announces the aircraft's official service name as the MH-139A Grey Wolf.



**March 17, 1924:** Four Douglas World Cruisers built for the U.S. Army Air Service leave Santa Monica, California, en-route to Sand Point Airfield outside Seattle, where they will officially begin their flight around the world. On Sept. 28, the Douglas World Cruisers Chicago and New Orleans complete the first ever round-the-world trip.

**Nov. 26, 1934:** The Kaydet trainer, built by Boeing Airplane Co. subsidiary Stearman Aircraft, makes its first flight. It will become the most common preliminary trainer, and Stearman will build 8,584 Kaydets in all versions, plus the equivalent of 2,000 more in spare parts.

**Oct. 26, 1940:** The North American Aviation NA-73X prototype single-seat fighter, built in just 102 days, makes its first flight. Designated the P-51 Mustang, it becomes one of the most important Allied aircraft of World War II. The company will build 15,586.

**Oct. 1, 1947:** The North American Aviation XP-86 Sabre, the first U.S. swept-wing jet fighter, makes its first flight. The Sabre jet would become famous for gaining air superiority over Soviet-built Migs during the Korean War.

**Oct. 22-24, 1948:** Over the course of one weekend, a Boeing team develops plans for a new eight-engine jet bomber, which will become the B-52 Stratofortress.

**May 27, 1958:** The McDonnell F-4 Phantom II, makes its first flight.

**Oct. 10, 1958:** The U.S. Air Force selects Boeing to assemble and test the Minuteman intercontinental ballistic missile (ICBM).

**1974:** Rockwell International is awarded a contract to build the first eight Block I NAVSTAR Global Positioning System (GPS) satellites. In 1992 the U.S. Air Force and Rockwell would be jointly recognized with the Collier Trophy for development of GPS.

**Sept. 6, 1990:** The VC-25A, a modified Boeing 747-200B, enters service as presidential transport Air Force One, replacing the modified 707s that had served for the previous 30 years.

**Jan. 17, 1995:** The C-17A Globemaster III enters operational service.

**Sept. 25, 2015:** First flight of the KC-46A Pegasus tanker aircraft.

**Dec. 20, 2016:** The Boeing T-X trainer completes its first flight. In Sept. 2018, the U.S. Air Force chooses Boeing T-X for its Advanced Pilot Training System Program contract, and in Sept. 2019, the U.S. Air Force announces the aircraft's official service name as the T-7A Red Hawk.

**Oct. 2019:** The X-37B autonomous spaceplane returned to Earth following 780 days on orbit.

**Feb. 2, 2021:** First flight of the F-15EX, the most advanced F-15 aircraft to date.

The KC-46 tanker and E-7, a replacement for the E-3 AWACS, are both derived from Boeing commercial aircraft and host the newest technologies in refueling and reconnaissance.

The KC-46A Pegasus tanker is a powerful example of the advanced capabilities that Boeing is delivering to the Air Force. With tactical situational awareness and secure datalinks, the KC-46A delivers data as well as fuel to give the 21st century warfighter an information advantage.

The next-generation T-7A advanced trainer was the first Air Force jet designed digitally from the ground up and will serve USAF pilots for generations to come.

Boeing is also reinventing venerable airframes like the B-52 and F-15. As the lead systems integrator for the B-52, it is responsible for integrating new engines into the ageless bombers, which first rolled off Boeing assembly lines more than half a century ago. Engineering the BUFF to keep flying for another 30 years or more, Boeing's overall integration program also encompasses a major avionics upgrade.

Boeing is similarly raising the bar for its F-15EX fighter, the Air Force's newest combat aircraft. The EX is, in effect, a

digitally remastered, 21st century variant of the Air Force stalwart air superiority machine, now featuring combat aviation's most powerful digital processor, an all-glass cockpit, open mission systems, and best-in-class payload, range, and speed, as well as the advanced capabilities of the Eagle Passive Active Warning Survivability System (EPAWSS), which integrates radar warning, geolocation, situational awareness, and self-protection to detect and defeat surface and airborne threats.

"With investments in open-mission systems architecture, digital engineering and agile software, we are supporting SECAF's Operational Imperatives to bring leading-edge capabilities to future fighters and bombers," Parker said.

Looking to the future, Boeing is partnering with the Air Force to develop the capabilities essential to the future of air battle management, the technologies essential to taking Joint All Domain Command and Control from concept to reality. For example, the KC-46's Wing Aerial Refueling Pods are slated to be the first integration of the Air Force's Advanced Battle Management System.

"Our mission is always to provide the most digitally advanced, simply- and ef-

ficiently-produced, and intelligently-supported solutions to the world's greatest air force," said Parker, whose portfolio includes the Air Force F-15, T-7A, and B-1 and B-52 bomber programs, as well as the Navy's F/A-18E/F and EA-18G Growler aircraft which is the only airborne Electronic Attack platform in the world today and is central to all U.S. combat air employment. He also oversees the 777X wing component manufacturing and assembly.

All of these programs have one thing in common: advanced digital technologies that enable new, improved manufacturing techniques to make aircraft more efficient, more survivable, and at a lower cost to operate and sustain —so they can get to the fight faster and stay there longer.

Those efforts extend to every part of Boeing's work for the Air Force, where Parker says, "we're reinventing many of the capabilities the Air Force uses today."

For example, Boeing is applying new algorithms to make C-17 transports more fuel efficient and applying digital analytics to reduce and streamline maintenance costs.

Speed is always in the discussion, Parker said. "From fighter aircraft to au-

tonomous platforms to work we are doing in our Phantom Works, it's all about burning down risk and validating and proving out technology and capabilities more quickly and efficiently."

Another part of the overarching connecting tissue that ties Boeing's Air Force portfolio together is today's focus on connectivity and the emergence of a shared battlespace that can be better managed and assessed through the use of open mission systems and agile software techniques.

"To deter the evolving threat, data must be distributed across all the Air Force's systems," Parker said. "Data will have to be managed securely and delivered in real time to deliver a collective effect across the DOD's battlespace. We are working to connect manned and unmanned platforms and sensors together, to provide an overwhelming capability."

To that end, "we're focused on connecting everything—Boeing products and non-Boeing products—to provide the disruptive advantage in any location around the world," he said. "It's a means of expanding the force capabilities exponentially."

Boeing's strong collaborative relation-

ship with Air Force stakeholders helps keep all parties on the same page. "Everything is totally transparent from a data perspective: status, opportunities, risks, issues," Parker said. "We manage them collectively—together."


Parker says that kind of mutual trust and transparency has helped the rapid development of the T-7A, it's not that every step in the development has been perfect, he said. "You're always going to discover things along the way—and when we do, we fix them together," Parker said. "That's how we have been able to redefine how a clean sheet aircraft can go from concept to first flight in just 36 months and move straight into developmental test and evaluation—something that was previously unheard of."

### LOOKING AHEAD

At its heart, Boeing is an engineering technology company, one that keeps one eye firmly focused on the future. "We are always working to get them the best aircraft, the safest aircraft, on time and predictable," Parker said. "Working closely with the Air Force enables us to do that, and the Air Force trusts us to deliver on the commitments we have made."

To ensure that remains the case, Boeing continues to invest its own resources in areas such as digital engineering technology and advanced manufacturing capabilities, Parker said. "We need to be able to rapidly field new technologies, to rapidly change and pivot as the threat changes, so that the U.S. Air Force always has the most capable assets in the world."

For Boeing, that means embracing not only its own ideas, but those of partners and even rivals as the Air Force presses ahead with an open systems/open architecture vision of the future. "Open systems will give the Air Force the ability to plug-and-play apps, to integrate third-party solutions," Parker said. "It means they will always have the latest and best technology available to them," both in crewed and uncrewed aircraft.

"We want the Air Force to be not only the most capable but also the most connected force on the planet, so that they can make informed decisions in real time," Parker said. "That's what it's about at the end of the day, and that's what gets us excited, it's all about their mission." 

# House Passes 2023 NDAA

By Greg Hadley

**T**he House of Representatives passed its version of the 2023 National Defense Authorization Act (NDAA) on July 14. The annual policy bill includes a \$37 billion increase to the top line of the Pentagon's budget and a number of provisions that will affect the Air Force and Space Force.

The final bipartisan 329-101 vote capped two days of deliberation on the House floor as lawmakers debated and voted on more than 600 amendments.

While NDAA's set policy and authorize funds, they do not appropriate the money the Defense Department spends. Still, they give Congress oversight of the Pentagon and are regularly considered "must-pass" legislation.

"For over six decades, the NDAA has served the American people as a legislative foundation for national security policymaking rooted in our democratic values," Rep. Adam Smith (D-Wash.), chair of the House Armed Services Committee, said in a statement. "Today's successful vote marks another chapter in that history—with considerable gains for those currently serving our country in uniform."

Among the amendments approved as part of the deliberation process was a provision from Rep. Adam Kinzinger (R-Ill.) to authorize \$100 million to provide training to Ukrainian pilots and ground crews to become familiarized with American aircraft. Ukrainian pilots and defense officials have pleaded for the U.S. to provide them with aircraft such as the F-16, and while thus far the Biden administration has rejected those calls, Kinzinger's amendment was agreed to in an uncontroversial voice vote.

Other amendments adopted by voice vote include one from Rep. Cliff Bentz (R-Ore.) that would limit the number of F-15s the Air Force can divest, at least until the service provides a report to Congress on the number of F-15s—including F-15Cs, Ds, Es, and EXs—it plans to buy and retire in the next five years, broken down by year and location, as well as an assessment of the negative impacts of such retirements and plans to replace those missions.

Kinzinger also introduced another amendment that was eventually approved as part of a larger package that prohibits the Air National Guard from retiring the RC-26 Condor, a tactical ISR platform, despite the fact that ANG leaders say it costs millions of dollars to maintain and other, cheaper technologies such as drones can perform the same missions.

But not all amendments were approved. Rep. John Garamendi (D-Calif.), a senior member on the House Armed Services Committee, introduced one that would have suspended funding for the LGM-35 Sentinel, the Air Force's modernization program for its intercontinental ballistic missiles, and instead extend the aging Minuteman III to 2040. That amendment was soundly defeated by a 118-309 vote.

Earlier in the legislative process, the House Armed Services Committee also voted against forcing the Air Force to hold a competition for its so-called "bridge tanker." One thing the House NDAA would do, however, is force the Air Force to



Senior Airman Zachary Rufus

**Ukrainian officials have pleaded with the U.S. for aircraft such as F-16s. So far, the U.S. has refused, but is providing other support, including \$100 million for pilot and aircrew training on U.S. aircraft.**

upgrade, not retire, its oldest F-22 fighters, despite the service's request to divest them.

The NDAA also includes a provision from Rep. Jason Crow (D-Colo.) that would establish a separate Space National Guard, a move that was also approved by the House last year before being left out of the compromise version of the bill crafted with the Senate. This year, however, a bipartisan group of a dozen senators have already proposed legislation supporting a Space Guard.

Finally, the House NDAA partially addresses the Air Force's unfunded priorities list (UPL) by adding \$978.5 million to procure four more EC-37B Compass Call electronic warfare aircraft, plus nearly \$379 million for weapons system sustainment—shy of the \$579 million included in the UPL.

The bill does not, however, add any more F-35As for the Air Force, leaving the service's much-reduced purchase of 33 fighters un-supplemented.

With the NDAA through the House, the Senate must now pass its version of the bill before legislators from the two chambers can craft a compromise bill in conference to vote on and send to President Joe Biden.

"I am glad to see the FY23 NDAA pass the House with overwhelming bipartisan support. However, our work is not done—we will continue to improve upon this bill in conference to ensure that this legislation gives our warfighters what they need," said Rep. Mike Rogers (R-Ala.), the House Armed Services Committee's top Republican.

Last year, that process lasted longer than expected. The House passed its version of the bill on Sept. 23, but the Senate struggled to do the same, to the point where leaders from both chambers finally unveiled a compromise bill on Dec. 7, bypassing the usual conference process. That bill cleared both chambers by Dec. 15 and was signed into law shortly thereafter. ❄️

# Skunk Works Sees Value in MUM-T, Autonomous Aircraft

By John A. Tirpak

**T**eams of autonomous aircraft collaborating with a crewed airplane, in which each aircraft in the formation performs a unique mission on its own, is far more effective than the so-called “loyal wingman” approach, in which a piloted aircraft pairs with just one similarly equipped, autonomous multimission aircraft—or so Lockheed Martin has concluded. It also found cost-effectiveness in pairing expensive but survivable uncrewed systems with relatively cheap ones.

So said John Clark, the new head of Lockheed Martin’s Advanced Development Programs unit, or Skunk Works. Clark, who has had a career with the ADP unit in intelligence, surveillance, reconnaissance, and uncrewed aircraft, has been running the unit since April, when previous general manager Jeff Babione retired.

The concept is the same one the Air Force has been touting with its Next Generation Air Dominance program, which the service calls a “family” of systems that can collaboratively defeat a high-level adversary. The industry has come to refer to manned-unmanned teaming by the acronym MUM-T.

Lockheed Martin has applied its “pretty formidable operational analysis” capability to looking at many approaches to future air combat with an eye toward the “value proposition,” Clark said in a Zoom call with defense reporters.

The company concluded that pairing a high-end crewed aircraft with a number of uncrewed types “matched” to it in speed and stealth, along with a number of less costly or even expendable platforms, offers the most effective combination against a peer adversary’s air defenses, Clark said. He said the uncrewed aircraft work best in a “detached” way, in which they function independently, rather than in an “attached” way, in which they effectively depend on direction from the crewed airplane. The uncrewed aircraft need freedom of maneuver, he said.

The combination is a winner in the context of “the first 10 days” of a fight with a peer adversary, Clark said. “That’s where you’re going to make a difference.”

That period will also be the riskiest period of a war, and “these team members, that are uncrewed, we can take more risk with them ... Being able to get better intelligence data, or, if we really need to take out an important command-and-control node in the adversary’s air capability, maybe these systems—even though they’re higher-end—they’re going to go on a one-way mission to ensure that system is taken out. And that unlocks a lot of other capabilities.”

The best results in the analysis were achieved “when you started to have a distributed team. And when that distributed team was operating each with their own unique roles,” Clark said.

He made an analogy to a disciplined soccer team spread out over a wide area moving the ball toward the goal, versus a team of youngsters all crowded around the ball. The latter draws defenders’ attention to where the ball is, he observed.

One “adjunct” of the team would be a highly stealthy platform that would fly ahead of the formation with four or so AIM-120 Advanced Medium-Range Air-to-Air Missiles (AMRAAMs) to shoot down defenders, Clark said. He described it as a “remote weapon station” for the manned aircraft, further back.

Clark said Air Force Secretary Frank Kendall “has started to expand on the CONOPS” for NGAD wherein “you actually have systems that are speed matched—they are signature matched” with the main, crewed airplane. “So the price point goes up ... but you’re likely to get them back each time because they’re better-equipped.” At the same time, “expendable” or “attritable” aircraft would also be part of the formation, low enough in cost that their loss or deliberate destruction wouldn’t be too onerous, he said. He drew a distinction between those terms, saying attritables are higher cost than expendables.

“There’s an opportunity there” for saving money with expendable aircraft, he said, but they must be “survivability matched,” meaning that while they might not keep up with the fastest members of the formation, they won’t tip off the defenders about where to look for the rest of the team.

Another conclusion was that the human pilot in the formation shouldn’t have to do too much work to manage the other aircraft, as the pilot already has a “pretty heavy burden” dealing with the unfolding air battle. So the level of autonomy for the other aircraft must be high, Clark said.

Clark said Lockheed Martin is deep in evaluating what specific missions the collaborative aircraft should be performing, such as electronic warfare, suppression of enemy air defenses, and secure communications.

“In a basic” formation, he said, “you’re going to be looking at two to four of these adjunct systems.” But in defining what’s in the formation, “the challenge is, where do you draw the boundary, because there are multiple, interconnected nodes that are all collaborating with one another.”

Maybe, he said, “some of those systems are around NGAD, but maybe there are some systems that are farther ahead with IRSTs [infrared search-and-track devices] on it, and those IRSTs are providing information and cuing being pushed back” to the fleet, “or maybe they have small AMTI [airborne moving target indication] radars on them, providing an air picture flowing back to other systems carrying weapons and working in conjunction with NGAD.”

The boundaries of the distributed team “gets a little bit tricky,” Clark said, especially when satellites or surface vessels are also involved as sensing systems.

“We’re really looking at bigger than ... the loyal wingman” concept, he said. “We have to capitalize on everything in

# Tactical Autonomy Research Partnership with HBCUs

By Abraham Mahshie

The Air Force will look to the nation's historically Black colleges and universities (HBCUs) in a closed solicitation that will create the Air Force's first university-affiliated research center (UARC), Air Force leaders said June 27.

The center will study tactical autonomy. The DAF will select the center's location from one of 11 qualifying schools. The current plan would make the chosen HBCU the leader of a consortium of other HBCUs studying the topic.

"Part of the future of the military is going to be autonomy—there's no doubt in my mind of that," Air Force Secretary Frank Kendall said in making the announcement.

Kendall said artificial intelligence (AI) is a "gap in our suite of research institutes" that is increasingly appearing on the battlefield.

"It's here to stay, and we need to be at the front edge of that. This is an opportunity to tap into that," he said. "I am very focused on the threat of Chinese military modernization and what that means in terms of our forces for the future."

The Department of the Air Force will provide \$12 million per year for five years to fund the research. DOD currently maintains 14 UARCs affiliated with the Army, Navy, and Missile Defense Agency. The first Air Force UARC will help close the gap of research dollars going to HBCUs, which currently receive less than 0.05 percent of total DOD research dollars, according to a news release.

Undersecretary of Defense for Research and Engineering Heidi Shyu said that in targeting HBCUs, the Air Force is following proven scientific strategies for better problem-solving.

"We're one of the most innovative countries in the world because of diversity," she said in response to a question from Air Force Magazine.

"It's a diversity of different ideas coming from a diversity of backgrounds that helps you to solve the most challenging problem with innovative ideas that you, maybe within your own perspective, wouldn't have thought of," she added, referencing her time working in a team of diverse engineers.

Shyu also said targeting HBCUs encourages American students to study science, technology, engineering, and mathematics (STEM) and opens them up to the possibility of joining the military or defense industry later on.

"One thing we ought to be doing is [tapping] into and growing our STEM education through universities, [where students] are U.S. citizens, rather than looking only externally for immigrants," she said.

Chief scientist of the Air Force Victoria Coleman said the tactical autonomy center will look at trust, collaboration between platforms, and human-machine teaming.

"What we mean by that is systems that act delegated and bound to authority, in support of tactical short-term actions that are associated with a more strategic long-term vision," Coleman explained.

While Coleman did not provide any specific examples, Kendall cited the battlefield in Ukraine, which has seen extensive use of unmanned aerial systems.

By partnering with HBCUs, Coleman said DOD is also responding to a call in the 2022 National Defense Authorization Act to increase diversity; and that doing so will help the Air Force develop a new pool of talent.

Among the more than 100 HBCUs in the country, with over 220,000 students, just 11 qualify for the Air Force's solicitation, meaning they have a research activity rating of R2. The R1 and R2 qualifications mean the university has "very high" or "high" research activity, as determined by the Carnegie Classification.

The eligible schools include Prairie View A&M University, Texas; Southern University and A&M College, La.; University of Maryland Eastern Shore; Tennessee State University; North Carolina A&M University; Morgan State University, Md.; Florida A&M University; Clark Atlanta University, Ga.; Jackson State University, Miss.; Howard University, D.C.; and Texas Southern University.

Tawanda Rooney, deputy director of the Air Force's Concepts, Development, and Management Office, and herself and HBCU graduate, said research dollars may lift the schools from R2 to R1 and develop long-term relationships for the Air Force.

"One of the things we're talking about is building that capacity," Rooney said in response to a question from Air Force Magazine.

Added Coleman: "This is a very deliberate effort to have much better access in those schools."

The Air Force plans to hold an industry day Aug. 8 and open solicitations Aug. 15. Kendall said he wants to make a decision on the AI university partner by year's end.

JADO [joint all-domain operations] ... to link these systems together and focus more on the data."

Clark said munitions carried by the collaborative aircraft will have a big effect on the types of formations and the missions they'll have, or whether they come back to be re-used.

"We have looked at" scenarios in which the uncrewed aircraft "actually ends with a bang, and we take advantage of everything it has up until that point."


Everyone doing analysis of the future air battle comes to a common conclusion that "there's not enough weapons close to the fight," Clark said. The collaborative formation brings more weapons forward, he said, and "weapons are more effective" the closer they are to the target when launched. Less can go wrong—fewer get detected, shot down, or jammed or go off course—when that's the case, he said.

Today's fifth-generation aircraft have to carry their weap-

ons internally to be stealthy, Clark noted, and unmanned adjuncts could be an extra magazine. The fourth-generation F-15EX, though, will have to shoot from far short of the battle line "because their survivability is compromised," forcing them to shoot more expensive standoff munitions, he said.

Autonomous adjuncts could be operational in "the next three [to] four years," he said.

Because "expendables ... have a lower price point ... we're looking at ways to get them out there much sooner, to have that option available ... for our folks in the Pacific to have that tool in their toolbox, should they need it."

In the medium term—"the early 2030s"—the rest of the concept could be fleshed out with operational craft, Clark said. It meshes well with USAF's agile combat employment model, because uncrewed aircraft could operate from a variety of basing options. 

# 27 Firms Win Chance to Bid on JADC2 Work

By Greg Hadley

The Air Force's plans for its portion of joint all-domain command and control, or JADC2, have taken a major step forward. The service awarded an indefinite delivery, indefinite quantity, multiple-award contract worth up to \$950 million July 1. The deal gives 27 contractors the opportunity to compete for work related to the Pentagon's ambitious effort to connect sensors and shooters across all domains into one network.

What exactly the contractors will be developing for the Air Force was not specified in the JADC2 contract announcement, but it will have to do with the "maturation, demonstration, and proliferation" of technologies that are part of JADC2, the contract announcement states.

The award also says that companies will have to leverage "open systems design, modern software, and algorithm development" as part of their development.

The Air Force Life Cycle Management Center made the award, which includes a mix of larger and smaller firms. JADC2 is intended to be a massive "network of networks," sharing intelligence, surveillance, and reconnaissance from sensors across air, land, sea, space, cyberspace, and the electromagnetic spectrum, identifying the proper units or platforms to deal with threats and connecting them with the necessary information.

In order to realize the concept, the Pentagon will have to use cutting-edge technologies such as artificial intelligence, machine learning, cloud computing, and new communication methods, experts say.

The Air Force's portion of the enterprise, the Advanced Battle Management System, has been in development for several



1st Lt. Nicole Mathison

**Warfighters at Nellis Air Force Base, Nev., are briefed on the capabilities of the Advanced Battle Management System (ABMS) at the Shadow Operations Center.**

years, but Air Force Secretary Frank Kendall has pushed in recent months for more urgency in having ABMS provide operational benefits faster instead of focusing on more experiments.

Spending on the project, meanwhile, hit \$268.8 million in fiscal 2022 after Congress slashed funding in 2021, forcing the service to adjust its plans. In 2023, the Air Force is requesting \$231.4 million, but the program is expected to grow significantly in the years ahead—the Future Years Defense Program is projecting at least \$550 million per year through 2027, peaking at \$870.8 million in 2026. ✪

## F-22s Head to Poland to Boost NATO

By Greg Hadley

F-22s arrived at RAF Lakenheath, U.K., on July 26 en route to Poland, as the U.S. Air Force continues to bolster its presence of fifth-generation fighters in the region.

U.S. Air Forces in Europe confirmed the F-22s' arrival, stating in a release that the fighters from the 90th Fighter Squadron of the 3rd Wing at Joint Base Elmendorf-Richardson, Alaska, will be traveling from Lakenheath to the 32nd Tactical Air Base in Lask, Poland, to support NATO's air shielding mission.

New USAFE commander Gen. James B. Hecker hinted at the F-22s' appearance in Europe at the Royal International Air Tattoo on July 17 in an interview with Air Force Magazine.

"We're bringing over F-22s ... that are going to be coming over shortly, within a month, and they'll spend four or five months over here," Hecker said. "So we're going to constantly cycle in fifth-generation in addition to what will eventually be two permanent [F-35] squadrons at Lakenheath. So we'll be cycling it in here in the meantime."

According to local media reports, six F-22s arrived at Lakenheath. When they arrive in Poland, they'll be tasked with supporting a new mission for NATO. Air shielding is intended to protect NATO nations from air and missile threats by leveraging air- and ground-based air defense assets.

Air shielding "will provide a near seamless shield from the Baltic to Black Seas, ensuring NATO Allies are better able to safeguard and protect Alliance territory, populations and forces from air and missile threat," USAFE's press release states, adding that the F-22's success as an air dominance platform makes it "a highly strategic platform to support NATO Air Shielding."

This marks just the latest deployment of USAF fighters to eastern Europe in an effort to reassure NATO allies on the eastern flank in the face of Russia's invasion of Ukraine and continued aggression.

Earlier in July, F-35s from the Vermont Air National Guard forward-deployed to Amari Air Base, Estonia, to support the air shielding mission. Prior to that, the Air Force has moved F-15s, F-16s, other F-35s, and still more aircraft into Eastern Europe, participating in NATO's Baltic air policing and enhanced air policing missions.

The constant rotation of new aircraft into the region is part of the Air Force's plan to remain vigilant as the Russia-Ukraine war drags on.

"What we're going to do is just kind of have six, 12 kinds of airplanes that will come in here for four months, and we'll do that for about a year or so, in addition with all the permanent aircraft that we have stationed here," Hecker told Air Force Magazine. "And that will increase our presence here, and then we'll have to readjust and see what this thing looks like a year from now." ✪



Staff Sgt. Caleb Pavao

Two AC-130J crews are recognized for close air support during the withdrawal from Afghanistan in August 2020. Both crews were awarded the Mackay Trophy.

## AC-130J Crews Share 2021 Mackay Trophy

By Greg Hadley

A pair of AC-130J Ghost Rider crews won the 2021 Mackay Trophy, awarded by the Air Force and the National Aeronautic Association (NAA) for the year's most meritorious flight. The trophy is in recognition of their actions during the withdrawal from Afghanistan that aided in the rescue of some 2,000 American diplomats.

All told, 18 Airmen from the 73rd Expeditionary Special Operations Squadron, Hurlburt Field, Fla., received the recognition June 30.

As the U.S. completed its withdrawal from Afghanistan in the summer of 2021, the Taliban seized territory at a rapid rate. On Aug. 15, Taliban fighters entered the capital city of Kabul, forcing the U.S. to rapidly evacuate its embassy in the city.

In the midst of that evacuation, two AC-130Js, call signs Shadow 77 and 78, alert-launched from Al Dhafra Air Base in the United Arab Emirates to provide close air support for the evacuating personnel.

According to the NAA citation, the crews "maintained visual custody of all American personnel" headed to Hamid Karzai International Airport and provided real-time video to Defense Secretary Lloyd J. Austin III and Chairman of the Joint Chiefs of Staff Gen. Mark A. Milley.

The citation also notes that the crews flew the longest un-augmented flight in the AC-130J's young history—the gunship first flew in 2014.

