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AIR FORCE

MAGAZINE



Chosen for Chief

A Pre-Nomination Interview with Gen. C.Q. Brown | **8**



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Photo: Airman 1st Class Caitlin Russell

Gen. Charles Q. Brown Jr. See "Q&A: What's on the Mind of Gen. C.Q. Brown," p. 8.

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Competition and COVID-19

This is the era of great power competition, and the means of competition are growing increasingly clear and diverse.

We are building a Space Force because competition and risk is growing in space. The Air Force sent a B-52 bomber to Africa in February, not to drop bombs, but to demonstrate U.S. military power and strength and communicate American resolve and commitment. The message was for allies and enemies in Africa—and for China, which is competing for those allies' allegiance. So, it is no accident when President Donald Trump calls the coronavirus that caused the COVID-19 pandemic "the Chinese Virus." This, too, is competition.

It works both ways.

The virus originated in China's Hubei province, and was initially called, even by the Chinese, the Wuhan virus, after the city where it began. Now, fearful of a potential international backlash and eager to leverage its wealth, China is offering aid in the form of masks, medical advice, and other equipment to eager recipients around the globe. This is the kind of generous aid for which the U.S. has long been known. Indeed, during many past crises, the U.S. was the only nation large and rich enough to provide significant emergency relief.

No more.

China's global charm offensive is competition of another sort. Like its claim that it never "engaged in any form of cyber theft" (see "Verbatim," p. 5), China's declarations in mid-March that it had registered no new confirmed cases of the coronavirus are what President Trump might call "fake news" and former Vice President Joe Biden would dub "malarkey." When China amended that claim a few days later, saying the only new cases it registered were individuals arriving in China from someplace else, China was competing. Its message: China had overcome the crisis, while Western nations were shutting down under pressure.

Was China lying? Not necessarily. China may well have stopped testing its citizens at home; doing so is only useful in tracking the spread of the disease, and once it has spread, further testing is essentially pointless. Without a cure, only symptoms can be treated, and treatments are the same whether one tests positive or not.

Projecting to the world that China is the good Samaritan, acting as a kindly neighbor to its brother nations, is not altruism. It is competition. Unburdened by the ugly business of democracy and debate, China was able to present omniscient competence to a world undergoing unprecedented economic upheaval. This was opportunism, not altruism.

Over the past few years, as Pentagon leaders embraced the concept of great power competition, many failed to grasp the full context of that message. Now, it should be clearer. This competition is not just a 21st century arms race. It's a full-on rivalry, the likes of which we have not seen since the Cold War. Then, the Space Race and the Olympics were tests of national competence, used to demonstrate the merits of competing systems. It was messy democracy and capitalism versus centralized, single-party authority. It was long-haired American amateurs against grim-faced Russian professionals, each playing for national pride. In their different

responses to the pandemic, each nation—indeed, each state—is likewise competing, showing its people and its neighbors how leaders believe the crisis should be handled. Is our country getting it right? Is there a better way ahead?

Competition for superiority applies to every aspect of every system, including diplomacy, commerce, and emergency response.

Meanwhile, the business of government goes on. Even as Congress and the administration shift their focus to the crisis before them, the legislative sausage-making—that is, the budget process—continues. Here, we can see a different kind of intense competition, as the military services grapple for relevance and funding at the end of an era of plenty.

Budgets will be flat at best for the foreseeable future. Indeed, in the aftermath of the pandemic-fueled financial crisis, that may be overly optimistic. At the same time, each of the military services is busy reinventing itself with an eye toward being capable of waging war with China a decade from now. The Air Force is giving up near-term capacity in tanker, fighter, and close-air-support aircraft

to develop future capabilities, including hypersonic missiles and a combat-cloud-like connectivity that will enable everyone in the battlespace to exchange targeting, location, and other data in real time. If successful, it will revolutionize warfare by presenting enemies with an overwhelming, complex, and perpetually changing threat picture.

Similarly, each of the services is trying to invent a new future in which its branch of the military is central to a future contest with China. The Army is imagining long-range artillery with a range of 1,000 miles or more—taking aim at target sets traditionally left to the Air Force or Navy. The Navy is rethinking its aircraft carrier battle groups for an age when maneuverable hypersonic weapons could turn those 4.5 acres of floating, sovereign U.S. territory into big, slow targets—or worse, vast, mass graves at the bottom of the sea. The Marine Corps' plan is to cut back battalions, helicopters, and jump-jets—and dispense with tanks—in favor of new, unmanned aircraft and long-range cruise missile batteries it can deploy from high-speed landing craft.

Logic must prevail. Not every service will be relevant to every fight. Investment must be prioritized to fund capabilities and strategies that will best deliver the needed effects. America will never fight a land war in China; it could not possibly win. China's strategy is designed to threaten its neighbors and to keep the United States at a distance. Russia's strategy is similar—it, too, intimidates neighbors and is developing long-range strike capabilities intended to hold U.S. military assets at risk. Both are likewise highly skilled in cyber warfare, recognizing those skills as critical to threatening Western democracies and their powerful modern economies.

More than any other, two U.S. military services are critical to neutralizing such long-range threats and, if necessary, to defeating them. Unique in all the world, the capabilities wrought by the U.S. Air Force and U.S. Space Force are unmatched today. The imperative for the Pentagon and Congress is to ensure that fact remains true in 2030 and beyond.

This is the era of great power competition, and the means of competition are growing increasingly clear and diverse.



Mission Impossible

As a civilian, I read with great interest Rachel Cohen's article "Space Force is Here" [January/February, p. 44] and the editorial "Launching the Space Force" by Tobias Naegele about the challenges facing the newest branch of the military, from its operations to its public image.

As a science fiction fan, I was admittedly intrigued by speculation over what the future uniforms for the sixth military branch might entail. Suggestions included necktie-less suits and naval-style sleeve lace to create a distinctive military culture for the information age.

My 2 cents is that a uniform along the lines of the 1990s minimalist Merrill McPeak service dress—but fly-fronted with a mandarin stand-up collar—would look sharp. A retro peaked bell-style cap and black pants could complete the uniform.

On one hand, such a streamlined service dress uniform would be akin to those seen in "Star Trek" and "The Expanse," yet it also would be descended from historic uniforms—the blue service dress worn by the U.S. Navy from the 1880s through World War I and the U.S. Army "shell jackets" of the Civil War.

Benjamin Turon
Ballston Spa, N.Y.

I would hope that Gen. [John] Raymond and his transition staff will turn to original source documents prepared in the mid-1970s by Gen. Bob Herres and Maj. Gen. Stuart Sherman Jr., who designed the original Space Command from several major Air Force commands under the watchful eye of CINC/SAC Gen. Russell Daugherty. Their bold leadership laid the groundwork for what became Air Force Space Command, under the command of a four-star general. While none

of these leaders are alive today, Gen. Lance Lord, who was at one time commander of AFSC, is alive and well. I am sure he could provide a wealth of hands-on, organizational, and operational perspective that might be helpful. I hope that General Raymond will turn to the current space operators and earlier generations to work out the knotty details he is facing..

Col. Quentin M. Thomas,
USAF (Ret.)
Woodstock, Ga.

Gene Roddenberry based "Star Trek" on Project Solar Warden—"The Secret Space Program." It is said that Roddenberry attended a meeting at the Pentagon just before receiving a call from Desilu Productions (Desi Arnaz & Lucille Ball)—the truth is stranger than fiction. The reason for the similar logo is because of Roddenberry's vision (along with some real intel). Of course, the public will not see things this way. The public has no idea that the "new Space Force" is about 40 years old.

Donnie Brooke
Grovetown, Ga.

McGee's Flights

The January/February issue mentioned Tuskegee Airman Charles McGee being given an honorary promotion to the rank of brigadier general, an event that I applaud, partly because I have known him for many years. I have spoken with him many times. Having worked at the Air Force Historical Research Agency for 37 years, I have written multiple books and articles about the Tuskegee Airmen. There is one error in your article I would like to see corrected. The article claimed that McGee's 409 combat missions remains a record, suggesting that no other Air Force pilot who flew fighters in World War II, Korea, and Vietnam, had more combat missions. At least two other USAF pilots, who also flew fighters in the same three wars, flew more combat missions in those wars: Col. Ralph S. Parr, with 641 combat missions, and

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—The Editors

Col. Harold S. Snow, with 666 combat missions.

Daniel Haulman
Montgomery, Ala.

Speed Limits

I just read the excellent article "The Bone is Back" by Brian Everstine [January/February, p. 34]. It was a great summary of the B-1B recovery from "overuse" through the devotion of devoted maintainers. Unfortunately, one piece of questionable information was repeated several times describing the B-1B as being "supersonic"—including attributing its rapid deployment to these supersonic speeds.

The original B-1A was a supersonic bomber. For the production B-1B that was resurrected years later, the variable intake ramps were removed for cost reasons. This limits the B-1B to high subsonic speeds in virtually its entire envelope. The only exception would be a very high altitude dash—which doesn't help the rapid deployment. Deployability is based on range, fuel capacity, fuel burn, and refueling capability. High subsonic is good enough for now.

This, by the way, leaves the FB-111A as the last U.S. supersonic strategic bomber. Back in 1975, we had a training requirement to make a supersonic high-altitude dash at 2.2 Mach. We never exercised the low-level speed capability, but like its TAC

(Tactical Air Command) cousins, it could perform low-level, terrain-following cruise at 1.2 Mach. If you wished to go faster (up to 1.5 Mach), you had to hand-fly the bird.

Cdr. John C. Hall,
U.S.N. (Ret.)
Newcastle, Wash.

OK, Boomer

The KC-46 tanker issue is a worrisome one for USAF. Boeing has left no options but to stop production on a platform that doesn't meet the specifications set in the contract. Convene a critical-design review panel and look strongly at the boom pod as it's currently on the KC-10. The remote visual system isn't working, and everyone knows it!

Ask yourself this: Would you like to be refueled by a system that requires multiple cameras and have anyone of them go inoperable while on the boom? What about when the tanker goes through the clouds and the receiver is on the boom? And don't tell me it hasn't happened because it's against regulations, because there isn't a fighter pilot out there that has not had that happen to him or her when a tanker went through the clouds and they stayed on the boom to get the gas they desperately needed to complete the mission. The same goes for the other platforms that are receivers. It happens all the time. Nothing beats the boomer with Mark One Eyeball when you

need fuel, especially at night.

Gen. Maryanne Miller has the power to fix this.

Do the right thing, stop production on a platform that isn't meeting the specifications set forth, and send Boeing a message.

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

What is the "operational requirement" that drove moving the boomer from the rear of the KC-10 and KC-135 to the front cockpit of the KC-46? How were the KC-10 and KC-135 failing with the boomer in the back of the aircraft? No one has ever answered those questions. For over 60 years, boomers have admirably performed the refueling mission from the back of the KC-10 and KC-135. There haven't been any glitches with that system.

Now, for some unknown reason, there's a requirement for them to be in the front cockpit, looking at a TV screen that gives them 20/50 vision with no depth perception, which is delaying full employment and deployment for years. I really hope they can articulate an operational requirement, because if it was for the sake of technology and cool points, we have failed.

Col. Seth Bretscher,
USAF (Ret.)
Lafayette, In.

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Photo: Mike Tsukamoto/staff

Space Power

"We now live in a world where there are threats in space, there are actors who wish to do us harm in space and we need to understand deeply what's there, who owns it, what its capabilities are, what it's likely to do and whether or not it poses a threat. ... There are plenty of people who are watching and have been watching for decades and those people live in China and those people live in Russia. ... The first thing they've been preparing to do is to take away our space capabilities. The second thing they are doing is recognizing how powerful space power is as part of a joint force."

Lt. Gen. David Thompson, vice commander of U.S. Space Force, speaking at AFA's Air Warfare Symposium in Orlando, Fla., on Feb. 27.

Who, Us?

"The Chinese military has never engaged in any form of cyber theft. The U.S. accusation is groundless and totally hegemonic."

Senior Col. Wu Qian, spokesperson for China's Ministry of National Defense, on Feb. 13 in response to the U.S. Department of Justice charging four Chinese military members for hacking Equifax, a U.S. credit-reporting firm, in 2017.

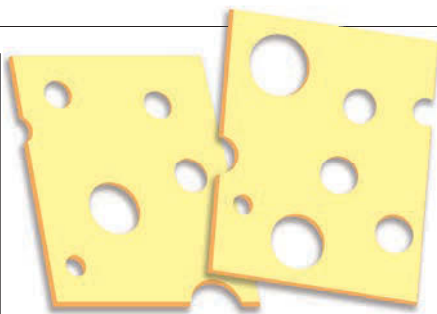


Illustration: Mike Tsukamoto/staff

Hole-y War

"If I see one more slide with a big red dome over China I'm going to execute choke-con on the slide builder. China cannot put a ... red dome over itself. It can put a block of Swiss cheese. My job is to know where the holes are, get in, and hold targets at risk at the time and place of the Commander in Chief's choosing."

Chief of Staff of the Air Force
Gen. David Goldfein to the House Armed Services Committee on March 4.



Photo: Roland Balik/USAF

Unsung

"Those in sustainment are heroes, keeping old airplanes flying decades past the point they were originally envisioned to serve. ... That logistics and sustainment is the difference between having an Air Force and an airshow. Lots of countries have airplanes they can go fly at events. But ... to deploy, anywhere around the world? That capability is undergirded by that sustainment and logistics enterprise."

Will Roper, Air Force acquisition chief, Feb. 28 press conference at AFA's Air Warfare Symposium in Orlando, Fla.

KEEP OUT

"We are not going to fight against anyone. We are going to create conditions so that nobody wants to fight against us"

Russian President **Vladimir Putin** in an interview with the state-run TASS news agency about new Russian weapons, March 2020.

Nuclear Crossroads

"The entire triad is reaching the end of its useful life. Either we replace what we have now, or start to divest!"

Adm. Charles Richard head of U.S. Strategic Command [Defense News, Feb. 28].

Think Twice

"You don't get to shoot at our bases, kill and wound Americans, and get away with it!"

Defense Secretary **Mark Esper**, at a March 12 Pentagon press conference after Iranian rockets struck Camp Taji, Iraq, killing 12 and wounding 12.

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The perfect fit



What's on the Mind of Gen. C. Q. Brown

The Air Force announced Gen. Charles Q. Brown Jr.'s nomination to become Chief of Staff in March, just days after Air Force Magazine News Editor Amy McCullough and Editor-in-Chief Tobias Naegele caught up with him for an interview during the Air Force Association's Air Warfare Symposium in Orlando, Fla. Once confirmed, Brown will become the 22nd Air Force Chief of Staff, replacing Gen. David Goldfein. His comments here have been edited for space.

Q. The National Defense Strategy focuses on the pivot to the Indo-Pacific. How do you change the playbook to make that happen, and what kind of progress are you seeing so far?

Part of it is education. And, what I mean by that is, the decision-makers [and] policymakers have to have a better understanding of the Indo-Pacific Theater. Because of what we've done over the past 25-plus years since the Cold War in Europe, and in our alliance with NATO, we have a comfort zone there. I don't know that the Indo-Pacific is an area that is well understood. The more we have decision-makers come out and visit the region and get to know the partners [there], they will have a better appreciation of the region and how we need to look at the threat as well as our partners. It's not one size fits all.

The size of the region is roughly five times the size of the [U.S. European Command] AOR. But then you also have different dynamics in the AOR. You know, Japan, Korea, Mongolia, are a bit different from India, which is at the other end of the spectrum, or Australia and New Zealand.

The other difference we have there, too, is that our economies are pretty well intertwined. If you look in the region, a large percentage of the world's population is in the Indo-Pacific.

Q. What impact does China's relationship with its neighbors play in the region?

The Russians aren't economically intertwined with a lot of things that are going on in Europe, not like the Chinese [across Asia]. You've heard people talk about, 'cooperate where you can, compete where you must.' Economically, there is a level where cooperation can occur.

Q. You've cited increased military cooperation between Russia and China in the past. Is that still an issue?

I don't know, I think they'd be hard-pressed to have a strategic relationship, partly because I don't know that they have the same outlook on the geopolitical aspects of what's going on in our region. They have exercised together, but they don't exercise like we do. You could probably describe it as exercising in the same location, same day; parallel play, less integration. We're much more integrated and operable with our partners than they are.

The other part is, because I've asked this question rhetorically, 'who's going to be the junior partner?' Because I don't think either one of them wants to be the junior partner. You don't necessarily *have to have* a junior partner, but you have to have an understanding of [the relationship] between the two.

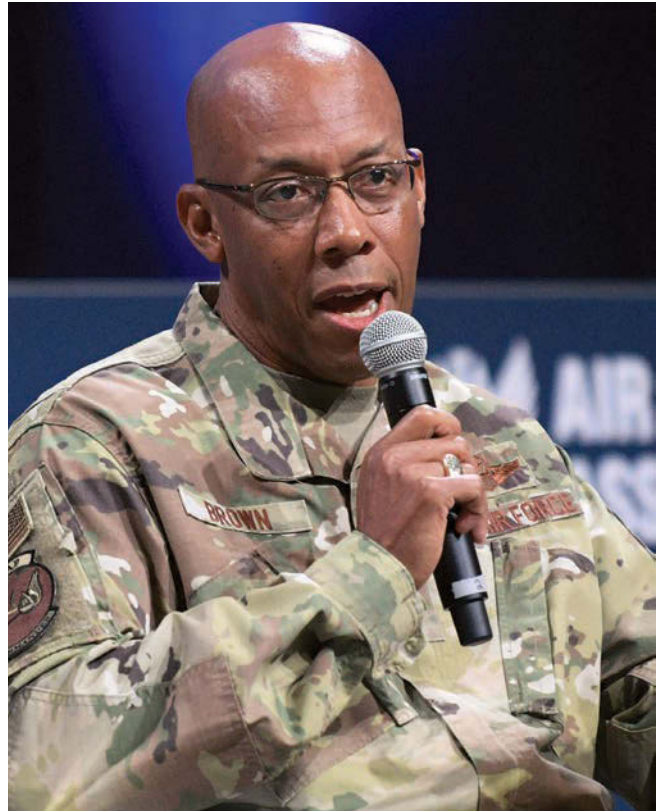


Photo: Mike Tsukamoto/staff

Gen. Charles Q. Brown Jr., Pacific Air Forces commander, discussed China and agile combat employment during AFA's Air Warfare Symposium in February. Brown has been nominated to be the next USAF Chief of Staff.

There's some natural friction that we don't necessarily have with our partners, where we're able to work closely together.

Some of our partners have capabilities we don't have. One of the things I share with you is, as I talk to our partners with small forces, they look at me and go, 'You guys are big Air Force, there's a lot of things you can do.' I say, 'You're a small air force, there's a lot of things you can do that I can't do.' You can be flexible in certain areas. There's some things we can learn from smaller partners with smaller air forces.

Q. In Europe, the European Deterrence Initiative sets money aside for regional defense and reassurance efforts. With the pivot to the Pacific and the focus on countering China, is there a need for something similar in the Indo-Pacific? Has that been discussed at all?

Oh, it has been discussed. We've talked about it quite often. We do need to think about how we invest in the region. It doesn't initially need to be big investments or large investments, but we do need to think about how we invest in the Pacific vis-a-vis in Europe.

I [went] to Ramstein [Air Base, Germany] as A3 for USAFE-AF-AFRICA the week after the Russians went into Crimea. So, that event drove what I will call a mini crisis, to actually energize a

lot of things. In the Indo-Pacific, what is the mini crisis? What is the [chance] the PRC is going to do something that actually is going to drive a big spike to get us to say, 'yes,' and throw a bunch of money in a different direction? They're looking at it long-term, and I think they do just enough below the radar, so that it doesn't spike. Because they don't want it to spike, but they are able to do certain things. That's how the features got built in the South China Sea.

Q. As the coronavirus spreads, what kind of safety precautions are you taking for Airmen in your theater? What impact is that having on exercises, and are they being quarantined when they come back from these exercises?

We're actually being proactive. We look at every exercise and the environment in that particular location, and we look at the additional travel restrictions put in place by various countries. We don't want to put ourselves in a position where we send forces to an exercise, and they get sick. But then, we also don't want to send a unit off to a location, and they come back and have to quarantine for X amount of time. That impacts our ability to go do something else, so we're being very judicious in our planning as we work through the exercises.

Q. PACAF launched the Agile Combat Employment (ACE) concept several years ago; the idea of operating from austere bases and quickly getting there. How much have you tested that? What have you learned since that concept was first launched? And how is it evolving?

We've learned a fair amount. I think the one thing I've learned is that if we can give the concept and some broad guidance to our Airmen, they can come up with ideas on how to do things differently. There's an aspect of being able to trust an Airman to go do what we've asked him to do, and then they need to feel confident to go do what you asked them to do without having to report back to the AOC or ask for permission. So, that is a cultural aspect that we've got to continue to work on. As I travel around and talk to squadron commanders, I tell them, 'I want to trust you. I do trust you,' but, unfortunately, some of our guidance actually lays out all the things that a commander shall, must do. So, we have probably more work to do.

We've asked commanders at the squadron level to do more things, and they probably have the bandwidth, guidance, time, and resources that we've provided them. I asked them to tell me what you can't do. And then we can talk about the risk associated with this. That dialogue I have with my commanders [is important], and we should be able to talk about the aspects where I've shorted them, or the Air Force has shorted them. There's going to be a risk factor associated with that, and we have to determine where that risk lies, and then how we approach it. Because there's certain things [where] you can say, 'We just can't get there. We can't do this.' And we may go, 'We're all good with that, because we just can't get there from here, but these are things we've got to be able to do.'