With the AC-130Js providing close air support, 2,000 Americans were able to evacuate with zero casualties.

The following Airmen crewed Shadow 77 and 78:

### Shadow 77

- Capt. Lawrence S. Bria
- Capt. Sam B. Pearce
- Capt. Aaron M. Rigg
- Maj. Joshua T. Burris
- Capt. Michael G. Shelor
- Staff Sgt. Daniel J. Mayle
- Staff Sgt. Kevin P. Heimbach
- Senior Airman Denver M. Reinwald
- Senior Airman Timothy J. Cisar

### Shadow 78

- Capt. Culley R. Horne
- 1st Lt. William A. Bachmann
- Capt. Ryan M. Elliott
- Capt. Benjamin A. Hoyt
- Staff Sgt. Dylan T. Hansen
- Staff Sgt. Andrew J. Malinowski
- Staff Sgt. Tyler J. Blue
- Staff Sgt. Gregory A. Page
- Senior Airman Miguelle B. Corpuz

The crews of Shadow 77 and 78 are the latest Airmen to be recognized for their efforts in the evacuation of Kabul amid chaotic conditions. A number of C-17 crew members, who landed at Hamid Karzai International Airport to airlift personnel and civilians out, have been recognized with the Distinguished Flying Cross and the Air Medal. ✪



Staff Sgt. Dana Tourtelotte

The Air Force selected a prototype design for its Next Generation Fixed-Wing Helmet competition. The future helmet will be lighter, better ventilated, and allow for custom fitting.

## USAF's Next Aircrew Helmet

By Greg Hadley

The Air Force has selected a prototype to develop as its new helmet for all fixed-wing aircrew, Air Combat Command announced June 25, picking LIFT Airborne Technologies' design.

The new helmet, which still has to undergo additional research and testing before the Air Force confirms the design and offers a production contract, is better-equipped to handle the addition of helmet-mounted devices and will offer a better fit for more diverse crews, the Air Force said in its announcement.

The service's current standard-issue helmet for aircrew is the HGU-55/P, first introduced in the 1980s. With the advancement of helmet-mounted display systems and other devices, however, the weight on crew members' heads and necks increased, and the center of gravity shifted.

Several academic studies over the years have found that heavier helmets or those with mounted devices can cause greater discomfort or muscle strains in the neck, compounded by the effects of high G forces.

"The legacy helmet was not originally designed to support advances in aircraft helmet-mounted display systems, causing pilots to fly with equipment not optimized for them, especially our female aircrew," Scott Cota, ACC Plans and Requirements branch

aircrew flight equipment program analyst, said in a release.

ACC worked with other major commands and the Air Force Life Cycle Management Center's Human Systems Program Office to develop requirements for a next-generation helmet. Among those requirements were "weight, pilot comfort, optimized fitment and protection, stability, optimized center of gravity, and integration with different helmet-mounted systems," the release stated.

ACC then collaborated with AFWERX, an Air Force innovation-focused organization designed to seek out interesting ideas from nontraditional vendors, to open up the competition process, according to the release. More than 100 designs were submitted, and from those 100, 38 companies were invited to present their proposals. The most promising were tested by the Air Force Research Laboratory, other labs at Wright-Patterson Air Force Base, Ohio, and squadrons at Eglin Air Force Base, Fla.

LIFT touts its design, called AV 2.2, as being substantially lighter than competitors, with increased ventilation and custom fitting options available. The helmet also has a modular design, making it easier to attach devices such as night-vision goggles or a helmet-mounted cueing system (HMCS).

It will still be years before pilots get their hands on the new helmets, however. The Air Force is estimating that a production contract won't come until 2024, and after that, ACC will deliver them in a phased approach, giving the first ones to those flying on the F-15E Strike Eagle.

One aircraft whose crew won't need the new helmet is the F-35—the Joint Strike Fighter has its own helmet, custom-made for each pilot and costing roughly \$400,000 each. ✪

## B-21 Director Hired to Advise DOD Acquisition Chief

By John A. Tirpak

Randall G. Walden, head of the Air Force's Rapid Capabilities Office (RCO), where he has directed development of the B-21 bomber and the Advanced Battle Management System, is moving to a new job at the Pentagon to advise the DOD's acquisition and sustainment chief, William A. LaPlante.

Walden, who is the director and program executive officer for the RCO, has been named "senior executive adviser" in the Office of the Undersecretary of Defense for Acquisition and Sustainment, according to a July 11 announcement from the Air Force.

The service could not immediately say whether a successor at the RCO had been determined.

LaPlante, formerly the Air Force's acquisition executive, put Walden and the RCO in charge of B-21 development in 2015, when the Air Force selected Northrop Grumman to build what was then called the Long-Range Strike Bomber. LaPlante at the time described the choice of putting a major weapon system such as the B-21 under the RCO, rather than in a traditional program office, as a way to use lean management techniques with minimal Pentagon bureaucracy while taking advantage of the RCO's ability to conduct projects in secret.

Pentagon leaders and cleared members of Congress alike have lauded the B-21 as a well-run program. The Air Force's current service acquisition executive (SAE), Andrew Hunter, revealed in June that the B-21 is actually under budget.

Walden has reported that six B-21s are in construction at Northrop Grumman's Palmdale, Calif., plant and that the



Tech Sgt. Anthony Nelson Jr.

**Randall Walden, Air Force RCO director and PEO will be advising acquisition chief William LaPlante.**

after the 9/11 attacks. During Walden's 20-year Air Force career as a flight-test engineer, he worked at times on classified projects. He retired in 2002 and was appointed to the Senior Executive Service that same year, subsequently working on special access programs, in the RCO, and as the director of test and evaluation for USAF. He became head of the RCO in 2014.

LaPlante was determined to write a good contract for the B-21 that could adapt to a changing threat, and the fact that the award handily survived a protest from the losing Lockheed Martin-Boeing team could be called one of LaPlante's signature achievements while he was the Air Force SAE. He insisted on an open architecture for the B-21, and while USAF secured a fixed-price contract for the initial aircraft, the development program was a cost-plus arrangement that rewarded Northrop Grumman for hitting milestones early. ✪

## F-35s Stand Down as Search For Faulty Ejection Seat Part Widens

By John A. Tirpak

The Air Force grounded its F-35A fighters July 29, as it checked for potentially faulty parts in the type's Martin-Baker ejection seats. The move followed by a day of the service's grounding nearly half its T-38 supersonic trainers and about a sixth of its T-6A primary trainers for the same issue.

The Navy is following a similar inspection protocol on its jets with Martin-Baker seats, including its F-35Bs/Cs, F/A-18s, EA-18s, T-45s, and F-5Ns.

ACC said it has known about the potential problem since April, when a routine inspection found a defective cartridge at Hill Air Force Base, Utah.

"An Immediate Time Compliance Technical Directive was issued" to inspect other aircraft, a spokeswoman said, which ordered that all the seats be checked within 90 days. When it was determined that a production-line quality failure was to blame, the F-35 Joint Program Office "rescinded the immediate action" TCTD and changed it to a "routine" TCTD, still to be completed within the 90-day period, she said.

The general stand-down was ordered "to expedite the inspection process," the spokeswoman said. A USAF spokesperson said "this is properly called a stand-down" rather than a grounding because the aircraft can resume flying after an inspection shows they are safe to operate. ✪

Maj. Gen. David Mikolaities, Adjutant General, New Hampshire National Guard, at the assumption of command ceremony. Approximately 50 Active-duty Airmen from the 306th FS will be the 10th and last fighter squadron in ACC's Total Force Integration restructuring push.



Tech. Sgt. Charles Johnston/ANG

## AIR NATIONAL GUARD

# Active-Duty Fighter, Tanker Squadrons Join Guard Wings

By Amanda Miller

**T**wo Active-duty squadrons joined wings of the Air National Guard in ceremonies July 8. The 306th Fighter Squadron became an associate of New Jersey's 177th Fighter Wing, and the 64th Air Refueling Squadron activated under the auspices of New Hampshire's 157th Air Refueling Wing.

The approximately 50 Active-duty Airmen of the 306th FS represent the 10th and final fighter squadron to associate with a Guard or Reserve wing under Air Combat Command's restructuring to achieve the objective of "Total Force Integration," according to a news release from the New Jersey Air National Guard.

A spokesperson for the wing confirmed that the Active-duty Airmen and their families will move to the area of Egg Harbor Township, N.J., where the wing has its base at Atlantic City International Airport.

Col. Derek B. Routt, commander of New Jersey's 177th Fighter Wing, called the concept of Total Force Integration "a critical piece of our nation's combat readiness" in the release. The new squadron's maintainers, pilots, and support personnel will become "fully integrated" into the wing and "support the increased maintenance requirements of the 177th's F-16 Fighting Falcon aircraft fleet, bolstering the fleet's

flying combat readiness.

Assigning Active-duty personnel to the wing allows Air Combat Command to gain "more experienced fighter pilots," while the Guard or Reserve unit on the receiving end "benefits from the infusion of people and flying hours provided by the regular Air Force," said Lt. Col. Anthony M. Mulia, deputy commander of ACC's 495th Fighter Group, which is supplying the Active-duty personnel to the Guard wing.

In such a relationship, called an Active association, the Active-duty Air Force provides personnel while the host Guard or Reserve wing supplies the equipment, according to the release.

At Pease Air National Guard Base in Newington, N.H., the 64th Air Refueling Squadron reactivated July 8 to fly KC-46 refueling missions under the state's 157th Air Refueling Wing with its 12 Pegasus tankers. The 64th ARS was originally at Pease "in support of the since-divested KC-135," according to a news release.

"We couldn't be more excited to have you all back," said Maj. Gen. David J. Mikolaities, adjutant general of the New Hampshire National Guard, in the release, while also recognizing the support of the state's congressional delegation. The new squadron will amount to about 160 Airmen by December 2023.

The wing displayed one of its KC-46s nicknamed "Spirit of Portsmouth" for the ceremony, its tail painted red, white, and blue and overlaid with a 16-foot-tall National Guard Minuteman logo. ★



# 'Herk Nation' Adds ANG C-130J Training Unit

By Greg Hadley

As the Air National Guard moves forward with its plans to replace aging C-130Hs with new C-130Js, it has decided where it wants to base its formal training unit for the new aircraft—Little Rock Air Force Base, Ark.

The decision, announced by the Department of the Air Force on June 24, will result in four C-130Js being located at Little Rock to help Air Guard members “gain the experience and knowledge needed to operate the newer aircraft,” according to a DAF release.

The Air Force has conducted the site survey and environmental analysis necessary to make the final decision for Little Rock. Arkansas lawmakers indicated in May 2021 that military leadership had selected Little Rock as its preferred location, with final approval coming from Air Force Secretary Frank Kendall.

Little Rock AFB's selection is in many ways unsurprising. The base already hosts the 314th Airlift Wing, the nation's tactical airlift “Center of Excellence” and the largest C-130 Formal Training Unit in the Air Force. The 314th Airlift Wing helps train C-130 crew members across the Department of Defense, the Coast Guard, and 47 partner nations.

The 189th Airlift Wing of the Arkansas Air National Guard, meanwhile, already has the C-130H Formal Training Unit.

All told, Little Rock has hosted C-130 Hercules training missions in some form or fashion for more than 50 years, resulting in its nickname of “Herk Nation.” Between the 314th Airlift Wing, the 189th Airlift Wing, and the 19th



Staff Sgt. Dana Tourtellotte

**Four C-130Js and the formal Air National Guard training mission will go to Little Rock Air Force Base in Arkansas.**

Airlift Wing, the base has dozens of C-130Hs and C-130Js.

While the Active-duty Air Force has almost completely transitioned away from the C-130H to the new C-130J Super Hercules, the Air National Guard is still very much in the midst of its changeover, with its number of H models still far exceeding the number of Js. The Guard previously announced four other locations that are getting the C-130J—Louisville Air National Guard Base, Ky.; McLaughlin Air National Guard Base, W.V.; Naval Air Station Joint Reserve Base Fort Worth, Texas; and Savannah Air National Guard Base, Ga.

Those first three locations have all taken delivery of their first C-130Js. ✪

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# Medal of Freedom to Wilma Vaught

By Tobias Naegele

President Joe Biden awarded the Presidential Medal of Freedom to retired Air Force Brig. Gen. Wilma L. Vaught at a July 7 White House ceremony. Vaught is only the eighth distinguished Airman to earn the honor.

Over the course of a 28-year Air Force career, Vaught, 92, was “the first woman to hold every job she ever had,” her medal citation states. Over a 28-year career, she became the first woman to deploy with an Air Force bomber unit, serving in Vietnam, and was among the first women to break into the general officer ranks, retiring as a brigadier general in the Air Force.

After retiring, Vaught spearheaded the creation of the first national memorial honoring the more than 3 million women who served in the U.S. military. The Military Women’s Memorial is the result of that work, located at the gateway to Arlington National Cemetery, where it features a portrait of Vaught as a tribute to her determination to recognize women veterans.

Vaught was among several notable women who received the award at the same cere-



Retired Brig. Gen. Wilma Vaught is the eighth Airman awarded the Presidential Medal of Freedom.

mony, including former Congresswoman Gabrielle Giffords and two female Olympic champions, gymnast Simone Biles and soccer star Megan Rapinoe. Biden said in his opening remarks that Biles’ and Rapinoe’s leadership and success were built on those of earlier pioneers like Vaught.

“Simone and Megan would be the first to acknowledge that they stand on the shoulders of those who came before them, like Air Force Brig. Gen. (Retired) Wilma Vaught,” Biden said. “Wilma is one of the most decorated women ever to serve in the United States military,” he said, praising her for “shattering conventions, shaping a new tradition of our military,” and founding the women’s memorial.

Seated in a wheelchair in a bright blue blazer and with her left arm in a sling, Vaught saluted the crowd as President Biden fastened the award around her neck, then repeated the gesture, as the President came around and saluted her, offering a quiet “thank you” before he presented the next award.

The seven previous Air Force leaders to be awarded the Presidential Medal of Freedom were all men and include three astronauts, a Medal of Honor recipient, and a five-term member of the Senate. ✪

| Name               | Year | Distinction  | President   |
|--------------------|------|--|-------------|
| Buzz Aldrin        | 1969 | Apollo 11 Astronaut                                  | Nixon       |
| Michael Collins    | 1969 | Apollo 11 Astronaut                                  | Nixon       |
| Fred Wallace Haise | 1970 | Apollo 13 Astronaut                                  | Nixon       |
| Chuck Yeager       | 1985 | Flying Ace, Test Pilot, first to break sonic barrier | Reagan      |
| Barry Goldwater    | 1986 | Five-term Senator and USAFR Brigadier General        | Reagan      |
| Jimmy Doolittle    | 1989 | Medal of Honor Recipient and World War II hero       | G.H.W. Bush |
| Richard Myers      | 2005 | Chairman of the Joint Chiefs of Staff                | G.W. Bush   |

## New ‘Atomic Veterans’ Medal

By Amanda Miller

Veterans who performed the secret, often dangerous work of testing nuclear weapons deserve new recognition and may now call themselves “Atomic Veterans,” according to the Defense Department.

The department announced the Atomic Veterans Commemorative Service Medal on July 5 to recognize that “the service and sacrifice of the Atomic Veterans directly contributed to our nation’s continued freedom and prosperity during the period following World War II.” Their work was “pivotal to our nation’s defense during the Cold War era,” according to the announcement.

A DOD spokesperson said as many as 500,000 veterans may be eligible for the medal.

Veterans who qualify for the medallion-only award include those who served between July 1945 and October 1992 and, as part of their military duties, took part in a nuclear detonation; or cleaned up radioactive material after a detonation or an accident; or were exposed to ionizing radiation during the “operational use” of nuclear weapons in World War II.

The dates coincide with those of nuclear testing in the U.S., starting with the first detonation in Alamogordo, N.M. The U.S. performed 1,032 tests in all.

Medallion-only medals, given to special groups of veterans, don’t hang from a ribbon and may not be worn on uniforms, the Pentagon said, citing as other examples the Congressional Gold Medal and the Pearl Harbor Commemorative Medal.

The director of the Defense Threat Reduction Agency will manage the program and expects to have medals available to distribute by the end of this year. Meanwhile, an online application will be set up for eligible veterans, or the next of kin of deceased eligible veterans, to start the process.

“Our nation’s longstanding nuclear deterrence capability resulted from the service and sacrifice of service members (now known as Atomic Veterans) who participated in the initial testing and development of our nation’s atomic and nuclear weapons programs,” according to the announcement.

“Notably, the dangerous and important work these veterans performed was often done in secret due to national security requirements.” ✪

# James M. McCoy, Former Chief Master Sergeant of the Air Force, Dies at 91

By John A. Tirpak

**J**ames M. McCoy, who was the sixth Chief Master Sergeant of the Air Force, and who was the first former enlisted member to be president and chairman of the Air Force Association, died July 13, three weeks shy of his 92nd birthday. He was a recipient of AFA's Lifetime Achievement Award.

McCoy was born in Iowa and entered the Air Force in 1951. He served first as a radar operator with Aerospace Defense Command in Alaska, but a glut of radar operators after the Korean War motivated him to seek a new career in training.

He returned to be a drill instructor at Lackland Air Force Base, Texas, from 1956 to 1957, and became a technical sergeant in just five years. While at Clark Air Base, Phillipines, where he was in charge of base noncommissioned officer (NCO) training, he set up and operated a command post during the 1958 Taiwan Strait Crisis, coordinating inbound and outbound USAF aircraft. He then spent a year as assistant to the commandant of cadets at the Air Force Reserve Officer Training Corps program at the University of Notre Dame, Ind.

In 1960, McCoy was commandant of Strategic Air Command's NCO preparatory school at Bunker Hill Air Force Base, Ind., and in 1962 was an instructor at the 2nd Air Force NCO Academy at Barksdale Air Force Base, La., becoming its sergeant major by 1966. In that year, he also received his bachelor of science degree in business administration from Centenary College of Louisiana. He was an honor graduate of the 2nd Air Force NCO Academy.

McCoy was head of Headquarters, 2nd Air Force's training branch then transferred to Headquarters, SAC, where he was in charge of NCO professional military education, setting up SAC's own NCO Academy and NCO Leadership Program.

In 1970, McCoy was in charge of NCO operations training at the 41st Aerospace Rescue and Recovery Wing at Hickam Air Force Base, Hawaii, where he supervised training programs for H-3, H-4, H-53, and HC-130 rescue aircrew throughout the Pacific and Southeast Asia; and as senior enlisted adviser to the wing commander.

He moved up to Headquarters, Pacific Air Forces, as chief of military training and deputy chief of staff for personnel in 1973, refreshing courseware. He graduated with the first class of the U.S. Air Force senior NCO academy at Gunter Air Force Station, Ala., that same year.

In an interview, McCoy said, "I had gone from a wing, to a numbered air force, to a major command. I was going back to a wing." He would have been eligible for retirement within a year, and he considered putting in his papers, but he decided to stay in, saying, "You look at every opportunity that comes along, and you don't turn it down based just on what it looks like. I looked at it as another opportunity to further my professionalism."

McCoy was named one of the Air Forces's 12 Outstanding Airmen of 1974 during his assignment with PACAF.

In 1976, McCoy returned to SAC as its senior enlisted adviser and during this assignment also chaired two worldwide senior enlisted conferences for AFA, which identified challenges to enlisted life and recommended improvements.

McCoy was named Chief Master Sergeant of the Air Force



Staff Sgt. Jeffery Landon via National Archives

**Chief Master Sgt. of the Air Force James McCoy with USAF Security Police at Zweibrucken Air Base, Germany, in July 1981.**

in 1979, advising Chief of Staff Gen. Lew Allen Jr. and Air Force Secretary Hans M. Mark on enlisted issues. He retired from USAF in 1981 after 30 years of service.

In retirement, McCoy settled in the Omaha, Neb., area where he was active with community, business, and civic organizations. But he focused on the Air Force Association, ultimately serving two terms as National President (1992-1994) and two terms as Chairman of the Board (1994-1996). He was the first enlisted Airman to hold both jobs. He was also the first enlisted person to chair the Air Force Retiree Council.

In 2007, the Airman's Leadership School at Offutt Air Force Base, Neb., was named for McCoy. In 2016, he was inducted into the Strategic Air Command Hall of Fame.

In 2021, AFA awarded McCoy its Lifetime Achievement Award. Upon receiving the award, McCoy said, "It means a lot to me because of what AFA has done" over its history. He added that "a lot of people think it's an officer's association. It's not. I'm living proof of that." Gerald Murray, the 14th Chief Master Sergeant of the Air Force and the second enlisted Airman to be the Chair of AFA, presented McCoy the award.

Murray, who rose through the ranks to follow McCoy as the 14th Chief Master Sergeant of the Air Force and is the only other former enlisted leader to become AFA's Chairman, praised McCoy as a role model.

"Chief McCoy joined the Air Force at 18 and our association not long after," Murray said. "Many are life members, but he led a life of membership—leading and giving his all at every level and in every way. He was an inspiration, and his mark is long-lasting."

Chief of Staff Gen. Charles Q. Brown Jr. said McCoy "left a legacy that highlights the instrumental role senior enlisted leaders have in our mission, both as executors and advisers."

"Improving education, equality, and quality of life were hallmarks of his time in service that helped shape the force we have today," Brown continued, "and his dedication to Airmen and families continued in his post-retirement work with the Air Force Association and other civic organizations. I am grateful for his contributions to our service and am saddened to learn of his passing."

Chief Master Sergeant of the Air Force JoAnne S. Bass said McCoy "was an icon of our great Air Force; a leader among leaders; a patriot of unparalleled honor and dignity." ★

# ★ FACES OF THE FORCE

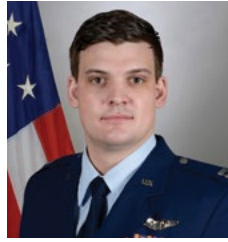


USAF

**Gen. William V. McBride**, who served as Air Force Vice Chief of Staff from 1975 to 1978, celebrated his 100th birthday on May 25. Over the course of a 36-year military career, McBride served in World War II, Korea, and Vietnam, becoming a highly decorated triple-rated officer working as a command pilot and navigator. Air Force Logistics Command. "I enjoyed every responsibility I was given. ... That's the reason why I made the decision to stay for 36 years. I think I did well. It was a very enjoyable career," he told his local newspaper, the Ellwood City Ledger.



In his newly published memoir, "American Airman," veteran **Jonathon Benjamin** details how he grew up as the son of an Army veteran, joining the Air Force after attempting college. An off-duty accident, however, left him with a severe traumatic brain injury that caused his eventual medical retirement. Transitioning back to civilian life, he finds his unlikely healing in the world of theater, first as an usher, and later, as an award-winning playwright.



Amazon

**Capt. Matthew McChesney**, an instructor pilot in the NYANG, was honored in June with a Distinguished Flying Cross with Valor device for actions during the evacuation of noncombatants from Afghanistan in August 2021. McChesney and the crew of Reach 824 landed their C-17 in Kabul, were struck by small arms fire, and unloaded equipment used to save hundreds. They flew out 348 people and helped transport the bodies of 13 service members killed in a suicide bombing. Five of his aircrew received the Air Medal with Valor device.



USAF

The Air Force Services Center recently announced 15 winners in its annual Air Force Art Contest, selected from more than 2,240 pieces of art and 1,600 participants of all ages. Divided across five categories—adult accomplished, adult novice, 6 to 8 years old, 9 to 12 years old, and 13 to 17 years old—the winners receive \$500, \$400 and \$300 gift cards for first, second and third place, respectively. Among those recognized, **Jennifer Slack** of Hurlburt Field, Fla., won the adult accomplished division (image above), and **Kelly Aistrop** of Beale Air Force Base, Calif., won the adult novice category. Among the youth divisions, **Samantha Lee** from Landstuhl, Germany, won the 6-8 year old category, **Eason Becker** from Hill Air Force Base, Utah, won the 9 to 12 category, and **Morgan Becker**, also from Hill AFB, topped the 13 to 17 age range.



Senior Airman Bailee A. Darbasie

The **14th Airlift Squadron**, JB Charleston, S.C., was recognized with the 2021 Gen. Joseph Smith Trophy for AMC's most outstanding airlift squadron. The "Pelicans" were AMC's most tasked squadron in 2021, involved in everything from safely transporting some of DOD's highest leaders to assisting in the noncombatant evacuation out of Kabul, Afghanistan. The squadron supported the ACE concept with the first virtual mission management process during Phoenix Sword.



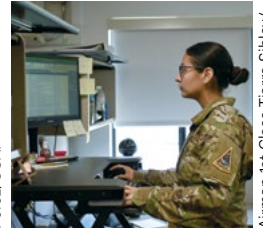
Staff Sgt. Adrian Brakeley/ANG

**Staff Sgt. Johnny Cox** is a full-time recruiter with Missouri ANG's 131st Bomb Wing. He rose through the ranks to become a professional cornhole player, taking part in the American Cornhole League as the top-ranked player in the state. Supported by the Guard to practice and play in tournaments, Cox has taken on some of the nation's top players and held his own, and he has also competed in the 2022 U.S. Armed Forces Tournament, finishing as the runner-up in both the singles and doubles event.



Armando Perez/USAF

A group of Airmen representing Air Force Gaming made history May 28 to 29, becoming the very first champions of an esports competition recognized by the U.S. government—the first Department of Defense Armed Forces Esports Championship. **Staff Sgt. Shane Posey**, **Staff Sgt. Trey Christensen**, **Senior Airman Cole Schlegel**, and **Airman First Class Allyson Stephenson** combined to claim the title, going undefeated in the competition against other teams from the Army, Navy, Marine Corps, Space Force, and Coast Guard while playing the game 'Halo: Infinite.' "We are the roots, this is definitely going down in the history books. This is awesome to be a part of," Schlegel said.



Airman 1st Class Tierra Stibley/USAF

After an office team event in April at Vandenberg SFB, a member of the group collapsed. **Staff Sgt. Cristina Garza**, a financial analyst with the 30th Comptroller Squadron started CPR while other team members called 911. Security Forces arrived and helped her to continue compressions and breathing cycles, before they started using a defibrillator. When medics arrived the man was transported to a medical facility, where he is recovering.

Tell us who you think we should highlight here. Write to [afmag@afa.org](mailto:afmag@afa.org).



Tech. Sgt. Nieko Carzis/ANG

C-130J Super Hercules airlifters are powered by Rolls-Royce AE-2100D3 turboprop engines.

# Rolls-Royce Supports USAF with Experience, Innovation

By Adam Stone

The roots of innovation trace back to World War I. Rolls-Royce's predecessor company in Indianapolis, the Allison Engine Company, adapted early automobile engines for the De Havilland DH-4, a single-engine, two-seat biplane bomber. Later, Allison designed and manufactured thousands of engines for such legendary American military aircraft as the P-51, P-38, P-39, P-40, and others, and provided engines for the British Spitfire. Throughout the history of its Indianapolis operations, Allison and later Rolls-Royce have remained a trusted Air Force partner through technological, economic, and military revolutions—including the acquisition and name change.

"When Rolls-Royce acquired Allison in 1995, it picked up that legacy and tradition of supporting first the Army Air Corps, and later the U.S. Air Force," said

Lt. Gen. Darryl Roberson (retired), senior vice president of business development at Rolls-Royce North America. "From the very start with this company, there was an innovative mindset—a determination to stay on the leading edge of technology and capabilities in support of warfighters."