The other aspect is how do we go lighter and leaner with what support equipment we take? Sometimes we bring things just in case. What if you didn't bring it? Or what if we had another partner who is flying the same airplane at a third location? How do we set up an ACSA [acquisition cross servicing agreement], so I could actually borrow that part from you and not have to ship it to that location, so having that understanding of what capacity lays with our partners.

The last thing I will tell you is that what I found was there was a lot of entities across the Air Force doing ACE-like events, maybe with different names. And there was a little bit

of, 'My ACE is better than your ACE.' And so, what I pushed for last June, was to get all the Majcoms and get our deputy commanders to come together in a forum to look at and talk about ACE. The goal was not to debate ACE. The goal was to figure out what things can we agree on? We know the first thing you need to agree on is some lexicon, so we're using the same terminology. But then what things are we doing? Okay, let's codify that part. And then let's continue to work on some other areas that we're pretty close on.

Q. Can you elaborate on the things you agreed on beyond the lexicon?

We're using the expeditionary center to build a training syllabus for multicapable Airmen. There are certain scenarios where regardless of AFSC, you can do more than one thing. I look at when we do our contingent response groups. We have a small team that is multicapable. I wouldn't say every Air Force Specialty Code has to be multicapable. There are certain ones that ought to be only capable on one thing because the thing that they're doing is really important. But there's others where they have bandwidth based on the tempo of a conflict, or contingency, to do something else.

Q. Should some of those AFSCs be collapsed, or is this like a secondary specialty?

It's almost like a secondary specialty. It gets rid of some of the union cards, and the idea that you can't do this because you're not fully trained. If we go into conflict, and we start losing people, and I need somebody to go refill aircraft or help load an aircraft, or help unload a C-130, we're going to figure out some folks who can work with someone who is actually trained and go, 'Here's what I need you to do. You stand here and you do this.'

What I want to be able to do is to give the Air Staff a one-pager, 'Here's what we're trying to achieve.' I think on the training aspect, because the syllabus is being worked on with the expeditionary center, we're actually in a pretty good spot.

Q. The Arctic has been an area of increasing attention recently. And you're probably one of the very few people who can say, 'I've been to the Antarctic.' Why are these polar regions so important right now?

When you look at the Arctic, if you're a late mover there, opportunities may be lost, whether it's a great power competition, economically, whatever the case may be. The capabilities that you need in the Arctic are some of the same capabilities you need today in the Antarctic. And there's a Russian presence on Antarctica. There's also a Chinese presence on Antarctica. And the Chinese presence is growing. And it's all supposed to be about science.

Q. U.S. Northern Command boss Gen. Terrence O'Shaughnessy has said this is not one of those areas where you can just hop into and be successful. So, eventually the Antarctic is not going to be all about science. Are you considering exercising in that area? How do you do something like that?

I wouldn't call it exercising, but you know, whatever training we do for Arctic training, Arctic survival, those kinds of things are probably the same things you do in the Antarctic. If you talk about the ice melting in the Arctic, there's potential for the ice to melt in Antarctica, and it may open up some things. I bring it up so we're thinking about it, and it is not just written off. ... If you don't think about it, when 2040 comes around, you don't want to go, 'If I coulda, woulda, shoulda,' because you weren't thinking about it. ❄️



Public health medics from the 51st Aerospace Medicine Squadron screen occupants of a car outside Osan Air Base in South Korea on March 4, 2020. At the time, the COVID-19 outbreak was still limited to a handful of countries in Asia and Europe. Just eight days later, the World Health Organization declared a global pandemic, the White House barred travel by Europeans to the United States, and the Pentagon stopped nonessential travel as the worst health crisis in a century came into focus.

Photo: Staff Sgt. Greg Nash



An HH-60G Pave Hawk helicopter from the 56th Rescue Squadron soars over Aviano Air Base, Italy. The all-weather search-and-rescue unit relocated from Lakenheath, U.K., to join the 31st Fighter Wing based at Aviano in May 2019. The Air Force announced in February that the Pave Hawks are slated to be replaced by HH-60Ws. The new helicopters will be dubbed "Jolly Green II," in honor of the Vietnam-era HH-3E rescue choppers, known as Jolly Green Giants.



An F-35A Lightning II on the ramp at Nellis Air Force Base, Nev., in February. The jet is among 78 F-35As operating out of Hill in four operational squadrons. The Air Force is seeking 48 more F-35As in its 2021 budget request, well short of the 72 required per year the Air Force has said are needed to rejuvenate the fighter force with fifth-generation stealth and sensors.

Photo: Airman 1st Class Bryan Guthrie

By John A. Tirpak

What Are Putin's Five New Nukes For?

A frame grab from a Russian Ministry of Defense video shows the new *Sarmat* heavy intercontinental ballistic missile (ICBM) as it undergoes its second test launch at the Plesetsk Cosmodrome in northwest Russia on March 30, 2018. The *Sarmat* is part of Russia's new arsenal announced in 2018 by President Vladimir Putin.



Photo: Frame grab from Russia Ministry of Defense video via RT

Russian President Vladimir Putin made a grand announcement in March 2018, declaring that Russia is developing five new nuclear or nuclear-powered weapons. The new nukes would be in addition to Russia's extant, START-compliant strategic nuclear forces and thousands of nonstrategic nuclear weapons ranging from torpedoes to artillery and short-range missiles.

Russia's existing nuclear force already holds the U.S. at risk. These new weapons wouldn't appreciably change the nuclear deterrence equation. So why does Putin need them?

The Atlantic Council's Scowcroft Center for Strategy and Security took up that question, in conjunction with experts from Los Alamos National Laboratory. In a March report, "Russia's Exotic Nuclear Weapons and Implications for the United States and NATO," 28 strategic arms experts confessed they're still scratching their heads. It's hard to see the rationale for expending so much Russian treasure on a prodigious nuclear modernization program that doesn't really give Russia more capability than it already has, participants said.

Perhaps the most plausible rationale could be "a genuine paranoia about the vulnerability of Russia's nuclear deterrent and a desire to signal Russia's great-power status to foreign and domestic audiences."

A second would be a desire to overwhelm U.S. and allied theater missile defenses. A third, that the new weapons could be used as coercive measures in a crisis. The new nukes could be a backstop to Russia's conventional weakness as it threatens countries on its borders or to achieve what Russia oxymoronically has called "de-escalation:" the use of low-yield nuclear weapons to scare adversaries into capitulation to avoid all-out nuclear war.

Putin may also see the weapons as a counter to perceived threats from the U.S. and its allies, which he may fear are trying to back a "color revolution" against Russia to achieve regime change there. While these are not stated U.S. policies, the report states, Russian officials "appear to be genuinely fearful of the possible spread of democracy to Russia with U.S. backing."

On the more speculative side, the Atlantic Council report posited that Russia could seek a "decapitation" strike against Washington, D.C., in the event of a war with NATO. "To be sure, this would be an extreme scenario, but military plans and postures are sometimes developed to deal with remote, but important, contingencies," the report noted. Still, a nuclear cruise missile deployed from a commercial vessel could achieve similar effects less expensively.

More mercenary explanations for Russia's new programs could include a make-work program for Russia's defense industrial base or to promote foreign sales of Russian military hardware.

"It is unclear," the report concluded, "what advantages these new systems provide."

COUNTERS, AND COUNTER-COUNTERS

How should the U.S. respond to Russia's new weapons? The Atlantic Council offers three options: "Ignoring, or even ridiculing, Russia's new systems; pushing to include a wider range of systems in negotiations over New Strategic Arms Reduction Treaty (New START) renewal; and strengthening the U.S. and NATO deterrence posture, including by continuing to introduce low-yield warheads to the U.S. nuclear arsenal." This last step was actually called for in the 2018 Nuclear Posture review, drawing widespread debate in Congress and criticism from some think tanks.

Russia has relied on its nuclear arsenal in the post-Cold War era to preserve its status as a world power and, in recent years has made “explicit military threats” to use it, the Atlantic Council report pointed out. Recent Russian exercises have concluded with simulated nuclear strikes on European targets, and Putin placed his nuclear forces on alert during the Georgian and Ukraine crises.

Viewed in this context, “Russia is building the nuclear force posture necessary to back up this ambitious strategy,” the report said. The Atlantic Council also noted that even while the Intermediate Nuclear Forces treaty was in effect, Russia cheated, “developing and deploying multiple batteries of nuclear-capable, intermediate-range, ground-launched cruise missiles.”

STRATEGIC DEBUTANTES

Russia’s new nuclear weapons are:

■ **Sarmat ICBM:** Replaces the SS-18 heavy ICBM, code-named Satan by NATO. It can carry either 10 reentry vehicles or at least one hypersonic glide vehicle. Russia has said it will begin production of *Sarmat* this year. Plans call for six *Sarmat* regiments, the first to be deployed in 2021.

■ **Avangard Hypersonic Glide Vehicle:** This is a very long-range, maneuverable weapon that would be difficult to defend against. It would be pushed to hypersonic speed by *Sarmat*, eventually, but in the near-term, it has been fitted to the SS-19, code-named Stiletto by NATO. Russia tested *Avangard* successfully in 2016 and 2018 and said it had activated two in December.

■ **Kinzhal hypersonic missile:** This weapon would be carried to altitude on wing pylons or in bomb bays. Russia has boasted about having developed such a weapon before the U.S.

■ **Burevestnik nuclear-powered, long-range missile:** Putin claims this weapon has unlimited range. Code-named SSC-X-9 “Skyfall” by NATO, its existence was disclosed in 2018 when Putin showed a video animation of the missile traversing huge distances on a map—crossing Europe, the Atlantic Ocean, and parts of South America before approaching a target in Florida. Russia claims the weapon features a low-radar cross section.

■ **Poseidon nuclear-armed, autonomous underwater drone:** Previously known as “Status-6,” six of these torpedoes could be carried by a Russian guided-missile submarine. Armed with a conventional or nuclear warhead, it would operate at depths too deep to use satellite navigation, rendering it an imprecise weapon intended for use against a large target, such as a coastal city. The Atlantic Council report speculated that Poseidon could be “laden with a multimegaton warhead seeded with cobalt—which would result in particularly deadly nuclear fallout.”

The report noted that Russia is having trouble with developing some of these weapons—Skyfall, particularly, had a noteworthy accident. But Russia has been “comfortable rushing weapons systems into the field at a pace that would not be possible in the United States,” the authors noted.

In response, the Atlantic Council report recommends the U.S. Intelligence Community invest resources to capture “more detailed information about the origins of these programs, and what prompted Putin to unveil them in a major public address in March 2018.”

The authors also suggest the U.S. seek to reassure Russia that it is not seeking a first-strike capability while modernizing the U.S. strategic nuclear arsenal. Failing that, the U.S. should proceed on the findings of the Nuclear Posture Review, the Atlantic Council said, to “strengthen their deterrent and defensive measures” and “develop low-yield capabilities.”

The report also urged the U.S. to develop its own hypersonic missiles and defensive countermeasures to such weapons built by Russia and China, following a “deterrence-by-denial” strategy. The

U.S. should also develop countermeasures to Poseidon, it said.

“Fond hopes” that the world could be rid of nuclear weapons after the Cold War “have not been borne out by the facts,” the report said. “Great power competition has returned, and with it, the importance of nuclear weapons to international politics.” Such weapons “remain the ultimate instrument of military force, and Russia is emphasizing nuclear force as a central pillar of its military strategy.” Western leaders, therefore, must again make effective nuclear deterrence the “foremost priority of the NATO alliance.”

THE EU’S CAPABILITY DEFICITS

The latest comprehensive analysis of the global military balance from the International Institute for Strategic Studies (IISS) suggests America’s NATO allies will have to invest more in defense if the U.S. continues to focus on the Indo-Pacific region. In fact, NATO allies may fall short by a third of a trillion dollars’ worth of capability in “enablers” alone if the U.S. devotes the bulk of its military attention elsewhere.

Since 2019, global defense spending grew by 4 percent, in 2015 dollars, according to the IISS’s annual assessment, “The Military Balance 2020.” This was the largest increase in 10 years. Non-U.S. NATO defense spending was back to where it was before the 2008 financial crisis.

The emergence of a new economic crisis with the global COVID-19 pandemic raises new questions about NATO’s ability to maintain such spending. Time will tell, but as governments pour funds into bailouts and emergency measures, there could well be inevitable calls to curb spending on defense.

“The Military Balance 2020,” which was published before the pandemic hit, paints a picture of what could happen in the event the U.S. becomes fully engaged in a Pacific war and cannot respond in full force to a European conflict. In such case, NATO allies would be operating at a serious deficiency in key enablers, such as mobility, airborne tankers, and intelligence, surveillance, and reconnaissance, the IISS pointed out.

Indeed, that is also the case with allies in other regions, such as the Middle East. “It may transpire that Washington cannot always supply capabilities needed by allies and partners,” the report said.

The IISS estimates that it would cost America’s NATO allies between \$288 billion and \$357 billion “to fill gaps highlighted by a scenario where they would have to defend their territory without U.S. support against a state-level attack.”

Mobility, for example, is a key area where NATO partners are badly underinvested. The entire European Union tanker/transport fleet totaled just 49 aircraft in 2019, less than a tenth the size of the U.S. fleet, which numbered 555.

“Were a crisis to erupt that required rapid mobility of U.S. equipment, for instance in the Asia-Pacific, it is highly likely that the U.S. would look to move relevant enabling assets from where they are currently stationed.”

While great power competition “continues to dominate long-term Western defense policymaking and procurement ... there is now less apparent coherence than before in terms of political responses,” the IISS said. The growing disharmony evidenced by French President Emmanuel Macron’s famous declaration that NATO is “brain dead,” means NATO allies will be challenged to overcome these problems.

The fundamental problem is that military assets are limited. If the U.S. is suddenly faced with a conflict in the Asia-Pacific, it may have no choice but to move ISR, mobility, and other assets out of theaters where they have historically been available, sounding a wake-up call to allies that have grown too reliant on those capabilities. ★

USAF Rebuilds Precision Munition Stockpiles



An F-15E Strike Eagle armed with a variety of Joint Direct Attack Munitions on a May 7, 2019, mission over Southwest Asia.

Photo: Master Sgt. Russ Seal

Production surge slows as Air Force nears weapons goal.

By John A. Tirpak

After an intense period of restocking, Air Force precision weapon inventories are almost back to acceptable levels, Air Force leaders say. Now they are throttling back planned purchases for fiscal 2021.

“We have been able to make a dent” in the munitions shortage, said Gen. Arnold Bunch Jr., head of Air Force Materiel Command during the Air Force Association’s Air Warfare Symposium in February. The sharp reduction of U.S. air attacks against the Islamic State group “has allowed us to get in a better place and on a better trajectory” in terms of war reserves.

Bunch has previously referred to ups and downs in purchasing as a “sine wave” that plays havoc with budgets and frustrates weapon producers, who have had to add tooling and shifts to meet USAF’s urgent demands for replacement weapons in recent times.

“What I would hope we would do, is level off ... at this year’s level, maybe plus or minus a little bit,” Bunch said.

During Operation Inherent Resolve, the Air Force was using up Joint Direct Attack Munitions (JDAMs) so quickly that they were being loaded onto combat aircraft in the Middle East a scant 24 hours after being crated up and shipped from Boeing’s St. Louis fac-

“What I would hope we would do, is level off ... at this year’s level, maybe plus or minus a little bit.”

—Gen. Arnold Bunch, head of Air Force Materiel Command

tory. This rapid usage was exacerbated by allied air forces “borrowing” munitions from the U.S. because their own limited stocks were depleted from action in Afghanistan and Libya.

Precision munitions were the weapon of choice in the fight against ISIS due to the rules of engagement. Because civilians were mixed in with ISIS combatants, extremely accurate targeting and strikes were required to avoid civilian casualties.

The shortages prompted the Air Force to surge production of weapons like the JDAM, Small Diameter Bomb 1, and the AGM-114 Hellfire.

In planning the fiscal 2021 budget, Bunch said, the Air Force had to “focus on the high-end fight,” reducing its appetite for JDAMs. The Air Force bought 30,872 JDAMs in fiscal 2019, which was its high watermark. It requested 37,000 in fiscal 2020, but Congress only approved 25,000. The request for fiscal 2021 is only for 10,000 JDAMs, including both “base budget” and Overseas Contingency Operations accounts.

Production of the SDB 1 increased from 5,743 units in fiscal 2019 to 7,078 in fiscal 2020; USAF is seeking only 2,462 in fiscal 2021.

Was the munitions downshift a bill payer for other programs? Or was it a signal that the Air Force intends to start buying longer-range weapons that can be released farther away from enemy air defenses?

Production Slowdown

The Air Force is seeking to slow production of six key precision munitions in its 2021 budget request, as combat demand throttles down and concern over shortages abates.

Weapon	2019 (Enacted)	2020 (Request)	2020 (Enacted)	2021 (Request)	
JDAM	30,872	37,000	25,000	10,000	↓
SDB I	5,743	7,078	7,078	2,462	↓
SDB II Stormbreaker	510	1,175	1,175	1,133	↓
AGM-1145 Hellfire	2,771	3,859	3,859	2,497	↓
AGM-158 JASSM-ER	360	430	390	400	↑
AGM-158C LRASM	15	-	-	5	↑

“It might be a little bit of all of those,” said Gen. James “Mike” Holmes, head of Air Combat Command. “After several years of the Air Force working hard to replenish the JDAM stocks, we’re approaching the objectives that we set, and those objectives are set by looking at the war plans and the different contingencies.”

Holmes said “the right balance of risk was to continue to acquire those weapons, but as we approach the objective, to start slowing down a little bit on the JDAM,” which is a gravity-fall weapon.

The Air Force is investing in “the things we’ll need for long-range fires, across the joint force, to challenge a peer adversary,” Holmes said. “When you look at everything that had to fit in the budget, some pretty good work was done over the last several years to replenish the JDAM stocks and work toward the objective, and in the Department they made the decision that they’re getting close enough that they can slow down that buy rate a bit.”

While contractors have purchased tooling and hired staff to meet larger production goals, the Air Force footed the bill, Holmes said. “When they go to tool, we actually pay for it,” he explained. “The industry comes to us and says ‘to go to whatever rate, this is what it will cost you.’” Now that the tooling is in place, it provides the potential to surge production in the event of a large-scale conflict, Holmes said.

Bunch said the Air Force budget plan does not throw contractors back to low production, but rather creates an “opportunity” for allies to replenish their stocks, as well, through increased foreign military sales. U.S. military demand had made such sales difficult in recent years. Now the Air Force wants allies to know those weapons are available again.

“We want them to buy ahead,” so the U.S. is not seen as the store in a contingency. “We want them ... to replenish, buy ahead, so they’re prepared,” Bunch said.

The longest-range conventional weapon the Air Force is buying is the Joint Air-to-Surface Standoff Munition (JASSM), which is on its fourth variant. The JASSM-ER (for Extended Range) has maintained a steady production rate, with buys of 360 in 2019, 390 in ’20, and a request for 400 in ’21. Beginning in 2021, the Air Force would also acquire five Long-Range Anti-Ship Missiles, or LRASMs, the counter-maritime version



Boeing’s Powered JDAM, now in development, would add a motor and wing kit to extend the weapon’s range by 20 miles or more.



An F-16 loaded with a JASSM-ER prior to an operational test sortie at Eglin Air Force Base, Fla. The Air Force wants to buy 400 of the weapons in 2021.

Illustration: Boeing
Photo: 1st Lt. Savannah Bray

of the weapon.

With help from Congress, “we stood up an additional JASSM production facility,” which is now under construction, Bunch said. Lockheed Martin Missiles and Fire Control builds the JASSM and LRASM in Troy, Ala.

Bunch said the National Defense Strategy tells the Air Force “we need to take more risk in the near, and look for the far. Those standoff and those more advanced weapons are the far, and we’re trying to make the move to that area.”

Multiple studies have argued for increased purchases of longer-range weapons in recent years. Some have suggested adding motors to conventional gravity weapons. Indeed, Holmes has told *Air Force Magazine* that USAF needs new munitions that combine lon-

ger range and a degree of stealth in a package that’s inexpensive enough to buy in mass quantities.

The Air Force developed the precision-guided GBU-39 Small Diameter Bomb I because it found that JDAM-sized weapons were too large for the small, precise attacks necessary in wars like the counterinsurgencies in Afghanistan and Iraq. Its 250-pound warhead was a better size for many targets, and its lighter weight meant USAF aircraft could carry more weapons. The SDB I uses GPS/INS, laser, and even radar-homing guidance for some variants, and has a range of about 45 miles, for use against stationary targets.

The GBU-53 SDB II, built by Raytheon and named “Storm-Breaker,” increases that range to some 70 miles. It adds Link 16 connectivity and can attack moving targets in brownout or adverse weather. An F-15E can carry up to 28 SDB IIs.

Boeing, the maker of JDAMs, showed off a new variant of that bomb at the AFA 2020 Air Warfare Symposium. Called “Powered JDAM,” it adds a wingset and power module to increase JDAMs’ range by 20 times. The company is pitching the munition as a lower-cost alternative to a cruise missile.

The munitions would have the range to “stand outside the engagement zone,” said Wade Kirkbride, a business development representative for Boeing, calling the weapon the “centerpiece” of the company’s plan to “evolve JDAM for the future.” The munitions, which could use any of a number of sensors for targeting, could also be used as a decoy for more expensive missiles such as JASSM, which cost more than \$1 million per round.

'The Fighter Jet Era Has Passed'

Elon Musk to USAF: Autonomous drones are the future.

By Rachel S. Cohen

With six words, Elon Musk sent a shudder throughout the great hall in which thousands of Airmen and aerospace industry officials had gathered to hear his comments at the conclusion of AFA's annual Air Warfare Symposium in February.