Engine making is and was always part science, part art. There is a reason just a few companies today can build high-tech jet engines. "There are fewer, in fact, than nations with nuclear arms," he said. No wonder, he adds, that "Even today, the Russians and Chinese still try to steal our technology—they can't match it on their own."

That long-standing engineering culture helps ensure that Rolls-Royce delivers today—on its promises, with its technology, under any conditions, from extreme heat to destructive sands, to bone-chilling cold.

"There is a lot of technology that goes

into this, as well as the ability to test and modify, to work out the wrinkles," he said. "We use our long history, our experience, to optimize these engines in ways that others cannot."

One reason, Roberson said: The deep, direct ties between Rolls-Royce employees and their Air Force customers. Roberson spent 34 years as a USAF fighter pilot and commander. "I was a part of the Air Force for half of the time that the Air Force had been in existence," he mused. "I grew up with it." Now he gets a thrill from continuing to contribute.

"As an industry partner for the Air Force, it is critically important for us to understand their needs and desires, where they're trying to go and how best to help them get there. The years spent servicing those engines, upgrading those engines, helping to improve capabilities—that tight relationship and our daily side-by-side work—all that gives us a deep understanding of the culture of the United

SPONSORED CONTENT IS PRODUCED BY AIR FORCE MAGAZINE



# Flying Together for 75 Years

American Made Jet Engines



For more than seven decades, U.S. Air Force pilots have taken to the skies, and Rolls-Royce has proudly supplied thousands of engines to keep them aloft. From the early V-1710 engines powering P-51 Mustangs, to the current fleets of C-130J, CV-22 and Global Hawk aircraft, as well as the modernized B-52s soon to be powered by Rolls-Royce engines, our facilities in Indianapolis, Indiana, have kept those aircraft soaring.



(From Left) P-51 Mustang, powered by the V-1710; C-130J, powered by the AE 2100; and B-52, soon to be powered by the Rolls-Royce F130.

Even before the Air Force was established in 1947, aero-engines to power U.S. military aircraft were manufactured at our Allison Engine Company factories in Indianapolis, which continue to support the Air Force. These factory locations produced the power plants for the iconic fighter aircraft of World War II: P-51s, P-38 Lightning, P-39 Airacobra, P-40 Warhawk and others.

***These were the most powerful and advanced engines of their time.***

Following the war, skilled engineers and mechanics began producing innovative and powerful jet engines for the first Air Force jet fighter, the F-80 Shooting Star. By the mid-1950s, the mighty T56 turboprop engines were powering the new C-130 transport planes for the Air Force. The T56 engine line proved to be one of the longest running engine types in history, and T56 engines are still being produced at Rolls-Royce Indianapolis.

Today, Rolls-Royce produces the powerful and efficient AE family of engines in turboprop, turboshaft, and turbofan variants. The AE 1107C powers the CV-22, the AE 2100 powers the C-130J and the AE 3007H powers the Global Hawk. Altogether, over 7,000 engines in the AE family have been produced, totalling more than 82 million engine flight hours of dependable service. And we will soon begin assembly and test of the F130 engines in Indianapolis for the iconic B-52.

While our history unites us, it's our future with the U.S. Air Force that inspires us day in and day out, including our work on hypersonics, directed energy, micro-reactors, and sustainable propulsion solutions. So from us to you, congratulations for 75 years of aerospace innovation. We are happy to continue the ride into the wild blue yonder!



States Air Force.”

Rolls-Royce engines power the C-130, the workhorse transport and its derivatives, and the versatile CV-22 tiltrotor, as well as the unmanned Global Hawk long-endurance, high-altitude, remotely piloted surveillance aircraft.

C-130J airframes have flown more than 2 million flight hours performing airlift, search and rescue, special ops, electronic warfare, and other needs. “It is critically important and super versatile aircraft,” Roberson said. Whether older -H models or newer C-130Js, “I have no doubt we will be supporting C-130s for at least the next 20 or 30 years.”

Rolls-Royce was a pioneer in vertical lift, powering the Marine Corps’ AV-8B Harriers as well as the V-22 and the engineering enabling those engines to direct their thrust through the transition from horizontal to vertical flight and back again—among the most complex engine technologies. Rolls-Royce also provides the vertical lift capability for the F-35B Lightning II.

“We are the leader in understanding how to take off vertically and transition to horizontal flight,” Roberson said. “When you tilt it from one orientation to another, when you transition from one type of turbofan to a turboshaft capability, these are extremely complex operations. Rolls-Royce’s experience is unparalleled.”

No less unique is the B-52, and Rolls-



Rolls-Royce won the competition to replace the original B-52 Stratofortress engines with its F130 powerplants, which will pay for themselves in increased fuel efficiency and decreased maintenance.

Senior Airman Tessa B. Corrick

Royce continues to evolve engine capabilities. Engineers work to improve the propulsion, and to deliver more electrical power to support emerging systems.

“These advanced electronic systems that are important for survival in engagements with the enemy, the systems that are needed to put precision fires on a target—all of that requires additional power,” Roberson said. “We are constantly improving, constantly upgrading and advancing to provide what the Air Force needs to conduct the modern fight.”

Rolls-Royce is at the heart of an effort to keep the B-52 Stratofortress flying until it approaches the century mark. To do that, Rolls matched the proven engines from its business-jet business to the rigorous requirements demanded of a long-range bomber. Advanced engineering made that easy.

“The ability to digitally manipulate the data that we have on our engine made a big difference in the competition,” Roberson said. “Suppose a question came up: ‘What if we needed more power for this or that?’

Our ability to digitally analyze the B-52 allowed us to very accurately predict what we could or could not do, and what the impacts and potential cost implications would be. All of that allowed us to be very precise and responsive both to the Air Force and to Boeing.”

Rolls-Royce is likewise applying those technologies to manufacturing, using digital twins to model performance and predict maintenance, and applying digital engineering and advanced materials and manufacturing processes to reduce

parts count, increase reliability, and boost performance.

“In some cases, we’ve leveraged modern manufacturing and materials technology to reduce the thousands of parts that make up an engine by up to 90 percent,” Roberson said.

“We’re delivering better fuel efficiency and longer flight times, but with less maintenance and greater reliability,” he said.

**LOOKING AHEAD**

Military aircraft must fly under often

difficult conditions, often under extreme heat, cold, and in

dirty, sub-optimal environs. Combat conditions only make the demands more intense. “We work hard to give the Air Force engines that do what they need to do in combat,” Roberson said. “That requires a lot of engineering prowess.”

Modern technologies like additive manufacturing enables fewer parts, and new materials, such as coatings, can last longer and reduce downtime. Digital engineering is the key enabler, because it makes it possible to experiment using digital models rather than real life, so that in the long term, “We can manufacture parts in innovative, new ways, much more quickly, and much more reliably,” Roberson said.

“Technology now is allowing us to achieve greater levels of performance in higher-temperature engines than we ever could before,” Roberson said. Further down the road, Rolls-Royce is working on hybrid-electric flight, a solution Roberson said could give pilots greater stealth, as they switch to the quieter electric mode when approaching enemy positions. And the reduced heat profile of an electric engine would also reduce the likelihood of detection.

“This company is absolutely committed to hybrid electric and electric flight for the future,” Roberson said. “We always want to be on the leading edge.”

**A Trusted Partnership**

Throughout the history of its Indianapolis operations, Allison and later Rolls-Royce, which acquired the company in 1995, has remained a trusted Air Force partner.



National Museum of the U.S. Air Force

**1917:** Early American military pilots begin flying DH.4 aircraft, initially powered by Rolls-Royce Eagle engines. Later versions featured Liberty powerplants, which were based on race car engines, from Allison Engine Co. in Indianapolis.

**1956:** First production C-130A aircraft are delivered to the Air Force, the first among more than 2,600 aircraft to be produced in the C-130 line. The initial aircraft were powered by four T56 turboprop engines from the Allison factories in Indianapolis. The T56 becomes one of the longest production engines in aviation history, with over 18,000 engines produced.



USAF



PHCS Terry Cosgrove/USN via National Archives

**1985:** An Allison engine, designated T406 and later renamed as the Rolls-Royce AE 1107C, is selected to power the V-22 tiltrotor aircraft.



USAF

**1996:** First flight of the C-130J, powered by four Rolls-Royce AE 2100D3 turboprop engines.



Staff Sgt. Markus Walter

**2006:** First operational CV-22 aircraft delivered to Air Force at Kirtland AFB, powered by Rolls-Royce AE 1107C turboshaft engines.



Rolls-Royce

**2021:** Air Force selects Rolls-Royce F130 engines, to be produced in Indianapolis, for B-52 engine replacement.



USAF via National Archives

**1942:** Allison opens new factory in Indianapolis, Indiana, to produce V-1710 piston engines. These engines would power P-51, P-38, P-39, P-40 and other aircraft during and after World War II. Later versions of the P-51s would be powered by Rolls-Royce Merlin engines, iconic for their use in RAF Spitfires and Hurricanes. Allison would go on to produce thousand of Merlin engines under license from Rolls-Royce.



USAF

**1947:** Allison begins producing J33 engines, which will go on to power the P-80 Shooting Star, the Air Force’s first operational jet fighter, as well as the F-94 Starfire and the T-33 jet trainer. Allison produced nearly 7,000 J33 engines. Its later J35 engines would become the primary powerplant for the F-84 Thunderjet and F-89 Scorpion.

**1968:** First flight of the USAF A-7D Corsair II, powered by a single Allison TF41 turbofan engine, a license-built version of the Rolls-Royce Spey. A-7D aircraft flew in the Air Force fleet for more than 20 years.

**1995:** Rolls-Royce purchases Allison Engine Co. with U.S. Government approval, officially joining two companies with a long, intertwined history of aerospace collaboration.



Rolls-Royce



Courtesy

**1998:** First flight of the Global Hawk UAV aircraft, powered by a single Rolls-Royce AE 3007H turbofan engine.



Senior Airman Donald Hudson

**2019:** Rolls-Royce AE 2100D3 engines surpass 8 million engine flight hours on the C-130J fleet.



USAF via National Archive

Gen. Merrill A. McPeak



Staff Sgt. Michael Boquette

Gen. Ronald R. Fogleman

# Four

## The Air Force formed them into

BY TOBIAS NAEGELE

In its 75-year history, 22 Airmen have led the Air Force as Chief of Staff. Each came to the post shaped by the experiences—and sometimes scar tissue—developed over three decades of service. Each inherited an Air Force formed by the decisions of those who came before, who bequeathed to posterity the results of decisions and compromises made over the course of their time in office. Each left his own unique stamp on the institution.

As part of Air Force Magazine’s commemoration of the Air Force’s 75th anniversary, Sept. 18, 2022, we set out to interview all of the living former Chiefs of Staff, ultimately interviewing seven of the eight former Chiefs from 1990 to the present. In this first in a two-part series, we share the stories of four of those Chiefs:

### PART 1 OF A 2-PART SERIES

No. 14 Gen. Merrill A. McPeak (1990-1994); No. 15 Gen. Ronald R. Fogleman (1994-1997); No. 17 Gen. John P. Jumper (2001-2005); and No. 18 Gen. T. Michael Moseley (2005-2008).

This period begins the pinnacle of American air power, the planning and execution of 1991’s Operation Desert Storm, in which the fruits of a decade of modernization were put on display to devastating effect: This was the first time the world saw how stealth could evade enemy air defenses and how the dream of precision bombing that motivated the Bomber Mafia in the interwar period leading up to World War II was actualized five decades hence. Yet the years since did not result in the “revolution in military affairs” many envisioned in the wake of Desert Storm. Instead, a confluence of budgetary, military, and of course politi-

### Gen. Merrill A. McPeak, CSAF No. 14 (1990-'94)

## Discordant Visionary

Every Chief is unique, shaped by his time and the world as he rose through the ranks and the events and personalities defining the national security landscape when he takes office. To these circumstances each Chief adds his unique personality, style, and attributes.

When Gen. Merrill “Tony” McPeak arrived as Chief in October 1990, Iraq had only months before invaded and occupied Kuwait. The United States was assembling an enormous coalition against Iraq and the Air Force would soon demonstrate a new era of American air power: Stealth aircraft that could evade enemy detection; precision weapons that could strike with pinpoint accuracy; and dominance like no air force had ever demonstrated before.

Yet McPeak’s job was not to fight that war, but to organize, train, and equip the Air Force for what would follow. By the time he became Chief, the Cold War that had defined his entire adult life was over. Born in 1936 in the midst of the Great Depression, McPeak had reached adulthood in the immediate aftermath of World War II. The Soviet Union was suddenly no longer America’s archrival. In fact, the Soviet Union no longer existed.

“Desert Storm began a couple of months after my swearing in,” McPeak recalled in July. We’re on a video call and he’s in



USAF

McPeak flew more than 200 missions in Vietnam and 199 air shows for the Thunderbirds. Criticized for favoring fighter pilots, he argues not guilty. “I wasn’t so much interested in who’s a fighter pilot as I was in who’s a warrior.”

workout gear from his home in Oregon. A photo taken in the Oval Office in December 1990 of the Joint Chiefs meeting with President George H.W. Bush and Defense Secretary Dick Cheney rests on the credenza behind him. McPeak wears a beard, and



# Chiefs



Gen. John P. Jumper

Senior Airman Priscilla Robinson via National Archives



Gen. T. Michael Moseley

USAF via National Archive

## Airmen. They shaped the Force.

cal decisions led to an Air Force that grew ever older, smaller, and less ready than when this period began.

From Gen. Carl Spaatz (CSAF No. 1, 1947-48), who was an Army Airman for all but two years of his 34-year military career and guided the Air Force through its first post-war drawdown, to Gen. Charles Q. Brown Jr. (CSAF No. 22, 2020-present) today, all the Chiefs have shared common traits: Every one of them was a pilot who excelled both in the cockpit and in command. Each was also a warrior. Each was a man. And every one of them was lucky. The Air Force is a meritocracy, not a machine. Talent is only one of the factors that goes into the selection process. Timing, health, politics, friendships, and luck are all critical factors.

No matter what heady plans one might bring to the office, it is the reality of the tasks and choices that land on his desk that truly defines a Chief's tenure. Whether world events, the miscues of Airmen, or choices made by the Chief himself, these events determine where his attention must be focused and what he can accomplish on his watch. No Chief ever completes his own to-do list.

Every Chief is both the beneficiary and victim of the choices made by those before him. Combined with the external factors affecting him, these shape the hand each Chief is dealt. How he plays those cards shapes not just his legacy as Chief, but more importantly, the future of the Air Force.

**Next month:** Gen. Norton A. Schwartz, CSAF No. 19; Gen. Mark A. Welsh III, CSAF No. 20; and Gen. David L. Goldfein, CSAF No. 21.

sounds very much like he did as Chief, still ramrod straight, still intense, still able to laugh at and with himself. "You would think that I spent a lot of time worrying about how to support [Gen.] Chuck Horner out in the sandbox, and I did. But I was also talking to the Secretary [of the Air Force] from Day One about how we were going to reorganize the Air Force. ... [Secretary] Don Rice and I had agreed before the end of January '91 on how we wanted to reconfigure the Air Force."

The Air Force had 535,233 Airmen on Active duty when McPeak came to Washington. It had 426,327 when he left four years later. The drawdown was a dramatic reworking of a force that had been locked in a strategic competition for more than four decades and was anticipating President Bush's "New World Order," a unipolar world in which the U.S. was the sole superpower remaining. McPeak thought the entire military was ready to be reset at a much smaller scale than what the nation had been used to.

"My idea was to simplify the structure of the Air Force," McPeak recalls. "Complexity is the enemy of success in combat. You've got to keep it simple. And that starts with a simple organization." As Chairman of the Joint Chiefs, Army Gen. Colin Powell had already developed the "Base Force," defining the scale of the coming drawdown. The aim was to avoid creating a hollow force that would retain structure devoid of capacity, but instead outline a force that could fight two wars on the scale of Operation Desert Storm simultaneously.

McPeak did away with Strategic Air Command, Tactical Air Command, and Military Airlift Command. Instead of three of these Major Commands, the Air Force would have two: Air

Combat Command and Air Mobility Command. The change in acronyms was intended to help drive home the changes, which were driven by the notion that the distinction between tactical and strategic forces was anachronistic.

"I think how we organize to fight is the most important thing a leader can do," McPeak says. "Then of course you've got to turn them loose to fight. And if they're well trained, they'll do well. But first, it's how you organize to go to battle. That had been very important in my thinking for a long time, certainly before I became Chief. ... And remember: the way you organize something is, first, you organize it, and then, second, you're reorganizing."

First moves aren't always right, and McPeak is quick to own his mistakes (at least where he sees decisions as wrong). "I put the ICBM force into Combat Command—that was a mistake," he says. He changed his mind, altering people's lives in the process, and moved it to Space Command. Later, it would be moved again, combined with bombers into Air Force Global Strike Command. McPeak was passionate about getting organization right, and achieving a viable structure that made logical sense. "When, I took over the Air Force it had 200 things called 'wings,'" he says. "When I left, we had 100 things called wings. They were real wings."

Organizational upheaval created turmoil. "Any organization that wants to stay at a high level of performance is in virtual reorganization all the time," McPeak says. For example, there were two wings at Andrews Air Force Base, Md., south of Washington, D.C., and when asked why, McPeak was told it was too much for one colonel to manage. "I said, 'Well, let's make it a one-star and put the whole wing under him and get rid of a headquarters and

a staff car and a secretary.' Man, if one person can't run Andrews then what am I doing trying to run the whole Air Force?"

McPeak's structural remaking of the force was, he recalls, about one-third drawdown and Base Force, "but two-thirds of it was closing superfluous wings."

Cutting the force was an opportunity, if it meant the service could be more efficient. But getting the message across was difficult. McPeak saw the Base Force not as an objective floor below which the Air Force and other services would not go, but as a ceiling: the biggest it could possibly be when the cutting was finally done. That proved prescient. Service budgets that peaked before the end of President Reagan's eight years in office continued to decline through most of the 1990s. At the same time, demand for Air Force operations remained constant. While the services returned to a massive homecoming celebration in Washington, D.C., in 1991, the Air Force found itself adapting to a new way of life, rotating forces and aircraft through the Middle East to enforce no-fly zones in the south and north of Iraq, protecting Iraqis from their own military.

None of that was clear when McPeak was still in charge. He was remaking the Air Force in his own image, and he was a different kind of Airman. He remains today a different sort of former Chief, still marching to the beat of his own drummer, still intimately familiar with the Air Force but from a greater level of remove than other former Chiefs. He is a Chief who sweated details others would ignore. He had the Air Force Band create a string quartet to play chamber music because he felt the Strolling Strings were outsized for his quarters at the Air House. He took part personally in the auditions.

He introduced a new uniform. If there's anything most Chiefs won't do, it's work on uniforms. Everyone has an opinion, and everyone is an expert. The uniform McPeak introduced was derided both for being cut for McPeak's wiry physique and for looking too much like a commercial airline pilot's uniform. Yet while the decorations on that uniform would change, the basic suit remains the same.

"No guts, no glory," he says of Chiefs who shy away from uniform controversy. "If you don't want to take on big challenges, then you shouldn't be in the Chief's office. [The uniform] didn't take up much of my time. It was easy. And by the way, that uniform is being worn today. That's my uniform, except it's been glitzed up. ... My idea that simplicity is what works in combat? Well, it also works in uniforms. The blue suit with three Arnold patch buttons on the front is .... the uniform I helped to redesign."

Others knocked McPeak as symbolizing the "fighter mafia" and favoring combat aviators. A former Thunderbird, McPeak had flown more than 200 sorties in Vietnam and 199 as a Thunderbird, surviving the team's first-ever crash in front of a public audience when the wings of his F-100 sheared off on a maneuver in Del Rio, Texas, in October 1967. Pulling his jet heavenward at 6.5 Gs, he heard a loud bang as the wings came off, releasing fuel that turned into a fireball. That he survived the accident is a testament as much to skill as luck.

McPeak questions the fairness of the fighter mafia label. "I

made Billy Boles a four star and sent him to run Training and Education Command. Not only was he not a fighter pilot, he wasn't any kind of pilot. He wasn't a navigator. He had a slick uniform right here where here you put your wings. First guy ever sent to Air Education and Training Command who was nonrated. I sent up to the Air Force Academy Paul Stein. First Air Force Academy Superintendent who was not a rated officer, not a pilot. I brought in a guy to be Vice Chief who was a space guy, he wasn't a pilot. But he was a warrior. Billy Boles was a warrior. Paul Stein—go find me a warrior better than Paul Stein. I wasn't so much interested in who's a fighter pilot as I was in who's a warrior. Turns out a lot of fighter pilots are in that category. Thank goodness!"

McPeak was no dictator when it came to selling his vision of the force. "I spent about one-third of my time in front of audiences, working on consensus," he recalls. "No organization that I know of goes anywhere based on what Mussolini tells them to do. We all operate on consensus. And that's true in the military. I never thought I could just come in and turn on the light

switch and expect everybody to have all the lamps in the building go on. So I worked hard to build consensus, [but] I was only about 51 percent successful. Change is hard to do. It's hard to lead."

The reason it was so hard, he says, is that he wanted to do more than incremental change. "Look, you know how to create the best dictionary in the world?" he asks, pausing for effect. "Start with the existing best dictionary and then fix one mistake, one word. That's what some people have as an idea of leadership. But that wasn't my idea. I wanted to start building a new dictionary. That's pretty ambitious."

That would not work if every Chief wanted to do that, he acknowledges. "We can't have an Air Force that every four years gets turned on its head and shaken hard. But every once in a while, it's not a bad idea."

McPeak blew up thousands of pages of regulations, calling in his functional Chiefs and asking them to boil down those regulations to four or five pages, double-spaced. He recalls it took multiple iterations to boil these down to their essence. "The idea was we should have instructions that say what is important to us. And if 100 things are important, it's like saying nothing's important."

By going to the functional Chiefs—"the head cop, the head chaplain, the surgeon general"—McPeak sought to build consensus around a singular idea: "What is it that we're in business to do here? What is the Air Force all about? With the central idea being that it's about excellence," he says. That vision is too often lost, he said, in other pursuits. "I hear way too much today about diversity. It is not the mission of the Air Force to solve society's diversity problems. I'm not against diversity, but I am for winning in aerial combat. That comes first."

When McPeak took office he had a four-by-six card in his desk on which he had written five simple, declarative sentences, five things he wanted to accomplish in that office. "Every day I was inundated by other things that other people wanted me to do," he said. "People would come in and say, 'Hey, boss, I've got a horrible problem. You've got to help me. I'd listen to them and say, go fix it. Come back and tell me how you fixed it. Then I'd

**"An Airman is a member of an elite group.** ... To be an Airman, you have to meet high standards. You have to be a high school graduate to join us an enlisted man and a college graduate to become an officer, which automatically makes us exclusive. ... We're not a bell-shaped curve. And that's good because our job is to defend this country. We want to defend it with people that are physically and mentally and emotionally capable of doing that. ... Then we take those people and train them with the objective of making them excellent at what they do. The leading edge of that is a warrior class that is at the sharp end of the spear, face to face with the enemy. And when we put people in that position, we want to make sure that we've trained them to be very good. **We want to win every fight that occurs in the atmosphere that surrounds this planet.** We want to be excellent at air combat. And that means you're an elite, and you want to walk proudly every day when you go to work."

— Gen. Merrill A. McPeak, CSAF No. 14

open that top drawer and look at the little card to tell me about the things I wanted to do. .... Never got them done, by the way. Never accomplished those five things.”

What were they? McPeak won't say. "Because I failed," he says. "I'm not in the confession mode here, and you're not my priest. I'm not willing to admit the depth and breadth of my failure." But was it failure to be ambitious, to strive for things that remained out of reach? For an 85-year-old former Chief, the frustration is not that, but the reality of the constraints of time, which, like the constraints of gravity, limit most people

to live life inside the lines. McPeak spent his life trying to break free of those constraints.

"You only have four years," he continues. "To do the things that I had in mind would have required eight or maybe 10 years. Therefore I was too ambitious. You have to decide what mistakes you want to make in life. You don't ever get it right. So the mistake I want to make is to be too much of X and too little of Y. ... My five things were things I couldn't get done in four years. And, so part of my problem as Chief was I tried to get them done in four years. ✪

**Gen. Ronald Fogleman, CSAF No. 15 (1994-'97)**

## A Quest for Stability, A Last Stand on Integrity

**W**hen Gen. Ron Fogleman became Chief of staff in 1994, the Post-Cold War drawdown was well underway, and the military was embroiled in social issues. The Navy's Tailhook scandal had fueled a rethink of women's roles in the military, and in aviation in particular. President Bill Clinton, the first Baby Boomer to become president, was also the first since Franklin Delano Roosevelt not to have served in the military, and had campaigned to allow homosexuals to serve openly in the military.

Fogleman was not the first choice; having already been told he was not going to get the job in May of 1994, he was contemplating retirement when, in August, McPeak called to tell him he would be the next Chief. He had barely two months to prepare.

"The Air Force had been through all this turbulence—restructure, drawdown, all kinds of events had occurred that were causing angst within the Air Force," Fogleman said. "At the same time, we had been given sort of a Northern Star, this thing called Global Reach, Global Power... which gave the blueprint for what the Air Force was going to look like." Fogleman asked his fellow four-stars what the Air Force needed, and answered his own question: Stability.

That may have been his focus, but it wasn't to be his legacy. Every Chief sees his areas of interest collide with the reality of the present day. Seven months after Fogleman took office, a B-52 Stratofortress crashed at Fairchild Air Force Base, Wash., during a practice flight for an air show the next day. The crash, which was caught on video and ended in a fiery collision with the runway, killing all four Airmen aboard, was blamed on the pilot's recklessness and on a culture of permissiveness that had failed to challenge the pilot's documented pattern of behavior.

Then came the bombing of Khobar Towers, in which 19 Airmen died, and the controversial case of Kelly Flinn, the Air Force's first female B-52 pilot, whose case set off media and congressional fireworks about double standards for men and women in uniform. Flinn had engaged in an affair with the husband of an enlisted Airman and ignored warnings to end the matter. Eventually, she was charged with the crime of adultery, a matter few in the public realized was a crime under military law. Flinn claimed she was the victim of a double standard; the Air Force argued the opposite. When details of the investigation spilled out in the media, the case drew congressional interest.



USAF via National Archives

Fogleman's proudest contribution was the service's Core Values. "It's the only thing I know of in the Air Force that was adopted 25 years ago and is still there today."

All this played out at just about the same time as another famous adultery case: President Clinton's affair with White House Intern Monica Lewinsky. Flinn, who was about the same age as Lewinsky, was cast as a victim in the media, but as the perpetrator in the case brought against her. When Air Force Secretary Sheila Widnall floated the idea of granting her an honorable discharge, Fogleman said if she did so she would have to start looking for a new Chief. Her behavior, he would say later, didn't merit that honor. It was, he told an interviewer in 1997, the only time he made such a move, but it foreshadowed Fogleman's ultimate decision to retire early, rather than live out his full four-year tour.

"It's a tour, not a sentence," he would say more than once. He was free to go when he chose, and he remained true to that promise.