"The fighter jet era has passed."

First came a moment of silence, then a rolling murmur. Reporters tweeted. Chief of Staff Gen. David Goldfein, seated in the front row, sat up straight, then leaned in to hear what followed. The rumble died down.

"Locally autonomous drone warfare," Musk added, "is where the future will be." Then he said, "I can't believe I'm saying this, because this is dangerous, but it's simply what will occur."

Musk also told Lt. Gen. John Thompson, commander of the Space and Missile Systems Center, in a lengthy on-stage interview that Lockheed Martin's F-35 would benefit from a competitive challenger.

"The competitor should be a drone fighter plane that's remote controlled by a human, but with its maneuvers augmented by autonomy," Musk said later that day via Twitter. "The F-35 would have no chance against it."

Musk has long been known for bold and dramatic promises. He swore his Tesla car company would produce 500,000 cars per year in 2018, and barely hit half that number. He promised fully autonomous cars, but despite effective self-driving capabilities, has yet to achieve that vision. And he announced he had the funding to take Tesla private in 2018, only to get sued by the U.S. Securities and Exchange Commission. Yet, Musk has also proven to be a visionary, creating a market for electric cars with Tesla and a viable space launch vendor with SpaceX.

His comments underscore his predilection for sweeping predictions, as well as a long-standing tension between backers of manned and unmanned aircraft and the rapid advance of Air Force concepts for drone warfare.

He's hardly alone. Advocates for unmanned and autonomous systems have trumpeted the end of manned aircraft for more than a decade, even as the Air Force has brought online its newest—and some suggest last—manned fighter jet, the F-35, which will remain a centerpiece of its combat aviation forces for the foreseeable future. Air Force leaders argue it is more beneficial to keep a person in the cockpit because the algorithms that would let an aircraft think on its own aren't sufficiently mature



The F-35 needs competition—perhaps from drones, entrepreneur Elon Musk told leaders at AFA's Air Warfare Symposium in February.

yet—not to mention the ethical dilemmas that come with waging war without a human present.

"Qualified fighter pilots must be able to master highly aggressive, three-dimensional maneuvering at rates exceeding twice the speed of sound in a highly dynamic battlespace, operate highly sophisticated mission equipment, and face adversaries doing everything in their power to kill them," Doug Birkey, executive director of AFA's Mitchell Institute for Aerospace Studies, wrote in a recent op-ed. "The distant promise of autonomy must not be confused with meeting the clear and present threats of today and tomorrow."

But even the four-star general in charge of sending fighters into battle acknowledged that the businessman had a point. The Air Force will need manned fighters and bombers for a long time, but will run more and more experiments to try out other options, Air Combat Command boss Gen. Mike Holmes said March 4.

ACC's fighter roadmap charts a 30-year path forward, and the next addition to the fleet may not be a conventional fighter. Rather, the Air Force is trying to define a requirement around a capability instead of around a specific sort of platform.

"What is that going to do to the missions that we've been doing with fighters as we work through into the future?" Holmes said.

For now, the best option is to continue replacing fighters with fighters—like continuing to add F-35s and bringing on the updated, fly-by-wire F-15EX as F-15Cs age out of service.

"The next decision point I have is when ... the Block 30 and older F-16s, when they need to be replaced, what am I going to replace them with? I want to work to do the experimentation to answer that question," Holmes said. "Will I still want to replace them all with F-35s or will

I start cutting in something else, like Elon talked about, or like [Air Force acquisition chief] Will Roper and I are discussing?"

Holmes and Roper have advocated for a rolling series of rapidly developed combat aircraft under what's been dubbed the "new Century Series," a variation on what the Air Force achieved from the late 1950s through the 1960s with the first Century Series planes that spanned the F-100 through the F-117.

An advanced aircraft office at Wright-Patterson Air Force Base, Ohio, is helping tackle that question in bite-size pieces. Instead of pursuing one singular Next-Generation Air Dominance solution, the Air Force wants industry to pump out experiments under the Century Series initiative. Each design might yield as many as 100 planes, breaking new ground—or failing at relatively low cost and risk.

For the foreseeable future, however, both manned and unmanned platforms will be in the mix. F-35s may be the "quarterback" in combat, calling the plays, but the rest of the team will include remotely piloted and manned platforms. Adding

Photo: Mike Tsukamoto/staff

9 Takeaways from Musk's Message to the Air and Space Forces

Elon Musk is known for mic-drop moments and outlandish predictions. He's also proven most of his critics wrong, developing a cult following while disrupting the space industry with his SpaceX launch business and the automotive industry with his hot-selling Teslas. Here's what he had to say to Air Force and Space Force members at AFA's Air Warfare Symposium Feb. 28:

On competition for space: *"If the United States does not seek great innovations in space, it will be second in space, as sure as night follows day."*

On the potential for interplanetary spaceflight: *"We can go a long way towards making Starfleet real and making these sort of utopian or semi-utopian futures real, but it will definitely require radical innovation. One can't get there by incrementally innovating expendable boosters."*

On reusable spacecraft: *"It's absolutely fundamental to achieve full reusability in*

access to space. This is the Holy Grail of space."

On Lockheed Martin and the F-35: *"There should be a competitor to F-35. ... It's not good to have only one provider."*

On high-speed, long-distance travel: *"You could actually do point-to-point on Earth to go long distances and be much better than aircraft. Basically, just think of ICBM, minus the nuke, add land. It's sort of in the option package: Uncheck nuke, and then add landing system. That's definitely going to get you wherever you want to go the fastest. ... That's going to be pretty exciting."*

On how to incentivize the workforce for innovation: *"If somebody is completely failing to innovate ... then they should either not be promoted or exited. You'll get innovation real fast."*

On building spacecraft: *"At this point, I think designing a rocket is trivial. Just trivial. ... The making of even one is hard. The making of a production line that builds and launches many is extremely hard. The next level beyond that would be creating a fully reusable system and having that be in volume production and volume launch. That's super, super hard."*

On intellectual property (IP) rights: *"The real way I think you actually achieve intellectual property protection is by innovating fast enough. If your rate of innovation is high, then you don't need to worry about protecting the IP because other companies will be copying something that you did years ago."*

On developing the Space Force: *"I think there should be a new uniform. Cool uniforms, cool spaceships. ... Warp drive and teleportation, probably not—but big spaceships that can go far places? Definitely. That can be done."*

autonomy into combat is a harder problem than it may seem. "We've done really well at teaching some [artificial intelligence] machines to play complicated games," Holmes said. "But they're playing games where they know 100 percent of the information. When you're playing a game where you have uncertainty and you don't know everything, then there's still a role for people to play, whether that's in the cockpit of a fighter or whether it's in the command and control center."

Even as the Pentagon and industry make strides in unmanned technology development, the ability to take direction from fighters is often at the core of those ideas.

Four years ago, the Air Force and Lockheed Martin partnered on a demonstration of manned-unmanned teaming using F-16s, where the company said the experimental drone "autonomously [reacted] to a dynamic threat environment during an air-to-ground strike mission." More recently, the Navy and Boeing proved they could use one E/A-18G Growler to control two others.

In 2018, the Air Force Research Laboratory mounted a "moonshot" effort to develop a fully autonomous fighter drone within 18 months, with no public results so far. The Air Force's "Skyborg" program similarly seeks an attritable, artificial intelligence-powered wingman aircraft that could accompany fighter jets into combat to assist with a variety of missions. It could also act as a communications gateway to let platforms with different data-sharing software "talk" to each other.

In contrast, current remotely piloted assets such as the MQ-9 Reaper and RQ-4 Global Hawk follow a preprogrammed path through the sky and rely on human operators to make decisions during strike missions and when taking off and landing.

To Musk's credit, understanding of how unmanned aircraft could be used is evolving. The next generation of drones may look more like a fighter than they do the Reaper or Global Hawk and will be purpose-built for "great power competition" that

requires them to be sturdier and smarter, wield new firepower, and handle more complex missions than the current inventory can take on.

For example, MQ-9 manufacturer General Atomics in Orlando displayed concept art of the "Defender," a modified version of

its earlier Avenger aircraft equipped with air-to-air missiles. The company argues Defender could protect large, slow platforms like tankers or big-wing intelligence aircraft from attack.

Still, even the most advanced unmanned aircraft are only capable of rudimentary roles compared to today's fighter jets, said Arthur Holland Michel, a founder and co-director of Bard College's Center for the Study of the Drone. He envisions autonomous resupply could be possible in the next five years, but dogfighting won't be possible until long after because it is so complicated.

Once the technology has matured to tell an aircraft where to go, how to react to a changing environment, and what actions are appropriate, it will still take time to convert the Air Force's very human fighter pilot culture into one that embraces drones as equals or superiors.

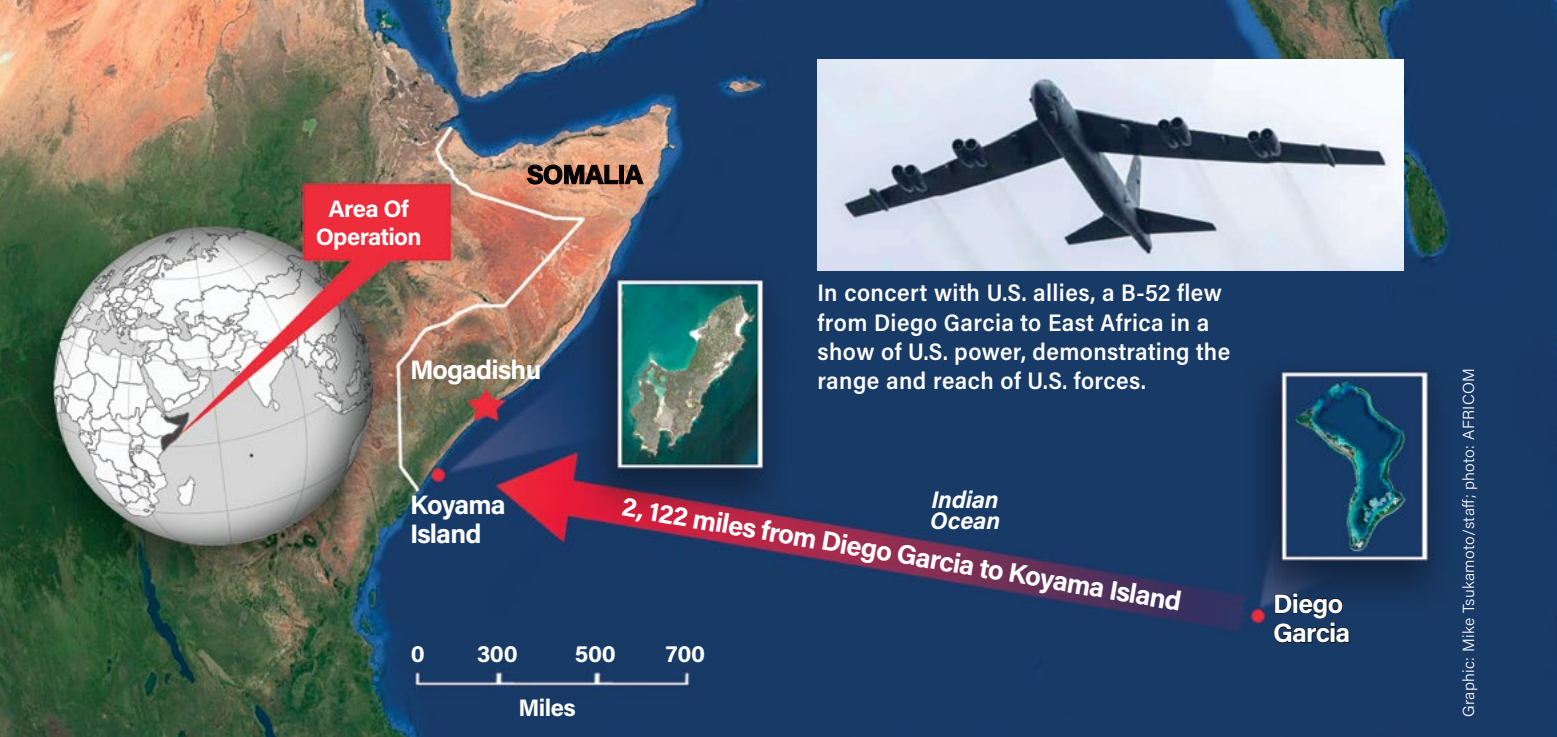
Fully swapping fighters for drones would require a "radical and comprehensive U-turn" in strategy, aircraft development, and culture, Holland Michel argues.

"The future, as far as I can see it, looks like a massively complex ecosystem of manned and unmanned systems working in very tight networked coordination," he said. "There will be lots of unmanned 'wingmen,' lots of automated target cueing by forward unmanned hunter assets, lots of remote weapons releases through [manned-unmanned teaming], and even lots of swarming for roles like [suppression of enemy air defenses], eventually."

There could come a day when planes no longer need humans. It's not today. 

"Will I still want to replace [F-16s] with F-35s? Or will I start cutting in something else, like Elon talked about?"

—Air Combat Command boss Gen. Mike Holmes



In concert with U.S. allies, a B-52 flew from Diego Garcia to East Africa in a show of U.S. power, demonstrating the range and reach of U.S. forces.

Graphic: Mike Tsukamoto/staff; photo: AFRICOM

Competition Over Africa, as U.S. Sends a Signal

USAF bolsters soft power projection with an unambiguous show of military might—the BUFF.

By Brian W. Everstine

Great power competition isn't limited to Eastern Europe and the South China Sea. In Africa, the U.S. military is investing and operating more aggressively in response to the growing presence of China and Russia on the continent.

The Air Force is building a new operating base in Niger and increasing deployments for exercises, advisers, and state partnerships to help build up allies' capacity as part of a broader effort to ensure those nations can resist and counter Russia and China, if necessary. Partner countries, in turn, are investing in their own infrastructure and deploying their own forces along with private military contractors.

For "global power competition, it's really about gaining and maintaining influence," U.S. Africa Command boss Army Gen. Stephen Townsend told lawmakers in a March 10 hearing. "That's what competition is all about. So, in some future rainy day, we have the access and influence that we need. So, we're in a struggle with China and Russia to gain and maintain that influence."

The Air Force sent a bold message in mid-February, flying a nuclear-capable B-52 over the Somali coastal town of Kismayo in an unmistakable show of force.

In a region where U.S. operators routinely fly drones against al Shabab militants, the Feb. 15 B-52

flight was a symbolic demonstration, said U.S. Air Forces in Europe-Air Forces Africa boss Gen. Jeffrey Harrigian. "There's a message opportunity here, not just to al-Shabab and [violent extremist organizations] on the ground, but more broadly to Russia and China that: 'Hey, we're competing with you down here, we're engaged here, we have high situational awareness as to what's going on, and we're going to use this opportunity to demonstrate that to the collective world,'" Harrigian told *Air Force Magazine*.

His message: "We can be here quick, and we can be here with strength."

"We can be here quick, and we can be here with strength."

—US Air Forces in Europe-Air Forces Africa boss Gen. Jeffrey Harrigian

HOW CHINA AND RUSSIA ARE OPERATING

China has been investing in Africa for the long term and is the top trading partner on the continent. It is building 23 ports on the continent, has a military installation in Djibouti, virtually adjacent to Camp Lemonnier, the main U.S. location on the Horn of Africa, and there's more to come, said AFRICOM spokesman Col. Christopher Karns. "They're looking to expand their influence."

China is investing billions in railroads, stadiums, ports, palaces, and more, all across the continent. The U.S. can't compete on that basis, Townsend said.

Moscow is leveraging private military corporations (PMCs) to spread its influence in the region. Companies such as the Wagner Group, which have operated extensively in Syria and the contested area of Crimea in Ukraine, are now showing up in places

such as Libya, where the November shootdown of a U.S. MQ-1 over Tripoli appears to have been done with the help of outside experts. While the Libyan National Army claimed responsibility for the downing, “there’s not a strong belief,” Karns said, that it was shot down “either by the LNA operating sophisticated Russian air defenses, or by PMCs.” Karns said Russian private military contractors are operating in 18 countries on the African continent.

“There’s a lot of activity that is occurring, whether it’s Russia and their interference in Libya, or China, and the challenges they could present to us in the future if that space is not challenged in a meaningful way,” according to Karns.

AFRICOM also is using soft power to try to spread its own influence, including training opportunities such as African Partnership Flight events, exercises such as the recently completed Flintlock, or small interactions such as deploying USAF mobility support advisory squadrons or National Guard State Partnership Program teams.

“In Africa, we believe our U.S. military training, equipment, and expertise provides an edge in winning partnerships, access, and influence over the likes of Russia and China,” Karns said. “Additionally, the training and engagements we conduct on the continent has the mutual benefit of increasing the U.S.’ readiness as well.”

Partner nations have shown they want American help to train their security forces and to address the counterterrorism threat.

“I believe, in Africa, building partner capacity and counterterrorism efforts, or counter [violent extremist organization] efforts are a way we do global great power competition, because that’s what our partners are hungry for,” Townsend said. “They come to us because of our capacity to do that. They come to us because of our skill, and they come to us because of how we treat them and our values.”

All the while, the Pentagon and AFRICOM are undergoing

an audit of themselves. Defense Secretary Mark Esper has ordered a “zero-based review” of force posture on the continent, currently about 5,200 personnel, to ensure it is “right-sized” to address the National Defense Strategy and to counter Russia and China.

For now, however, the counterterrorism fight will not go away, prompting some lawmakers to worry the review could result in reducing AFRICOM’s presence or shift away from combating the likes of al-Shabab.

In January, al-Shabab was able to breach the perimeter of Camp Simba in Kenya, destroying multiple U.S. aircraft and killing one U.S. Army soldier and two U.S. contractors. It was the worst attack in the past two years. AFRICOM boss Gen. Stephen Townsend has said U.S. forces were not ready for the attack, and the command has been increasing security at all its locations since then.

“There are lessons to be learned from a layered base defense perspective,” Harrigan said. “This is a chance to refine the way we do business, and how we train not only individually but collectively.”

Strikes on al-Shabab have continued at a high pace this year, with 63 conducted in 2019 targeting more than 320 al-Shabab targets, and approximately 25 strikes conducted in the country as of early March. With more operations being conducted against the group in other parts of the country, such as the Sahel region of Niger and Mali, AFRICOM is trying to balance how it addresses current and future threats.

“We’re starting to see a cooperation between ISIS and al-Qaeda that hasn’t existed anywhere else, but yet they are finding commonality to cooperate and project out a level of strength,” Karns said. “So Africa has that violent extremist organization threat. But at the same time, it has the global power competition dynamic. ... You combine the two and that problem set doesn’t exist anywhere else in the world.” 🌐

Oklahoma Air Guardsman Killed in Camp Taji Attack

By Brian W. Everstine

USAF Staff Sgt. Marshal Roberts, 28, a member of the Oklahoma Air National Guard, as well as a U.S. Army Soldier and a British medic were killed, and at least 18 others were wounded in an attack U.S. officials attributed to the Iranian-backed Kataib Hezbollah militia. The group fired 30 rockets, with 12 striking targets at Camp Taji near Baghdad.

Roberts, of Owasso, Okla., enlisted in 2014 and was assigned to the 219th Engineering Installation Squadron of the Oklahoma ANG’s 138th Fighter Wing. Also killed was U.S. Army Spc. Juan Miguel Mendez Covarrubias, 27, of Hanford, Calif., who was assigned to 1st Battalion, 227th Aviation Regiment, 1st Air Cavalry Brigade, 1st Cavalry Division, Fort Hood, Texas; and United Kingdom military medic Lance Cpl. Brodie Gillon, 26.

U.S. fighter aircraft launched retaliatory airstrikes the following night, destroying five weapons storage facilities linked to the militia around Baghdad, said U.S. Central Command boss Gen. Kenneth McKenzie. McKenzie would not identify the type of aircraft or weapons used, but said the strikes were “designed to send a clear, unambiguous signal that we will not tolerate this behavior in the future,” McKenzie said March 13.



Photo: Oklahoma ANG

USAF Staff Sgt. Marshal Roberts, 28, a member of the Oklahoma Air National Guard, was killed in an attack by Iranian-backed Kataib Hezbollah militia. The group fired 30 rockets, with 12 striking targets at Camp Taji near Baghdad.

Two days later, three more service members were injured—two seriously—in a second attack on the base, DOD announced.

“The threat remains very high. I think the tensions have not gone down,” McKenzie said. In a sign of increased U.S. military presence, two aircraft carriers began operating simultaneously in the CENTCOM area for the first time since 2012, McKenzie said.

To bolster base defenses, the U.S. Army deployed Patriot missile defense systems and an associated Counter Rocket, Artillery, and Mortar (C-RAM) system to al-Asad Air Base in Iraq, which Iran attacked with missiles in January.

A C-RAM system could have helped defend Camp Taji against

the 107 mm rockets used in the attack, but with a limited number of the systems available, that was not possible. Patriot, by contrast, is intended to protect against ballistic missiles, like those used in the state-sponsored Iranian attack on al-Asad Air Base in January.

U.S. forces were able to use radar and other electronic systems to locate the source of the March 11 attack, and Iraqi Security Forces recovered the truck that was used to launch the rockets. Analysis showed that the group intended to fire 33 rockets, with 30 actually firing and about 12 impacting the base. "That's a large strike, that's an intent to produce a lot of casualties, and we're certain of that," he said. ✪

Combat Controller Dies During Training Swim

By Brian W. Everstine



Photo: USAF

Airman 1st Class Keigan Baker

A special tactics combat controller from the 24th Special Operations Wing at Hurlburt Field, Fla., died March 19 during a training swim in Panama City.

The Airman has been identified as A1C Keigan Baker, 24, of Longview, Wash. Baker enlisted in the Air Force in 2018 and was in training as a Special Tactics combat controller apprentice.

"Keigan's loss is felt across the entire training wing, where the safety of our trainees is our top priority," Col. Parks Hughes, commander of the Special Warfare Training Wing, said in a release.

Baker was taking part in an Air Force Combat Dive Course at Naval Support Activity Panama City when he went missing at

about 11:05 a.m. Multiple search and rescue agencies, including the Naval Diving and Salvage Training Center, U.S. Coast Guard Station Panama City, and the Bay County Sheriff's Office searched the area.

He was found unresponsive at around 4:30 p.m., according to a Hurlburt release. The Air Force is investigating the incident, and no additional details are available.

This is the third fatal training incident involving the wing in the past six months. On Nov. 5, Staff Sergeant Cole Condiff, a combat controller with the 23rd Special Tactics Squadron, died after falling from a C-130 during parachute training in the Gulf of Mexico near Hurlburt. In November 2019, Tech Sgt. Peter Kraines, a pararescueman with the 24th SOW, died from injuries sustained while performing mountain rescue techniques in Boise, Idaho.

The Air Force briefly paused parachute, mountaineering, and dive training following those deaths, so Air Force Special Operations Command could review its regulations, as well as equipment and procedures used during training. ✪

Pilot Training Next Integrated in Experimental Curriculum

By Jennifer-Leigh Oprihory

The Air Force is integrating lessons learned from its Pilot Training Next initiative into its regular pilot-training syllabus as part of an experimental curriculum that will begin testing this summer.

The new syllabus will reduce reliance on the T-1Jayhawk trainer and aim to determine whether or not Pilot Training Next can scale, said 19th AF Commander Maj. Gen. Craig Wills.

"Our plan for force development is that the Air Force training adapts to the skills that the Airmen bring to the fight, not

What's Holding Up Space Force Legislation in Congress?

By Rachel S. Cohen

It's taking longer than expected to finalize legislative language building out the Space Force in the 2021 defense policy bill, indicating points of difference across the government.

The amendments are being crafted under the authority of the Department of the Air Force, which encompasses the Space Force, and will seek to apply existing law to the new Space Force and to address issues ranging from acquisition to personnel and organization.

Amendments will define details on how service members transfer into the Space Force, how civilian employees are managed, and what legal changes are required to build a better space acquisition enterprise. "Those proposals are going to [say] ... 'If you really want us to do this, here are the things we think we need,'" said Lt. Gen. David Thompson, the service's vice commander, in February. "It'll be an interesting discussion, just to see how far and how willing folks are to ... do what we believe they've asked us to do: Create a lean and agile and responsive 21st-century force."

The Pentagon must first make sure everyone from Space Force and Air Force leadership to top-level Pentagon officials are on the same page, then sell the package on Capitol Hill with "challenging and aggressive" proposed provisions.

"You can imagine there are a couple of places that make some people nervous," Thompson said. "There's a couple of personnel things we're talking about, there's ... acquisition and budgeting, and other things."

Shawn Barnes, acting assistant secretary of the Air Force for space acquisition and integration, said he hasn't gotten pushback on any particular provisions, but debate is inevitable.

Officials are also working on an acquisition organizational plan mandated by the 2019 National Defense Authorization Act. OSD's report will largely focus on describing the internal reforms made to speed up acquisition, such as implementation of fast-track contracting and prototyping authorities. A separate Air Force acquisition report will look at similar work to make procurement more flexible as well as lay out ways that Congress could further improve the process, Barnes said.

Tory Bruno, chief executive officer of United Launch Alliance, said several of the acquisition ideas under consideration will be "very, very effective if they are allowed to do them." He urged DOD to go ahead and try new ways of doing business if they know there won't be catastrophic consequences and refine them along the way.

"It depends on how forward-leaning the Hill will be," Bruno said. "Everyone wants [the Space Force] to succeed and I think everybody has gotten to the same place that, boy, this is a big challenge. ... We really, really, really need these guys to be able to go faster." ✪



Photo: USSF

USAF 2,100 Pilots Short

The Air Force is still 2,100 pilots short of its 21,000-pilot target, indicating the end to the pilot shortage is still not in sight.

Pilots continue to leave military service for better-paying civilian jobs with greater flexibility at airlines and elsewhere. The pilot shortage has remained relatively steady for the past several years.

Pilot production is up 30 percent over the past four years, according to Vice Chief of Staff Gen. Stephen Wilson. He said the Air Force produced about 1,000 pilots in 2015 and 1,300 in 2019. The goal is to turn out 1,480 aviators a year by fiscal 2024.

"Between all the services, we're going to produce 2,200 pilots and the airlines are going to hire 5,000," Wilson told lawmakers in March. "We, too, are concerned on being able to produce the number. But then the next part is I've got to be able to season them with the right flying hours, then I've got to retain them on the back end."

— Rachel S. Cohen and Jennifer-Leigh Ophihory

make everybody adapt to the training program we have," Wills said. For example, Wills said, current practice meant the Air Force recently required one new Airman who had worked as a civilian T-6 test pilot to complete a full course on how to operate the very same aircraft.

"As we move forward, what we'd really like to have is a system where we have the ability to assess what skills and talents you have and then make the training program more focused on how do we make you better?" Wills explained. "In some ways, if you're not careful, the way we do it now, we have a tendency to drag everybody to the same baseline."

Pilot Training Next makes use of immersive training devices to increase familiarity with many pilot skills. "They're basically little simulators that we build from off-the-shelf parts, and the cost of the units is somewhere around, you know, \$8,000-\$10,000, compared to a \$26 million regular simulator," Wills said.

The most recent Pilot Training Next cohort, which began training in January, shortened the time needed for many trainees to be ready to fly solo. Typically that takes 10 to 15 flights, but among this group, two students soloed after just four sorties in the airplane.

"The difference is that they had ... about 15 sorties in these immersive training devices," Wills said. He sees two potential opportunities coming from these successes: Teaching Airmen the same lessons in less time or covering more skills and tasks in the same time frame to gain a much higher-quality pilot."

AETC Commander Lt. Gen. Brad Webb told *Air Force Magazine* this kind of student-centered training is changing the face of USAF training for Airmen across the Total Force.

Wills said the curriculum to be tested this summer will include four cohorts of 11-15 participants at Joint Base San Antonio-Randolph, with the first one kicking off in July and starting about every "two and a half months." The length of each Airman's training will hinge on what kinds of airframes they're slated to fly.

"If they go to the mobility forces, for example, we think it's gonna be around nine months," Wills said. "We're still developing the fighter side of that syllabus, but we think that'll be a little bit closer to the traditional ... 12-to-14 month syllabus."

Once proven, the aim is to extend the experimental curriculum to all USAF pilot training bases, Webb said.

"You know, we have to do it methodically," he said. "We're

gonna fail if we just go *poof*."

Pilot training has largely unchanged over the past 50 years, despite huge strides in technology. Meanwhile, today's Airmen are "smarter than any group of Airmen" the service has ever seen, Wills said, and "better able to access multiple channels of information" simultaneously than in the past. "It's an imperative for us to transform." ✪

USAF Weighs Bases for First B-21s



Illustration: USAF

USAF artist illustration of the new B-21 Raider bomber in a hangar at Ellsworth Air Force Base, S.D.

By John A. Tirpak

The Air Force will soon start studies assessing the environmental impact of basing the B-21 Raider at Dyess Air Force Base, Texas, and Ellsworth Air Force Base, S.D., the service announced on March 6. One of the two locations will be the first base to host the bomber.

Typical environmental assessments consider the impact of operations, noise, and pollution from a weapon system on the local area's population, agricultural enterprises, water quality, transportation, cultural resources, airspace, and wildlife.

The two bases already support bombers, with B-1B squadrons on site, which should "minimize mission impact, maximize facility reuse, minimize cost, and reduce overhead, as well as leverage the strengths of each base to optimize the B-21 beddown strategy," according to the Air Force announcement. Public hearings will be held in nearby locations through April.

The announcement, published in the Federal Register, said the environmental impact analysis will support the choice of "Main Operating Base 1" for the B-21, which will include B-21 operational squadrons, a B-21 formal training unit, and a weapons generation facility. The announcement noted the B-21 will be capable of "penetrating and surviving into advanced air defense environments," delivering both conventional and nuclear weapons. Future beddown locations will be chosen after MOB 1 is selected.

The B-21 is expected to enter into service in the 2020s, and USAF plans to build at least 100 of the aircraft, which will fall under Air Force Global Strike Command.

In addition to Dyess and Ellsworth, Air Force leaders have said the B-21 will likely also beddown at Whiteman Air Force Base, Mo., which has been home to the small B-2 stealth bomber fleet since the early 1990s.

Besides direct area impacts, the assessment will consider the areas where the B-21s will practice. In South Dakota—as well as neighboring states Wyoming, Montana, and North Dakota—it would be the Powder River Training Complex. In the Southwest, it would be the Brownwood Military Operating Area, the Lancer MOA, and the Pecos MOA, in Texas and New Mexico.

The Air Force needs to base the B-21 in an "appropriate geographic location" that can support operations, training, facilities, and airspace for the bomber mission, according to the announcement. ✪

B-2 Task Force Deploys to Europe



Photo: Master Sgt. Matthew Plev

A B-2A Spirit bomber assigned to the 509th Bomb Wing conducts operations in support of Bomber Task Force Europe 20-2 over the North Sea March 12.

An undisclosed number of B-2 stealth bombers touched down March 9 at Lajes Field in Portugal for the latest bomber task force deployment to Europe.

The Spirit bombers from the 509th Bomb Wing and 131st Bomb Wing at Whiteman Air Force Base, Mo., deployed to the base with the help of KC-10s from the 305th Air Mobility Wing at Joint Base McGuire-Dix-Lakehurst, N.J., according to a U.S. Air Forces in Europe release.

The bombers are scheduled to fly out of multiple bases across Europe to familiarize aircrews with the area and to prove America's commitment to its allies and partners, according to USAFE.

B-2s most recently deployed to Europe last August, when they operated out of RAF Fairford, England. ✪

USAF Touts Promising Research Despite Flat S&T Budget

By Rachel S. Cohen

The Air Force's flat science and technology budget request for fiscal 2021 is worrying some lawmakers.

As the U.S. looks to develop advanced military systems such as improved hypersonic weapons and enabling technologies such as artificial intelligence faster than Russia and China, Roper lamented that the service's research fund lost ground to more pressing priorities. Nuclear modernization, Joint All-Domain Command and Control, and the effort to stand up a Space Force pulled money and resources away from basic research in the 2021 request released last month.

"Sometimes the innovation voices did not win at budget closeout," said Air Force acquisition boss Will Roper. "[There are] a lot of things on the Air Force's plate ... and unfortunately when we had to make the budget balance,

we had to look for areas to take risk."

Congress in fiscal 2020 allocated \$35.2 billion for USAF research and development. The Department of the Air Force, which includes the Space Force, asked for \$37.3 billion for R&D in 2021.

Rep. Jim Langevin (D-R.I.), chairman of the House Armed Services intelligence and emerging threats and capabilities subcommittee, noted that planned Air Force spending on basic research and advanced technology development both drop by about 8 percent in the 2021 request.

Roper agreed that the proposed S&T plan can erode the Air Force's technological advances over time, but he pointed to progress in classified programs.

"As we think about competing against countries like China and Russia, if we have foundational research that publishing it would simply let our adversary jump ahead, it's great that we have researchers that are willing to work with us at a classified level, not publish their research, and help us have a military edge," Roper said. "We made a sizable movement in that portfolio."

He brought up two other eye-catching, science fiction-like projects underway as well. One is developing small sonogram machines akin to the handheld tricorder in "Star Trek"—a sensing, computing, and recording device that analyzes the surrounding environment and can help diagnose illnesses. Another program is pursuing samarium nickel oxide, which "decouples the temperature of that material from its thermal emission, paving the way for what could be a cloaking device," Roper said. ✪

PT, Promotion Tests Postponed

By Brian w. Everstine

The Air Force paused Weighted Airman Promotion System testing through at least May 11 and suspended PT tests until at least June due to the COVID-19 pandemic.

So many testing centers have closed due to the outbreak that the Air Force chose to give Airmen more time. But those testing centers that remain open are still authorized to support testing and those who have already sat for the exam may not retake it this cycle.

"Any Airman who is unable to test within the extended testing cycle window will be automatically considered for in-system supplemental promotion once they are able to test," the Air Force said.

PT tests are being delayed six months. Tests originally scheduled for March will be held in September; April will shift to October; and May tests will shift to November. ✪

■ The War on Terrorism

Casualties:

As of March 23, 2020, 92 Americans had died in Operation Freedom's Sentinel in Afghanistan, and 95 Americans had died in Operation Inherent Resolve in Iraq, Syria, and other locations.

The total includes 183 troops and four Defense Department civilians. Of these deaths, 87 were killed in action with the enemy, while 100 died in noncombat incidents.

There have been 570 troops wounded in action during OFS and 214 troops in OIR.

FACES OF THE FORCE



Photo: Sr. Airman Joseph Levelle

An AC-130U Spooky aircrew from the 4th Special Operations Squadron received 14 medals for their roles in providing more than nine hours of air support, enabling the rescue of 15 patients during a mass casualty evacuation on an April 2019 mission in Afghanistan. "The most lethal part of the gunship is the crew," said Air Force Special Operations Command boss **Lt. Gen. Jim Slife**. Aircraft commander **Capt. Neils Aberhalden** and navigator **Capt. John Crandall Jr.** received DFCs with a "C" (for combat) device, and Air Medals were awarded to fire control officer **Capt. Micah Uvegas**; co-pilot **Capt. Brian Yee**; electronic warfare officer **1st Lt. Nicholas Maiolo**; flight engineer **Tech. Sgt. Jacob Griffen**; direct support operator **Staff Sgt. Jonathon Friesz**; aerial gunners **Tech. Sgts. Ryan Estes** and **Austin Parrent**, **Staff Sgt. Michael Martinez**, and **Senior Airman Jacob Bateman** and **Zadok Dean III**; and sensor operators **Staff Sgts. Samuel Mayfield** and **Omar Diaz**.

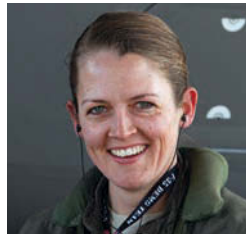


Photo: Capt. Kip Sumner

Capt. Kristin Wolfe became the first woman to fly on, as well as lead, the F-35A Lightning II Demonstration Team. "I don't consider myself a female pilot, but a pilot that happens to be a female," she said. "I'm here to do a job, and that is to make this team the best out there." Wolfe has flown the team's cornerstone aircraft since 2017. Prior to flying F-35s, Wolfe was an F-22 Raport instructor pilot. She has near 1,000 hours combined in stealth aircraft.

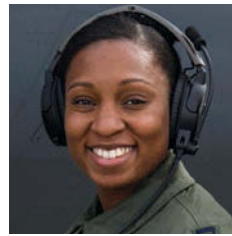


Photo: Airman 1st Class Whitney Laine

On Feb. 18, an all-African American aircrew from Washington's Fairchild Air Force Base refueled F-16s flown by Airmen from the Red Tail Squadron at Maxwell Air Force Base, Ala., to honor Black History Month and to pay tribute to the Tuskegee Airmen. "We don't have much [African-American] representation here right now," said **Capt. Jazmind Roberts, 93rd Air Refueling Squadron pilot**. "I am the only black female pilot. This flight is to show we also have representation on [the KC-135]"



Photo: Sr. Airman Ann McCready

Laughlin Air Force Base, Texas, instructor pilots **Maj. Will Smith** and **Capt. Andrew Campbell** will soon become foreign affairs officers. Smith will join the U.S. European Command staff after completing Russian language training, spending time at an embassy, and getting his master's degree. Campbell will work as a security cooperation officer at an American embassy in Australia after finishing his master's and completing language and embassy affairs-related training in Asia.



Photo: James Bowman/USAF

Col. Terrence Adams, received the Military Service Award during the 34th Black Engineer of the Year STEM Global Competitive Conference in February. The award honored Adams' "exceptional achievements and mentorship in the STEM career fields," USAF said. "This award is not about me, it's about a community of people working together to build pipelines of students interested in cyber, STEM, and aviation for our nation's defense," Adams said.



Photo: Tech. Sgt. Alexandre Morites

Chief Master Sgt. Cyrus Snider Sr. and his son **Airman 1st Class Cyrus Snider Jr.** have made serving in the Illinois Air National Guard a family affair. Both joined the 182nd Airlift Wing immediately after high school and recently deployed together to Ali Al Salem Air Base, Kuwait. "To be here with him right now, what can make a dad prouder?" said Cyrus Sr., who is preparing to retire after more than 12 deployments and nearly 1,000 combat flying hours.



Photo: Rachel Simones/USAF

The Federal Laboratory Consortium for Technology Transfer has named AFRL's Sensors Directorate Tech Transfer and Alliance Program Manager **Jack Owsley III** as its Rookie of the Year for 2020. "My job is to help protect the intellectual property (IP) of the government," Owsley explained. His achievements include negotiating a joint ownership agreement for USAF between the United States and the United Kingdom" and executing "20 new cooperative research and development agreements."



Photo: USAF

The Bay County Chamber of Commerce in Florida recently bestowed its Chairman's Award upon **325th Fighter Wing Commander Col. Brian Laidlaw** in recognition of Tyndall Air Force Base's resiliency and role in helping the county come back from Hurricane Michael. The award honors remarkable community service and has only been given out on five previous occasions. Laidlaw accepted the honor, but, he said, "Team Tyndall earned it."



Photo: USAF

Retiring Joint Base McGuire-Dix-Lakehurst, N.J., **Military Working Dog Kira**—who, during her six years on the job, worked in patrol and explosives detection—got the best present possible: a forever home. One of her former handlers, **Staff Sgt. Nicholas Gray**, flew to New Jersey for the 9-year-old canine's retirement party and adopted her as soon as it ended. "She was misunderstood and feared for how intense she was," he recalled. Kira now calls Tyndall Air Force Base, Fla., home.

Know of someone we should recognize? Send nominees to afmag@afa.org

The Hypersonics Push

Pentagon leaders provide a first look at plans for testing and producing future hypersonic weapons.

The Air-Launched Rapid Response Weapon (ARRW), developed by Lockheed Martin, will be the Air Force's first hypersonic missile.

By John A. Tirpak

Three years into a diversified, crash program to catch and surpass China and Russia in hypersonic missiles, the Air Force and the Department of Defense are beginning extensive prototype flight-testing and offering a first peek at their plans for large-scale production.

"We've got a series of up to 40 flight-tests planned for various hypersonic systems" over the next four years, said Mark Lewis, DOD's director of defense research and engineering, in a February interview. Michael Griffin, undersecretary of defense for R&E, and Lewis' boss, has designated hypersonics his top priority among 11 critical modernization technologies.

A Pentagon roadmap about how hypersonic missiles will be developed and built has recently been completed, and Congress "will get various versions" of it, ranging from unclassified to top secret, Lewis reported.

The roadmap lays out work by the military services, their research laboratories, the Defense Advanced Research Projects Agency, and others. It explains how "we want to move beyond prototyping ... to delivered capability," Lewis said. "That means taking the successful prototyping programs and getting them to effective,

"It's essential that the Air Force not have single points of failure by relying on a sole supplier" for hypersonic components.

—Will Roper, USAF's acquisition chief

useful weapons. And by 'effective,' I mean not only capability, but numbers."

The Pentagon has no interest in simply putting "a few weapons in tubes—we're talking about a fully realized capability," he added.

The first task is proving DOD's chosen approaches can work and that they can be produced affordably and in significant numbers.

Pentagon acquisition chief Ellen Lord has created a hypersonics "war room," she reported in March, chaired by Lewis and Assistant Secretary of Defense for Acquisition Kevin Fahey. Comprised of representatives from many offices within the Office of the Secretary of Defense, from industrial policy specialists to doctrine experts, the "war room" panel will assess whether the industrial base is able to produce supersonic-combustion ramjet engines, or scramjets; high-temperature materials; new guidance systems and other required items for hypersonics. It will also consider whether DOD has access to the personnel and expertise needed, and whether it should establish new relationships with universities to "identify talent."

Working on a "pretty short-time fuse," the team will have initial answers "in the next couple of months," Lewis said.

Illustration: Lockheed Martin

The Hypersonic Six

The Pentagon discusses only six hypersonic programs, with others remaining shrouded in secrecy. How the six known programs compare:

Service or Agency	System	Range	Contractor(s)	Type	Launch Mode
1. Air Force	Air-Launched Rapid Response Weapon	Medium	Lockheed Martin	Boost-Glide	Air
2. Air Force/DARPA	Hypersonic Air-Breathing Weapon Concept	Medium	Lockheed Martin/Raytheon	Air-Breathing	Air
3. DARPA/Air Force	Tactical Boost Glide	—	Lockheed Martin/Raytheon	Boost-Glide	Air
4. DARPA/Army	Operational Fires	Medium-Long	Lockheed Martin	Boost-Glide	Ground
5. Army	Long-Range Hypersonic Weapon	Long	Lockheed Martin	Boost-Glide	Ground
6. Navy	Intermediate-Range Conventional Prompt Strike	—	Lockheed Martin	Boost-Glide Surface	Submarine

Driving the effort is the fact that the U.S. has ceded the lead in hypersonics to its great power competitors, Russia and China. Those nations have surged ahead because the U.S. for too long “consistently made the decision to not transition” hypersonic technologies in the laboratory “to weapon applications,” Michael White, assistant director of hypersonics for R&E, said at a Pentagon press conference. Russia and China, however, did not hesitate, and that “got their efforts jump-started. And that’s what we’re accelerating now.” White added that the Pentagon leadership has decided “we can’t allow that asymmetry to stand.” America’s competitors have developed hypersonics in large part to “challenge ... our domain dominance in space, on land, at sea, and in the air.”