The Flinn and B-52 cases, among others, convinced Fogleman that what the Air Force needed more than stability was more basic: It needed to hew to its own values.

"It became obvious to me that while the Air Force was going through some things, it might have lost sight of its real values," Fogleman said. "And so I began to try and send the message of what it was we did—deter, and if deterrence fails, we fight and

win America's wars. That's why we're here. We're not a social organization. We're not an employment agency. We're here to fight and win America's wars. So if you sign up with the Air Force, that's what you expect. And, oh by the way, we have some values and some standards, which have got to be universally known—everybody's got to know what they are—and they've got to be uniformly applied, so that whatever applies to an enlisted troop applies to an officer."

Fogleman, who had taught history at the U.S. Air Force Academy, launched onto the lecture circuit. He set out to speak with all of them, making stops in Nebraska, the Pacific, and in Europe. Adopting the Academy's Core Values—Integrity First, Service Before Self, and Excellence in All We Do—he shared his view of what Airman should stand for. "I'm very proud of that," he said. "It's the only thing I know of in the United States Air Force that was adopted basically 25 years ago and which is still there today. And that's the way it ought to be: You need some stability in a force."

But the 1990s did not deliver stability. Small-scale contingencies followed one after the other. Somalia, Haiti, Bosnia, and Kosovo. No-fly-zone enforcement over Iraq continued nonstop. Budgets declined as the nation sought its post-Cold War "peace dividend." Culture wars took root. Each of the services fought for relevance to match its capabilities to a changing world order, but instead of unity, there was infighting.

"The 1990s was a period from my perspective, where the United States of America missed an opportunity," Fogleman says. "We had a chance to demobilize. After every major war we had demobilized—even after the Second World War. The Cold War required us to have generally larger standing forces than we'd ever had before. But at the end of the Cold War, we had a chance to demobilize and invest in smart things. Getting ready for the future."

Instead, Fogleman said, the nation got caught up in pursuing a strategy built on a perceived need to fight two major regional contingencies at the same time. "We literally wasted tens if not hundreds of billions of dollars maintaining an army force structure that, when 9/11 came, was the wrong Army—and then they had to rebuild it anyway," he said.

That decision to "glom on to these two major regional contingencies" as a force-sizing construct was the central error of the era, Fogleman said. "We had never been able to do that. During the Second World War ... we made a decision to fight in Europe and then go to the Pacific. ... Folks had lost sight of that. And so instead they decided to try and keep this large standing military force in peacetime and just wasted hundreds of billions of dollars doing that."

Fogleman had wanted to think harder about the future, to invest in the kinds of technologies that had been used to such devastating effect in ousting Iraq's occupying army from Kuwait in Operation Desert Storm. But the leading strategy makers at the time had an Army bent, and that colored the strategy they developed, undervaluing air power. They saw small wars and peacekeeping as central missions in the 1990s, and reasoned that the United States could afford to delay weapons modernization by skipping a generation of technology. Fogleman saw that as folly.

"Anybody who had watched what was going on could see that after the first Gulf War, the Chinese went to work studying

what we had done," Fogleman said. "And they began, back in the 1990s, trying to build the capability to negate our combat capability—or emulate it."

Fogleman's predecessor, Gen. Merrill "Tony" McPeak, had likewise viewed this as an error, but he says it was not surprising. "Victory is a poor teacher," McPeak said. "And we were victorious. Defeat isn't even a good teacher, because the tendency is to do tomorrow what you did today." Changing course, making a dynamic and bold commitment to break with the past and move in new directions, was the harder course to take, but it required greater imagination and determination. "There are too many rice bowls that have to be broken, too much furniture has been bought," McPeak said. He offered an example: "You can't tell the Marines that they're never going to use vertical takeoff in combat, that you cannot logistically support operations off the beach—you can't get the bombs there or the fuel there, so they're not going to operate off the beach." But the decision to build as much commonality as possible into the F-35 while offering Air Force, Navy, and Marine variants required compromises in performance, capacity, and range that affected all of those planes, not just some.

The Marine version "sized the profile of the F-35," McPeak said. "And while the F-35 looks like it's going to be a pretty good airplane, it is never going to be as good as it could have been if it was not sized by the big fan."

Similarly, the two-MRC [major regional contingencies] strategy cost more to sustain and left less money to invest in next-generation technology. In an interview with Richard Kohn conducted in December 1997

and published in the Spring 2001 edition of *Aerospace Power Journal*, Fogleman recalled being visited by a two-star Army general representing the Chairman of the Joint Chiefs of Staff, Gen. John Shalikashvili. The officer sat on the couch in Fogleman's office and said, "I have a message from the Chairman." The message, he explained to Fogleman, was that the Chairman wanted the Quadrennial Defense Review to "maintain as close to the status quo as we can." In fact, he went on, "the Chairman says we don't need any Billy Mitchells during this process."

Fogleman was stunned. But that was just the beginning. He had a modernization program in place, but as the QDR unfolded, it became clear it would be a budget-driven review, rather than strategy driven. The F-22 had been fully funded to that point, but now as the Department sought to find \$60 billion in cuts, it began to draw attention. Fogleman saw it as the most revolutionary program the Pentagon was pursuing, combining stealth, super cruise, and integrated avionics: "a quantum jump" in capability that would be critical "in such situations as the Taiwan Strait crisis ... we need that airplane."

Fogleman fought for it, but did not sense his advice was valued by Defense Secretary Cohen, a former senator, who had succeeded William Perry in early 1997. By then, he was growing increasingly frustrated in his role. But the last straw was not about airplanes, but about people and accountability. It went back to the values message he had been delivering throughout his tour as Chief. On June 25, 1996, a truck bomb exploded at an Air Force housing complex called Khobar Towers. The explosion killed 19 Airmen and wounded close to 500 others. It was one in a string of such attacks that dated back to 1983 when a Marine barracks in Beirut exploded, killing 241 Marines, Sailors, and Soldiers.

"Within the Air Force, **Airman is a term that should be devoid of rank.** It's somebody in the profession of arms whose major contribution is to understand the application of air power in the deterrence of war, and if deterrence fails, the application of air power to fight and win America's wars."

— Gen. Ronald Fogleman, CSAF No. 15

The Americans at Khobar Towers were responsible for Operation Southern Watch, the southern no-fly zone over Iraq. The facility was known to be a target and threats had already been received when the attack took place. To Fogleman, it was clear America was at war. But in the aftermath of the attack, he became convinced that the Intelligence Community had failed the Airmen at Khobar Towers—that they had the warnings but failed to understand the risk. When some time later Brig Gen. Terryl J. Schwalier, the commander at Khobar, was selected for promotion to major general, the issue became a political matter.

“I had a commander who had done everything in his power, and he was in the field in wartime conditions and was struck by an enemy,” Fogleman said. “You either support the commander or you make a scapegoat out of him. And I was not about to make a scapegoat.”

Defense Secretary William Cohen disagreed. “So then it became clear that my military advice was not valued,” Fogleman said. “If the people above you don’t value that advice, then it’s time to get out of the way and allow somebody else to come in and provide military advice for your service. From my perspective, it was in the best interest of the Air Force that I depart and that they get somebody else.”

In his brief public statement, Fogleman wrote: “My values and sense of loyalty to our Soldiers, Sailors, Marines, and especially

our Airmen led me to the conclusion that I may be out of step with the times and some of the thinking of the establishment. This puts me in an awkward position. If I were to continue to serve as Chief of Staff of the Air Force and speak out, I could be seen as a divisive force and not a team player. I do not want the Air Force to suffer for my judgment and convictions.”

Looking back now, he acknowledges that had he stayed in place another year, some of what he’d done “would have become institutionalized. Instead, they were allowed to die.” The Battle Labs he established did not survive—six labs designed to create new capability rapidly in specific areas. “Does that sound like something we have today, something they had to reinvent? Yes.” Likewise, he established information operations squadrons. Those too did not survive, but were later recreated.

“That last year is when you can institutionalize things,” he said. “And so in that context, I failed the force by leaving early.” Fogleman retired early, he says. He did not resign. He was not protesting anything. But he felt it important that he announce his retirement before Cohen made his final determination on Schwalier, perhaps because it might change his mind, but in any event so that the retirement would not be seen as a response to that decision. The story played out in the media as a protest regardless. Fogleman has been trying to set the record straight ever since. ✪

**Gen. John P. Jumper, CSAF No. 17 (2001-'05)**

## ‘I tried to always make things better.’

**G**en. John P. Jumper was holding his first staff meeting in the Air Force Operations Center in the Pentagon’s basement when the first plane hit. It was Tuesday morning, Sept. 11, 2001, and whatever plans he may have had as he began his tenure as Chief, the next four years were going to play out very differently than he could have imagined. The intel briefing was paused and the screens were switched to CNN, which had live video of the burning Pentagon on the screen. That was when the second plane struck the World Trade Center.

“That was the point of max confusion, of course,” Jumper recalls. “We took off from our command center to go up and warn our people away from the E-ring,” the outer offices of the Pentagon. In the Secretary of the Air Force’s office, Jumper found Secretary Jim Roche “sitting on his phone and sort of physically tucked him away from his phone back toward the middle of the building.” Then the third plane struck, exploding into the West side of the Pentagon.

Jumper was an experienced four-star. He had commanded U.S. Air Forces Europe during the Kosovo War in 1999 and had run Air Combat Command for 18 months after that. He hadn’t expected to be the Chief, an assignment he attributes as much to luck and timing as to talent, but he had a ready list of ideas he’d been “harboring” and was ready to start right in on them when 9/11 reworked his agenda in a flash.

The first order of business was America’s response, and it began with the Joint Chiefs of Staff. “The cooperation was remarkable,” he recalled. When we started the planning ... there



Lisa Normandy/USAF

Jumper was told the Air Force could afford cutbacks. “We heard ... we’re overmatched with air power, with air superiority, that we have too much of it,” he said. “Now we have eroded away our technological advantage.”

was no infrastructure to really go after. ... We were developing targets, figuring out the logistics. We knew we had to have ground bases over there [but] we had no good history of ground basing in that area. We had a lot of coordination to do. And so I went to Vern Clark, who was the Chief of Naval Operations, and I said, ‘Vern, in order to get this done, we’re going to need aircraft carriers.’ And he put everything that he could generate out there, ready to go and fly sorties.”

The Navy would launch the first aerial strikes on Afghanistan in October 2001, learning in the process to fly six- to eight-hour sorties, longer than the typical Navy deck cycle, and leveraging

Air Force tankers to make the journey. It took time to seize ground and open bases in Afghanistan and the vicinity and to bring in Air Force F-15s, F-16s, and A-10s. Bombers were launching out of Guam.

"Because Afghanistan is landlocked, and we didn't have a history of basing, it took some development time to get that done," Jumper said. "The bomber force reacted well, I think: We had the processes and procedures for that kind of deployment worked out, basing and all that, from our time in Kosovo." Air Force C-17s went to work as tactical airlifters, flying in and out of makeshift airfields. "I think we rose to the occasion," he said, noting that there are lessons to be applied today, as the Air Force experiments with Agile Combat Employment, that were tested and proven in the months after 9/11.

But Jumper said the Air Force could have been quicker to see the value of its unmanned platforms. "The biggest thing we could have made better use of, more rapidly, is armed UAVs," he said. "We didn't have them in great numbers at the time, and the ones we had were extremely effective from a strategic point of view."

Jumper knew something about UAVs. He'd employed them in Kosovo, seen their potential. But he'd also seen their shortcomings. "This was what we, at that time, called the dialogue of the deaf," he said. "The Intelligence Community, who owned the Predators and were looking at streaming video through sort of a soda straw, [were] trying to communicate in this very dysfunctional relay system to the A-10 pilot in the cockpit about where the target was."

To target a tank behind a building, for example, they would say, "It's right behind the red roof building." But as Jumper explained, that made little sense to the A-10 pilot who was looking out over 50 miles of red-roofed buildings. "So then they say, 'Well, it's beside the small stream that goes by the red roof building.' I called it the dialogue of the deaf because nobody was understanding, because there was no common frame of reference."

Predators had been built to be an ISR asset, to collect, analyze, and report. Jumper and Mike Short, the Air Component Commander operating out of Italy, shared their frustration. "It became evident that if nothing else, we needed to put a laser designator on the Predator," Jumper said. Within weeks, the Air Force's 645th Aeronautical Systems Group, better known as Big Safari, "made that happen magically in a couple of weeks," Jumper recalled, but "by the time we got it over there and ready to use, the conflict was over."

The idea, however, remained. Jumper's next assignment was to head Air Combat Command. When he got there, he discovered, much to his surprise, that ACC's acquisition and requirements teams had removed the laser designators. "It wasn't part of the program. And there was no money in the program to do that. 'I sort of blew my top about that, and we got ourselves on the road. But it occurred to me that as long as we're doing that, why don't we put something on there that can do something about these targets when we find them?'"

Jumper had been a weapons officer in his younger days, and he knew something about armaments. The Hellfire missile wasn't an Air Force weapon—it was developed by the Army—but it seemed the perfect fit. "It would be the most lethal and light enough to put on something like a Predator—or at least I thought it could be, but we had to check it out."

The Air Force got over the technical hurdles in a couple of months, Jumper said. "But the bureaucratic system decided that

this Predator with a Hellfire missile would have to be designated a cruise missile under the missile control regime, and it would require us opening up negotiations with the Russians again. Well, I thought that was ridiculous, and [then-Air Force Chief of Staff] Mike Ryan helped."

The battles weren't over. The intel community was worried that their intel asset would now become a weapon instead. "The biggest thing about the Predator is that we brought it into the inventory." Jumper reached back a little further into his history. In 1996, when he became deputy chief of staff for operations (the A-3) under Gen. Ron Fogleman, the Chief at the time, Jumper was sent to evaluate three systems, Dark Star, Global Hawk, and Predator. "General Fogleman knew we needed the Predator. He was trying to decide on the other two," Jumper said. "On the Predator side, it was obvious that this was something that would help us find targets precisely and be able to stare at targets over a long period of time, to make the job of those carrying the weapons more certain when they arrived that they were hitting exactly the right thing, exactly the right spot."

The problem, he recalled, was that the ground station controls were built as if for a remote pilot. "It was based on the premise that you had to pretend you were at a station flying the Predator like a pilot with stick, rudder, pedals—I mean, like a pilot—that flying the airplane was more important than taking the picture.

... In fact, we should have built this thing around the cameras." Had it been up to Jumper, he'd have changed the entire thing right then. But the rules didn't allow that. "We couldn't change anything for two years."

— Gen. John Jumper, CSAF No. 17

In time, Jumper would help organize a Predator 9-1-1 project to speed up the process of getting the weapon into the inventory, with spare parts and operating procedures. "I remember hosting a group from the Pentagon about rapidly putting the Hellfire missile on the Predator," he said. "And the message to me was clear, that this is going to take tens of millions of dollars and is going to take not months, but years. And I just simply refused to accept that answer. Because I knew that Big Safari had had a different answer. So therein lies some of the friction. Big Safari—if we don't embrace that as an Air Force, even today, if we don't embrace that kind of rapid prototyping and fielding today," the Air Force will fail.

That lesson stayed with Jumper throughout his tenure. "I had a little sign on my desk when I was Chief that said: 'Never accept no from somebody not empowered to say yes.' There are way too many people that have the power of the veto, or think they do. We need to be able to challenge and ask the second and third question. ... We have to be always ready to challenge the system, and not confuse a responsible challenge to authority with insubordination. We've got to be able to cross that line. It's always a delicate line. But it's just a responsible leadership point of view."

"It took a while to get to the things like the Air Expeditionary Force idea ... which needed to be matured," he said. "And of course, carrying forward with the whole idea of the remotely piloted vehicles—Predator—and how best to integrate that into the force more completely."

Another project Jumper had been involved in long before becoming Chief was the development of the Air Expeditionary Force, the Air Force's 1990s-era deployment model. The Air Force didn't deploy in the same way as, say, an Army division or brigade, because air power is typically shaped and sized to the mission at hand. The AEF was a system for addressing that,

**"The heart and soul of the Airman embraces the warrior spirit of America, bringing to bear kinetic firepower on the enemy, and all the things that go into that as part of a warrior culture. ... And I think we have to take care to make sure that is emphasized in today's world."**

enabling the Air Force to identify ready forces and assemble mission packages on a rotational basis. That meant that units could work through readiness cycles.

“The original concept was actually four months of a deployment,” Jumper said. “But it was designed to be rapidly deployable. You had nine buckets of capability, fairly similar capability, and depending on the contingency, you could draw capabilities that weren’t in the bucket forward to be able to join that AEF to get the right kind of capability over there. That was based on the assumption that you could pull Airmen that were trained exactly the same way to exactly the same standards by the same checklists and various weapons systems. And they could join a unit, if they had to, to augment that capability.”

But under Jumper’s watch, in the wake of 9/11, the rotations broke down. “It was designed to use tactical equipment, tactically deploy, for a tactical amount of time—not to become a rotational practice for a 10-year war. It was never designed to do that.”

In Kosovo, USAFE opened 18 bases for tankers and other operations, and the AEF was employed. “We went over there, got it done, packed up, and went home,” Jumper said. “We loaded up Aviano, put special ops in certain places, put tankers all over the place. It worked just fine. But when we transition into this 10 years of constant combat, then another policy has to be developed to deal with the necessities of experienced commanders staying in place longer, knowing the problems more deeply, and being able to do more than come in and just generate combat power for short periods of time. ... [That requires] a more permanent rotational policy.” He notes that the short deployment cycles anticipated for Agile Combat Employment (ACE) by today’s Air Force also has short deployment cycles. Like the original AEF, the focus is on agility. “If ACE transitions into longer engagements like we had in the Middle East, then that process is going to be challenged as well.”

Jumper was the last Air Force Chief to work alongside an Airman as Chairman of the Joint Chiefs of Staff. His tenure and that

of Gen. Dick Myers as Chairman were almost perfectly aligned. That might have been an advantage for Jumper in the early 2000s, before the occupation of Iraq went sour and the occupation of Afghanistan grew old. Jumper’s success as Chief was built on a cooperative approach; his successor, Gen. T. Michael Moseley, was more aggressive, and perhaps aggrieved, in his dealings with his fellow Chiefs. His bluntness ultimately cost him his job.

Over the past two decades, the Air Force shrank in size and prowess. Readiness slipped. Political leaders reasoned America had so great an edge in air power after the first Gulf War that the nation could afford to throttle back. “We heard terms like ‘we’re overmatched with air power, with air superiority—that means we have too much of it,’” Jumper said. “We were told we didn’t need as much training, we could have tiered readiness. We were essentially too good. ... [Now] we have eroded away our technological advantage, and our training, and our readiness, to the point that it has begun to affect morale. I think the Chief would agree with that, and I think they’re working as hard as they can to resurrect that, but that’s what happened along the way.

“So how do we re-instill that [confidence]? We have to start internally first, we have to make sure that our force sees themselves as the world’s greatest Air Force, one that is ready to go fight, that is proficient. They have to feel themselves that they’re flying 20 hours a month, that they feel like they’re the dominant power and nobody’s going to be trained any better than I am, in my specialty, no matter what my specialty is. And that I can go anyplace, I can do anything, I can do what I’m going to be asked to do, and nothing—no contingency that arises—is going to surprise me, because I have a training program that ... gets me familiar with the part of the world I’m most likely to go to, gets me out there so I can see it and touch it and feel it. I’m flying off and I am proficient: I’m good. I know how to set up a base. I have the right people who know how to run a deployed operation. I have the right security forces that can protect that base, inside and outside the fence.

That’s the Air Force I had.”



## Gen. T. Michael Moseley, CSAF 18 (2005-'08)

# ‘Buzz was right.’

**T**he one thing everyone knows about Gen. T. Michael “Buzz” Moseley is that he was fired from the job. Being relieved short of completing his four-year tour as Chief was not on the radar when Moseley moved up from Vice Chief to become Chief of Staff in September 2005.

Moseley had been the vice Chief for two full years. His prior experience included commanding U.S. Central Command Air Forces for nearly two years before that and before that two years as the Chief Air Force legislative liaison. Few were better versed on the issues facing the service at the time. But Moseley was no politician. Shaved-headed and stiff-necked, he remains as bluntly plainspoken now, 14 years after leaving office as he was when the bombshell struck in July 2008.

Moseley was enroute to a Corona meeting—a gathering of Air Force four-stars—in Dayton, Ohio, when word came that he and Air Force Secretary Michael W. Wynne were both being relieved, a stunning dual beheading executed by Secretary of Defense Robert M. Gates whose frustration with the Air Force had become a public feud in recent months.

Gates had considered the Air Force “one of my biggest headaches” for some time. But in a speech at the Heritage Foundation

on May 13, 2008, he unloaded his concerns publicly: “There is a good deal of debate and discussion—within the military, the Congress, and elsewhere—about whether we are putting too much emphasis on current demands—in particular, Iraq—and whether this emphasis is creating too much risk in other areas, such as preparing for potential future conflicts; being able to handle a contingency elsewhere in the world; and overstressing the ground forces, in particular the Army,” Gates said.

“Much of what we are talking about is a matter of balancing risk: today’s demands versus tomorrow’s contingencies; irregular and asymmetric threats versus conventional threats,” Gates went on. “As the world’s remaining superpower, we have to be able to dissuade, deter, and, if necessary, respond to challenges across the spectrum. Nonetheless, I have noticed too much of a tendency toward what might be called ‘Next-War-itis’: the propensity of much of the defense establishment to be in favor of what might be needed in a future conflict.”

Gates had taken over as Secretary in 2006 from Donald H. Rumsfeld, as the War in Iraq descended into its messiest phase. Two-and-a-half years prior, President George W. Bush had flown onto the aircraft carrier USS Abraham Lincoln and

delivered a televised speech in front of a giant banner proclaiming “Mission Accomplished.” By the 2006 mid-term elections, that image had come to haunt the administration. Far from being over, things had only gone downhill from that moment on. By 2006, it was clear the Army was ill-sized or equipped for the mission in Iraq, recruiting was suffering, and the Army was lowering its standards for incoming troops. The Iraq War had become precisely the kind of quagmire the administration had wanted to avoid, and Defense Secretary Donald Rumsfeld, who had become a media sensation in the wake of 9/11, had fallen out of favor.

The weekend before the election, the *Military Times* newspapers wrote that, regardless of the outcome, the time had come for Rumsfeld to go. “His strategy has failed and his ability to lead is compromised,” the editorial said. By Wednesday morning, victorious Democrats were in full agreement. “The *Army Times* has spoken,” said Nancy Pelosi, who would soon be the next Speaker of the House.

That afternoon, Bush announced, with Rumsfeld standing awkwardly on his right and Gates on left, that change was coming to the Pentagon.

That Gates would shake things up was a foregone conclusion. But that his focus would be the Air Force, rather than the Army, was not quite so clear. But Air Force leaders were not solely focused on the Iraq problem. They saw trouble on the horizon—and in their own aging force.

By 2006, the weapons that had so impressed the world in 1991’s Operation Desert Storm had aged 15 years. Except for 100 or so Predator unmanned aircraft, the force was otherwise much the same, though smaller, and without some capabilities that had been sacrificed over the intervening years. The force was also getting tired; the service had been flying nonstop patrols over Iraq for 15 years and had supported combat operations in Somalia (1992-’93), Haiti (1994), Bosnia (1995), and Kosovo (1998-’99), prior to going to war in Afghanistan (2001) and Iraq (2003).

The job description of the Chief of Staff is spelled out clearly in Title 10, U.S. Code: The Chief leads the Air Staff, with responsibility for “recruiting, organizing, supplying, equipping, ... training, servicing, mobilizing, demobilizing, administering, and maintaining of the Air Force.” The Chief administers today’s force, but his real work is in ensuring that tomorrow’s force is up to the job. Each Chief is heir to the decisions of those who came before him, and each Chief leaves a legacy to those who will follow.

Moseley was worried about the future. In January 2007, China successfully conducted an anti-satellite missile test, destroying a defunct satellite and producing thousands of space debris fragments that continues to orbit the Earth even now. Air Force leaders saw the strike as a wakeup call, a clear indication not only that China was ascendant in the East, but that it was honing the ability to threaten a key U.S. advantage: air and space dominance.

At the center of the Air Force’s modernization plans was the F-22 Raptor, the stealthy fifth-generation air-dominance fighter. This was the key weapon the Air Force wanted for the future. But it was also Exhibit A in Gates’ case against “Next War-itis.” The stealth fighter was unparalleled in the world and a generation ahead of any rival. But it was also an “exquisite” technological



Staff Sgt. Monique Randolph

**Air Force Chief of Staff Gen. T. Michael Moseley and Secretary of the Air Force Michael Wynne fought against cuts to the F-22. That ultimately cost them their jobs.**

marvel, intended for a war that Gates didn’t think was ever going to happen.

“I kept saying, ‘We can’t defer this. We have to fund the [F-22],’” Moseley said in a May video interview. “That’s when I got accused of Next-war-itis. And I wrapped myself in that. I said, ‘Man, I want that framed on the wall.’ Because that’s an A-plus for me doing my job: organize, train, and equip. If someone thinks I’ve got Next-war-itis, hallelujah! I do! Because that’s my job. A combatant commander fights today’s fight. I’m fighting tomorrow’s fight.”

That future fight would challenge the nation with technology and weapons far more complex than anything the insurgents could muster in Iraq or Afghanistan, and Moseley saw his requirements as obvious: “We need the best air -superiority fighter. We need the best utility fighter. We need the best penetrating bomber. We need a reliable tanker. We need a combat search-and-rescue helicopter that can go some distance. And every combatant commander said, ‘Thank you.’ The Army Chief, the Navy CNO, the Marine Commandant, they all said, ‘I get it.’”

Not Gates.

Prior to Gates’ arrival, Moseley and Wynne had already secured both Rumsfeld’s and the President’s support for modernizing. “The President had even agreed to give us the money,” Moseley said. Bush, who was flying F-102s in the Air National Guard when Moseley was in fighter training, liked to point out when meeting with his national security team that the two of them were the only fighter pilots in the room.

But now Rumsfeld was gone, and Bush was trying to rescue a presidency damaged by the Iraq War. Gates was running the Pentagon. The wind had shifted.

“I remember one time in a discussion with President Bush,” Moseley said. “He said, ‘Moseley, you said you think we’re going to fight the Chinese or the Russians?’ I said, ‘Mr. President, I’m praying not. ... I think the probability is very low. But I think there is a 100 percent chance we’re going to fight their aircraft and their SAMs and their early-warning radars.’ And he goes, ‘I agree with you.’ So I said, ‘Therefore, you need an Air Force and a Navy that is beyond question the most technically capable, skilled, and modern because that’s where you can persuade, dissuade, and deter.’”

The Air Force executed a mission area analysis that took more than a year, preparing modernization roadmaps for each mission



area: strategic lift, tankers, space, air superiority, suppression. The analysis covered every major defense system. “And out of all that, we defined the budget deficit for the force that we needed,” Moseley said, “and we took that to every combatant commander and got his OK, and I personally briefed it to the Navy CNO, the Marine Commandant, and the Army Chief, and I said, ‘Look, you don’t have to agree with me, just please don’t get in my way.’”