He said the industrial plan is moving ahead early because “we’re looking to make critical investments in advanced techniques and capabilities that get affordability into the equation right from the start.”

Overall, the Pentagon has asked Congress to fund just over \$3 billion for hypersonics research in fiscal 2021, including basic research and advanced prototyping.

DOD describes its hypersonics programs with terms like “medium” or “long” range. What does that mean?

“We’re very cautious about attaching numbers to exactly what we mean,” Lewis said in an interview. “All these systems wind up flying really long distances.”

For medium range, though, he said, “we’re talking about handfuls of hundreds of miles. Long range, we’re talking ... a couple thousand nautical miles. It’s intentionally fuzzy.” The Pentagon, he said, is “still figuring out the concepts. That’s part of what we’re going to be exploring with our upcoming flight tests.”

White noted that the Conventional Prompt Strike program will be the first to fly, later this year. Wherever possible, the Pentagon will “accelerate our transition” from prototype to fielded capability. “We’re going to deliver to the warfighter as expeditiously as possible.”

When the Air Force halted the Hypersonic Conventional Standoff Weapon, or HCSW, in February, it effectively anointed its other system, the AGM-183 Air-Launched Rapid Response Weapon, or ARRW, as its first hypersonic missile.

Will Roper, the Air Force’s acquisition chief, said in a February press conference that the heavy load of big-ticket initiatives in USAF’s fiscal 2021 budget request—nuclear modernization, the Advanced Battle Management System, Joint All-Domain Command and Control, space superiority and the standup of the Space Force, to name a few—meant it couldn’t fund two boost-glide hypersonic missiles in parallel.

The ARRW is “more advanced” than HCSW, Roper said, and “unique.” By contrast, HCSW would have used the same hypersonic glide body as the Army and Navy systems. The



Photo: Department of Defense

Michael White became the assistant director for hypersonics in the Office of the Under Secretary of Defense for Research and Engineering on October 29, 2018.

resulting diversity of approaches will give adversaries more to worry about, he stated.

Lockheed Martin released two artist’s concepts of ARRW at the end of February. They portray a missile coming off a B-52 bomber pylon and flying up to a high altitude, at which point its aeroshell nose comes off, exposing the hypersonic glide vehicle within. Based on real photographs of the AGM-183 in captive-carry tests on a B-52, if the artist’s concept is correct, the hypersonic vehicle is probably only about five feet long.

“The reason we went with ARRW was not that HCSW was bad, but ARRW is smaller,” Roper said. “We can carry twice as many on a B-52.” The weapon might also be carried on the centerline station of the F-15, Roper added.

Both ARRW and HCSW are boost-glide hypersonic missiles, which use a rocket to push the glide body to hypersonic speed, after which the rocket motor is detached and the weapon glides and maneuvers to the target.

“I truly, truly hated to down-select between HCSW and ARRW a year early,” Roper said. Both were about to clear their critical design reviews (CDR) and would have yielded test flights this year. White said the Air Force is appropriately placing its’ “bet” on ARRW now, but HCSW will be put “on a shelf, and [we] can pull it off if we need it. But we want to focus our energies on ARRW to make sure that’s successful.”

The ARRW is “on track for an early operational capability in FY22,” an Air Force spokeswoman relayed in an email, confirming that it’s the only hypersonic prototyping effort the Air Force will fund in fiscal 2021. The USAF budget plan requests \$382 million for hypersonics prototyping, down from the \$576 million in this year’s budget.

A senior Air Force official confirmed that about \$200 million left over from the HCSW effort will now be diverted to ARRW. Lockheed Space had been developing HCSW under a 2018 contract worth up to \$928 million.

The DARPA program, called Tactical Boost Glide (TBG)—intended as a Mach 7 missile—was to serve as the basis of

A B-52 from Edwards Air Force Base, Calif., carries an AMG-183A Air-Launched Rapid Response Weapon (ARRW). The Air Force hopes to have a second supplier for the weapon, in addition to prime contractor Lockheed Martin.



Photo: Christopher Okular/USAF

ARRW, but now the projects seem to be in parallel. John Varley, vice president for hypersonics at Lockheed Martin Missiles and Fire Control (MFC), said ARRW's progress allowed it to pull even with the TBG effort.

The two projects were not intended to run in parallel, but had the company waited until all the work on TBG was complete, Varley said, "we wouldn't be moving at the pace the customer's looking for. ... So, we're going to learn. We're going to fly TBG," and incorporate discoveries into ARRW.

In the meantime, TBG will continue to do flight verifications, developmental testing, "inertial measurement testing, booster testing, and glide body testing. And we're going to insert those lessons along the way."

Prototype programs typically don't have hardware built by the critical design review stage, he acknowledged, but "this is very mature."

Varley acknowledged Lockheed has about \$3.5 billion in hypersonics work across multiple divisions—MFC, Space, Skunk Works, and Aeronautics—and that the Pentagon has granted clearance to share information across those entities, which are governed by a company "hypersonics executive steering council." Lockheed is the sole source on all but two of the major, acknowledged Defense hypersonics programs. The other principal contractor at the prime contractor level is Raytheon.

Regarding HCSW, Varley said he thinks the Air Force "made a very courageous decision—earlier than we thought [it would]—but we have to have the agility, as a corporation, to meet our customer's changing demands. So, right now, ARRW is the Air Force's main hypersonic program."

Lockheed broke ground last September on a new facility in Courtland, Ala., close to the Army's Huntsville, Ala., missile headquarters, that will ultimately be its hypersonic "center of excellence." Varley said it will handle "all-up round integration, test, and buyout ... so subsystems that will come across all our different business areas will end up there. We'll do final integration, coding, testing, fueling, and ordnance assembly there."

LONGEST POLES IN THE TENT

Five major challenges must be overcome for hypersonic weapons to become reality, Varley said:

■ **Managing Heat.** With exterior temperatures rising to over 4,000 degrees Fahrenheit, the hypersonic vehicle must be strong enough to hold its shape, and guidance and communication electronics must be thermally hardened.

■ **Connectivity.** At extreme temperatures, ionization may black out conventional communications, requiring sophisticated workarounds.

■ **Materials.** Metal alloys and composite materials that can handle high heat loads must be developed. The vehicle will also require heat-resistant coatings.

■ **Maneuverability.** Maneuvering at Mach 5-10 without causing the vehicle to tumble out of control will require delicate, autonomous handling.

■ **Accuracy.** Extremely precise inertial measurement and other guidance systems will be essential, since a miss at hypersonic speed could put the vehicle far from its intended aimpoint.

Roper said that a further advantage to down-selecting to a single, rocket-boosted glide vehicle early means "we get to focus on producibility."

The Pentagon "would like to get to dual suppliers, for both (ARRW and the Army/Navy systems), so that we don't just succeed in flight-testing, we move into an industry base that's capable of building at scale," Roper said. That scale won't be mass production, he added, "but we'd like a very adaptable, agile industry base that can allow us to do spiral upgrades, lot to lot."

Choosing ARRW ahead of schedule lets the Air Force "start bringing on second suppliers a year earlier," he explained.

One requirement will be an ability to 3D-print leading edges, Roper noted, because he believes refining that element of the design will require many iterations. It's essential that the Air Force not have "single points of failure" by relying on a sole supplier for any key component.

KEEP BREATHING

In addition to ARRW, the Air Force and DARPA continue to pursue an air-breathing system called the Hypersonic Air-breathing Weapon Concept, or HAWC.

Viewed as a longer-term project, HAWC will require numerous advancements and is the type of problem Lewis calls “DARPA-hard.”

“They’re being very successful in that program,” Lewis said, “but the proof will be in their flight-test.”

Lewis said he has “more confidence in air-breathing at the tactical scale than the rocket-boost glide,” adding that he believes the nation needs both because “they bring different capabilities to bear.”

Air-breathing hypersonics weapons operate at lower altitudes and speeds. The Pentagon successfully tested the concept in the X-51 nearly 10 years ago, generating more than 200 seconds of air-breathing, hypersonic flight, Lewis noted. “So we know how to do this.”

Drawbacks of air-breathing hypersonic systems are that they require oxygen to combust with fuel, so they must operate at a lower altitude than rocket-boost glide systems. Moreover, their complex air intake geometries limit maneuverability, lest airflow be interrupted. The upside, though, is that they “don’t have to carry around an oxidizer,” Lewis said, so they can be lighter and smaller than rocket-powered alternatives, making them well-suited to air-launched applications.

“If you compare air-breathers to boost-gliders, you get more air-breathers for your dollar,” Lewis said. Air-breathers also can achieve “four to five times” the range of rocket-powered options at certain altitudes. White also noted that air-breathers have more room onboard for a terminal guidance capability and are “more affordable.”

The Pentagon is pursuing both technologies to diversify the problems U.S. forces present to adversaries, similar to operating a “high-low mix” of both F-15s and F-16s, Lewis asserted. “We use both, and in the way they perform best.”

Not all applications for hypersonics are medium or long range, he noted. For extremely short ranges and very long-range systems, the boost-glide is probably best, Lewis said. A rocket-powered, short-range missile—like a dogfight missile—can be “incredibly compact” and doesn’t need the volume required for an air inlet. It has a huge advantage in thrust to weight ratio and doesn’t need time to spool up to high speeds.

For “very, very long distances—say, a large fraction of the radius of the Earth—you ... want to do it with a rocket,” Lewis said. For those missions, “what you really want to do is get out of the atmosphere and then get back in. ... That’s why ICBMs are rocket-powered.”

For middle distances—“a couple hundred nautical miles to maybe a thousand miles ... the air-breather is the better solution,” he said. “And that’s where we see the advantage in the hypersonic realm.”

The acquisition strategy is still being developed, White said. It’s in its early stages because the prototyping and experimentation phase is still underway. But the strategy will allow the Pentagon to “transition from [Research and Development] to weapon prototype. The transition to actual weapons ... is where the acquisition strategy will come into play.”

Asked if hypersonics represent a potentially destabilizing technology, White opined that “it’s more destabilizing if [adversaries] have them, and we don’t.” Lacking such a capability, the U.S. would give up deterrence in a major area of competition, he said. “We have to be able to counter with similar capabilities when the time comes.”

Lewis said he does not expect the Pentagon’s hypersonics quest to narrow down to just a couple of programs.

“I don’t expect us to zero-in on just one or two things and stop there,” he predicted. “I expect development efforts to continue. ... We have a very strong focus on delivering real capabilities, getting these things out of the laboratory ... out of prototype and ... into the hands of the warfighter, and that’s our primary focus now.”

Interservice Collaboration Continues

By John A. Tirpak

The Air Force’s Hypersonic Conventional Standoff Weapon was to have used the same gliding body as the Army’s Land-Based Hypersonic Missile and Navy’s Intermediate-Range Conventional Prompt Strike Weapon. Asked if USAF will continue to be involved in the other services’ efforts, Roper said collaboration will continue.

“We will certainly stay synched with them, on just the state of hypersonics in general.” Having a different approach “diversifies the number of flight bodies that are being looked at” in the Pentagon’s hypersonics portfolio, he said.

Lewis, in an interview, provided a little more background on the HCSW decision. The approach had some “very attractive features,” he said in an interview. That work was based on research already done by Sandia National Laboratories. Pentagon leaders reasoned, “wouldn’t it be great if we could leverage what they had done?” and save some money by having some commonality of systems among the services, he said.

However, HCSW started turning into a modern version of the TFX/F-111 project of the 1960s, Lewis observed, in which both the Navy and Air Force tried to develop a common fighter-bomber. Compromises began to mount for both, and “you realize, maybe

you’re not saving so much money, after all, and maybe it’s not such a great performer for your specific application,” Lewis explained.

The Air Force “came to the realization that the ARRW, derived from the DARPA tactical boost-glide program, for the specific Air Force application ... was the better bet,” he asserted. “It was just a realization that although well-intentioned, the Air Force was better off investing in other areas, and we applaud them on that.” He added, “We have to be concentrating on the things we have the most confidence in.”

The HCSW decision isn’t a sign that USAF is backing away from hypersonics, Lewis said, but should be viewed instead as “an increase in the commitment. ... It was a refocusing of their hypersonic efforts,” and a recognition that not all hypersonic projects now being explored “are going to become programs of record.”

While HCSW wasn’t the right solution for the Air Force, that doesn’t mean it’s not a good idea for the Army and Navy, Lewis noted. The decision to terminate HCSW was “more about the application; it wasn’t about the technology.” In OSD, “we’d rather see the services focus on what each one does best, so we’re frankly glad the Air Force is focusing on things that come off the wings of airplanes and come out of bomb bays; just as the Navy should be focusing on things that come out of tubes on ships.”

The Tanker Gap

USAF gives up capacity today for capability tomorrow. But it's TRANSCOM that must live with the risk.



An MC130J takes on fuel from a KC-135 over the Pacific Ocean in November 2019. The Air Force wants to retire 13 of the refuelers in its 2021 budget.

Photo: Senior Airman Rhett Isbell

By Brian W. Everstine

The Air Force's 2021 budget request accepts a near-term shortage in today's refueler fleet to pay for future capacity. The budget proposal calls for cutting 16 Active-duty KC-10s and 13 KC-135s from the Active and Reserve fleets.

Meanwhile, the Air Force will continue to buy new KC-46s to keep that production line running, maintaining the current 15-planes-per-year rate even though the new tankers are still years away from being fully operationally capable. Indeed, Chief of Staff Gen. David L. Goldfein told a Senate committee in March that he would not use the new tankers in war unless absolutely necessary.

"If we go to a high-end contingency, we will put every KC-46 we have into the fight," Goldfein said, referring to a conflict with a country like Russia or

"The stress point is the day-to-day demand."

—Gen. Maryanne Miller, Air Mobility Command boss

China. "We won't use it for day-to-day operations, but it will be made available for a contingency."

For Goldfein, the aim of the 2021 budget—his last as chief—is to build a force capable of fighting and winning in 2030 against both peer threats and violent extremists.

His "Air Force We Need" plan defines what the Air Force should include to meet the requirements of the National Security Strategy. It calls for a total of 386 operational squadrons, including 40 tanker squadrons. Because the typical tanker squadron includes 12 aircraft, that works out to a requirement for roughly 480 tankers; the Air Force specifies 479. By contrast, today's force includes 26 tanker squadrons made up of 394 KC-135s and 59 KC-10s, or 453 tankers as of Oct. 1, 2019. That suggests the Air Force has only 65 percent of the squadrons it needs, and only 85 percent of the air refuelers required. (The 33 KC-46s delivered so far do not count toward that

total). If the Air Force gives up 29 refuelers as planned, those percentages get worse.

A second study, by MITRE, predicts the Air Force will need more KC-46s than the 179 aircraft now on order. And the Center for Strategic and Budgetary Assessments, in yet another study, argues the service should delay retiring KC-10s until the KC-46s are ready for operations. CSBA also calls on the service to develop a second tanker platform; for its part, the Air Force is only in the nascent stages of defining the requirements for what has been called KC-X.

The demand signal for tankers is certainly high and steady. In 2019, USAF tankers delivered almost 950 million pounds of fuel, with an average of 47 tanker sorties daily, according to U.S. Transportation Command. Tankers refueled aircraft every five minutes in Iraq and Afghanistan in 2018, according to the command. Meanwhile, Air Mobility Command says it is flying 15 percent more hours now than it did four years ago—with a smaller fleet and with fewer Airmen.

Even so, the Air Force and Defense Department leaders in

the Pentagon are asking combatant commanders to make do with less capacity in the short term to pay for future capability tomorrow.

"We in the Air Force are looking to the future fight," said Air Mobility Command boss Gen. Maryanne Miller. "And we have to look at our legacy capacity that we have right now. The idea was, can we give up legacy capacity, still meet the demand today, and still prepare for the future? The stress point is the day-to-day demand."

The Air Force's budget proposal worsens a shortfall that worries combatant commanders and major commands alike, and it will be hard to convince skeptical lawmakers who have repeatedly blocked similar requests in the recent past.

Goldfein acknowledges the risk, but says the Air Force simply can't afford everything it needs, particularly the advanced connectivity envisioned for the Advanced Battle Management System that will enable a future Joint All-Domain Command and Control capability.

"You've got to find ways to pay for this," he said in February,



Photo: Tech. Sgt. Matthew Fredericks

Senior Airman Derek Chau prepares to drain fuel from the engine of a KC-135 during a routine inspection at Kadena Air Base in Japan. Cutting 13 KC-135s and 16 KC-10s “creates a capacity gap,” TRANSCOM officials say, with significant impacts on daily operations.

laying the groundwork for his budget arguments. “You have platforms that are not going to play in that 2030 fight. Is there near-term risk, which is real risk, that we need to take as a department to buy our future?”

Paying for a largely classified digital capability while giving up tangible hardware makes the argument that much harder, he admitted. “It’s not an easy narrative in a town that’s focused on platforms.”

Maj. Gen. John Pletcher, USAF’s deputy assistant secretary for budget, argued these cuts are “acceptable risk,” given that they total 488 tankers, above the official requirement of 479 refueling aircraft. In reality, however, roughly three dozen of those aircraft are KC-46s that will remain in operational testing for three or four more years. The new tankers rely on a remote vision system for the boom operator that has been found faulty in certain light conditions. The boom is also incapable of refueling A-10 aircraft, which fly slower and have difficulty maintaining the connection to the boom’s actuator. The Air Force didn’t state its requirements accurately, USAF officials have said, so the Air Force is paying to develop a new actuator. Officials anticipate it will take years to fix these two problems.

Meanwhile, U.S. Transportation Command reports refueling capacity is falling short of operational demand. In a 2018 briefing to industry, the command cited a capacity shortfall of 20,000 to 30,000 refueling hours. Not surprisingly, tankers are high on the command’s unfunded priority list. But tankers were not included on the Air Force’s unfunded priority list, indicating a further gap

between tanker consumers in the combatant commands and tanker providers in the Air Force.

U.S. Army Gen. Stephen Lyons, TRANSCOM commander, told Congress in February the loss of 29 tankers would worsen the tanker capacity shortfall.

“This creates a capacity gap with significant impacts to combatant command daily competition and wartime missions, and negatively impacts senior leader decision space for mobilization when confronted with a crisis,” Lyons wrote in the unfunded requirements documents sent to Congress.

The initial fiscal 2021 cuts, and expected retirements of KC-135s and KC-10s in 2022 and beyond, create a “capacity bathtub” until KC-46s come online and are operational. For now, TRANSCOM is asking Congress to reverse the proposed budget cut and “buy back” 23 of the 29 aircraft targeted for retirement, then conduct a “year-by-year review” of the KC-46 before determining any further cuts. Doing so would cost about \$110 million, according to the command.

Lyons said TRANSCOM must continually “position/reposition tankers to meet the highest priority NDS requirements while taking risk in lower priority missions. ... Limited fleet capacity, an aging fleet with degraded readiness, and non-mobilized operational utilization challenges pose significant risks to meeting future demands.”

Similar concerns were raised last year.

“We are working closely with the U.S. Air Force to retain sufficient [aerial refueling] capacity and potentially delay the retire-

ment of KC-135 aircraft in order to maintain [a] sufficient number of aircraft to meet operational requirements,” Lyons said a year ago. “We strongly advocate for continued congressional support to enhance tanker readiness and balance new aircraft fielding with aging aircraft divestiture in order to retain the necessary number of accessible AR assets over the next decade to ensure TRANSCOM can meet [National Defense Strategy] demands.”

Miller expanded on this push last September, saying AMC was working with the Air Force to slow down KC-135 retirements “because I have to keep booms in the air.” Goldfein backed her up at the time, insisting, “We can’t retire [old tankers] until we have an airplane that’s combat-capable.” Pacific Air Forces boss Gen. Charles Q. Brown Jr. (nominated to be the next Chief of Staff) has also emphasized the need for tanking capacity in the 105 million square miles of airspace in which his forces operate, saying more refueling means more flexibility.

This divide between Air Force and various commands’ planning comes down to different, competing priorities. “For TRANSCOM, they work the day-to-day mission,” Goldfein said, adding that the Air Force is “looking at balancing risk against a stacked portfolio.”

MITIGATING THE RISK

The service is taking steps to try to mitigate these risks, including hiring contractors to fill in some of the gaps.

Air Mobility Command and TRANSCOM have held multiple industry days to discuss commercial refueling support, meeting with 14 companies in December to provide “boom-type air-to-air refueling” during training, test, and evaluation, and domestic fighter refueling missions. This would free gray-tail refuelers for combat operations and high-level training.

In June 2019, TRANSCOM detailed a requirement for contractor-owned and -operated aircraft for both boom and hose-and-droge refueling, to meet an operational demand of about 7.6 sorties per day. Contractor discussions are ongoing, but no contract has been awarded, according to AMC.

Miller said the command finalized a feasibility study on the

possible award in March, which in turn would inform a formal request for proposals. The initial goal would be a contract within a year of the RFP to cover about 6,000 flight hours. There’s a hiccup in this planning, however. The Federal Aviation Administration needs to be involved and sign off on the safety regulations for private aircraft refueling military planes. “The FAA is really averse to having two airplanes very close together,” Miller said.

AMC is also trying to figure out how to wring more efficiency from the tankers it has. By leveraging existing data and machine learning, the command aims to get smarter about how tankers are tasked, getting more usable refueling hours downrange from each flight. AMC is using historical data to predict when the demand for booms is greatest, and how to support those peaks and valleys. From July 2018 to early March 2019, that effort meant reducing by nine the number of KC-135s in theater and saving 17 KC-135 crews. Likewise, the command reduced by two the number of KC-10s in theater, saving six KC-10 crews. Potentially, this could reduce the required number of aircraft, but for now it has other impacts.

“This allows our most stressed force to improve quality of life and squadron vitality, while finding additional time to maintain full-spectrum readiness,” AMC said.

While the service has not identified the specific airframes it would like to retire, a service spokeswoman said the selected aircraft would be the “least ready” in the fleet. The entire tanker force is old: KC-135s average about 57 years old and the KC-10s average 34.

Those aircraft that remain will benefit from continued investment. The Air Force budget request includes \$88.25 million for Block 35 upgrades to the KC-135, but only \$117,000 for KC-10 modifications.


The Air Force needs to look to the future and what capabilities will be relevant.

“We’ve got to do the trade here,” Goldfein said, lamenting a lack of funds to pay for all his needs. “The risk is real. If we had money, we wouldn’t be asking the combatant commanders to take short-term risk.”



A KC-135 extends its boom toward a KC-46 during a rendezvous in August 2019. Delays in operational capabilities for the KC-46 mean USAF is scrambling to keep booms in the air.

Photo: Staff Sgt. Mary McKnight



An unarmed Minuteman III launches from Vandenberg Air Force Base, Calif., during a developmental test on Feb. 5.

Missile Testing in the GBSD Era

A new era in land-based nuclear weapons could usher in changes to the Air Force's missile test regime.

Photo: Senior Airman Clayton Wear

By Rachel S. Cohen

VANDENBERG AIR FORCE BASE, CALIF. —

You see the intercontinental ballistic missile before you hear it. Upon ignition in its underground silo, the horizon blooms bright red-orange, and a ball of light rises west over the Pacific Ocean. A dull roar intensifies as the unarmed nuclear missile jets upward to arc over the moon on its way to the Kwajalein Atoll in the Marshall Islands. Brief sparks mark each time a section of the Minuteman III burns up and falls away. A jagged trail of smoke imprints its path across the sky. The crowd below claps as the missile body separates from its nonnuclear payload and disappears into the dark. It would splash down more than 4,200 miles away, about 30 minutes later.

As these weapons approach 50 years since they were first deployed across the United States, the Air Force is assessing whether its more than 400 Minuteman IIIs can still perform, and is looking ahead to the future Ground-Based Strategic Deterrent (GBSD) missiles that will replace the Minuteman III.

Airmen here test-launched a nonnuclear ICBM at 12:33 a.m. on Feb. 5 to see whether a new fuse in development is working as expected, a test that exemplifies the in-between space the land-based

“How reliable is the weapon system? How ready are our test procedures? How ready is the crew?”

—Col. Omar Colbert, 576th Flight Test Squadron commander

missile enterprise occupies right now. This test was slightly different from the usual assessments by the 576th Flight Test Squadron, which typically focus a few times a year on how boosters are performing. Those operational tests require pulling a weapon from its silo, whether at F.E. Warren Air Force Base, Wyo., Malmstrom Air Force Base, Mo., or Minot Air Force Base, N.D., then bringing it to Vandenberg for launch.

The information gleaned from such tests helps the Air Force tweak procedures and systems, shapes future parts design, and bolsters the war plans of U.S. Strategic Command. “We’re looking at, does it go where it’s supposed to? How accurate is the weapon system?” said 576th FLTS Commander Col. Omar Colbert. “How reliable is the weapon system? How ready are our test procedures? How ready is the crew to do what they’re called upon to do, and how well does everything function?”

NEXT UP: GBSD

The coming Ground-Based Strategic Deterrent missile has lofty goals: To be modern and digital, but not hackable; to ease the burden on operators, but not cut them out; to bring on a capable new weapon, but not upset the balance of global nuclear deterrence; to spend many billions creating that weapon, but not bankrupt other parts of the federal budget.



Photo: Airman 1st Class Aubree Milks

Col. Omar Colbert, 576th Flight Test Squadron commander, answers questions from the media on the role of the intercontinental ballistic missile test launch program. The 576th FLTS tests and measures current and future ICBM capability.

But to own an effective deterrent, the United States has to make sure it works—meaning the Pentagon needs to design a new ICBM test regime. The Air Force is in the early stages of that work now.

The GBSB program is slated to include more than 600 intercontinental ballistic missiles with a price tag of \$22 billion for development alone. Northrop Grumman, the lone contractor after Minuteman III manufacturer Boeing halted its bid, is scheduled to start delivering new GBSB missiles in 2029 for underground silos in Montana, North Dakota, Wyoming, Colorado, and Nebraska.

The Air Force Operational Test and Evaluation Center is responsible for testing while GBSB is still in development. The 576th FLTS at Vandenberg, the sole squadron in charge of testing the existing inventory of Minuteman III ICBMs, is still figuring out how it will help with that phase. Traditionally, it would handle operational tests once the weapons are fielded, checking the viability of everything from compatibility with the existing silos to communications with the launch range.

The small cadre of ICBM testers could feel the crunch as GBSB comes online.

About 200 people work for the 576th, which spends about \$11 million each year—a number that will have to change in the future, Colbert said.

“We don’t yet know what the new system will look like and what it will require to operate the weapon system,” Colbert said Feb. 3 at Vandenberg.

The unit is responsible for trying out technology upgrades to the Minuteman III that can roll over to the GBSB, such as a fuse modernization program. Airmen are working through a slate of five ICBM improvements worth more than \$3 billion right now, according to a squadron briefing.

Still, vetting GBSB could become a little less strenuous, a

little simpler, and somewhat less time-consuming than the Minuteman III, if only because the older weapon needs closer scrutiny. The new missile’s components may be easier to swap out for different test needs as well.

As the Air Force figures out where and how to deploy the missiles, and how many launch control centers and silos to fill, it must also determine what it needs to maintain the weapon system, Colbert said.

The service holds live test launches of unarmed ICBMs at least a few times a year, though the number changes depending on what data officials want to collect. Some launches are intended to measure the reliability of the missile, for example, while others seek to measure the performance of system’s upgrades or of the connection to airborne launch platforms such as the E-4 Nightwatch plane.

Today, ICBM testers spend months planning the movement of an ICBM to Vandenberg from the operational missile wings at Malmstrom, F.E. Warren, and Minot, or from the maintenance depot at Hill AFB, Utah. In each case, they must slowly and carefully transport the missiles across the country, outfit them with test-specific systems to track the weapon’s performance in flight, and load it into a tractor-trailer-like vehicle, which tips the missile into its silo.

That’s on top of the days they log traveling to the Air Force Nuclear Weapons Center, missile fields, and elsewhere to discuss Minuteman III sustainment, test planning, system development, and software with other USAF officials and the companies working on the new designs.

“We’re hoping to streamline and make a lot of those processes a lot more efficient and a lot more effective and a little bit less of a footprint required, as we gain access to new technology,” Colbert said. “Innovation is the key to all of that ... not only with the developmental system, but also with our



A Minuteman III on alert status at F.E. Warren Air Force Base, Wyo., is worked on by 90th Maintenance Group Airmen. ICBMs must be repaired and maintained frequently.

Photo: Senior Airman Abbigayle Williams

current system.”

“Innovation” includes automation, something that raises significant concerns for the nuclear enterprise, where safety depends on human input and redundancy, and leaders are more cautious about adopting changes than elsewhere in the force.

Colbert argues automation should play a limited role in the future of nuclear weapons. For instance, algorithms could change the way the U.S. handles targeting and tracking, yet stop short of creating a “dead hand” system that could launch missiles on its own. In testing, automation might mean more efficient ways to display data in control centers, among other places.

“I’d like to think that for nuclear weapons operations, we’ll always have a human hand in that process,” he said. “We don’t want to automate to the [same] extent where you will see within other weapons systems. ... We want to make sure that we have trained, we have certified people ... that we can count on to do the right thing in the right moments, and under authorized orders, from the right authority.”

The nuclear command, control, and communications (NC3) system is getting its own makeover, one that could ideally combine commercial and military-grade systems into a network so complex that adversaries can’t hack it. The GBSD, the first digital-age ICBM, has to talk to that command and control web without fail for successful launches. Future tests could possibly use red teaming to ensure the NC3 network is secure as part of preparation checklists, or enlist “friendly” hackers to look for vulnerabilities in the missile’s software.

Air Force Scientific Advisory Board Chairman James Chow said in 2017 that modern cyber threats change the equation when it comes to nuclear surety. “You cannot ever assure to 100

percent,” he said. So the Air Force needs to judge how much cyber risk it can accept for nuclear systems. Operational tests can show how well that standard holds up in the real world.

Certification also poses challenges for additive manufacturing (also called 3D printing), another emerging technology that could make the GBSD easier to test.

Favorably, 3D printing could make it easier to swap out missile parts. The test enterprise already uses additive manufacturing to build training models for maintainers to work on, but introducing that technology into the real thing will be much more challenging.

“We would have to go through a rigorous process to make sure that anything that we produce met our nuclear certification requirements and standards,” Colbert said.

MODERN TECH

The Air Force must also overhaul its above-ground command centers with new monitors, workstations, and software.

Jerry Rogers, a flight test analyst at the squadron whose workspace is already upgraded, said the ICBM data experts have been in touch with the GBSD acquirers. With the new system, he said the squadron hopes to increase the amount of data gleaned from a test launch and be able to process more of that information.

GBSD’s upgrades can “probably give us a lot more situational awareness as we fly,” Rogers said. “We’ll see some things that we don’t necessarily see today ... probably a better solution of the exact position and velocity of the vehicle, that type of stuff.”

“We are not going to use any more thermal paper,” he added. (Just a few years ago, the squadron retired thermal paper, an antiquated product that allows for inkless printing.)

Hardware and software that control the missile’s connection

to GPS satellites, its own inert guidance, its command-destruct function, and other pieces needed for test also have improvements on the horizon.

Others at Vandenberg, in particular, an Airman overseeing weather information at the Western Range Operations Control Center, said he's got all the data he needs to ensure successful test flights.

As the nuclear enterprise moves further into the 21st century, Air Force Global Strike Command Deputy Commander Lt. Gen. Anthony Cotton said they must consider the possibility that algorithms might replace some Airmen. Around 10,600 people currently work for 20th Air Force at F.E. Warren, the organization that oversees America's 400 deployed intercontinental ballistic missiles and related operations daily.

"That could be a possibility. We haven't gone down that path yet," Cotton said of a smaller workforce. "How many people does it take to do a task today? And then how many people would it take to do a task tomorrow? We have to recognize that when we say there's efficiencies, you might see efficiencies in manpower as well."

The Air Force is waiting on Northrop to decide how many people it would need to run its system before reviewing manpower needs itself. Northrop declined to comment for this story.

Those tasked with guarding, operating, and sustaining ICBMs are supposed to be among the Air Force's best and brightest, but the field has suffered in recent years, with scandals involving drug use, a test-cheating scandal, mental health issues, and low morale. In response, the Air Force began a public campaign to make those Airmen feel appreciated and improve its workforce.

Global Strike is working to cut the number of Airmen who rotate out of the missile enterprise from 43 percent to 20 percent—hoping that retention will build better leaders and grow institutional knowledge in the ranks.

These days, Colbert said, Global Strike is targeting engineers, scientists, and others with backgrounds that are well-suited to the nuclear mission instead of trying to turn anyone into a missileer or maintainer, whether they had an inherent interest or not.

"It's a very competent and capable range of folks that we're getting in now," he said.

Command leaders want Airmen to learn about their ICBM career options so it might spark a desire to continue growing within the field. Cotton said he's taken people onto airborne command post planes who had "no idea" they could occupy some of the five positions on those jets.

"I think we've done a much better job at doing that now than we did in the past," he said. "Are we there yet? ... Absolutely not."

"This is something that you constantly have to have pressure on ... to make sure that we're going to have the right talent and have everybody ready when we do the transition to GBSD," he said.

Missileers, who can sit underground for days at a time, hope the GBSD spurs added creature comforts in their control centers. They already have a chef upstairs to feed them, but they'd also like a shower and more workout equipment.

"Any kind of skylight would be nice," 1st Lt. Claire Waldo, from the 12th Missile Squadron, said before the Feb. 5 test launch.

Airmen have a computer and a television in the capsule, but they can only use one at a time. It'd be great for one person to be able watch a show while the other catches up on work requirements, the 490th Missile Squadron's 1st Lt. Mitch Nairn said.



Photo: Airman 1st Class Aubree Milks

At the launch control center at Vandenberg Air Force Base, Calif., 1st Lt. Claire Waldo, 12th Missile Squadron missile combat crew commander, conducts a dry run for a Feb. 5 test launch.



Photo: Senior Airman Ashley Boster

A transporter erector at Minot Air Force Base, N.D., during an annual proof-load test to ensure its safety and structural integrity. The transporter is used to load Minuteman III ICBMs into silos.

Another request: a better, private toilet, instead of an austere one concealed by a curtain next to the workstation.

“It’s pretty much a prison,” Nairn said.

Down in the bunker, the dissonance between current ICBM mission systems and what they could become is tangible. Missileers no longer know what a knob on the dashboard labeled “WAR PLAN” was once used for.

Eight-inch floppy disks that connect the missile system to national decision-makers are retired, but smaller ones are still in place. Giant black folders hold piles of hard-copy instructions and computer screens—primitive by today’s standards—still get the job done.

The Airmen who work on the ICBMs every day were born decades after the first nuclear bombs exploded on Hiroshima and Nagasaki. Nor do most remember the Cold War’s “duck-and-cover” drills under school desks or the fear of imminent nuclear destruction. But the possibility that they might one day be called upon to open their lockbox, remove the keys, turn the four switches and keys in sync, and launch a new era in nuclear weapons history—connecting the antiquated system to modern day in another way—is as real to them as the underground control stations they occupy 24 hours a day.

That mindset will carry through to the digital era of the GBSD as well. In the meantime, they’ll put up with the dials that no longer matter and the workstation that brings “Dr. Strangelove” to mind. They’re doing the best with what they’ve got, until a new weapon system for a new generation of nuclear experts is in place.

“For deterrence to be credible, you have to announce that, ‘Here’s our weapon system. It works as we designed, and it still works, even though it is aging,’” Colbert said. “We have the will. We have the intent. We have the training. We have

the forces that are able to employ it professionally, safely, and reliably.”

As the United States prepares to develop its next-generation nuclear weapon, the question remains whether the GBSD will be tested with or without its warhead, the W87-1. America has only tested a live, operational nuclear weapon once, in 1962 during a submarine-launched ballistic missile event dubbed “Frigate Bird.”


The U.S. signed the United Nations’ 1996 Comprehensive Nuclear Test Ban Treaty but has yet to ratify the agreement, keeping the door open to future nuclear vetting even though the nation hasn’t detonated such a weapon since 1992.

“The United States will not resume nuclear explosive testing unless necessary to ensure the safety and effectiveness of the U.S. nuclear arsenal,” stated the 2018 Nuclear Posture Review.

Patty-Jane Geller, a nuclear expert at the Heritage Foundation, believes the U.S. will stick to its moratorium.

Government laboratories have nonnuclear means of checking warheads and missile components for anomalies, Geller noted. But she suggested the U.S. might decide to resume explosive testing if a problem pops up that simulation methods can’t help fix, or when creating totally new warheads.

For now, though, she believes the political consensus appears to be in favor of continuing that approach.

“It is essential that U.S. leaders seek and support ways, including actions by the UN Security Council, to reinforce the de facto global nuclear testing moratorium and make it clear that further nuclear testing would be a threat to international peace and security,” Arms Control Association Executive Director Daryl Kimball said in 2016 at an event for the treaty’s 20-year anniversary. 

The Budget and the Truth



Pass-through funds inflate USAF spending by almost 25 percent, hiding the truth from friends and foes alike. Is this the year it finally ends?

Photo illustration: Mike Tsukamoto/staff

By Amy McCullough

The Department of the Air Force's \$207.2 billion top line in its fiscal 2021 budget request looks pretty good on paper, especially when compared to the \$207.1 billion requested for the Department of the Navy or the \$178 billion for the Army. But looks can be deceiving.

In reality, the Department of the Air Force's share of the budget pie is significantly smaller than those other services. That's because the Air Force funding line includes \$38 billion in proposed spending that will never be seen, used, or controlled by the Air Force. This is the so-called "non-Blue" budget, also known as the "pass-through," because it is spending that passes through the Air Force, but is never under its control. This portion of the Air Force budget has artificially inflated the service's top line for decades.

Without the pass-through, the 2021 Air Force budget request seeks just \$169 billion for the depart-

"The pass-through has been a thin disguise, but with a big penalty"

—Barbara Barrett,
Air Force Secretary

ment, including \$153.6 billion for the U.S. Air Force and \$15.4 billion for the fledgling U.S. Space Force.

"A myth exists that the Air Force is funded equally with the other services," wrote Mark Gunzinger, director of future aerospace concepts and capability assessments for AFA's Mitchell Institute for Aerospace Studies, and Carl Rehberg, a non-resident senior fellow at the Center for Strategic and Budgetary Assessments, in a December 2019 policy paper, "Paying For the Air Force We Need."

In reality, the Air Force share of the fiscal 2020 budget is only 23 percent of the total, well below the 28.6 percent for the Department of the Navy (which includes both the Navy and Marine Corps) and 26.7 percent for the Army, according to the paper.

Gunzinger and Rehberg argue that the pass-through has resulted in consistent and dramatic underfunding of the Air Force, compared to the other services.

Now, with the launch of the Space Force within the Department of the Air Force, the opportunity to clean up this long-standing practice seems within reach.



Photo: Wayne Clark/USAF

The standup of the new U.S. Space Force, led by Gen. Jay Raymond, could help USAF get the pass-through out of its budget.

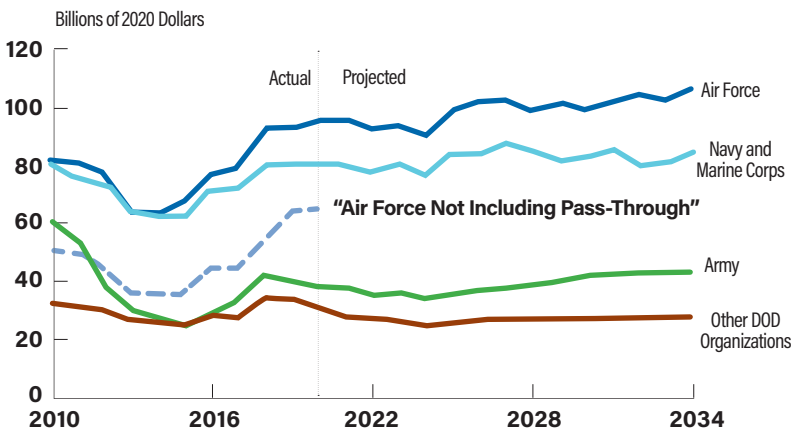


Photo: Mike Tsukamoto/staff

Secretary of the Air Force Barbara Barrett argues for making the pass-through either part of the Space Force budget or moving it out of the Department altogether. The ultimate decision rests with the White House and congressional appropriators.

Acquisition Funding Gap

A comparison of the services' acquisition budgets shows that, once pass-through funding is removed, investment in Air Force air and space programs falls by more than \$20 billion per year.



Source: Mitchell Institute for Aerospace Studies

“It’s now or never,” said Mackenzie Eaglen, a budget expert at the American Enterprise Institute and a longtime proponent of removing the funds from USAF’s budget. “Although, even if they are successful, it’s only half of the battle. It’s still not clear what the Space Force budget will look like as it comes out of the Air Force budget.”

While it’s still possible for the Air Force to convince congressional appropriators to move the funding this year, Eaglen said, if it doesn’t happen by 2022, the window will close.

Air Force Secretary Barbara Barrett said in January that getting the funding moved will be an uphill fight. In the weeks leading up to the budget release, she said the issue had come up almost daily in discussions with Defense Secretary Mark Esper.

“The pass-through has been a thin disguise, but with a big penalty,” Barrett said. “We need to be looking at better solutions. Those solutions will all be fashioned buildingwide. We need solutions that a former Army Secretary—who’s now Defense Secretary—will find equitable. He needs to be persuaded on these, but all the services are beneficiaries of the space capabilities [that will come from the Space Force], and if no one else contributes, the space asset will be starved.”

Exactly what is contained in the classified non-Blue budget is closely guarded; though the aggregate figure is mentioned

annually when the budget is released, it is never explained. A 2013 RAND report said the funding supports the Defense Health Program, special operations, and the National Intelligence Program, but Barrett’s suggestion to shift the funding to the Space Force confirms, perhaps for the first time, a widely held belief that the majority of the pass-through budget funds satellites that are already on orbit.

Todd Harrison, a defense budget analyst with the Center for Strategic and International Studies, said changing the pass-through will require White House and congressional action. “It’s not a DOD decision,” he said. “You have to get it through OMB [Office of Management and Budget] and the appropriators. It is interesting that Barrett proposed putting it in the Space Force budget. It seems to explicitly acknowledge that this is space funding, which I don’t think they’ve acknowledged before.”

Eaglen said she raised the issue with Deputy Defense Secretary David Norquist and Esper in February, making the case that the Air Force’s top line is misleading. The non-Blue budget, she said, makes the Air Force appear healthier than it really is and de-emphasizes the Intelligence Community’s “sizable means.”

“When I raised this with the deputy in front of the Secretary a couple weeks ago, he looked at David and said, ‘Look into that,’” Eaglen noted.

There are several ways to initiate the change:

- The Office of Management and Budget can tell the Defense Department to move the funds.
- DOD can ask permission to remove the pass-through from USAF’s budget.
- Legislators can push for change.