When he presented it to Rumsfeld and the President, he had a friendly audience. “Secretary Rumsfeld’s handshake with me was that we would modernize and re-cap the Air Force,” Moseley said. They would use multi-year deals to buy out their C-130J and F-22A requirements, then focus, in order, on the new tanker, the combat search and rescue helicopter, the F-35, and new survivable maneuvering systems for all four families of satellite systems. And they would acquire a new bomber that would reach initial operational capability by 2018.

“Rumsfeld said, ‘Press.’ The President said, ‘How much more do you need?’ I said, ‘\$20 billion more a year.’ He goes, ‘Deal.’

Rumsfeld had no hesitation. According to Moseley, he said, “We’ve put you in this position, haven’t we?” And Moseley answered, “Yes, sir, the department has, because we kick the can on things, we study things, we jack around with them. We’re flying airplanes right now in combat that were never designed to fly this long. And we’re asking our kiddos to go do this, and yes, they make it look easy. People think it’s easy. It’s not.”

The problem in Iraq wasn’t the Air Force, but the Army. It didn’t have enough forces to man the mission, its vehicles were too light to withstand increasingly sophisticated improvised explosive devices, body armor wasn’t good enough, recruiting was in the dumps, and the public was turning against the war. America had invaded Iraq with the Army it had, to paraphrase an infamous Rumsfeld comment, not the Army it needed, and to keep that fight going it had to sacrifice the very forces it would need to stave off China and Russia in the future.

“We were hemorrhaging money,” Moseley said. “I get it. But if it’s going to cost \$48 billion to buy MRAPs [Mine Resistant Ambush Protected vehicles], then write a \$48 billion check. You don’t take the seed corn for the next 20 years to do it. Because it’s not going to end well.”

Discussions in the tank, where the Joint Chiefs met, focused almost exclusively on the Army’s challenges: “Almost every problem we dealt with in the tank was an Army problem: Recruiting, retention, the size of the Army, the force deployment rotations of units.”

The need for more overhead intelligence, surveillance, and reconnaissance flights. Gates wanted the Air Force to do more. Moseley, who was the first Wing commander to use the Predator at the 57th Wing in 1996-97, understood the issue firsthand. Moseley told Gates the Air Force was all in, but that the Army actually had more ISR to answer its needs than the Air Force did.

“Look, we’re giving you everything we’ve got,” Moseley recalls telling Gates. “We can close down the Weapons School, we can throttle down the schoolhouse, and we’ll do it. But you’ve also got a few hundred of these things [Army Shadow UAVs] that are living in the Army, that are in garrison, and the Army won’t deploy them.”

The Army’s Shadows were organic assets to its battalions, and

the Army didn’t have a model for pulling them out and deploying the operators as detachments. “I said, ‘Give us the airplanes and give us the sensor operators. ... This is a no-brainer. We’ll shut everything down and give it to you,’” Moseley said. Gates’ response, as Moseley recalls it: “It’s more complicated than that.”

Moseley found himself disagreeing with the Army over other issues, as well. When the Army wanted Airmen to help drive convoys moving fuel, food, ammunition and other supplies to forward units, Moseley asked Army Chief of Staff Gen. George W. Casey Jr. why the Army could not manage this on its own.

“George, does every Army company commander have a driver?” Moseley asked.

“Oh, yeah,” Casey said.

“And the drivers are trained in small arms and self-protection?”

“Oh, yeah.”

**“An Airman is unique because you operate in a dimension that takes you away from the physical boundaries that define the other services. An Army or a Navy or Marine Corps is different: They have aviation elements, but their core, the sense of their being, is not that. The sense of our being is that—from the beginning. The first time you break ground in an airplane—in my case I started flying when I was 14—you realize this is a different environment. You are not limited by your ability to traverse terrain or the surface of the sea. This is something different, that gives you advantage: You can see around, you can see over. You can operate in a dimension that gives you speed and access.”**

— Gen. T. Michael Moseley, CSAF No. 18

“So why don’t you guys deploy your own drivers? The company commander can drive his own jeep.”

It was no use. Airmen started doing Army convoy duty in 2004 and thousands continued to do so for several years afterward.

Gates had begun his career as an intelligence officer in the Air Force, including a year at Whiteman Air Force Base, Mo. But Gates soon joined the CIA,

and growing up as an analyst there had not endeared him to the Air Force. In the early 1990s, while with the CIA, he had tried to get the Air Force to join in developing unmanned aircraft but was rebuffed, Gates wrote in his book.

“I think he was just frustrated. The surge was about that time and none of the Joint Chiefs were in favor of that. I think there was just a lot of anxiety.” As Wynne said in a 2008 interview with Air Force Magazine, Gates “didn’t beat up the Army, which had almost a thousand Shadows. He beat up the Air Force, which had about 100 Predators.”

Gates couldn’t have dismissed Wynne and Moseley over the UAV dispute, and the F-22 debate—which amounted to a U-turn in terms of administration policy—did not amount to a fireable offense either. What did work as suitable cover, and to end, once and for all, the discussion about building more F-22s, was the sloppy performance of a B-52 bomber crew in Minot, N.D. On Aug. 29, 2007, a B-52H Stratofortress lifted off from Minot and flew to Barksdale Air Force Base, La. On board were six AGM-129 ACM cruise missiles, each one carrying a W80-1 variable yield nuclear warhead. No one realized the error for a day and a half, so the nuclear weapons had effectively gone missing—what the Air Force calls a Bent Spear incident.

A series of investigations followed. A number of officers were disciplined. And the following June, Moseley and Wynne were asked to resign. The Air Force had indeed become lax about nuclear weapons handling and procedures. But no one in the know ever believed the dismissals were about the nukes. Moseley and Wynne had fought hard for the funding and programs they believed in, and they had warned, loudly and often, of the consequences if those investments were put off any further, predicting that aircraft would age, become unsafe, and that training and readiness would decline. The record shows that’s exactly what happened.

Says Moseley today: “Buzz was right.”






# 75 Years of Innovation in Flight

**F**rom its 1947 inception, the Air Force has been oriented to high technology, expanding the boundaries of human flight and pushing back the aerospace frontier. In partnership with industry, USAF built scores of prototypes and experimental types, using the knowledge obtained to build operational aircraft, sensors, and munitions to strengthen the nation and fight its wars. Often unseen is the extensive industrial base needed to produce those machines, many of which had no civil application and required extremely specialized materials and manufacturing techniques.

On the following pages are most of the nearly 200 operational aircraft the Air Force has fielded over the last 75 years, ranging from sleek, triple-sonic fighters to utilitarian bush planes operating from unimproved jungle strips. While many were purpose-built for a specific role, many more proved to be versatile enough for a range of missions. Some were built in their thousands, yet were quickly set aside as the pace of technological change made them obsolete, while others built in small numbers proved so adaptable that they have remained in service, if not in production, for decades.

Many aircraft portrayed here were holdovers from World War II, and some of those persisted in service long enough to play an important role in the Korean War, and even the Vietnam conflict. The most explosive periods of Air Force advancement in aircraft were in the late 1950s and 1960s—as the service transitioned to front-line jet aircraft—the 1980s, when computers and innovative materials made leaps in performance possible, and the 2000s, when high-speed computing, the mainstreaming of stealth and sensor fusion, and precision-guided weapons multiplied the power of aircraft many times over relative to those that had come before.

Due to space limitations, this gallery is limited to the aircraft that flew and fought operationally, and in fleets of more than just a few examples, with the exception of types like “Air Force One,” which serve in very small numbers for decades. We have not included prototypes or experimental machines that paved the way for those in operational use (See, “The X-Files,” March 2018), and we have not attempted to portray every variant. Our goal is to recognize the aircraft around which so many Airmen were organized to fly, fight, and win over 75 years. 



### **B-52 STRATOFORTRESS**

More than 70 years since its first flight, the B-52 fought in four hot wars and the Cold War and remains the backbone of USAF's bomber fleet.

# BOMBERS

**B**ombers were among the main reasons the Air Force came into being. In 1947, the U.S. had no other way to rapidly deliver nuclear weapons at world-girdling ranges. Since then, bombers have been the principal means by which the Air Force holds at risk enemies' most highly defended targets. The Air Force's means of achieving this has swung between speed, low-level agility, range, and stealth. But the bomber's greatest Achilles' heel has been funding: more than a half-dozen promising aircraft have been canceled, and the Air Force's bomber fleet is now smaller than it has ever been.



### **B-45 TORNADO**

The first USAF jet bomber, the B-45 fought in Korea but was halted in favor of the B-47.



### **B-36 PEACEMAKER**

The huge "Flying Overcast" later had both prop and jet engines, and the range to reach strategic targets deep in the Soviet Union.



### **B-50 SUPERFORTRESS**

The upgraded B-29 carried the nuclear mission until jets replaced it. The B-50s were then converted to tankers, serving into the 1960s.



### **B-47 STRATOJET**

With six engines and swept wings, the B-47 offered a leap in bomber range and capability. More than 2,000 were built, with recce variants.



### **B-57 CANBERRA**

This British design was used as a strike aircraft in Vietnam, but found its true niche in reconnaissance and signals intelligence.

Photos: USAF



### **B-29 SUPERFORTRESS**

The prop-driven, long-range B-29s that ended WWII also bombed strategic targets in Korea and served as USAF's first nuclear bombers.



### **B-66 DESTROYER**

Loosely based on the Navy A-3, the B-66 was a medium bomber earning most of its fame as an optical and signals reconnaissance platform.



### **B-58 HUSTLER**

USAF's only Mach 2 bomber, the Hustler served just 10 years due to low altitude performance and handling challenges.



### **B-1B**

The swing-wing "Bone" is USAF's fastest and biggest-payload bomber. Withdrawn from nuclear service by treaty, it was a close air support platform in the Middle East.



### **B-52H STRATOFORTRESS**

New engines and other upgrades are planned to keep the B-52 flying until the 2050s, as a stand-off conventional and nuclear missile launcher.



### **B-2A**

Only 21 of a planned 132 B-2s—the first strategic stealth bomber—were produced, yet it has led the way in every American war since 1994, never missing a real-world target.



### F-35A

The Air Force's strike "quarterback," due to its massive information-collection capability, the "Panther" is nevertheless a 9G fighter and a multirole attack jet which will be the backbone of the combat air forces for decades to come.

# FIGHTER/ATTACK

**T**he Air Force's longtime motto was "to fly and fight," and in service of that mission, developed diverse technical approaches to gaining control of the air and the ground below. The fighter force has evolved from single-purpose, dedicated air-to-air combat machines—some long-range interceptors, others intended as tight-turning dogfighters—to multirole aircraft able to do a variety of missions including ground attack, electronic warfare and defense suppression, borrowing from transports and trainers as well, to impressive result. The pursuit of excellence has led to a Combat Air Force dominant for 75 years.



### A-20 HAVOC

A WWII holdover, the Havoc was used largely in the Pacific by the Army Air Forces.



### P-47 THUNDERBOLT

Later the F-47, the "Jug" of WWII served with the Air National Guard for years. The type was used against Puerto Rican nationalists in 1950.



### A-1 SKYRAIDER

Developed for WWII, the Navy-designed "Spad" was a star at counterinsurgency in Vietnam and in helping recover downed airmen there.



### A-26/B-26 INVADER

This WWII-era bomber proved highly effective at counterinsurgency in Vietnam and was used by the CIA at the Bay of Pigs invasion in Cuba.



### 1944 F-80 SHOOTING STAR

USAF's first operational jet fighter, the F-80 served in Korea as a dogfighter and attack aircraft.



### 1946 P-51 TWIN MUSTANG

USAF's last piston-engine fighter, the "Double Trouble" scored the first kills in Korea and served as a day/night interceptor.

Photos: USAF



### F-84 THUNDERJET

The F-84 destroyed 60 percent of the ground targets attacked by air in Korea and was the first mount of the Thunderbirds aerial demo team.



### F-84F THUNDERSTREAK

A swept-wing upgrade of the straight-wing F-84, the Thunderstreak was a fighter-bomber in Korea, later serving in the Berlin crisis and ANG.



### F-51 MUSTANG

The WWII-era Mustang's agility and range made it ideal for close air support missions in Korea, flown largely by Guard and Reserve units.



### F-86 SABRE

USAF's first swept-wing jet fighter could outfly its counterpart in Korea, the Soviet MiG-15. Nearly 10,000 served in countries worldwide.



### F-86D SABRE DOG

A development of the F-86A, the Sabre Dog was larger, had afterburning engines, and a long-range radar, equipping it for interceptor missions.



### F-94 STARFIRE

A development of the F-80, and constantly upgraded, the F-94 served as an all-weather Air Defense Command interceptor during the 1950s.



### F-89 SCORPION

The twin-engine Scorpion was the first interceptor armed with guided missiles and the Genie, an unguided nuclear air-to-air missile.



### F-101 VOODOO

The Voodoo was mainly an interceptor, but the RF-101 reconnaissance version played a key role in Vietnam and the Cuban Missile Crisis.



### F-100 SUPER SABRE

The first USAF operational jet to fly supersonic in level flight, the F-100 earned its reputation in Vietnam as a fighter-bomber.



### F-104 STARFIGHTER

Developed in two years, the "Missile With a Man in It" served in Vietnam and as an interceptor. Rocket-aided test models flew to the edge of space.



### F-102 DELTA DAGGER

The supersonic, delta-winged "Deuce" Air Defense interceptor also flew in Vietnam as a bomber escort and in a few ground-attack missions.



### F-105 THUNDERCHIEF

The "Thud" scored dogfight kills in Vietnam, but was mostly used as a bomb truck and a Wild Weasel defense suppression jet.



### F-106 DELTA DART

USAF's last dedicated interceptor, "The Six" was optimized for speed, radar target detection and range, equipped with internal weapons.



### F-4E PHANTOM II

Another Navy adaptation, the F-4C/D/E were USAF's premiere fighters in Vietnam, also adapted to ground attack and fitted with guns.



### F-5E TIGER II

A development of the T-38 trainer, the F-5 served many years as USAF's main "Aggressor" jet, emulating adversary aircraft like the MiG-21.



### OA-37 DRAGONFLY

Used for target marking and light attack, the OA-37's bigger engines and underwing stores distinguished it from the T-37B trainer.



### OV-10 BRONCO

A lightly armed observation and Forward Air Control airplane, the Bronco marked and attacked targets in Vietnam, but did not deploy to Desert Storm.



### A-7D CORSAIR II

Adapted from a Navy jet, USAF used the A-7 for precision attack of ground targets and close air support from the 1960s to the 1990s.



### F-4G WILD WEASEL

The F-4G used HARM missiles and jamming gear in Iraq to silence or destroy enemy air defense radars and missile systems.



### F-111 AARDVARK

Arising from a troubled joint fighter program, the F-111 evolved into a fine medium bomber used in wars from Vietnam to Iraq.



### AC-130 GHOSTRIDER

Bristling with cannons, the AC-130 gunship variant of the Hercules transport orbits and watches an enemy, destroying vehicles and formations.



### **1976 A10 THUNDERBOLT II**

Designed to stop 1970s Soviet tanks with its huge 30 mm gun and absorb damage, the A-10 has flown close air support for nearly 50 years.



### **F-15A/C EAGLE**

Undeclared in air combat nearly 50 years after its rollout, the Eagle boasts triple-sonic speed and high maneuverability.



### **F-117 NIGHT HAWK**

The world's first operational stealth combat jet, the F-117 was a prodigy at destroying the most-heavily defended targets in Iraq and Serbia.



### **EF-111 RAVEN**

The Raven was USAF's only dedicated escort jammer of the 1980s and 1990s, reaching its apex in the 1991 Gulf War.



### **F-16A/C**

USAF's "backbone" fighter since the 1980s, the F-16 has evolved from a day fighter to a multirole platform focused on ground attack and SEAD.



### **F-15E/EX**

Strengthened for heavy payloads, the Strike Eagle has conformal fuel tanks for longer range. The new EX features fly-by-wire flight controls.



### **F-22 RAPTOR**

Acknowledged as the world's best-ever dogfighter, the F-22 combines stealth and supercruise with sensor fusion and extreme agility, aided by thrust-vectoring.



## HC-130 COMBAT KING

An adaptation of the C-130 Hercules, the Combat King has extended range and gear to allow airdrop and personnel recovery in contested airspace, among many other roles.



# UTILITY/SPECIAL OPERATIONS

**W**hile the Air Force has purpose-built some aircraft for special missions, it has also often adapted commercially available aircraft or types already in service—notably transport aircraft—for these roles. Special missions can involve everything from dropping leaflets to observation, to moving special forces, to providing fire support to ground troops, among many, many applications.



## SA-16 ALBATROSS

Used for search and rescue in Vietnam, as well as for special operations infil/exfil, the Albatross was a rugged performer in several roles.



## AC-47 SPOOKY

The first-ever fixed-wing gunship, "Puff the Magic Dragon" was an immediate success in Vietnam and was in-demand with U.S. ground troops.



## U-6A BEAVER

The Beaver was used in Korea and Vietnam for courier duty, aerial photography, light cargo and medical evacuation, among other missions.



## UA-3 BLUE CANOE

A militarized Cessna 310, the twin-engined "Blue Canoe" was used for liaison, VIP transport, and other utility functions.



## U-10 SUPER COURIER

A jack-of-all-trades "bush plane," the Super Courier was used for light cargo and supply work, forward air control, and even psyops.



### **U-28 DRACO**

A militarized Pilatus PC-12, the Draco conducts intelligence, surveillance, and reconnaissance for special operations forces.



### **C-146 WOLFHOUND**

A Dornier 328 turboprop, the Wolfhound is used to quickly move special operations forces while keeping a low profile on foreign airfields.

### **AC-119 SHADOW**

Adapted from the C-119 transport, the AC-119 Shadow and Stinger offered more gunship firepower for the Vietnam War than the AC-47.



### **MC-130 COMMANDO/COMBAT TALON**

These multirole aircraft can do stealthy troop insertion, refuel helicopters, and conduct other special operations.



### **LC-130 HERCULES**

The Air Force supports US activities in the Arctic and Antarctic with the ski- and rocket-equipped LC-130, having taken over the mission from the Navy in 1999.

# Collins Aerospace and the USAF: A Parallel History in Evolving Aviation

In the days before the Air Force was an independent service, when it was still part of the U.S. Army, companies like Collins, Goodrich, Hamilton, and Sundstrand filled the skies. That shared legacy still ties today's U.S. Air Force to Collins Aerospace, a modern company built on a long historic legacy of shared innovation.

"We've provided electromechanical flight displays, autopilot systems, and flight directors in military cockpits dating back to WWII," said Marc Ayala, senior director, customer capabilities and requirements for Military Avionics at Collins Aerospace. "Collins' components supported USAF aircraft like the KC-135, B-52, and C-130 from World War II through the Cold War, with some still operating today."

Collins delivers and upgrades aircraft avionics to sustain venerable USAF aircraft like the C-130.

"The C-130 has existed in various models from the 1950s to the current day J model," Ayala said. "We've upgraded its flight director and autopilot in the 1970s, added military radios and advanced cockpit displays in the 1990s, and the C-130 AMP [Avionics Modernization Program] is retrofitting the H-model fleet going forward."

Modernizing the C-130 is essential to the vital mission sets and theaters it serves.

"Inter-theater airlift has always been [the C-130's] specialty and that capability has proven itself necessary over every major conflict since the birth of aviation," Ayala said. "The C-130 excelled in Vietnam, the Persian Gulf, Operation Enduring Freedom, Operation Iraqi Freedom, and throughout the Cold War. The need [for inter-theater airlift] is constant."

Inter-theater airlift has long been a differentiating factor in military operations. It will continue to be in the future.

"The ability to move our Department of Defense assets and resources around the theater of operations in short order is a major capability discriminator for the U.S. Air Force," Ayala said. "That capability separates us from our peers and adversaries,

and [Collins] couldn't be prouder to associate our name with that."

## COMMUNICATIONS TECHNOLOGIES AND SYSTEMS

Collins also develops and supports communication technologies and systems delivered to the USAF. Collins made communication possible during the Apollo, Gemini, and Mercury space programs including for the iconic Apollo 11 moon landing in 1969.

In today's modern geopolitical context, Collins' systems enable communications between USAF and international partners.

"We need to communicate securely with our international partners and allies, and within our own forces as well," Ayala said. "Our airborne communications systems, such as the ARC-210 V/UHF radio, are present in the vast majority of USAF platforms and those communication technologies help make USAF's interoperability objectives a reality."

Collins is leveraging its experience to ensure USAF communication capabilities are secure well into the future.

"The transmission of secure data in modern conflicts is more important than ever," Ayala said. "The country that can transmit, process, and distribute data the fastest and most efficiently is the one that is going to prevail."

## MODULAR AND OPEN AVIONICS SOLUTIONS

As Collins continues to innovate around USAF priorities and interests, the company has invested in development of Modular Open Systems Architecture (MOSA) avionics solutions to better enable and more quickly integrate technology for the operator and the mission of tomorrow.

"Modular systems, open systems architecture, and the need to outpace the technical evolution of peer adversaries is vital to air dominance," said Jeffry Howington, principal business development manager for Military Avionics at Collins Aerospace. "We need to keep aircraft relevant by upgrading their capability in days, if not

hours, rather than the years it takes under traditional approaches."

Collins has been utilizing open systems for decades. A prime example is Collins' upgrades to the KC-135, which has been upgraded dramatically over the past 50 years. The tanker's evolution is key to [the] Advanced Battle Management System (ABMS), according to Howington.


"To compete with peer adversaries and the Joint Automated Command Control network of the future, that's going to require additional upgrades using open systems," he added.

Collins Aerospace has played an integral role in making key upgrades to the KC-135.

Collins is focused on developing software-centric capabilities that incorporate digital engineering and enable efficient flexibility and reuse of capabilities. That's why, Howington says, up to 80 percent or more of avionics capabilities are already implemented in the software Collins provides.

"We're seeing more software seamlessly integrate with cybersecurity, artificial intelligence, and containerization methods," Howington said. "Digital engineering and open architecture are easing implementation and integration times by providing a 'digital testbed' to the operator, so we can understand how any changes might affect an aircraft's operations, performance, and capability before implementers physically touch the aircraft. That's a huge win."

Throughout the Air Force's 75-year history, Collins Aerospace has evolved alongside USAF to meet the technological demands of the day. It's a partnership that, Ayala says, will continue to develop to meet the demands of the future.

"We provided precise navigation and control for USAF aircraft, which ultimately led to electromechanical instruments and flight management systems," Ayala said. "That's evolved into the digital infrastructure we have today, with glass and helmet-mounted displays, multi-core processors, and advanced networking, so the journey Collins has experienced embodies aviation itself." 

# THE FUTURE OF AIR DOMINANCE IS WIDE OPEN



## Bring open system solutions to your next-gen aircraft.

For programs like 6th Generation Fighter, open and connected systems are essential to enabling rapid technology insertions, increased mission flexibility and sustained air dominance. As a leader in open systems, Collins leverages proven and innovative solutions to ensure next-gen platforms are equipped to face the challenges of the future.

CONNECTING THE  
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[collinsaerospace.com/6thGenFighter](https://collinsaerospace.com/6thGenFighter)

## MQ-9 REAPER

The MQ-9 offered a significant step up in range, payload, and sensors over USAF's first remotely piloted ISR/strike platform, the MQ-1.



# ISR, C3

The first military aircraft were used for collecting information on the enemy, and the Air Force has been heavily invested in intelligence, surveillance, and reconnaissance since its inception. While a few noteworthy types have been designed expressly for ISR work, most have been adapted from other aircraft. While satellites have increasingly taken over the mission, airborne platforms continue to provide persistent watch over targets of interest. As the means developed to observe and direct large numbers of aircraft, USAF has added command and control to its portfolio, a subset of that being influence operations on enemies and civilian populations. These support aircraft play a critical role in USAF's overall mission to control the combat airspace.



## RB-47 STRATOJET

Derived from the B-47 bomber, the RB-47 overflew the Soviet Union, collecting information. Three were shot down doing this work.



## O-1 BIRD DOG

As late as the 1970s, USAF used the Bird Dog for target spotting, forward air control and liaison activities, especially in Korea and Vietnam.



## RF-101 VOODOO

A tactical reconnaissance jet developed from the F-101, the RF-101 was a key asset in the Cuban Missile Crisis and in the Vietnam conflict.



## EC-121 WARNING STAR

Forerunner to AWACS, the EC-121 supplemented ground-based early warning radars and also conducted electronic warfare.



## RB-66 DESTROYER

Adapted from the B-66 bomber, the RB-66 conducted electronic intelligence and countermeasures in Vietnam.



## U-2 DRAGON LADY

Routinely upgraded over its nearly 70-year career, the U-2 has provided ISR from the Cold War through the Syria campaign.

Photos: USAF



### **RF-4C PHANTOM II**

Nearly 500 RF-4Cs were built to provide tactical reconnaissance in every conflict from Vietnam through Desert Storm.



### **EC-135 LOOKING GLASS**

Precursor to the E-4B, an EC-135 was always kept aloft to assure nuclear command and control, serving into the 1990s.



### **SR-71 BLACKBIRD**

Retiring in 1994 with its speed records intact, the SR-71 was USAF's triple-sonic, 85,000-foot-ceiling ISR jet which could outrun any threat.



### **RC-135 FAMILY**

The current RC-135S Cobra Ball trace their lineage to C-135's originally modified in 1961 and operated in 24-hour alert status out of Shemya AFB, Alaska.



### **O-2 SKYMASTER**

The O-2 was used for target marking, forward air control, and, when equipped with speakers and leaflets, psychological operations.



### **D-21 TAGBOARD**

A pilotless, supersonic drone launched from a B-52, the D-21 was to self-destruct after deploying a film canister for retrieval.



### **E-4 NIGHT WATCH**

The National Airborne Operations Center is a flying command post ensuring command and control over America's nuclear arsenal.



### **EC-130 COMMANDO SOLO**

A flying broadcast studio, the Commando Solo conducts information operations and electronic warfare.



### **E-3 SENTRY**

The E-3 provides broad monitoring and control of the air battle, and its presence has been a powerful symbol of U.S. commitment.



### EF-111 RAVEN

The Raven, a modified F-111, was an escort jammer and electronic attack platform used in Operation Desert Storm.



### RQ-170 SENTINEL

A stealthy, remotely piloted aircraft, the RQ-170 is largely classified, but is believed to have discovered Osama Bin Laden in Pakistan.



### E-11 BACN

The E-11 serves as a translating node letting incompatible data link and voice systems to talk to each other, even in mountainous terrain.



### RC-26 CONDOR

The Condor performs counter-drug trafficking ISR and disaster response, such as fire detection for civil authorities.



### MC-12 LIBERTY

Rapidly developed and fielded for the Afghanistan War, the MC-12 is a self-contained system providing ISR directly to ground troops.



### RQ-4 GLOBAL HAWK

The high-flying Global Hawk is an unmanned ISR complement and possible successor to the U-2. A variant performs the BACN mission.



### MQ-1 PREDATOR

USAF's first remotely piloted aircraft built in large numbers, the Predator could conduct persistent ISR and, later, strike missions.



### E-8 JSTARS

Prototypes of the E-8, which tracks enemy ground movements with a large radar, were fielded during Operation Desert Storm. USAF is migrating the mission to space.