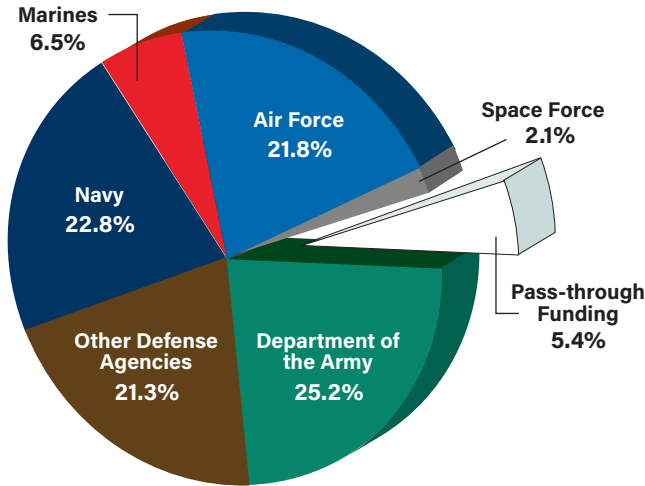
In 2018, the Senate version of the 2019 defense policy bill recommended the Secretary of Defense transfer the pass-through funds from the Air Force budget to the defense-wide budget for fiscal 2020 and beyond. Nothing happened.

Since then, the pass-through has grown from about \$22 billion, or “just less than half of the total Air Force procurement budget,” according to the 2018 Senate report, to \$38 billion—well more than double the entire Space Force budget request for 2021. The committee agreed that the pass-through

Deceptive Accounting

Despite the common perception that all three military departments get an equal share of the budget, this has never been true. Over time, the balance has shifted among the three military departments: Army, Navy, and Air Force. Pass-through funding exacerbates this misperception.

Pie Slice. The Department of the Air Force share of the budget also includes Space Force and pass-through spending.



“provides a misleading picture of the Air Force’s actual investment budget.”

Similar language was not included in the House version of the legislation, however, and the initiative failed to advance to the conference report. Since then, the black budget has only increased, with \$39 billion approved for 2020—or just over 19 percent of USAF’s total obligational authority.

That’s “the equivalent to the last four years of total Air Force new aircraft procurement funding,” according to Gunzinger—enough to buy 400 new fifth-generation F-35As, Gunzinger and Rehberg wrote.

Eaglen said the biggest problem with the pass-through is that most members of Congress don’t understand the issue. “What do you mean there’s a blue and black budget?” “There’s 100 ways to slice that argument,” she said.

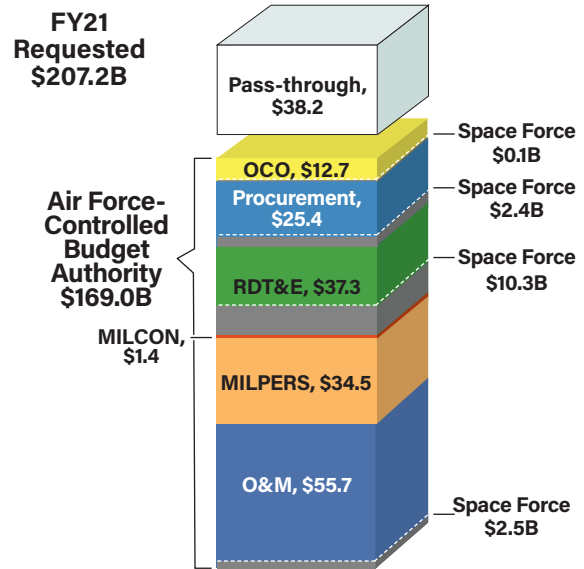
Moving the funding is essentially an accounting shift, but it’s a political landmine. Although it’s a long-held common assumption that DOD’s budget is evenly split among the departments, that has never been true.

In the 1950s, the newly formed Air Force took the lion’s share of funding as the Eisenhower Administration built up a nuclear deterrent to counter the Soviet Union. With two of three legs of the nuclear triad under Air Force control, the new service owned about 49 percent of the budget, Harrison said. During the Vietnam years, the Army received more funding, and afterward—as the Navy was rebuilt—its share rose following the war. For a little over a decade after the 9/11 terrorist attacks, the Army once again garnered the largest share of the budget to pay for continuous ground combat in Iraq and Afghanistan.

In the wake of the Cold War, all of the military services lost buying power, but none more so than the Air Force. In constant 2020 dollars, the Air Force saw steep reductions from 1989 to 2001, losing more buying power than the other services in four of five spending categories, according to the Mitchell report:

- Military Personnel—USAF (-37.2%); Army (-34.4%); Navy (-31.6%).

Stacking Up. How the \$207.2 billion allocated for the Department of the Air Force breaks down. After Operations & Maintenance, the pass-through is the biggest piece of the budget.



Source: USAF

- Procurement—USAF (-52.0%); Army (-35.9%); Navy (-32.0%).

- Research, Development, Test, & Evaluation—USAF (-39.7%), Navy (-17.7%); Army (-8.0%).

The only category in which the Air Force did not lose more was Operations and Maintenance.

“Now things have fallen back, and the Air Force and Navy are fighting it out for the top spot” among the services, Harrison said.

Another portion of the budget that has grown in recent years is the share that funds defense agencies outside the armed services. That portion now comprises about 17 percent of all defense spending, funding programs ranging from the Missile Defense Agency to U.S. Special Operations Command. This category is where the pass-through funding belongs, Harrison said.

“It’s not really for the Space Force any more than it was important to the Air Force,” he added.

Eaglen agreed, but said the Space Force could be a temporary parking place for the funds. She suggested the Chief of Space Operations, USSF Gen. Jay Raymond, could decide if the funding makes sense in his top line and, if not, push for it to be moved out of DOD all together. That might be an easier sell coming from a new service, she said.

“These assets are purely Intelligence Community-controlled and owned, and they support the entire force. That’s exactly what defensewide is meant to do,” Eaglen said. “Members of Congress don’t have time to dig deep into budget matters. ... If the intelligence budget suddenly grows by double-digit numbers, I think it would be great because members of Congress would have to wake up to this artificial pass-through. Then we can try to have a bigger discussion on why the Intelligence Community is parking money in DOD. It should just go to the Intelligence Community. It shouldn’t even be appropriated to the Defense Department.”

Range Roving

Japan's Draughon Range is now among the most sophisticated training areas in the world.



A B-52H Stratofortress, F-16s, and Japanese JASDF F-2s engaged in familiarization training at Draughon Range near Misawa Air Base, Japan.

By Jennifer Hlad

MISAWA AIR BASE, JAPAN

Imagine this: F-16s flying over Draughon Range in Japan, pilots in a simulator in South Korea, ground targets showing up on everyone's radar—and it's all controlled by someone at Nellis Air Force Base, Nev. Today, this kind of live, virtual, and constructive (LVC) training isn't just possible, it's likely.

Misawa is just the third base in the Air Force to get LVC capability, and the only one outside the United States. The technology makes Draughon Range—the only air-to-ground range on mainland Japan—"the premier range in the western Pacific," according to Lt. Col. Ethan Rutell, director of operations with 35th Operations Support Squadron.

Twelve miles north of Misawa, running along the Pacific coast near the northernmost tip of Japan's main island, the range has been in use since 1952. Unofficially dubbed Ripsaw Range, the Air Force changed its name over the years from Amagamori Range to the Misawa Air-to-Ground Gunnery and Bombing Range and, in 2003, to Draughon Range in honor of Navy Petty Officer Matthew Draughon, a diver lost at sea in 2001 during an operation to recover a Misawa aircraft that had crashed into the ocean nearby.

"Our range is probably the most adaptive, flexible, I would say, of any range around," Rutell said. Pilots train here on strafing, bombing, rocketry, lasing, and air drops; combat search and rescue; survival, evasion, resistance, and escape, and more.

The Bomb Electronic Attack Range System here consists of several unmanned threat emitters that replicate surface-to-air missile (SAM) sites. Col. Kristopher Struve, commander of 35th Fighter Wing, said the wing's primary mission is suppression of enemy air defenses (SEAD), so realistic training against SAMs is critical.

USAF C-130s, F-16s, MC-130s, CV-22s, and B-52s train here, as do Navy EA-18G Growlers, Marine Corps F-35s, and Japanese F-2s, CH-47s, and F-35s.

"We're here to deter aggression in the Pacific—really worldwide," he said. "When you think about the four countries that are listed as threatening countries [to the United States], three of them are within an hour flight of us. ... We're prepared all the time, ready for any aggression from North Korea, Russia, China."

Lt. Col. Trevor Cichowski, commander of the 13th Fighter Squadron, added: "The Korea mission is really why I think this base, with these capabilities, exists in this theater."

Struve said Misawa F-16s have performed "every mission the F-16 does: close-air support, strike, all those things."

"But what we've managed to do in recent months is add capacity to Draughon Range, such that we've created an electronic range, and we're modernizing and advancing that electronic range," he said.

Credit for the work goes to "a couple of young enterprising captains and majors who put this together and got [Pacific Air Forces'] support," he said. "They sourced some local unmanned training emitters, SAM replicators, and they built that up into a fully operational combat range."

Struve, an F-16 pilot, said a recent SEAD training flight with the SAM emitters was the best SEAD sortie he's completed through nine years at Misawa.

"Yeah, I got killed twice. It was awesome," he said. "But that's how we learn. We train hard and fail forward. It's a great opportunity to provide that for our young aviators, and it's really increased the capability of what we're able to train to, which gets right after force modernization as part of the National Defense Strategy. Not just modernization, but increasing our readiness."

The emitters are movable and can be rearranged, enhancing realism so that, according to Cichowski, they present "a very similar picture [of] an integrated air defense that we might see from certain host nations."

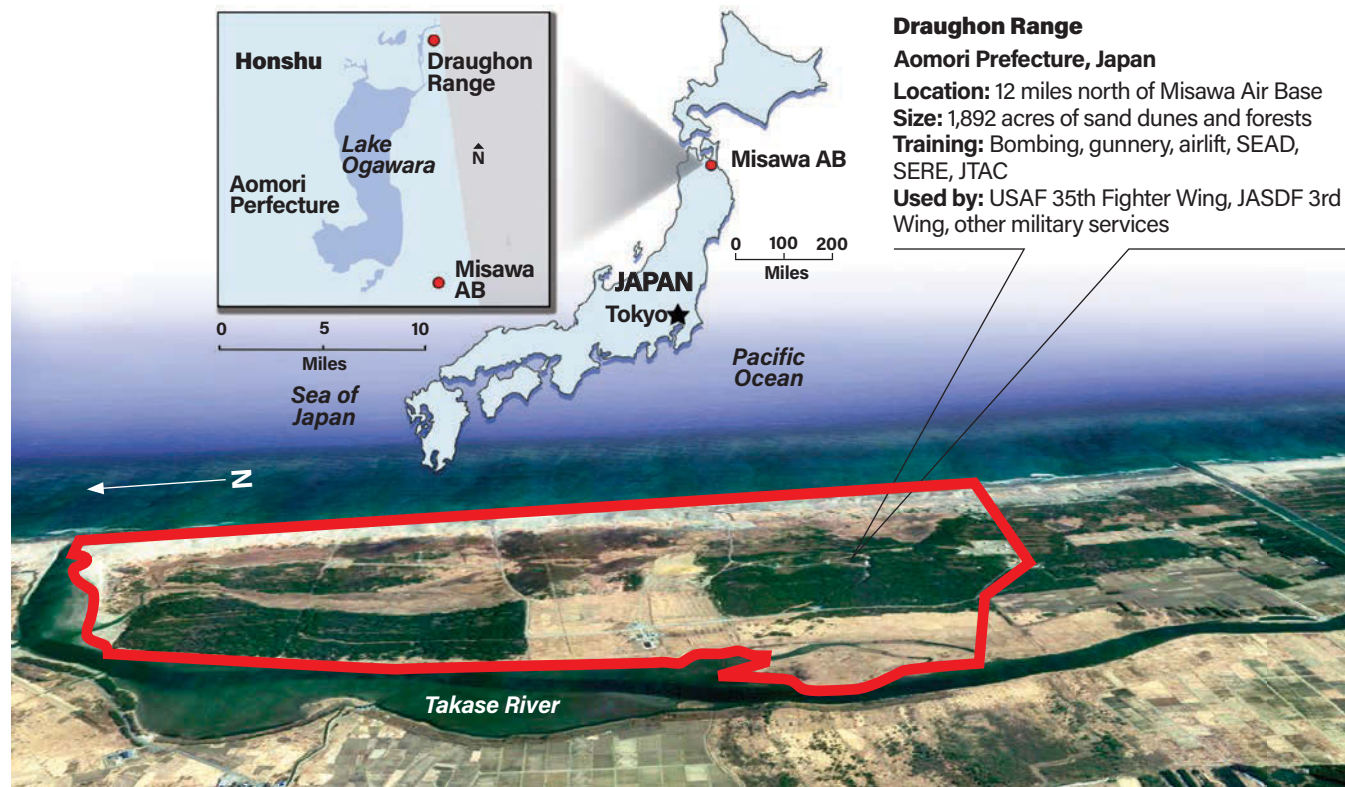
They can also be altered "to simulate different threats so we can simulate different threat countries."

That's quite a shift from just a year ago when pilots would have to fly out "to the West Coast of Japan, and we would fight a threat scenario that we had kind of made up ourselves," Cichowski said. "So at least one person in every flight already knew the secret, what was going to happen. We were just like, 'Here it comes.'"

Photo: Staff Sgt. Melanie Bulow-Gonterman

Best Training in the Pacific

Draughon Range provides unique training opportunities close to home for Misawa-based Airmen. Recent upgrades mean the compact space now provides some of the best training in the Pacific, even in this congested area.



Now pilots can “do more hacks” on each mission. “It allows me time and gas to execute more training.” And then with the emitters being controlled, “It’s, no kidding, an operator who’s actually using them as a SAM system is supposed to be used. So it produces honest threat reactions. It makes our training much better.”

Capt. Jared Morris, assistant operations director for the 14th Fighter Squadron, said the emitters also allow for “real feedback during the fight, versus coming back and seeing if your tactics work” after the fact.

All that realism is now “less than 10 minutes from my home station.”

That’s not possible anywhere else, Cichowski said. “I definitely can’t do that in Alaska, not during a Red Flag.” In the continental U.S., pilots travel hours to train on an electronic range and would have to plan the entire mission around the small window of time at that range. Here, he said, “basically they can take off and they’re in the airspace at the range if they want to be.”

The capability is “part and parcel to their SEAD mission,” Rutell said. “They’re the only SEAD wing in PACAF, so it builds the foundation of their training.”

The base is also home to a Japanese F-35 squadron. But the F-35s’ computer systems are so much smarter than the F-16s’ that it knows the emitter isn’t a real SAM, Rutell said. To train F-35s, the range is getting new, more advanced emitters, which should be fully operational soon. The range was also recently certified for the F-35 electro-optical targeting system, which will allow them to drop weapons on the range.

Struve said it’s all part of building a bilateral capacity for the U.S. and the Japan Air Self-Defense Force (JASDF). “The current emitters don’t meet the snuff for what the F-35 is capable for, so

we need to modernize it,” he said.

The most recent upgrade is the LVC capability, which went fully online in November 2019, Rutell said. The live piece is pretty self-explanatory: Aircraft can fly in the base’s airspace, drop inert weapons on the range, or fly against the SAM simulators. The virtual piece allows them to “connect with assets across the United States. So you could connect with, let’s just say, an E-3 out of Tinker Air Force Base [Okla.], or any other unit” via the simulator.

For the constructive component, additional aircraft and ground targets can be simulated to add depth and complexity to training scenarios.

The LVC capability, described in a 2017 Air Force press release as “a video gamer’s greatest dream come true,” is enabled by Northrop Grumman’s Distributed Mission Operations Network (DMON). Northrop called it “the most complex and integrative live simulator available that connects both people and resources, spaced out over a vast geographic area in near-real time.”

Rutell said the network enables training despite weather, maintenance, or other problems that may arise. Previously, Misawa pilots could only do the virtual part—joining Red Flag in Alaska via simulators twice in 2018, for example, because weather kept them from reaching Alaska.

“Now we can actually have live aircraft flying, we can have guys in the [simulator] that are flying with them, and then can have constructed aircraft, and they can all pass messages and communicate,” he said.

Others are taking note of the range’s capabilities. Misawa’s quarterly exercise, Pacific Weasel, is “starting to become more high profile,” as all the improvements are made to Draughon Range, Cichowski said. “As they improve on that range, it be-

comes more of a training asset to this entire Indo-PACOM region, and as a result, we have seen an increased interest in having outside units come and participate with us at our home station.”

Forces from Yokota Air Base, Japan; Andersen Air Force Base, Guam; and South Korea have used the range, Struve said. “It’s an opportunity for us to get training here in the western Pacific without having to make the hop to Alaska, which costs a little bit in tanker and cargo and time.”

Rutell said it’s also safer and better for the mission to be able to do training close to home, instead of sending assets back to the United States.

“We can do all of our training in-house ... to aid in the protection and self defense of Japan and its people, and increase readiness and operational capability,” he said.

Another recent improvement to the range is the size and availability of the airspace, Rutell said, which will now allow integrated training with the JASDF.

At 1,900 square acres, the range is not as big as some others,

Struve said, so planners have to be careful about how operations are managed. But the range can’t be beat for its flexibility.

“We can do everything from basic surface attack to more advanced attacks with some [joint direct attack munitions] and laser-guided weapons, and then of course we have the electronic capability on the range. But it’s more than just that,” he said. “It’s also our Ospreys who train for assault landings. It’s a location where they can shoot their 50-cals. We used it in our survival, evasion, resistance, and escape training. Guys crawling around in the muck there, and an Osprey picks them up out of the grass. So we actually get to train the way we would get picked up if we actually found ourselves in that situation.”

Between the SAM emitters, the LVC capabilities, and the upgrades to be compatible with the F-35, “we’ve become really the best thing outside of Nellis or [Joint Pacific Alaska Range Complex], with the most capability,” Struve said. “And it’s building, and we’ve got some amazing things on the horizon that we’re working on.”

Keeping 'the Knife Sharp,' Major Boosts Realism at Japan Range

By Jennifer Hlad

Maj. Daniel House spent a decade hunting down surface-to-air missile threats as an electronic warfare officer on the RC-135 Rivet Joint. Now he’s using that knowledge to help train fighter pilots to survive those threats in the wild.

House controls the unmanned threat emitters on Draughton Range at Misawa Air Force Base, pretending to “be the bad guy” and using some of the tricks he’s learned from enemies over the years to help better prepare U.S. and allied pilots.

“I sometimes drive them crazy,” he said. “But the more realistic I am here in training, hopefully more of them come home alive if anything ever goes haywire.”

House draws from personal experience as well as from other real engagements over the past 30 years, applying tactics and procedures that challenge the pilots.

“They’ll fly and pretend to drop bombs on me, and I’ll pretend to shoot missiles at them,” he said. “I’ve been loving it.”

House, the 35th Operations Support Squadron assistant director of operations, helped get updated threat emitters for the range and proved so good at his job that he was named was the 35th Fighter Wing’s Field Grade Officer of the Year in 2019.

Soon, Draughton Range will have the only emitters in the region that work against the Japanese F-35s based at Misawa. The new emitters are more reliable than the ones they replaced and can also replicate more threats.

“To get good at something, you have to practice it on a day-to-day basis, and you can’t go back to Alaska every single day,” House said. Achieving this kind of training fidelity in Japan will help better prepare pilots here for the threats they could face if called into action. “Now, are we as big and robust ... as Alaska? Absolutely not,” he added. “But for day-to-day training, we knock it out of the park.”

When the first piece of the new live, virtual, and constructive training system arrived, House could have waited six months to be trained to use it. Instead, he dove in, taught himself the system, and put it to work.

“I just logged on,” he said. Then he started writing up reports on what worked and what didn’t. “For a while, it was just me holding down the system.”

Now that all the hardware is in place, House is working



Photo: USAF

Maj. Gen. Daniel House is finding new ways to challenge pilots at Misawa’s Draughton Range.

through the final bugs. The new system is like leaping from 1980s video game consoles to today’s worldwide cloud-based systems, and it’s so realistic that recently, when House was asked to use the constructive technology to simulate a pair of F-15s to challenge live aircraft, he baffled the live pilots. Over the radio he heard one pilot say to his to his squadron commander, “Sir, sir, I see them on the [computer screen], I hear them—where are these guys?”

That kind of realism challenges all aspects of a pilot’s skills. “He was dead set certain there were real aircraft in the air, and he was trying to find them,” House said. Here in Misawa, within range of China, Russia, and North Korea, Draughton is more than just another training range. “We really have to keep the knife sharp, and keep our people trained up,” he said. “We call ourselves the premier training range in the western Pacific, and we really are.”

But House’s goal is to be that and more. Not just the premier range in this part of the world, but the No. 3 range in the Air Force after the Joint Pacific Alaska Range Complex and Nevada Test and Training Range. With capabilities like those House has helped add here, he has a strong case to back that claim.



Survivors of the Storm

In the face of repeated natural disasters, Puerto Rico's Air Guard proves resilient.

Staff Sgt. Kelving Matos Guzman, an IT specialist with the 156th Communications Flight, powers up a Hawkeye II satellite dish to provide communications and internet service at a tent city set up for displaced citizens following earthquakes on the island in January.

By Jennifer-Leigh Oprihory

CAROLINA, PUERTO RICO

First came the Category 5 Hurricane Maria. Then an underground wildfire. Then earthquakes. Puerto Rico has had it rough these past three years. For the Airmen of the Puerto Rico Air National Guard's 156th Wing, who also endured a deadly airplane crash in 2018, the blows just kept coming.