### EC-137 COMPASS CALL

A Gulfstream G550 fitted with the electronics swapped out of EC-130H aircraft to disrupt sensors and enemy command and control.



### KC-135 STRATOTANKER

USAF's tanker workhorse since the Eisenhower administration, the KC-135 has been extended with numerous upgrades and a re-engining.

# TANKERS

**A**erial tanking was long one of the Air Force's unique capabilities, vastly increasing its ability to project American power around the world. While more and more nations have been adding this capability, USAF still has the largest and most capable tanker fleet. The tanker community can always one-up the combat air forces by pointing out "NKAWTG," or, "No Kick-A\*\* Without Tanker Gas."



### KB-29 SUPERFORTRESS

USAF's first aerial tanker, the KB-29 pulled a receiver aircraft's hose inside its fuselage to make the refueling connection.



### KC-97 STRATOFREIGHTER

Derived from the C-97, the KC-97 freighter/tanker expanded fighter range in Vietnam and served with the ANG well into the 1970s.



### KC-10 EXTENDER

Based on the DC-10 airliner, the 60 KC-10s were a needed enhancement of the tanker fleet, their capacity easing long-distance deployments.



### KB-50 SUPERFORTRESS

Replacing the B-50's bomb bay with fuel tanks, the KB-50 had jet engines added to its turbo-props to stay ahead of jets during refueling.



### KC-135 STRATOTANKER

Over-engineering allowed the KC-135 to serve long past its planned retirement. In Afghanistan, it was used for aeromedical evacuation.



### KC-46 PEGASUS

It took two competitions and an abortive lease before USAF got the KC-46. Based on the 767 freighter, it's the first new tanker since 1988.

Photos: USAF



## C-130J

Operational since 1956, the Hercules remains USAF's tactical lift workhorse and go-to platform for countless special missions. The "stretched" J-30 version is USAF's new standard.



# TRANSPORTS

**M**oving large volumes of people and materiel at global distances on short notice is one of USAF's singular capabilities. Airlift capability has been a crucial demonstration of U.S. power in crises like the Berlin Airlift, the Operation Nickel Grass support of Israel in 1973, Operation Desert Shield/Storm in 1990-1991, the evacuation of Afghan civilians in 2021, and in countless other operations and humanitarian relief efforts. Not simply flying trucks, USAF transports have been adapted to every special flying mission imaginable, from gunships to hurricane hunters.



### 1941 C-46 COMMANDO 1

A workhorse in flying the Himalayan "Hump" in WWII, the C-46 was a higher-altitude transport often used from unimproved airfields.



### 1942 C-54 SKYMASTER

Derived from the DC-4, the Skymaster lugged coal and food in the Berlin Airlift and served as one of the first presidential transports.



### 1944 C-82A PACKET

Designed for cargo, troop transport and paratroop, the C-82 was underpowered, but the twin-boom idea succeeded in the C-119 Flying Boxcar.



### 1941 C-47 SKYTRAIN

Gen. Dwight Eisenhower called the C-47 one of the four things that won WWII. The reliable Skytrain was also a star in the Berlin Airlift.



### 1942 C-87 LIBERATOR EXPRESS

Converted B-24 bombers, the C-87s were used for long-distance VIP and light cargo trips the C-47 didn't have the range to complete.



### 1945 C-45 EXPEDITOR

More than 4,500 Expeditors were used for transport, pilot and navigator training, aerial photography, and gunnery training.

Photos: USAF



### 1945 C-74 GLOBEMASTER

Only a handful of the first Globemasters were built, developed during WWII as a strategic airlifter, but quickly superseded by other types.



### 1946 C-118 LIFTMASTER

Based on the Douglas DC-6, the C-118 was used during the Korean War. A shortened version flew President Harry Truman overseas.



### 1947 C-97 STRATOFREIGHTER

The "double bubble" variant of the B-29 bomber proved a durable design for a freighter, serving USAF in Korea as well as Vietnam.



### 1948 C-121 SUPER CONSTELLATION

Used mostly for personnel transport, some "Connies" were also adapted to electronic warfare and battle control.



### 1949 C-119 FLYING BOXCAR

Used for transport and paratroop work, the -119 saw action in Korea and Vietnam, where it was also adapted as a gunship.



### 1950 C-124 GLOBEMASTER

Refined from Korea lessons learned, "Old Shakey" was the first USAF transport that could move oversized equipment.



### 1956 C-123 PROVIDER

Based on an assault glider design, the C-123 earned fame operating from austere, remote strips in Vietnam for USAF and the CIA.



### 1958 C-7 CARIBOU

Prized for its austere jungle landing strip capability, in Vietnam the C-7 carried everything from ammo and passengers to pigs and cattle.



### 1956 C-133 CARGOMASTER

USAF's only turboprop-powered strategic transport, the 50 C-133's could handle outside cargo like Minuteman and Titan missiles.



### 1961 C-135 STRATOLIFTER

An interim jet transport until the C-141 arrived, the C-135 was the first presidential jet and the basis for myriad special mission variants.



### 1961 C-140 JETSTAR

The JetStar was a USAF VIP transport and "flight check" navigation test and certification aircraft, with some also used as communication relays.



### 1965 C-141 STARLIFTER

USAF's premiere strategic airlifter for 30 years—from Vietnam to Desert Storm—most C-141s were "stretched" to C-141Bs in the early 1980s.



### 1995 C-17 GLOBEMASTER III

Program troubles nearly killed the C-17 in the 1990s, but it recovered to become the workhorse of USAF's strategic airlift fleet.



### 1968 C-9 NIGHTINGALE

Used for aeromedical movements and VIP transport—including the First Lady—the C-9 was based on the McDonnell Douglas DC-9.



### 1997 C-37 GULFSTREAM

A Gulfstream 550, the C-37 transports high-ranking VIPs and has an extensive on-board secure communication system.



### 1970 C-5 GALAXY

USAF's biggest outside cargo transport, the C-5 went back into production in the 1980s, and in the 2000s, was up-engined to become the C-5M.



### 1975 C-32A AIR FORCE TWO

The C-32 transports senior diplomats and VIPs, and even the President when the destination airfield can't accommodate Air Force One.



### 2000 C-40 CLIPPER

A Boeing 737, the C-40B and C models transport combatant commanders and their staffs and members of Congress on overseas trips.



### 1973 C-21 LEARJET

A militarized Learjet 35, the C-21 has served since 1985 as a VIP transport and in light utility and aeromedical evacuation duty.



### 1980 C-20 GULFSTREAM

The C-20 replaced the C-140 JetStar, and was used for high-ranking VIP transport. It was retired in 2017.



### 2009 C-27J SPARTAN

Meant for disaster response, and despite good performance, USAF gave its C-27s to the Army and Coast Guard after just a few years.



### 1974 C-12J HURON

Adapted from the Beech Super King Air, the C-12 delivers light cargo and VIPs, and has been the basis of a series of specialty ISR platforms.



### 1990 VC-25 AIR FORCE ONE

The flying White House, the VC-25 is loaded with defensive gear, luxury amenities, and the most powerful flying communication system.



### HH-60 PAVE HAWK

USAF's dedicated combat search and rescue helicopter, for day or night extractions, the Pave Hawk also supports civil disaster response and NASA operations.

# HELICOPTERS

**T**he Air Force has operated helicopters for utility work, but mostly for the combat search and rescue mission, leaving most other rotary-wing missions to the other services. The Air Force is re-thinking how it will do combat search and rescue in the future, however, given the emphasis on the Pacific and the extended distances between operating locations in that theater.



### H-19 CHICKASAW

The Air Force's first search and rescue helicopter, the Chickasaw saw extensive use in Korea and also served in cargo roles into the 1960s.



### HH-43 HUSKIE

The first USAF helo to be nicknamed "Pedro," the Huskie's unique intermeshed rotors made it a good platform for CSAR, as well as aerial firefighting.



### CH/HH-3 JOLLY GREEN GIANT

The first aerial-refuelable USAF helo, the HH-3 version was also armored and armed for rescues in enemy territory.



### CH-21 WORKHORSE

The "Flying Banana" was used for transport of people and cargo and for ground assault, able to carry 20 troops or 12 litters.



### HH-53: SUPER JOLLY GREEN

Super Jolly Green: A larger and more powerful version of the HH-3, the Super was also used for combat search and rescue.



### UH-1N HUEY

Used as VIP transport and to monitor missile silos, the UH-1N has been in USAF service since 1970, and is to be replaced by the MH-139A Grey Wolf.



### MH-53 PAVE LOW

A special operations variant of the H-53 series, equipped with guns, navigation, and protective gear for night penetration of enemy territory.



### CV-22 OSPREY

The Osprey's tilt-rotor design allows turboprop speeds and vertical takeoff and landing for armed, long-range special operations missions.

## T-38 TALON

T-38 Talon: Now past 60 years of operations, the T-38 was the world's first supersonic jet trainer and served for a time as the mount of the Thunderbirds.



# TRAINERS

**A**ir Force trainers tend to be long-lived and have often been extended in service when attempts at replacing them fell to program problems or budget cuts. From the 1950s to the 1990s, most USAF fixed-wing pilots went through exactly the same training program. In that decade, specialized undergraduate pilot training was introduced. The Air Force is now overhauling training yet again, making far more use of simulators and part-task trainers, aiming for more personalized, but quicker, instruction.



## T-37 TWEET

Serving more than 40 years as USAF's primary trainer, side-by-side seating in the forgiving T-37 aided pilot instruction.



## T-28 TROJAN

Adopted first by USAF and then the Navy, the T-28 was a rugged trainer later adapted for light combat, seeing service in Vietnam and with the CIA.



## T-33 SHOOTING STAR

Derived from the Korean-era F-80 fighter, the T-33 was used by more than 20 countries. As a full-scale target, it served USAF until 1997.



## T-38 TALON

Advanced pilot trainer, companion trainer and even Aggressor adversary, upgrades have extended the T-38's service life several times.

Photos: USAF



### T-41 MESCALERO

A militarized Cessna 172, the Mescalero was used to screen potential pilots and smooth their transition into Undergraduate Pilot Training (UPT).



### T-39 SABRELINER

A converted corporate jet, the swept-wing T-39 served as a proficiency trainer, radar trainer, VIP transport, and light cargo aircraft.



### T-1 JAYHAWK

A militarized and strengthened Beech 400A, the Jayhawk trains USAF pilots in the tanker/transport specialty track, as well as navigators.



### T-3 FIREFLY

Just four years into its career as a flight screener, the Air Force grounded the T-3 after several fatal crashes and scrapped the fleet a decade later.



### T-6 TEXAN II

Based on the Pilatus PC-9, the turboprop T-6 Texan II replaced the jet-powered T-37 beginning in 2001 as USAF's primary pilot trainer.





# Air War Over Korea: Lessons for Today's Airmen

The post-World War II drawdown left the Air Force ill-prepared for conflict. The parallels with today are enlightening.

An F-51D taxiing in the austere airfield conditions found at most bases on the Korean Peninsula during the war.

By Douglas A. Birkey

**N**orth Korean forces crossed the 38th parallel into South Korea at 0400 on Sunday, June 25, 1950, launching a war that would fundamentally reshape the global security environment. South Korean and American land forces were caught by surprise, but air power transformed the panicked fallback into an effective counteroffensive. Air power proved to be the principal tool at the strategic, operational, and tactical levels, delivering air superiority, air-to-ground strikes, close air support, reconnaissance, command and control, and mobility that surface forces alone could not manifest. Ultimately, air power enabled UN forces to bring overt hostilities to an end.

Yet Airmen had to overcome severe challenges, including a shortage of aircraft to sustain operations. Many front-line planes dated to World War II, and too often remained out of commission with maintenance problems. The shortfalls were exacerbated by the lack of suitable airfields on the Korean Peninsula, requiring fighters to fly from Japan, stretching their aerial range to the limit. Command decisions were complicated by fears that the war could turn into an overt conflict with Russia, barring Airmen from targeting major sources of enemy power. Meanwhile, ground commanders clashed with air leaders



**Douglas A. Birkey is the Executive Director for the Mitchell Institute for Aerospace Studies.** Download the entire report at <http://MitchellAerospacePower.org>.

over how best to leverage their air power, whether conflicting on the benefits of focusing on the last tactical mile or targets deeper behind enemy lines.

These experiences are still relevant today, as the Air Force seeks to address a strikingly similar set of challenges: a small, aging aircraft inventory; not enough air base availability; lack of training capacity; and disagreements with joint counterparts about how best to employ air power.

## NO BUCKS, NO AIR POWER

North Korea's invasion of the South was a surprise to the United States and its allies, who were not ready to fight so soon after World War II. Massive disarmament efforts had slashed the U.S. Air Force active aircraft inventory 82 percent from its peak in WWII to 1950. A mere 2,500 jets of all types populated Air Force ramps, and the rest were predominantly WWII leftovers of dubious technological relevance. Air Force manpower and budgets had been slashed, squeezing training pipelines, spare parts inventories, maintenance depots, and logistics lines. Everything was in short supply.

The Cold War was now well underway. Air operations over Korea ranked behind Cold War activities as national concerns, and leaders prioritized maintaining sufficient reserves in Europe to deter and, if



necessary, fight a war against Soviet forces. The same held true for defending the continental United States. The Air Force was now too small to concurrently meet the nation's requirements.

The motley collection of aircraft in theater at the start of the war included 657 airplanes: F-80 jet fighters, F-82 Twin Mustang propeller-driven interceptors, B-29 and B-26 bombers, plus C-54 and C-47 WWII-era transports. USAF's Far East Air Force (FEAF), the command responsible for air operations over Korea, asked for more aircraft, but too often spares did not exist or were not readily accessible. Airmen were left to improvise with what was available. To meet the demand for more F-80s, early models lacking key combat capabilities had to be rapidly upgraded and deployed.

In March 1951, FEAF commander Gen. George E. Stratemeyer wrote to Gen. Hoyt S. Vandenberg that he was losing F-80s so quickly that new types, like the F-84, had to be rushed to Korea to sustain operations. One month later, FEAF lost 25 P-51s, 13 F-80s, and 2 F-84s to ground fire. Strategic Air Command, worried that F-84 crews were losing bomber escort proficiency for the nuclear deterrence mission, withdrew their F-84s later that year, further squeezing the force. Backfill fighter aircraft were receiving just a 10 percent attrition reserve, rather than the 50 percent required for a combat unit.

Shortages affected everyone. In August and September of 1951, B-26 squadrons lost 11 aircraft, but the Air Force had no combat-ready replacements available, and no production line to produce new planes. Desperate to offer combat units a solution, Air Force leaders deployed B-26s without required operational capabilities.

A pilot shortage contributed to the troubles. The A-26 training pipeline produced only 45 crews per month, too few to overcome FEAF attrition that demanded 58 to 63 crews a month. FEAF air commanders had to limit A-26 sortie rates, matching not what combat requirements demanded, but what crew and aircraft backfills could sustain.

Parts shortages further degraded sortie rates. Production lines had long since closed for WWII-era aircraft, so there was no ready source of component parts. By January 1952, the F-86 mission capability rate was just 45 percent. Spare parts supplies were programmed at peacetime, not wartime rates, forcing planners to ration flight hours to what they could sustain.

Rapid technological development ratcheted up the pressure.

Air Force pilots challenging communist opponents over MiG Alley along the North Korea-Manchurian border began the war flying propeller-driven and early jet aircraft. But on Nov. 1, 1950, Chinese pilots flying Soviet MiG-15s squared off against U.S. aircraft over the Yalu River. "Almost overnight, communist China has become one of the major air powers of the world," Vandenberg declared. Air Force leaders had no choice but to deploy their newest fighter, the F-86 Sabre.

The first F-86 engagement against MiG-15s followed just weeks later, on Dec. 17, 1950, and for the rest of the war, the U.S. Air Force would struggle to keep enough F-86s in the Korean theater to control the skies. F-86s were often outnumbered by MiG-15s three or four to one, even by accelerating F-86 production with added manufacturing capacity in Canada.

In the wake of World War II, flying budgets had been cut, depriving new pilots of needed flight training. Combat skills atrophied. Once in theater, pilots had to learn on the job; the shortage of aircraft was such that noncombat missions to build competence were all but impossible.

The entire air warfare system was badly out of balance, and Airmen were paying with their lives. Yet losing air superiority posed dire risks to every facet of the war. UN ground forces would be subject to indiscriminate aerial attack. Strike missions against enemy logistics lines would be unsustainable. Naval forces operating offshore would be forced to retreat further out to sea. Managing air power to survive another day, rather than flying and fighting to win, posed dangerous risks. Had these operations been against a peer threat, the results could have been catastrophic.

## NO AIR POWER WITHOUT AIR BASES

When communist forces first invaded the South, there were 10 principal airfields in the region, mostly WWII relics in poor repair. Only two—Suwon and Kimpo—possessed concrete runways. The others were gravel, dirt, and grass airfields not able to support jet aircraft. Combat engineers were also in short supply. Of 4,315 authorized billets, FEAF could fill just 2,322, a little more than half. Outdated equipment made their work harder. It took over a year to bring units to full strength; growing new talent took time.

Covering primitive WWII-era runways in pierced steel planking was an improvement. While still a far cry from a



National Museum of the U.S. Air Force

The Douglas A-26/B-26 bomber served as a first-line bomber during the Korean War. The World War II-era B-26 Invader served as the Air Force's light bomber during the Korean War, used to strike the enemy's storage centers and transportation system. Here, a B-26C crew prepares for a mission.



USAF

North American F-86 Sabre fighter jets are readied for combat during the Korean War at Suwon Air Base, South Korea. Note perforated steel mats. Steel mats allowed some aircraft to successfully use degraded and decaying runways at South Korean air bases.

robust tarmac capable of hosting jets, it allowed basic operations for piston engine aircraft like the F-51, B-26, and C-47. Upkeep was a constant challenge: In the spring of 1951, the pierced steel plank runway at Taegu had to be shut down for a complete overhaul, having been beaten to pieces by nonstop takeoffs and landings.

Supply lines and maintenance were no less difficult. The 51st Fighter Group at Kimpo Airfield consumed 60,000 gallons of fuel daily. Lacking proper hangers, maintainers kept much of their gear in crates. The 49th Fighter Wing operated from Taegu, but sent their F-80s back to Japan for major overhaul work; such rotations back to Japan proved essential in keeping mission capability rates at an acceptable level.

Many combat aircraft operated from Japan, a distance of 700 miles, effectively reducing useful mission employment time to a handful of minutes. Just getting from Japan to Korea ate up 85 percent of F-80 flight operations, leaving a mere 15 minutes for combat. F-84s launching from Japan could provide close air support over front lines for just 30 minutes. Operating from bases in South Korea was no better, though: F-86s leaving South Korean bases were limited to 25 minutes over MiG Alley along the North Korean-Manchurian border. MiG pilots knew the limitations—and took advantage.

North Korean fighters were also in range to attack U.S. bases. On the opening day of the war, a C-54 was strafed and destroyed by North Korean fighters, and in the autumn of 1950, enemy aircraft destroyed 11 P-51s at a forward air base. Such raids continued for the duration of the war. As with everything else, air base defense was often underresourced.

## AIR-MINDED LEADERSHIP

Air and ground commanders during the Korean conflict held divergent views regarding how best to employ air assets. Ground commanders favored focusing air power on enemy forces along the front line of battle, while air leaders sought to engage further into the north, expanding the enemy territory under attack, by focusing on the strategic and tactical targets whose destruction could have a greater impact on the conflict.

Service views were represented by component commanders:

Far East Air Forces, Naval Forces Far East (NAVFE), and Army Forces Far East (AFFE). But the overall commander, Army Gen. Douglas MacArthur, established a precedent of triple-hatting the Army component commander as the lead commander, adding Commander of U.N. Forces and Commander in Chief Far East (CINCFE) to his titles. Air Force and Naval leaders were thus placed in a distinctly subordinate status. Similarly, MacArthur populated his staff with Army officers primarily; the official Air Force of the Korean War goes so far as to characterize the General Headquarters (GHQ) as “essentially an Army staff.”

“Lacking joint representation of air, naval, and ground officers, the GHQ staff was unable to accomplish the most efficient and timely employment of air power in Korea,” the official history states.

With outsized influence, the Army commanded the employment of air power from the earliest stages of the war. Air crews were ordered to focus missions on the front lines, even when more lucrative targets further north were largely undefended. In the opening weeks, enemy logistics lines, supply depots, air bases, and other centers of gravity were not threatened by U.S. air attack. Not for a full month after hostilities erupted did Airmen gain authority to strike targets north of the 38th parallel.

With Air Force, Naval, and Marine aircraft in the theater all flying and fighting over the same territory, command was service-centric at the start without formal coordination. In fact, Air Force leaders could not even talk to their naval counterparts during the initial weeks of the war because the aircraft carriers sailing off the Korean Peninsula insisted on maintaining radio silence. To manage requests for air power, the CINCFE staff organized a “target group,” but Army staffers, who lacked background in air power strategy and tactics, held most of the seats and routinely outvoted Navy and Air Force representatives.

When Gen. Mark W. Clark assumed the U.N. Command and CINCFE role in 1952, however, among his first actions was to fix the balance of service representation in his headquarters staff. The group “should be a joint, tri-service operation, rather than an Army project,” he said. When joint principles were attacked by his Army counterparts, he advocated joint solutions. Some

Army leaders understood the merits behind Clark's approach. As Gen. Walton Walker explained, "You hear and read about the type of support furnished by the Marine air units. It's good, it's excellent, and I would like to have that kind of air support available too—but if the people who advocate that would sit down and figure out the cost of supplying air units for close air support only, in that ration to an army the size we should have, then they would be astonished."

These lessons had been learned previously during WWII, but the debates resurfaced in Korea anyway.

### APPLYING THE LESSONS OF KOREA TODAY

Viewed with hindsight 70 years later, the Korean experience remains relevant today, especially in the context of the threat posed by China in the Pacific. Then as now, the Department of the Air Force faced a severe resource challenge.

In the aftermath of the Cold War, the Air Force budget was cut severely. From fiscal 1989 to fiscal 2001, procurement spending plunged 52 percent, nearly 20 percent more than the other services. Then, in the wake of 9/11, budget increases failed to keep pace with joint commanders' demand for air power. New joint missions, including the surge in requirements for intelligence, surveillance, and reconnaissance over Afghanistan and later Iraq, did not come with their own funding streams.

The Air Force acquired and operated a huge fleet of remotely piloted aircraft while reducing the size of its overall force. Then, with the creation of the Space Force in 2019, the department assumed a new mandate to launch a new military service—all within its existing budget wedge.

At the same time, pass-through spending—funds allocated to the Department of the Air Force but then passed through directly to other agencies—continued to rise. Today, \$40 billion of the annual DAF budget is allocated to other agencies in DOD. While those funds would be enough to buy some 400 F-35s or half that many while still nearly doubling the Space

Force budget, the Department of the Air Force has no say in how those funds are used.

Similar to 1950, today's Air Force is a shrunken version of its former self, operating what is now the oldest, smallest aircraft inventory in its history. The bomber inventory now stands at 141, an all-time low; fighters reached an all-time low in 2016 and are only beginning to recover. At 5,625, the Total Force aircraft inventory is less than half the size it was 40 years ago.

Mobility; command and control (C2); and intelligence, surveillance, and reconnaissance (ISR) inventories are similarly fragile. Critical attributes like stealth are in short supply—just 20 percent of the USAF fighter inventory and 13 percent of the USAF bomber inventory can evade enemy radar this way. Spare parts are again a problem, having too often been chosen targets for budget cuts, even though parts availability can be directly correlated to mission capability rates. A persistent shortage of pilots again plagues the Air Force, which lacks the training aircraft and flying hours to produce enough pilots fast enough to close the gap between requirements and reality. Shortages also persist among seasoned maintainers and others—just as they did 70 years ago in the runup to the Korean War.

The Air Force is investing and experimenting with new operating concepts designed to better prepare U.S. forces should combat in the Pacific become necessary once again. Concepts like Agile Combat Employment (ACE), in which detachments move forward from larger operating bases to make U.S. actions more dispersed, flexible and less predictable ultimately, depend on solving larger issues with the logistics and sustainment enterprise, which must evolve to meet new requirements. The austere conditions Airmen faced in Korea 70 years ago are not that different than those Airmen will face under ACE today, except they expect now to operate across a broader region and against a much more sophisticated foe, armed with fifth-generation sensing and strike capabilities.

In that context, limiting sorties for want of parts or main-



National Museum of the U.S. Air Force

Early model F-80s lacking key combat capabilities were rapidly upgraded and deployed to meet USAF's fighter needs.

During the Korean War, damaged aircraft like this C-47 were often stripped for parts to keep others flying. Limiting sorties for want of parts or maintenance or available aircraft, as happened in Korea, poses greater risks now than before. If war does erupt, there will not be time to backfill deficiencies in personnel and aircraft.



USAF

tenance or available aircraft, as happened in Korea, poses greater risks now than before. If war does erupt, there will not be time to backfill deficiencies in personnel and aircraft. The timeline necessary to train new pilots or build new airplanes is measured in years and decades, not months. Commanders not postured to fight and win from Day One risk defeat.

The Korean War leadership issues are also similar to patterns seen today. No Air Force officer has ever been the joint commander for U.S. Indo-Pacific Command, U.S. Central Command, or U.S. Forces Korea. Only one Airmen has ever commanded U.S. Southern Command. When Gen. Tod D. Wolters retired in July and turned over U.S. European Command to Army Gen. Christopher G. Cavoli, he was just the fourth Airmen to hold the position in the 70 years since the command was established. Gen. Richard B. Myers was the last Air Force Chairman of the Joint Chiefs of Staff, serving from 2001 to 2005. Even the Secretariate has become land-centric, with the last three confirmed secretaries of defense all having been retired ground commanders: former Marine Gen. James Mattis, former Army Lt. Col. Mark Esper, and former Army general and now Defense Secretary Lloyd Austin. This parallels the situation in Korea in 1950.

Joint does not mean everyone gets to engage in each mission area. It means developing centers of gravity for each domain and allowing them to articulate their value to a joint commander who assembles a menu of capabilities that will best net the desired strategic effect, regardless of the domain form which they originate.

As air power expert Lt. Gen. David Deptula, USAF (Ret.), dean of AFA's Mitchell Institute for Aerospace Studies, explains: "To be joint, the U.S. and its allies require separate services. It is an imperative that service members understand how to best exploit the advantages of operating in their domains. Articulating the virtues and values of your service is in fact 'being joint.'" The failure to appoint Air Force leaders to lead major joint commands relegates Airmen—and air power—to understudy status. This has an impact and

influence on how the services invest and posture for future conflict and can inadvertently steer strategy. Consider long-range strike, for example. The Army is investing in a wholly organic long-range strike solution—its own munitions, launch vehicle, and C2ISR construct—rather than developing solutions that leverage joint capabilities. Similarly, the Space Force has subsumed almost all Air Force and Navy space assets, but full consolidation has yet to occur, with the Army retaining significant organic space capabilities.

Finally, the issue of limited warfare faced by Airmen in Korea presents incredibly useful areas for today's Air Force leaders to consider, especially as the United States and its allies focus on a renewed era of peer competition with specific focus upon China. Military leaders must carefully consider whether they have the tools to achieve the desired outcome given the actors involved.

As the U.S. learned in Afghanistan and Iraq, superior military prowess is of little value if there is a fundamental disconnect between strategic objectives and the indigenous population. The U.S. achieved a favorable, if imperfect, outcome in the Korean War because the U.N., the United States, and the people of South Korea shared a common objective. Such alignment is the foundation of any successful campaign, but which was fundamentally lacking in Afghanistan and Iraq.

In 2018, then-Secretary of the Air Force Heather Wilson proclaimed, "We must see the world as it is. That is why the National Defense Strategy explicitly recognizes that we have returned to an era of great power competition. We must prepare."

That call to action, echoed by all Air Force leaders since, speaks directly to the air power lessons of the Korean War. That conflict's history is instructive today because air power has been crucial to every successful military campaign in the past century. In the 21st century, as in the 20th, "Victory Through Air Power" is possible—only if we apply the lessons of the past to the challenges of the future. ✪

# How Google Cloud helps government agencies stay ahead of security threats

By Lynn Martin, Vice President, North America Public Sector, Google Cloud

Cybersecurity remains a top national concern, and Google Cloud is committed to providing government agencies with the security capabilities they need to achieve their missions. At the annual Google Cloud Security Summit today, we're excited to share updates on how we're helping governments around the world address their pressing security challenges and meet the demands of new and evolving cybersecurity mandates.

## Introducing Assured Open Source Software service

Google Cloud is announcing its new Assured Open Source Software (OSS) service to help improve the security of the software supply chain, one of the major objectives of White House Executive Order 14028 on Improving the Nation's Cybersecurity. Assured OSS can assist in making the open source ecosystem more secure and help government agencies identify, assess, and respond to cybersecurity risks throughout all levels of an organization's supply chain, in alignment with guidance from the National Institute of Standards and Technology (NIST) in support of the EO.

We continue to work closely with government leaders to innovate and develop initiatives and frameworks that strengthen open source software and the software supply chain. For example, Google launched Supply Chain Levels for Software Artifacts in June 2021. Also known as the SLSA framework, it formalizes criteria around software sup-

ply chain integrity to help the industry and open-source ecosystem secure the software development lifecycle. We also introduced Open Source Insights, which helps developers better understand the structure and security of the software they use. Assured OSS, which is expected to enter Preview in Q3 2022, reflects our continued commitment to building safer security practices in government.

## Transforming security analytics and operations

Google Autonomic Security Operations (ASO) solution is available to help public sector agencies and government leaders meet the requirements set forth in EO 14028 and OMB M-21-31 around cybersecurity analytics and threat management.

Powered by Google Chronicle and Siemplify, ASO can allow agencies to comprehensively manage cybersecurity telemetry across an agency, support the Event Logging Tier requirements of the White House guidance, and ultimately transform the scale and speed of threat detection and response. ASO can also help government agencies support continuous detection and continuous response so that cybersecurity teams can increase their productivity, reduce detection and response times, and stay ahead of attackers.

## Expanding our government compliance

To continue to help meet government's security and compliance needs, we're expanding Assured Workloads to help enable regulated workloads to run securely at scale in Google Cloud's infrastructure. We are also pleased to

announce that 14 new Google Cloud services<sup>1</sup> support FedRAMP Moderate and three services<sup>2</sup> are being added to support FedRAMP High — with more coming this summer.

To help meet the Zero Trust requirements outlined in EO 14028, Google Cloud provides a range of capabilities to help federal agencies progress toward a Zero Trust architecture. Google Cloud's BeyondCorp Enterprise can enhance government agencies' ability to implement and scale Zero Trust secure access to applications and data on premises or in any cloud. For the Defense Innovation Unit (DIU), Google Cloud is implementing a Secure Cloud Management solution — leveraging Anthos, our container deployment and orchestration solution — to help provide a scalable, highly responsive alternative to the Department of Defense's current network boundary security architecture. Google Cloud also offers a range of Professional Services engagements to help accelerate agencies' adoption of cloud and of Zero Trust architectures.

We are proud to help government agencies innovate securely, and we will continue to pursue federal certifications to support their needs. For more information on our work with the federal government and our security capabilities, please visit our Google Cloud for U.S. federal cybersecurity webpage.

<sup>1</sup>—New FedRAMP Moderate services include: Anthos Config Management, Anthos Service Mesh, Assured Workloads, Binary Authorization, Certificate Authority Service, Cloud External Key Manager, Cloud Run for Anthos, Cloud Scheduler, Cloud Tasks, Connect Service Directory, Document AI, Game Servers, and Secret Manager

<sup>2</sup>—New FedRAMP High services include: Cloud Admin Console, Cloud Data Loss Prevention, and Cloud Logging Logging



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# Gulfstream: A Historical Partner in Critical Transportation for Senior Leaders

**G**ulfstream has been a critical Department of Defense partner throughout its history. While Gulfstream first delivered its modified Gulfstream GII aircraft to the U.S. Navy in 1967, the company has been directly supporting the U.S. Air Force since 1983.

“Almost 40 years ago, we delivered the first C-20B Gulfstream GIII aircraft at the 89th Airlift Wing at Joint Base Andrews to support critical transportation for executive airlift command and control mission,” said Troy Miller, regional vice president for military and special mission sales at Gulfstream. “We’ve been providing Gulfstreams around the world ever since.”

Since then, Gulfstream has continued to provide aircraft, logistics, and maintenance support to securely transport senior political and military leaders.

“Recently, we have also expanded our support by modifying special missions’ aircraft, most notably our modified G550s to support the EC-37B Compass Call program,” Miller said. “We’re modifying those aircraft for the mission system’s prime contractors: L3Harris and BAE Systems. Together, we’re addressing the critical airborne electronic attack requirements that the Air Force has made clear it requires in the EC-37Bs that are slated to replace the current fleet of EC-130Hs.”

Gulfstream’s support of executive airlift command and control is vital to ensuring senior leaders stay connected when they travel.

“Over the years, we’ve improved the secure communications capabilities of our aircraft,” Miller said. “Our C-37As and C-37Bs are equipped with secure communication suites that enable our senior military and government leaders to conduct business securely during those long-range flights.”

Gulfstream’s experience in developing business jets prepared them to continually innovate to enhance their aircraft.

“As a leading business jet manufacturer worldwide, Gulfstream focuses first and foremost on safety,” Miller said. “But we



Airman 1st Class Andrew Kobiak

**The Air Force has used Gulfstream executive jets for nearly four decades. The twin-engine C-37A is the military version of the Gulfstream V executive jet, used to transport senior military and government leaders.**

also focus significantly on innovation by developing and implementing new capabilities and technologies into our aircraft to improve communications, navigation, and environmental conditions in the cabin.”

As an example, Miller offers the modifications made to secure communication capabilities for the senior leaders, including combatant commanders.

“Our aircraft provide reliable, safe, and productive air transportation over long ranges and high altitudes of operations at high speeds,” Miller said. “In response to increased demand for secure communications, we provide a work environment that senior leaders can conduct their critical business, particularly command and control missions, in-flight.”

In 1999, the General Dynamics Corporation purchased Gulfstream, enabling Gulfstream to innovate and expand its product lines to meet the demands of the future with aircraft like the new Gulfstream G700, which is currently undergoing flight testing.

“The G700 offers increased range, speed, and 56 percent more space in the cabin compared to the G550,” Miller said. “A larger cabin provides air transportation for more people and the ability to accommodate additional crew rest capability or galley capability for the special missions. We’re excited to have our newest aircraft address the Air Force’s emerging and evolving requirements.”

This addition is significant considering Gulfstream’s G550 continues to be one of the most prolific contributions the compa-

ny has made to the Air Force, as evident by its recent incorporation into the C-37B fleet.

“With more than 600 G550s in service, that aircraft continues to be our most productive,” Miller said. “The C-37Bs are based on the G550 and recently, the Air Force has taken delivery of two additional C-37Bs. Without question, the G550 has been the workhorse that best represents Gulfstream addressing the needs of the Air Force to date.”

Gulfstream is a proud historical partner of the Air Force. Recently, two G550s delivered to Joint Base Andrews were selected to honor the Tuskegee Airmen and the Berlin Airlift, respectively, on their tails.

“Considering the Air Force’s emphasis on historical significance, it was humbling and a joy for our aircraft to receive a tail number that represents these historical events and figures,” Miller said.

It was a poignant reminder of the Air Force’s rich history, motivating Gulfstream to continue supporting the Air Force’s needs far into the future.

“Gulfstream’s next-generation aircraft family, including the G400, G500, G600 and G800, along with the G700, represent industry-leading capabilities and technology, and different segments of the performance spectrum in terms of ranges, sizes, and capabilities,” Miller said. “As we continue to develop new aircraft and modify our products, we will continue to support the executive airlift command and control needs and the special missions needs of the U.S. Air Force over the next 75 years.”



Mike Tsukamoto/staff, Lockheed Martin

An artist's illustration of a U.S. Air Force's Space Based Infrared System (SBIRS) satellite built by Lockheed Martin in Geosynchronous Earth Orbit (GEO).

# The Evolution of Space-Based ISR

By Maj. Gen. Thomas Taverney, USAF (Ret.)

**G**athering intelligence about adversaries has been central to military strategy since the advent of war. Knowing your adversaries' capabilities, order of battle, and intent can spell the difference between victory and defeat. Whether by means of human intelligence—spies and intercepted communications—or observation from a hilltop or, in the modern age, from the ultimate high ground of space, the ability to see what the adversary is doing is critical to understanding and, ultimately, victory.

The first intelligence satellites sought to replace airborne platforms in locations where access was contested or denied. But as space-based imagery advanced, it enabled U.S. intelligence analysts to look deep and persistently at adversaries' territory, often providing the first indications and warnings of military activity.

**"Military intelligence is the key to war; without it, you cannot win."**

—Sun Tzu

Starting in 1954, in a schoolhouse in Los Angeles, Air Force Gen. Bernard "Bennie" Schriever, supported by a civilian team led by Si Ramo, began developing the means to reach space. The missiles they built, learning from the German V2 rockets, led to development of the Thor, Atlas, Titan, and Minuteman intercontinental ballistic missiles (ICBMs). This was the time of the world's first great space race. In the Soviet Union, Russian scientists were pursuing their own capabilities. When Russia launched the Sputnik satellite, it shocked and scared the U.S. Though less known, Russia had launched an ICBM in August of 1957. Many believed a nuclear attack was possible—even probable. With the memory of Japan's surprise attack on Pearl Harbor still fresh—it was not yet 20 years later—U.S. leaders wanted the means to monitor the Soviet Union's missile activity and better understand the risks the nation faced.

The U-2 program began in 1954, about the same time as U.S. ICBM development, making it the first of these



new surveillance programs intended to fully inform national leaders about Soviet activity. The aircraft flew about 70,000 feet, high enough, it was believed, for the plane to be beyond the reach of Russian air defenses. That bubble burst on May 1, 1960, however, when a U-2 piloted by Air Force Capt. Francis Gary Powers, conducting a reconnaissance mission high over Soviet territory, was suddenly struck by a Russian SA-2 surface-to-air missile. Powers survived, was captured and held in a Russian prison, and eventually returned in a prisoner exchange. The shootdown forced President [Dwight D.]Eisenhower to order a halt to airborne photo reconnaissance missions over the Soviet Union.

Eisenhower had another solution in the works, however: He had authorized development of space-based surveillance and reconnaissance, and the U.S. would soon have the means to gather intelligence from beyond the Earth's atmosphere. Even if the U-2 couldn't fly high enough, satellites in space could reach a whole different level. With that, the U.S. would have a crucial intelligence edge and the ability to gather data about its adversaries. The Air Force had been working on satellites since 1956 and it had learned to track and recover film-carrying re-entry vehicles. Corona began as a CIA program with help from the Air Force and, in 1961, the Kennedy administration authorized the National Reconnaissance Office (NRO). Working together, the Air Force, NRO, the Department of Defense, the CIA, and industry created amazingly complex imaging satellites. In 1963, Gambit provided the highest-resolution imagery yet from space, allowing the U.S. to see finer details for areas of interest identified by Corona imagery. Hexagon, first launched in 1971 as a replacement for Corona, provided more persistent imagery, packing 60-mile rolls of light-sensitive film and four return vehicles.

Like Corona, Hexagon returned negatives to Earth in film return capsules, which USAF aircraft collected in midair near Hawaii, after which the film would be developed so the imagery could be studied and analyzed. The insights gained from these systems helped assuage fears of a "missile gap" with the Soviets in the development and deployment of ICBMs and enabled defense officials to act on facts rather than speculation.

Yet this intelligence process was slow, taking weeks to months to produce useful insight. The next generation of overhead imaging sensors would be digital, allowing rapid transmission from space to Earth without the elaborate but time consuming and expensive process of retrieving a bucket of film dispatched from a satellite back to Earth.

Since its inception, the NRO has leveraged space to enhance America's understanding of its global challenges and gain strategic advantage. This, in turn, has enhanced U.S. national security. Yet having built the world's best overhead intelligence, surveillance and reconnaissance systems, U.S. space intelligence supremacy is now being challenged. America's adversaries are investing money, training more people, and developing more resources and tools, both on the ground and in space, than is the U.S. China's economic and technological strength and Russia's willingness to exert power in ways not seen in decades, pose clear threats to U.S. capabilities in space.

The relatively new U.S. Space Force, the NRO, other defense agencies, and their partners in industry will have to work together in innovative ways to develop the tools and techniques that will keep the United States the undisputed leader in space and meet this challenge.

## WARFIGHTER SUPPORT

Overhead ISR space systems collect and process signals and



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**A JC-130 recovers the white cone of a Mark 8 parachute carrying film from a reconnaissance satellite. After a U-2 was shot down, the U.S. used satellite imagery to record the data.**

imagery for a wide range of activities in support of our regional warfighters: Maintaining order of battle and situational awareness; monitoring adversary activities and specifically their weapons and troop movements; developing highly accurate targeting data; providing indications and warnings and performing battle damage assessments.

Surveillance and reconnaissance satellites play an even more critical role today, not just in providing data for intelligence assessments of a strategic nature, but also in the rapid response needs of today for national security. While intelligence estimates remain a key element of the mission of these satellites, the mission has expanded from the strategic arena to more time-sensitive operational and tactical levels of support. These rapid-response requirements demand persistence to identify threats that can come from anywhere, at any time—from mobile launchers, ships, submarines, aircraft, and even from space. The limited number of sophisticated satellites that can provide exquisite imagery (the mainstay of the NRO) has historically limited their ability to provide global persistence.

In 1980, Congress directed the Pentagon to establish the Defense Reconnaissance Support Program (DRSP) to "improve the application of satellite reconnaissance support to operational military forces and create a mechanism through which tactical support enhancements to the NFIP [National Foreign Intelligence Program] could be identified, validated, and funded." DRSP resources and management mechanisms were tasked to:

- Modify or augment intelligence satellite systems for the primary purpose of supporting military operations;
- Acquire and operate satellite reconnaissance systems to fulfill validated requirements to support military forces;
- Design systems for dissemination of satellite reconnaissance imagery products to the Unified and Specified Commands and appropriate Joint Allied Commands and assure compatibility with service tactical architectures.

The U.S. also was able to leverage burgeoning commercial imagery providers to fill some of the gaps in satellite coverage,

providing ground commanders with information on potential enemy positions. Archived satellite imagery was merged with more recent imagery to identify changes over time, influencing targeting and enabling ground commanders to concentrate their forces on potential enemy hide sites.

Military commanders in Operations Desert Shield and Desert Storm (1990-1991) often referred to them as the first "Space War," because it marked the first time space-based capabilities were used to support terrestrial forces during conflict. A dozen years later, Operation Iraqi Freedom underscored how much progress had been made, as space overhead imaging capabilities were more tightly integrated into operations

Then known as the Military Intelligence Program, this effort was redesignated the Defense Space Reconnaissance Program (DSRP) in the late 1990s. In 2002, Deputy Secretary of Defense Paul Wolfowitz issued a new charter for the DSRP requiring that every tactical defense space reconnaissance project had to satisfy, address, or align directly with the validated requirements of one or more of the following:

- Combatant command Integrated Priority List (IPL);
- Approved Operational Requirements Document (ORD); Initial Capabilities Document (ICD), Capabilities Development Document (CDD) or Capability Production Document (CPD)
- Combatant command capability gaps, defined by the Joint Staff; or
- Other shortfalls identified by the Services and SOCOM that are preventing users from accessing and exploiting NRO Overhead Systems data.

One capability was Eagle Vision, a collection of deployable satellite downlink stations that processed commercial satellite imagery in near real time. Eagle Vision used satellite overflight modeling software to determine which commercial space-based sensors could view areas of change. In one case, for example, regional commanders used image comparison to identify mass gravesites near Baghdad, Iraq.

Deployed to the United Arab Emirates in support of Operation Iraqi Freedom, Eagle Vision provided an in-theater

solution that could leverage commercial satellite imagery in a fast-moving tactical situation in just 12 hours—half the time it would take using conventional means to gather those images from commercial vendors.

Today, the NRO is focused on delivering responsible and agile space-based ISR and working with partners in the Intelligence Community to enhance overhead tasking, collection and data processing capabilities, including using artificial intelligence and machine learning to fuse and make sense of diverse data sets.

Since Russia's invasion of Ukraine, allies have leveraged commercial space-based ISR to provide critical support to Ukraine.

## THE MODERN IMAGING MARKETPLACE

As the commercial imagery marketplace has grown, the number of U.S. national security assets has stayed relatively flat. From 2005 to 2010 commercial satellites nearly tripled; from 2010 to 2015, they quadrupled; and from 2015 to 2022 they nearly quintupled. As a result, "remote sensing" has evolved from being something only nation states could provide to now, where 40 percent of the remote sensing satellites in orbit are privately owned—and less than 10 percent are owned by the U.S. government. Today, more than 60 companies are pursuing space-based data collection and some 50 countries own space-based collection assets.

Commercial providers have realized that excellent, spectral, radiometric, and temporal resolution (revisit rates) can be complementary or in some cases more valuable than high spatial resolution. To achieve this capability, companies are deploying large numbers of small and mid-size satellites. A handful of commercial companies are deploying constellations with meaningful numbers and decent revisit times, but achieving true persistence will require the ability to connect multiple constellations using "plug-and-play" interfaces. Ensuring multiple players survive and flourish in this business is a worthy goal for U.S. policymakers.

In 2021, the Space Force approved rapid experimentation



**Staff Sgt. Neil Holdren and Capt. Kevin Mahar run a maintenance inspection on an antenna feed. USAF, and now USSF, has for decades understood the importance of space surveillance.**

Staff Sgt. Melissa Koskovich

and prototyping for a new Tactical Space Layer, which will take advantage of commercial satellite imagery to improve battlespace awareness and expand its beyond-line-of-sight targeting capability. Industry innovation will yield new solutions to help make that possible. Based on experience in Ukraine, for example, Maxar is now offering mobile terminals that provide direct access to commercial imaging satellites in real time. This could enable military units in the field to downlink electro-optical (EO) imagery from Maxar's satellites, combine it with radar imagery from Canadian satellite firm MDA's Radsat-2 and possibly other commercial providers, and use it as a tactical operational tool.

## TASKING, COLLECTION, AND MORE

The biggest beneficiaries of new commercial capabilities are tactical/theater warfighters, and international partners, both of which historically were under served by space-based imagery intelligence (IMINT) providers. Tactical users need persistent coverage and near real-time data delivery. By using multiple systems, they can assure persistent coverage. International partners—even Five Eyes partners—are frustrated by delays in sharing imaging intelligence.

Tactical intelligence (TACINT) users today have growing needs:

- Immediate operational support. Users want “over the hill” insight in as close to real time as possible—meaning seconds or minutes—to identify the source of ground fires or movements beyond the line of sight;

- Tactical planning support. Users want the ability to detect operational shifts, such as aircraft, ship, or ground unit movements, an influx of fuel trucks, or new construction, which could indicate changing plans or capabilities;

- Ground and air order of battle and location of ground fires;

- Moving target indicators. Air users want actionable ground moving target indicators (GMTI) and air moving target indicators (AMTI);

- Insights provided by fused intelligence, such as fused electro-optical and synthetic aperture radar products or multi-spectral products that make use of EO and infrared images (post processing for various domains);

- Multi-Int fusion (EO/SAR/IR/RF/SIGINT/ELINT). RF, signals, and electronics signatures can tip ISR systems to use high-resolution modes to identify and detect dark ships, for example, as part of maritime domain awareness missions;

- Overhead persistent Infrared (OPIRP) can “tip” a system to collect more detailed data about a topic of interest. Thus, the fidelity of new staring sensors can help identify dim ground targets as well as larger test sites.

The United States is only beginning to leverage all the sources of space-based ISR capability now being developed. While no single company can provide the truly persistent coverage of all the ISR needs of any given government customer, the combination of available resources means combined capabilities can be truly amazing.

## CURRENT STATUS

“The Space Force has increasingly looked to partner with the private sector as companies and investors pour into the space industry. I’ll tell you, I’ll bet on our commercial industry any day.”

—Gen. John W. Jay Raymond, Chief of Space Operations

As we move to an era where we will combine the scarce but exquisite resources of the NRO with the wide and varied commercial resources being developed commercially, the Defense

## Terms and Definitions

**Intelligence (I)** is the gathering of information to understand an adversary or situation;

**Surveillance (S)** is performed over large areas over long periods of time, with no specific targets in mind;

**Reconnaissance (R)** is performed over specific targets at specific times.

Department will need a different approach to the combined tasking, collection, processing, exploitation, and dissemination (TCPED) of satellite intelligence. As the battlefield has turned from localized areas of interest to multiple simultaneous areas at the same time, tactical timelines have shrunk from days or hours to minutes and seconds. Shortening the delay from sensor-to-shooter is critical. The concept driving joint all-domain command and control (JADC2) is intended to give U.S. forces considerable advantage in the and Observe, Orient, Decide, Act (OODA) decision loop

The Air Force's Advanced Battle Management System (ABMS), the Army's Project Convergence and Remote Ground Terminal (RGT) TITAN (bringing together systems for the next generation of intelligence), and the Navy's Project Overmatch all seek to develop all-source ingestion nodes and rapid information processing and dissemination to accelerate warfighting commanders' decision process.

Bringing each of the services' battle management approaches into a concerted whole is the driving concept behind joint all-domain command and control (JADC2). Air Force Secretary Frank Kendall sees this clearly. “The Army's Project Convergence initiative is driven by the need to develop required technologies for interconnected, multi-domain sensor-to-shooter relationships. The Navy's Project Overmatch effort is designed to develop and integrate resilient command-and-control (C2) networks to improve and accelerate the teaming of their own unmanned air, surface, and underwater vessels with manned weapons and platforms,” he has observed. “We want to be able to integrate well with the Navy and take advantage of what their sensors can find and provide data from our sensors to the Navy as well. In Europe, it tends to be more an air, ground, [and] space theatre ... so there we want to be working closely with the Army. However, all the services are very serious about doing this in a joint fashion.”

The Army has demonstrated its progress fusing sensor data during its first two Project Convergence exercises at Yuma Proving Ground, Ariz. Both demonstrations reinforced that access to space-based sensors and in-theater tactical ground stations is “absolutely essential.”

The Army has experimented with providing real-time satellite imagery to the warfighter in recent years with its pathfinder Kestrel Eye program. The small satellite experiment showed how the Army could task a sensor in LEO to take images of the battlefield and then downlink them to the warfighter in real time. However, a single LEO satellite can only provide a small amount of relevant coverage each day due to its orbit. Our ground forces need more than that. While Kestrel Eye simply produced images and delivered them to the warfighter, the Army needs to be able to detect and track ground level threats automatically. The goal is to get targeting solutions for beyond line-of-sight ground threats to the warfighters on the battlefield in real time through a tactical data link like Link 16 or through DCGS. Instead of just delivering images to warfighters, the goal is to deliver targeting solutions to the warfighter based on those satellite images. To get the persistence we need we

## Three Levels of War

The United States military recognizes three distinct levels of war: tactical, operational, and strategic. Together, they link tactical actions to achieve national strategic objectives. There are no finite limits or boundaries between these levels, but the distinction between them helps commanders design and synchronize operations, allocate resources, and assign tasks appropriately. The strategic, operational, or tactical purpose of employment depends on the nature of the objective.

The **Strategic** level of war has the longest time horizon and involves national (or multinational) guidance and resources to achieve national- or theater-level objectives. The strategic level of analysis would analyze any actions taken that involve national (or multinational) guidance, resources, or objectives and end state.

The **Operational** level of war is the process of linking strategic goals and objectives to tactical goals and objectives. The operational level of war has a relatively shorter timeline than strategic, but longer than tactical and involves planning and execution of campaigns and major operations using operational art to achieve military objectives. The operational level of analysis would analyze any actions taken that involve operational art and planning and execution of campaigns and major operations.

The **Tactical** level of war involves the planning and execution of battles and engagements by the ordered arrangement and maneuver of combat elements in relation to each other and the enemy to achieve combat objectives. This encompasses the activities associated with the speed of warfare.

need to combine the exquisite NRO assets with the potential persistence provided by the large number of commercial imaging companies.

“We are going to be working closely with the [Intelligence Community] on this, and we are going [to] be talking to the other services, and we are going to try to take a leadership role to make sure joint operational requirements for future space-based intelligence systems and platforms, and we're moving down the path to satisfy [requirements] for all the services,” said Air Force Secretary Frank Kendall

Fortunately, with the formation of the USSF, in addition to their close partnership with SSC, they have forged a strong partnership between the USSF and the NRO, and between the USSF, the NRO, and the Army. They have signed a Memorandum of Agreement to assure the Army, Intelligence Community, and USSF are totally integrated on space-based Tactical ISR (TacISR). The Space Force and the NRO are working together closely to fully define the warfighter's tactical ISR requirements and close this tactical space-based overhead intelligence gap and support the evolving operational environment, as it changes almost daily.

USSF's Space Systems Command has multiple initiatives to encourage innovation and simplify and accelerate the contracting process to move commercial systems into the national security space ecosystem and break barriers to entry for new companies. These include:

- **Commercially Augmented Space Inter-Networked Operations (CASINO)** program. In conjunction with the Blackjack program, CASINO is working with PredaSAR on a project to

integrate a government-furnished optical communications terminal. In addition, they could incentivize commercial players to start integrating government-compliant optical crosslinks on their platforms. The Space Development Agency plans a similar inter-satellite demonstration with Capella Space.

- **“Commercial Services Office.”** This encompasses its commercial SatCom office to expand its scope across all USSF missions, including ISR.

- **“Front Door.”** This program focuses on reducing barriers to entry, building innovation and providing a bridge path to access Space Works, the Space RCO, Space Safari, Space Digital Ecosystem and Integration (SpaceDEN), Hack-a-sat, and others.

- **Reverse industry days** to engage the commercial ISR industry base.

The objective, in the words of SSC Commander Lt. Gen. Michael A. Guetlein: “Exploit what we have, buy what we can, and build what we must.” SSC is trying to leverage commercial solutions where possible and ensure investment isn't wasted through duplication of effort.

The Joint Requirements Oversight Council (JROC) has given the role of integrating joint space requirements to the U.S. Space Force, and the U.S. Space Force JROC member, Gen. David D. Thompson, Vice Chief of Space Operations, is spearheading the effort to develop this role, with Secretary Kendall and CSO Gen. John W. “Jay” Raymond providing advocacy and oversight. One of the first mission areas the Space Force is using to develop this role is tactical ISR and targeting. It is engaging the services and combatant commands to fully understand and document joint force needs, with the NRO and members of the broader Intelligence Community partnering in the effort.

### ULTIMATE HIGH GROUND

“We want to leverage commercial in a significant way. It is a huge national advantage for us.”

—Gen. John W. Jay Raymond, CSO, USSF

Successful military operations depend largely on surveillance and reconnaissance. Having timely, accurate intelligence improves situational awareness, mission planning, and damage assessment. While some reconnaissance can be accomplished with aviation assets, persistent surveillance, especially over denied areas, can only be feasibly and effectively provided from space. To leverage satellite image intelligence, combat units require reliable, scalable, secure, high-performance digital infrastructure ensuring reliable, secure access to satellite imagery assets to turn them into actionable intelligence—an important advantage in any warfighting scenario.

Space is a critical element in the operational planning and the tactical sensor-to-shooter kill chain. Commercial space imagery and electronics intelligence capabilities continue to expand, and their growing diversity and technical performance makes them increasingly valuable. The U.S. National Security Space establishment—the Space Force, U.S. Space Command, the NRO, and the Space Development Agency—are collectively focused on integrating commercial space capabilities into the military's kill chains more expeditiously. Inevitably, these new capabilities will also face new threats: electromagnetic, kinetic, and cyber. Threat awareness and defense will be necessary.

As Raymond makes clear, “This is not a time for patience. This is a time for action.” America's adversaries are moving very fast. The United States must move faster still. ★

*Thomas “Tav” Taverney is a retired Air Force major general and a former vice commander of Air Force Space Command. He is a senior executive with Leidos involved in developing space payloads.*

# Commercial Space Innovations: Unlimited Potential

Industry is developing new space-based surveillance and reconnaissance capabilities at a prodigious rate across every sector of sensor technology.

## VISIBLE SENSORS

Planet has a 150-satellite constellation in space with the goal of being able to take an image of the entire Earth each day. Maxar is working on its next-generation constellation called WorldView Legion, which reportedly will be able to revisit some locations on Earth up to 40 times per day. BlackSky has a fleet of high-resolution (80 cm) satellites with intraday revisit rate collection. SatRevolution is seeking to deploy large satellite constellations for electro-optical imagery. Maxar, Planet, and BlackSky have contracts in place with the NRO for their data.

## SPACE-BASED RADAR

Companies such as Capella, PredaSAR Corp, ICEYE, Umbra Lab, XpressSAR, EOS, NeoSAR, TerraSAR, TerraSAR-X, TanDEM-X, Cosmo-SkyMed, RADARSAT, and Synspec, are developing commercially owned synthetic aperture radar satellites, which can take imagery of the Earth through different atmospheric conditions during the day and at night. In June, Capella Space announced a cooperative research and development agreement with the National Geospatial-Intelligence Agency (NGA), and in October 2021, they signed a study contract with the NRO and is currently providing radar imagery to the government. Iceye has 13 satellites currently on-orbit. Capella Space now has seven satellites on orbit. ICEYE has established a CRADA [Cooperative Research and Development Agreement] with the U.S. Army Space and Missile Defense Technical Center (SMDTC) in June 2021 and expects to have a CRADA with NGA by April 2022. Airbus U.S., ICEYE U.S., PredaSAR, and UMBRA also have NRO study contracts.

## INFRARED AND HYPERSPECTRAL

Companies are also proposing remote-sensing satellite systems, with technology that could theoretically identify chemical composition, which might help agricultural conglomerates better decide what crops to plant in which fields but also can be used to spot a camouflage tarp hiding a weapon

system. In 2019, HySpecIQ was awarded a contract with the NRO for a commercial hyperspectral imaging study. Other commercial providers include Teledyne, Orbital Sidekick, and Hypersat.

## MULTI-PHENOMENOLOGY SERVICES

Maxar is doing this with several partners to combine their GEOINT capability with other sensor types. Ursa is developing an application for leveraging SAR from many providers in a software application. And start-up MINT is looking to put up constellations of satellites with EO, RF, and SAR sensors on separate vehicles to tip/cue each other within the same commercial family.

## SPACE-BASED ELECTRONICS AND SIGINT

HawkEye360 and Aurora Insight offer satellite-based radio frequency (RF) remote sensing collection. By detecting and geolocating a range of radio frequency emitters, this could be valuable for transportation tracking and search and rescue, among other applications. HawkEye 360 won a contract from the NRO in 2019 and is currently providing RF remote-sensing data to several mission partners for use-case validation and some operational support. Using this technology, HawkEye 360 began monitoring GPS interference in late 2021; shortly before Russia invaded Ukraine, they detected Russian jamming of GPS signals around Chernobyl before Russians forces attacked. USSF's Space Systems Command is developing tools for detecting, locating, and ultimately mitigating radio frequency and GPS interference. Maxar has identified cemetery extensions near Maripol, Ukraine, at both Vynohradne and Manhush.

## RF SIGNATURES

Commercial RF developers Spire (a U.S. concern) and Kleos (an international partner) are building constellations to sense and geolocate RF signatures for applications like tracking ships. They use RF "externals" (dots on maps representing frequencies) to map out and geo-locate RF threats.



Google Earth

In 2014 China occupied and built an artificial island on Fiery Cross Reef in the South China Sea, capable of supporting nearly any type of aircraft in China's inventory. While some reconnaissance can be accomplished with aviation assets, persistent surveillance, especially over denied areas, can only be feasibly and effectively provided from space.

# AFA IN ACTION

Updates on AFA's activities, outreach, awards, and advocacy.



## AFA Nominees 2022-2023

### Candidates for National Office and the Board of Directors.

The Air & Space Forces Association Nominating Committee met by video conference on May 14, 2022, and selected candidates to send forward for National Officer positions and National Director positions on the Board of Directors. The Committee consists of two past Chairmen of the Board (in addition to the current non-voting Chairman), one person selected by each of the two Vice Chairmen of the Board, two representing each geographic area, and one person each representing the Total Air Force, Air Force veterans, and aerospace industry constituencies. The slate of the candidates will be presented to the delegates in September.

#### CHAIRMAN OF THE BOARD



**Bernie Skoch**, Elkins, Ark., nominated for a first-year term as Chairman of the Board, joined AFA in 2010, becoming a Life Member in 2018. Skoch served 29 years in the Air Force, involved in a variety of communications roles and became Director of Communications Operations, Office of the DCS for Installations and Logistics, USAF, Washington, D.C. Prior, he served as the first-ever Principal Director for Network Services and Customer Advocacy at the Defense Information Systems Agency, Arlington, Va. He performed various duties on the Joint Staff supporting the National Military Command System and developing the Global Command and Control System, rising to the rank of Brigadier General. Skoch's previous AFA involvement began by launching AFA's CyberPatriot National Youth Cyber Education Program as National Commissioner, growing the program to one of the most widely regarded and successful cyber-focused STEM programs in the nation. He then became the Executive Lead for AFA Strategic Events boosting the profile, revenue, and attendance of AFA's Air, Space & Cyber Conference and also transforming AFA's Warfare Symposium into a showcase featuring the best of Air Force innovations. Skoch earned a bachelor's degree in industrial engineering from the University of Arkansas and a master's in management and supervision from Central Michigan University. He received the AFA President's Citation for exceptional leadership (2019); AFA's Chairman's Aerospace Education Award (2020); AFA's Hoyt S. Vandenberg Award for most outstanding contribution in the field of aerospace education (2021); and helped put AFA in position to be awarded the Trade Show Executives "Fastest 50" award for exceptional growth in attendance and exhibit sales. Skoch currently serves on the Military Cyber Professionals Association Board; the Civil Air Patrol Board of Governors; is a Senior Advisor for Aerospace/STEM Education on the AFA Education Council; and is presently AFA's South Central Region President.

#### VICE CHAIRMAN OF THE BOARD, FIELD OPERATIONS



**James W. Simons**, Minot, N.D., nominated for a third-year term as Vice Chairman of the Board, Field Operations has been an AFA member and Community Partner since 1995. Simons has held AFA positions including David C. Jones Chapter President and Treasurer, North Dakota State President, and the North Central Region President. He was a charter member of the AFA Field Council and also served on the National Membership Committee. Simons has received the AFA Medal of Merit; Exceptional Service Award; Chairman's Citation (2009); National Member of the Year (2014); and the Mary Anne Thompson Award (2009). He previously served AFA as the National Director, Central Area. Simons earned a bachelor's degree in criminal justice from Michigan State University, a master's degree in systems management from the University of Southern California, and a master's degree in administration of justice from Wichita State University. A retired U.S. Army Military Police Officer, and a retired financial adviser for a financial services company, he now spends his time serving Airmen and Guardians. His volunteer work includes treasurer of a local community group. He is involved in Arnold Air Society/Silver Wings and is a member of the 2022 Wings Society.

#### VICE CHAIRMAN OF THE BOARD, AEROSPACE EDUCATION



**Stephen K. Gourley**, Aurora, Colo., nominated for a second-year term as Vice Chairman of the Board, Aerospace Education, joined AFA in 2007 and has served as the Mile High 127 Chapter President and Colorado State Executive Vice President and President, member and Chair of the AFA Strategic Planning Committee, and is the former Director of the StellarXplorers program. He is currently serving as Colorado Mile High 127 Chapter Vice President, Aerospace Education, and State Vice President, Veterans Affairs. As the Vice Chairman, Gourley also serves as Chair of AFA's Education Council. He has been Colorado Member of the Year (2020) and received every other level of Colorado recognition, as well as a National level Medal of Merit Award (2012), Exceptional Service Award (2013), a Special Citation (2015), and a Chairman's Citation (2016, 2021). Gourley earned a bachelor's degree in aeronautical engineering and a master's degree from the MIT and a master's degree in national resource strategy from National Defense University. He retired from the USAF after more than 26 years of service in the space field, working in science and technology; research, development, test, and evaluation; operations, and command. He currently works as the president of an engineering and management consultant company.

## NATIONAL SECRETARY



**Michael J. "Mike" Liquori**, Springfield, Mass., nominated for a second-year term as National Secretary, has been an AFA Life Member since 2000. He received his bachelor's degree in mathematics from Boston University and a master's degree in managerial economics from the University of Oklahoma. He is a retired lieutenant colonel having served on Active duty for 12 years and as an Individual Mobilization Augmentee in the Air Force Reserve for 13 years. He is a member of the Martin H. Harris Chapter (Fla.) where he has served as President, Executive Vice President, AF Gala Chairman, AWS Awards Chairman, AWS Golf Chairman, and webmaster. Liquori was selected as an AFA Emerging Leader in the 2014-2015 class. At the national level he has served as Chairman of the Membership Committee and Audit Committee and he has also previously been a member of the Field Council, Nominating Committee, and Finance Committee. Liquori received an AFA Medal of Merit (2009), Exceptional Service Award (2012), and a Chairman's Citation (2013, 2019). He currently works in the real estate development/asset management field in Orlando, Fla.

## NATIONAL TREASURER



**Charles L. Martin Jr.**, Fort Mill, S.C., nominated for a third-year term as National Treasurer. An AFA Life Member since 1977, Martin has served as AFA National Treasurer, on the Finance Committee, and the Fresh Look Initiative Committee. Martin has received the AFA Special Citation; AFA Medal of Merit; AFA Colorado Chapter Meritorious Service Award and Certification of Appreciation; and AFA Scheidecker Award. He earned a bachelor's degree in economics from Manhattan College, N.Y., and an MBA in accounting from Michigan State University. Retiring after 28 years in the USAF as a comptroller, he served in executive staff or volunteer positions in national not-for-profit associations. Chuck holds certifications as an Internal Auditor and an Association Executive. His volunteer memberships now include the S.C. Governor's Task Force on Military Organizations, VFW, Indian Land Post-Investment Committee, Sun City Carolina Lakes Finance & Investment Committees, and Audit Committee, American Academy of Audiology.

## NATIONAL DIRECTOR AT LARGE

*The Nominating Committee submits four names for National Director at Large. Two will be elected for a three-year term. (Only two names were submitted this year)*



**Paul Hendricks III**, North Texas, an AFA Life Member, joining in 1973. He retired as a lieutenant colonel from the USAF after 20 years with service flying B-52Ds in Vietnam and serving as a Requirements Development Manager, and B-1B Flight Test and Development Manager. Hendricks received the Distinguished Flying Cross (1972); Air Medal (1972); Air Force Commendation Medal (1975, 1982); and Meritorious Service Medal (1985, 1990). He served as a Chapter Executive Vice President (2015-17); Chapter President (2017-2020); Vice President Government Affairs (2020-present); in the Emerging Leader Program (2020); and currently serves as the Texas State President. Hendricks also has chaired the Advocacy Field Subcommittee since 2020 and was on the Strategy Committee (2021). AFA awards received are: Freedom Medal; Medal of Merit (2017); Exceptional Service Award (2018); and the Chairman's Citation (2021). He served as a Program Manager for Rockwell/Boeing for 21 years supporting the B-1B development and maturity programs. Hendricks has served in his community on the Fairview Town Council as the Mayor Pro Tem and as the Vice Chair for the Planning and Zoning Commission. In 2014 he founded the Veterans Center of North Texas whose mission is to prevent Veteran homelessness and assist Veterans in establishing productive lifestyles. The organization was awarded the Texas Civilian Organization of the Year in 2021.



**Gabbe Kearney**, Alexandria, Va., is a Life Member who joined AFA in 2008 as part of the Arnold Air Society through ROTC. She has served as a member of the USAF for the past 10 years, recently performing duties as a Maintenance Operations Officer. Kearney's AFA involvement includes State President, Chapter President, Chapter Vice President, Vice President Aerospace Education, and Vice President of Communications. She has also served on the Chapter EXCOM, Aerospace Education Committee, and currently leads the Field Emerging Leaders Program as part of the D.W. Steele Memorial Chapter (Va.). Kearney was awarded the AFA Member of the Year Award (2021); Exceptional Service Award (2020), and the Medal of Merit (2019). She has also been active on AFA's Field Council, Aerospace Education Council, Advocacy and Finance Committees, as well as the Governance and Bylaws Committee. In addition, she was named Arnold Air Society's National Honorary Commander (2022). Kearney graduated with a bachelor's and master's from Michigan State University with degrees in political science and education and graduated from the Air Force's Maintenance Weapons School as a Distinguished Graduate (2016). She served for 10 years volunteering with Arnold Air Society and Silver Wings as a National Administrative Consultant. She is currently a member of the Oregon Air National Guard and works full time with one of GE Aviation's Leadership Programs. She co-founded the Leadership Consulting business Good Luck Don't Suck Consulting Group and published their first book "Good Luck, Don't Suck: A Tactical Guide to Early Success in the Workplace" (2020).

## NATIONAL DIRECTOR, CENTRAL AREA

*The Nominating Committee submitted one name for National Director, Central Area, who will be elected for a two-year term.*



**Janelle Stafford**, Shawnee, Okla., an AFA member who joined in 2016 starting out as a Community Partner. She has served as Chapter President, Chapter Vice President and Chapter Secretary for the Central Oklahoma Gerrity Chapter, Oklahoma State President, State Treasurer, and is currently the Texoma Region President. Stafford served on the Strategic Planning Committee (2020-21); Membership Committee (2020-21, 2022), Elections Committee (2019); and as Supervisor of Elections (2020, 2021). She received the Community Partner of the Year Award (2017-2020); Medal of Merit Award (2019); Exceptional Service Award (2020); Chapter Officer of the Year (2019); Chapter and State Person the Year (2020); and was a member of AFA's Emerging Leaders (2020-21). Stafford graduated with a bachelor's in political communications from Oklahoma Baptist University and attended the University of Oklahoma School of Law. She currently works as a Regional Business Development Manager at Moog, Inc., an Aerospace and Defense company and volunteers at all levels of AFA and also in her community.


# Scholarship Awarded to Ohio Cadet

**Air & Space Forces Association Steel Valley Ohio Chapter** presented Cadet Bryce Moleski on Feb. 11 with a \$500 scholarship presented by retired CMSgt. Theodore A. Pifer (USAF), chapter president. The chapter serves the Youngstown Air Reserve Station, its Air Force community, and greater Youngstown-Warren area in Ohio.

Moleski is a student in Air Force Reserve Officer Training Corps Det. 630 at Kent State University in Ohio. An Assistant Professor of Aerospace Studies at the University, Maj. Richard T. Spencer submitted his name for consideration to earn the scholarship. Spencer said, "Cadet Moleski is the epitome of servant leadership when it comes to assisting fellow cadets and creating a feeling of belonging and serving a greater cause than one's self."

Cadets interested in AFROTC at Kent State are required to take two classes per semester concentrating on: Aerospace Studies where they learn the basics of Air Force and Space Force leadership, management topics, and national security issues; and Leadership Laboratory, which includes physical fitness assessments, field days, drills and ceremonies, leadership studies, leadership-building exercises, as well as Air Force/Space Force career days.

AFA and its chapters provide students with a variety of scholarship options to advance their educational pursuits and to promote the Air and Space Forces mission.

For more information please see <https://www.afa.org/education-support/scholarships>. 




Maj. Christopher Finn, USAF

Left to right: Steel Valley Ohio Chapter President USAF CMSgt. Theodore A. Pifer (Ret.), Cadet Bryce Moleski, and SMSgt. Mike Mount. Moleski from AFROTC Det 630 received a \$500 scholarship from the AFA Steel Valley Chapter.

# Reaching Kids With STEM

Endeavor Elementary School, an AFA Community Partner in Florida, hosted a STEM outreach event for fifth-graders on May 6, its first since the COVID-19 pandemic limited in-person opportunities for mentors, academics, and scientists to introduce STEM opportunities to children in Brevard County.

In cooperation with AFTAC—Air Force Technical Applications Center—**AFA's Space Coast Chapter** Vice President for Aerospace Education Russell Lewey presented tech and science demonstrations including a Tesla Coil, liquid nitrogen, quantum levitation, a Van De Graaf generator, and explored the Bernoulli Principle with a windbag demonstration. Lewey and the AFTAC team then led a discussion with Endeavor teachers to discuss AFA/AFTAC and STEM opportunities appropriate for classrooms.

Endeavor's STEM coordinator wrote "The kids were so excited. ... One even [said] I needed to write down the name SrA. William Saunders for him," because the Airman made a big impact, and he needed to remember his name so he can "be like him." 



Courtesy

Senior Airman Dale George and Senior Airman William Sanders run an experiment using liquid nitrogen.



By Megan Tucker

# Bringing STEAM to Life

When Megan Tucker's annual Flight Funday Fest lifted off at Hillsboro Charter Academy, in Hillsboro, Va., in June, it was a community collaboration that drew together dozens of students and volunteers from AFA and Civil Air Patrol, along with aviation authors, commercial pilots and flight attendants, and a local meteorologist. Together, they executed a jam-packed day of aviation science and fun, an exciting day of fun and learning for the kids.

Tucker's enthusiasm for flight is nothing new. The 2021 Air & Space Forces Association/Rolls-Royce National STEM Teacher of the Year, an AFA member herself, revived Flight Funday Fest after a two-year, COVID-19-induced hiatus. To do so, she pulled in support and encouragement from AFA volunteers including Jim Hannam (former vice chairman for aerospace education), Melanie Jones (representing the **Gen. Charles A. Gabriel Chapter**), and AFA Board Member Susan Mallett, who traveled from Alabama to participate.

Flight Funday kicked off with the posting of colors by a CAP Cadet Color Guard from the Leesburg Composite Squadron, and continued with a remote-control airplane demonstration, motivational talks on mentorship and science, technology, engineering and mathematics (STEM) careers. School principal Paul Vickers addressed the students while flying as a passenger in a CAP Cessna, and hands-on activities continued throughout the day.

Students took part in rotating, volunteer-led sessions, such as hoop




**Capt. Stephen Caldwell, American Airlines and former Navy Pilot showing our scholars his RC planes and drones.**

glider and whirly-gig engineering, rotorcraft design, flight, aviation-associated meteorology, thermal effects, and drone pilot instruction with stunt flying and virtual reality goggles.

Tucker is Hillsboro Charter Academy's Dean of Curriculum and the school's STEAM—that's STEM plus art—specialist. She's also a member of AFA's Gabriel Chapter. In planning the day, she built in time for an aviation-themed movie at lunchtime and a student challenge: build an aircraft using manipulatable playground equipment. The day concluded with fifth-grade students performing a rocket-launching demonstration and the Smokehouse Pilots Flying Club demonstrating formation flying and skywriting overhead in two RV-7 aircraft.

"Civil Air Patrol and the Air & Space Forces Association are proud to jointly support teachers across the nation," said Mallett, AFA Central Area Board Member and CAP National HQ Education Outreach coordinator. "This flight day is an example of how any AFA chapter can join forces with CAP to support STEM programs for local teachers at no cost."

Mallett invited others to contact her and other volunteers for help in building their own collaborations in their home areas.

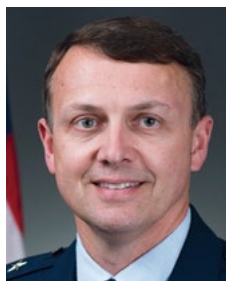
The real beneficiaries of the fun and opportunity were the kids. "We worked really hard on our rockets," said one fifth-grader, Cameron. "The best part of Flight Funday Fest for me was launching them into the sky at the end." 

## Two AFA Members Inducted into AFC4A Hall of Fame

The Air Force Communications, Command and Control, and Computers Association (AFC4A) on May 2 inducted two Air & Space Forces Association members into their Hall of Fame. The Class of 2020 included Maj. Gen. Earl Matthews and Col. Richard Lipsey. Brig. Gen. Walter Jones and Col. Phillip Heacock were also inducted.

The AFC4A Hall of Fame recognizes and honors military personnel and civil servants who made significant contributions toward innovation, creativity, and application of new technologies. Matthews finished his career as Director of Cyberspace, OSD, Pentagon; and Lipsey as vice commander, 24th Air Force, the USAF component of U.S. Cyber Command.

Dignitaries attending the ceremony included Lauren Knausberg-



**Maj. Gen. Earl D. Matthews**




**Col. Richard Lipsey**



**Brig. Gen. Walter Jones**



**Col. Phillip Heacock**

er, CIO for the Department of the Air Force, and Jim Lauducci, also a Hall of Fame inductee and former AFA Vice Chairman of the Board for Field Operations. The 92 inductees to date include such luminaries as Gen. Edwin Rawlings (also honored by AFA with a Citation of Honor in 1958), Lt. Gen. Lee Paschell, Lt. Gen. Harold Grant, and Brig. Gen. Billy Mitchell. 



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- 1 1st Lt. John Harold Buckley
- 2 Buckley Air Field in 1948
- 3 Satellite intelligence-tracking radomes at Buckley SFB, Colo.

# BUCKLEY

## Tragedy over France

The 1918 Meuse-Argonne offensive was the biggest U.S. armed campaign ever to that point. Among 26,277 American dead was 1st Lt. John Buckley of Longmont, Colo., who met a truly tragic end.

John Harold Buckley—today's Buckley Space Force Base, Colo., honors his name—was born in 1895 into a family of achievers. The family trait rubbed off on "Buck," as he was called. At Longmont High School he was an honor student and track star. At University of Colorado he continued to shine in academics and sports.

In 1914, however, the World War erupted. Buck joined the National Guard in March 1916. Within weeks, Washington mustered his unit to fight on the Mexican border, though it didn't deploy.

Buck returned to college and stayed in the Guard. The U.S., when it went to war in April 1917, federalized his unit. Buck, a month from graduation, left school and transferred to Army aviation.

Buckley took officer training and was commissioned at Fort Riley, Kan., primary pilot training at Chanute Field, Ill., and advanced flight training at Gerstner Field, La. By late 1917, he was a pilot in the 28th Aero Squadron and on his way to France.

From the day Buckley arrived, he knew he would see major combat. The air was thick with rumors of a big U.S. offensive in the works. His squadron trained relentlessly at Issoudun, France.

Flying from Vaucouleurs Aerodrome, Buckley saw his



2



3

### JOHN HAROLD BUCKLEY

**Born:** July 8, 1895, Longmont, Colo.  
**Died:** Sept. 27, 1918, near Lisle, France  
**College:** University of Colorado  
**Occupation:** U.S. military officer  
**Services:** Colorado National Guard; U.S. Army—Signal Corps, Air Service  
**Main Era:** World War I  
**Years Active:** 1916-18  
**Combat:** Western Front (Meuse-Argonne Offensive)  
**Final Grade:** First Lieutenant  
**Honors:** World War I Victory Medal, Purple Heart (posthumously awarded)  
**Resting Place:** Meuse-Argonne American Cemetery, France

### BUCKLEY SPACE FORCE BASE

**Service:** United States Space Force  
**State:** Colorado  
**Nearest City:** Aurora  
**Area:** 6 sq mi / 3,840 acres  
**Status:** Open, operational  
**Opened as Demolition/Bomb Range:** January 1938  
**Renamed Buckley Field:** June 14, 1941  
**Inactivated:** Sept. 30, 1946  
**Commissioned (Navy) as NAS Denver:** Sept. 28, 1947  
**Decommissioned (Navy):** June 30, 1959  
**Conveyed to USAF:** July 1, 1959  
**Renamed Buckley ANGB:** April 18, 1960  
**Converted to Buckley Air Force Base:** Oct. 1, 2000  
**Renamed Buckley Space Force Base:** June 4, 2021  
**Current owner:** Space Operations Command (USSF)  
**Former owners:** Technical Training Command (AAF); U.S. Navy Reserve; Colorado Air National Guard; Air Force Space Command (USAF)  
**Home of:** Space Delta 4 (USSF)



first combat. He and his squadron mates joined the St. Mihiel Offensive, dropping "hand bombs" on German ground targets. This posed severe risk, because it required attacking at very low altitude.

On Sept. 20, the squadron moved to Lisle-en-Barrois Aerodrome, much closer to the front. For the next week, its pursuit aircraft flew reconnaissance missions.

Buckley saw action when the Meuse-Argonne Offensive began on Sept. 26. Earlier, he had said: "If I knew tomorrow would be my last flight, I would still go with the same thrill that I have today." As it turned out, Sept. 27, 1918, was the last day of his life.

In heavy rain, Buckley and five other pilots took off in their Spad XIII's and formed up—encased in thick clouds—at 10,000 feet. They flew left-hand-turn circles, waiting for two other pilots to join the formation.

Visibility was poor. Suddenly, Buckley's Spad and another flown by 1st Lt. Kenneth Bell were seen to be a collision course. Both pilots dived and one turned away, but the left wing of one struck the left wing of the other, and both wings tore away.

The aircraft fell into a death spiral, crashed, and exploded, killing both Buckley and Bell. As in classic tragedy, neither protagonist could have avoided his fate.

Buckley Air Force Base was formally created in 2000, though antecedents reach back to 1938. It was renamed Buckley Space Force Base on June 4, 2021. It is home of Buckley Garrison, Space Delta 4, and other space-related organizations.

Buckley Space Force Base, 140th Wing/  
Facebook; Buckley SFB/Facebook



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