Yet out of the wreckage is rising a more resilient wing with a more relevant mission set, one built specifically for responding to the kinds of disasters that frequently strike here and across the U.S. island territories in the Caribbean. When the transition is over in about 21 months, the wing will include ANG's second Contingency Response Group, and a combat communications squadron designed to stand up emergency communications on a moment's notice.

These new mission tie the 156th AW to the National Defense Strategy and lay out a challenging course to retrain its Airmen and prepare for a future without aircraft. The wing is getting new buildings and new equipment, along with training to take on a whole new mission set.



Photo: Mississippi National Guard via Twitter

Contingency Response Group commander Lt. Col. Joelee Sessions, and Chief Master Sgt. Hector Garcia, the wing's command chief, are excited about the unit's new purpose.

"The CRG's primary mission is to open and operate an airbase in austere conditions," Sessions said in an email. "The equipment required for that mission runs the gamut from basic living requirements like tents to base defense capabilities, pavement assessment equipment, and mobile operations centers complete with satellite communications and computer network systems."

"The CRG's primary mission is to open and operate an airbase in austere conditions!"

—Lt. Col. Joelee Sessions, 156th Contingency Response Group commander

The combat communications squadron, which PRANG Deputy Commander and Chief of Staff Brig. Gen. Paul Loiselle said will be able to support a base of about 1,200 people, will also get new gear—"from handheld radios to satellite communications and everything in between," according to ANG Contingency Response Functional Manager Jerry Stoddard. The squadron will be able to communicate via classified and unclassified networks, and "to communicate directly with senior leaders across whatever spectrum that might be," Stoddard added.

The wing will have about 194 Airmen assigned to the contingency response group and 136 assigned to the combat communications squadron. Most will be part-timers.

Some Airmen will have to retrain for jobs in the combat communications squadron, while others may be allowed to transfer without retraining, said Col. Barbra Buls, vice commander of the Air National Guard Readiness Center.

In February, Buls said, more than 100 Airmen from the wing met with senior leaders "on an individual, face-to-face basis" to discuss opportunities, what the process of competing for those jobs would look like, and timelines and locations for tech school and other training.

Buls said all of the wing's Airmen have the potential to convert, as long as they don't flunk out of the required training.

The 156th Wing will also continue to contribute to the National Guard Bureau's Host Nation Rider Program, for which

Photo: U.S. ANG courtesy

The 156th Wing's Hangar One was severely damaged by Hurricane Maria in 2017. It is scheduled to be razed to make room for a new warehouse to support the Wing's Contingency Response Group.



Photo: Jennifer-Leigh Oprithory/staff

15 of its Airmen currently support U.S. counterdrug operations for U.S. Southern Command. That mission will continue post-conversion, though Buls said it's not yet clear how that will be organized.

"We are completely committed to placing and expanding the National Guard Bureau support to that mission set through the unique skills and geography of the Puerto Rico Air National Guard," she said.

DOWN, BUT NOT OUT

In September 2017, Hurricane Maria damaged about 85 percent of Muñiz Air National Guard Base here, punching a hole in the rooftop of its aircraft maintenance hangar and threatening the installation's network. Even now, more than two years later, plastic tarps still provide protection from the elements.

"That one ... little network that's under tarpaulins and gets rained on and there's buckets to collect the water, supports not only our entire network but our two [geographically separated units]," Loiselle explained. "It supports the Virgin Islands network, and ... it's the backup network for the FAA [Federal Aviation Administration], as well. So critical infrastructure and, hence, why we need to get this into a better situation and a better place."

Soon, a planned \$165 million renovation will restore Muñiz and support the 156th Wing's multiyear conversion from its former role as a nonrated C-130 wing to a contingency-response and combat communications role that answers a critical need in the region.

Guard leaders here acknowledged that much of the base's infrastructure was already in need of modernization before the storm, but more than half of the funds arrived because of the hurricane's damage. As part of the renovations, the base's network will be temporarily relocated while the old hangar is razed and a new permanent facility is built.

Muñiz's new medical building/dining facility is "already pre-wired to be able to accommodate generators," and future construction will include emergency power backup to ensure continuity of operations, Loiselle said. "Ever since I've gotten here since the end of August [2019], it was Hurricane Dorian, then it was the Cayey wildfires—now it's the earthquakes—so it's been constant," 156th Wing Commander Col. Pete Boone told *Air Force Magazine* in a recent interview at Muñiz.

Boone said the wing trains for emergency response efforts daily and works in concert with its joint operations center to improve and practice communication to ensure successful mission execution.

"The hardest thing we do is communicate, whether it's internally here, or external," Boone said. To improve, the Puerto Rico National Guard is planning "a tabletop exercise for hurricanes," in the near future.

The wing is also seeking a director of psychological health, essentially a full-time social worker dedicated to serving Airmen and their families, and it sent chaplains into the field during the earthquake response "just to see how our folks were dealing," he said.

Chief Master Sgt. Hector Garcia, the wing's command chief, said his Airmen are taking personal preparedness more seriously. While he said that people underestimated the steps they'd need to take to survive the storm—in some cases expecting to barbecue for a few days before power was restored—"the island got shut down for more than a year [in] a lot of places," Garcia said.

Lt. Col. Denny Lozano, deputy commander of the Wing's mission support group and director of the PRNG's Emergency Operations Center, said Hurricane Maria was a wakeup call.

"We must be very robust in our capability to ... be able to continue our mission," he said in a Jan. 18 interview at Muñiz. Because Puerto Rico is an island, the wing needs to recognize help cannot come instantaneously from outside. The immediate response must start at home.

BUILDING UP

While about \$555 million in MILCON funds were approved for projects in Puerto Rico in fiscal 2020, \$440 million of that was withheld to help pay for the border wall between Mexico and U.S. states in the Southwest. That left just \$115 million for the National Guard here, said spokesman Lt. Col. Paul Dahlen in an email. The Puerto Rico National Guard had to hit pause on nine out of 10 planned MILCON projects, he said.

To move forward, Guard leaders signed design contracts for all 10 planned MILCON projects begun before the funds for them were reallocated, meaning that if the design work is completed and funds are restored in fiscal 2021, the Guard "can go through the bid process and start building these facilities,"

added Maj. Gen. José Reyes, Puerto Rico adjutant general and incident commander for the earthquake response.

The wing is also waiting on funds from the Federal Emergency Management Agency (FEMA), which had reimbursed only \$29 million for reconstruction as of January—less than 10 percent of what was claimed.”

Meanwhile, Guard leaders want to be prepared for future disasters. They say the territory is in dire need of its own Disaster Relief Beddown Systems, the tent-city kits used to quickly provide housing for first-responders during humanitarian emergencies.

After Hurricane Maria, FEMA and its contractors filled the territory’s hotels and the base became an overnight housing facility for military personnel supporting the response. Throughout the entire United States, however, there are only 20 such kits, none of which are in the storm-prone islands in the Caribbean, Loiselle said. “Our goal is to get two of those permanently located here.”

IMPLICATIONS FOR 1ST AIR FORCE

The 156th Wing falls under 1st Air Force, U.S. Northern Command’s air component. When tapped by NORTHCOM, 1st Air Force supports local, state, regional, and federal emergency service agencies.

Natural-disaster response “efforts translate directly into a homeland defense scenario that, you know, that we may see if we are ever to respond to a man-made event,” said 1st Air Force Commander Lt. Gen. Marc Sasseville, who also leads the Continental U.S. North American Aerospace Defense Command Region.

Sasseville said in a phone interview that clear communications and situational awareness are critical in any emergency. “Being able to really understand what’s happening in the event is key to us being efficient and effective with the application of our resource center,” he said. “That awareness not only extends from the disaster itself—what dams are broken, what power lines are down, what airports have been destroyed, which seaports are no longer functioning. It also extends to what

is the interagency doing [and], what are the state and local authorities capable of doing so that we don’t duplicate efforts.”

Being able to utilize Civil Air Patrol (CAP), the U.S. Air Force’s official auxiliary, is central to addressing this need, Sasseville said. “It’s a great deal,” he added, because CAP missions only cost between \$120 and \$165 per flying hour, thanks to their all-volunteer crews. “It’s pennies on the dollar, and they give us tremendous capability.”

Civil Air Patrol National Operations Director John Desmarais agreed. “Events like the hurricanes and earthquakes in Puerto Rico and other wings continue to hammer home the needs for interoperability both inside CAP and with our partners, and [further] developing and continuing our relationships,” he said. “It seems that with every new event we make game-changing strides, and as long as we continue learning and adapting to our mission environments, we will remain relevant.”

CAP continues to implement changes in response to lessons learned, including:

- Developing “a standardized deployable capability” for small unmanned aerial systems to help CAP better support search and rescue teams.

- Obtaining two WaldoAirXCAM camera systems to perform 3D aerial imaging for FEMA and others.

- Setting up a virtual Incident Command Team to augment CAP wings.

- Developing Geographic Information System (GIS) mapping capabilities to help CAP and better support the needs of FEMA and others.

- Coming up with “redundant strategies” to move data out of its sensors and collection systems.

While Hurricane Maria “didn’t really change” how CAP trains, recent experience has highlighted the need to think and train differently. “Wings have traditionally been evaluated individually, but now this spring we will formally evaluate two Regions working together, and plan to move through all eight regions every four years, while also encouraging other cross-Region one-CAP training opportunities to be conducted,” Desmarais said. ❖



Photo: Jennifer-Leigh Ophriory/staff

Civil Air Patrol Lt. Col. R.E. Jiménez (in flight suit) and a second CAP volunteer prepare a Cessna 182 for an aerial imaging flight over Ponce, Puerto Rico, in support of the Federal Emergency Management Agency on Jan. 20.

The Future of RAF-USAF Integration

Constant competition and confrontation with rivals demand evermore cooperation among allies.

By Air Chief Marshal Mike Wigston,
Royal Air Force Chief of the Air Staff

Air Chief Marshal Mike Wigston is Chief of the Air Staff in the Royal Air Force. A career Tornado pilot, he has served as the Chief of Combat Operations in the Combined Air and Space Operations Center at Al Udeid Air Base, Qatar; as Commander of No. 903 Expeditionary Air Wing at Basra International Airport, Iraq; and as Director of Air Operations in Headquarters ISAF Joint Command in Afghanistan. This article is adapted from an October 2019 address at the Mitchell Institute for Aerospace Studies.



Screenshot: RAF

Throughout our histories, the Royal Air Force and United States Air Force have been unrivaled partners. Our collaboration has been forged and renewed many times as we have confronted the dangers that have threatened our way of life and imperiled the freedom of people across the globe. Together, we have created the most feared and respected air forces in the world.

The collaboration we enjoy today is as strong as it has ever been; and it has never been more important, because these are challenging times. The international system that has existed since 1945—which we rely on for our security and prosperity—is being eroded by states like Russia, China and Iran, which are actively destabilizing the world order and challenging our security, stability, and prosperity.

We operate today in a state of constant competition and confrontation, with threats to our nations diversifying, proliferating, and intensifying rapidly. As the U.K.'s Chief of

Defense Staff, Gen. Sir Nick Carter, remarked recently, “It is hard to remember a time when the strategic and political context was more uncertain, more complex, and more dynamic.”

The Chief of Staff of the United States Air Force, Gen. David Goldfein, has remarked that the U.S. Air Force of 2030 will be in the fight with the Air Force that he and his team are building for them today. I am equally conscious of the imperative to prepare the Royal Air Force for the challenges in the decades to come, as well as ensuring our success on operations today.

Both our Air Forces recognize the added value each brings to our capability, efficiency, and lethality. Consequently, in 2018 our two Air Forces agreed on a shared vision statement, which recognized the need to integrate and cooperate more deeply than ever before. That is not to say that we were not already deeply and meaningfully connected—we were and have been (to ever-increasing degrees) since Billy Mitchell first met Hugh Trenchard at his headquarters in France in the spring of 1917.

A B-2 Spirit (left) and two RAF F-35s near Dover, U.K., in August 2019. In 2018, USAF and the RAF crafted a joint vision statement recognizing the need to integrate and cooperate deeply and meaningfully.

Photo: RAF



Photo: Staff Sgt. J.T. Armstrong

An RAF space operator watches a space situational awareness demonstration at Lockheed Martin's Center for Innovation in Virginia during Global Sentinel 19. The RAF is a key member of the U.S.-led Space Coalition.

Still, for today's leaders, there is more to do, especially as we address a future in which potential adversaries such as Russia, China, Iran, and North Korea are becoming more expeditionary in their outlook, more confident in their approach, and more dangerous in the capabilities they field.

It is the fight against violent extremism and the toxic ideology underpinning it that has set the context for operations in the 21st century so far. In that context, air and space power has been the critical enabler in tackling violent extremists across Iraq, Syria, and Afghanistan. The streets of the U.K., the U.S., and our allies are safer as a result.

We have been able to achieve all of this because we have had almost complete control of air and space. But there is a risk of complacency about the freedom of maneuver that unchallenged control of the air has given us. Likewise, our undisturbed reliance on space has too often been taken for granted as a “free good.”

Why would we be concerned? The British armed forces have not suffered a loss to enemy air attack since 1982, and with our overwhelming reliance on space for just about everything we do in our day-to-day lives, are we too complacent about the disaster of losing services from space, even for a day?

Our potential adversaries have not been idle these last decades. They have watched us, and they have learned. Fifth-generation combat aircraft are no longer the sole preserve of our friends. Long-range, surface-to-air missile systems are becoming more capable and proliferating to proxy states, too. They are aggressively challenging us across multiple axes and through multiple domains, from sub-threshold threats in the gray zone of conflict to state-of-the-art hypersonic missiles—and from industrial-scale spam on social media to interference with our national interests in space.

Our potential adversaries are contesting our operating spaces across the board. Over Syria, we have been operating in close proximity to sophisticated Russian surface-to-air missile systems and their latest combat aircraft, and in Europe the tentacles of Russian surface-to-air missile systems extend into the sovereign airspace of our allies. At the same time, Russian aircraft and maritime units operate routinely around the edges of our sovereign airspace and around our shores. So, as Airmen in particular, we need to remain as vigilant as ever, for as one of Britain's greatest army generals, Field Marshal



The RAF's new sub-hunting P-8A Poseidon MRA1 aircraft is escorted by two RAF Typhoons at Royal Air Force Lossiemouth, Scotland. RAF cooperation extends to the U.S. Navy and Marine Corps, as well as USAF.



Photo: Sgt. Ashley Keates/RAF

Viscount Montgomery of Alamein, observed, “If we lose the war in the air, we lose the whole war, and we lose it quickly.” Today, space is just as important.

As the U.K.'s Chief of the Air Staff, maintaining the RAF's ability to secure control of air and space for all our operations at home and abroad is my foremost responsibility, ensuring we have the right equipment and the best people to do that.

The operation of cutting-edge aircraft such as the F-35B from our Queen Elizabeth-class aircraft carriers will ensure we remain the United States' leading military ally. But of equal importance to equipment in maintaining our combat edge will be the ability to manage vast amounts of information and to make decisions more quickly and accurately.

The superiority of the decisions our people make will preserve our Air Forces' decisive edge into the future, and with that, control of air and space. Underpinned by the principles of multi-domain command and control, information advantage will be a critical enabler of our future success. Speed is the real key here. So it is vital that our command and control systems are connected, networked, and resilient if we are to establish and maintain that advantage. Our shared vision statement recognizes these imperatives, with the aim of enhancing our ability to operate seamlessly and interchangeably as a single force—or alongside each other—as the situation dictates.

The F-35 Lightning II is the trailblazer in this regard. Already paying dividends is the close relationship between Royal Air Force Marham in eastern England, where the RAF's Lightning

Force is based, and nearby Royal Air Force Lakenheath, which will be home to all the U.S. Air Force F-35s in Europe beginning in 2021. In October 2019, the U.K.'s first operational F-35B Squadron (No. 617 Squadron of Dambusters fame in World War II) embarked in HMS Queen Elizabeth for operational trials, off the east coast of the United States. We will integrate evermore closely with the U.S. Air Force and Marine Corps, the latter of which will operate side-by-side on our new carriers. But integration goes much further than simply being able to operate in the same piece of sky or from the same carrier deck. The real challenge is ensuring that our information systems, data links, tactics, and logistical systems are all aligned.

We have driven forward fourth- and fifth-generation integration through the Point Blank series of exercises that involve RAF F-35s and Typhoons, and USAF F-15s and F-35s. Back in July, our F-35s exercised with B-2 Spirit bombers during their deployment to Royal Air Force Fairford in England—the first international fifth-generation training of its kind. We have hot-pitted and cross-serviced visiting F-35 fighter squadrons, just like the old Ample Gain exercises we conducted as NATO partners in Germany before the end of the Cold War.

Our ambition doesn't stop there. The ability to share data and forge deeper interoperability across data link networks has to reach the point where U.S. and U.K. F-35s are interchangeable in a four-ship formation, where our synthetic environments are fully connected to allow relevant collective training, and where follow-on operational test and evaluation



Photo: Airman 1st Class Shantice Williams-Jones

A USAF maintainer trains with an RAF Airman on hot-pit refueling for a USAF F-35A at Royal Air Force Marham, England, in 2019.

is optimized to get enhancements to our warfighters as rapidly as possible.

THE NEXT FRONTIER

Naturally, the benefits of collaboration and integration extend well beyond the Earth's atmosphere, and the virtues of cooperation in the ultimate vital high ground of space is inarguable, in my opinion. No nation—not even the U.S., dare I say—can work alone in space, so the imperative to work multilaterally is arguably greater in this expanding operational domain than anywhere else. The RAF and USAF have been working together in space for over 50 years, and we have taken great strides in recent years to expand our combined efforts. This reflects the reliance we share on space for all our military activities, but it also recognizes the threats to our national interests there.

Building on several years of commitment to the Combined Space Operations initiative, the RAF is now a key member of the U.S.-led multinational Space Coalition under operation Olympic Defender, giving us the opportunity to provide additional staff to the Combined Space Operations Center [CSpOC], to include key leadership roles. In October 2019, an RAF group captain (O-6) was appointed as a CSpOC deputy director, a move that testifies to the enormous trust the USAF and U.S. Space Command are placing in the RAF.

Both of our countries recognize the need to generate and, if necessary, replace space vehicles quickly and cheaply if we are to improve the resilience of our space-based capabilities and respond swiftly to operational demands. Under the Royal Air Force's Project ARTEMIS (not to be confused with NASA's lunar program), we are developing the military utility of small satellites as operationally responsive space capabilities with the aim of getting the best information as quickly as possible to the warfighter, whether on land, at sea, or in the air.

Project ARTEMIS builds on the success last year of our Carbonite-2 small satellite, which was the first satellite in low-

earth orbit capable of downloading full-motion color video in real time. This project was just as much a triumph of process as it was a technological one—program initiation to launch in nine months—and we are expanding the novel approaches developed by the RAF's Rapid Capabilities Office to deliver aircraft and systems across our portfolio quicker, cheaper, and better than ever before. We are vigorously exploiting these principles in the development of our next-generation combat aircraft, the Tempest.

Our collaboration in the intelligence, surveillance, and reconnaissance sphere is especially noteworthy, because it exemplifies the integration that exists between our two countries. The RC-135 Rivet Joint is a case in point. At our bases in the U.K., in the U.S., and on operations elsewhere around the globe, the seamless integration of our crews, aircraft, and systems is a genuine force multiplier. Added to this is the exceptionally close relationship which our MQ-9 Reaper forces have enjoyed, paving the way for the RAF's new Protector Remotely Piloted Air System, the lead derivative of General Atomics' SkyGuardian. It will provide the RAF with a remotely piloted air system that can operate worldwide for up to 40 hours in unsegregated airspace.

It would be remiss of me not to mention the extremely close relationship we have developed with the U.S. Navy, whose unstinting support has been the critical factor in helping the RAF regenerate its maritime patrol capability. We could not have asked for more, nor learned more, in preparation for the receipt of our first P-8 Poseidon on Oct. 30, 2019.

In this article, I have only scratched the surface regarding the extent and depth of the cooperation between our two countries, and especially between the Royal Air Force and the U.S. Air Force. But let me make myself clear: It is one of my key goals to reinforce and expand our cooperation and integration over the next three years, building on the solid foundations we have constructed together in peace and war over the past century.

The Difference in Korea

Without U.S. air power, United Nations forces would have lost Korea in 1950.

B-26s bomb North Korea during the so-called police action to limit Communist influence in South East Asia. To the U.S. troops, fighting there, it certainly felt like a war.

By John T. Correll

The North Korean invasion force crossed the 38th parallel into South Korea at 4 a.m. on Sunday, June 25, 1950. Seven infantry divisions were supported by 150 T34 tanks and more than 100 combat aircraft.

In three days, it easily swept aside the under-equipped South Korean army and captured Seoul, capital of the Republic of Korea (ROK).

The United Nations Security Council called for withdrawal. The Soviet delegate, no doubt, would have vetoed the resolution, but he was absent, boycotting Security Council meetings because of an unrelated matter.

The U.N. asked member nations to help South Korea repel the invasion. U.S. Gen. Douglas MacArthur was named commander of all U.N. forces in Korea. The U.N. command consisted mainly of Americans and South Koreans, with smaller representation from two dozen other nations.

President Harry S. Truman ordered U.S. air and naval forces to provide military cover and support for the South Korean army. The first U.S. units to engage, on June 27, were from Far East Air Forces (FEAF).

Eighth Army ground units, drawn from occupation duty in Japan, arrived July 1. Like the ROK forces, they were pushed back by the oncoming North Koreans and set up a defensive perimeter around the port of Pusan at the southern end of the peninsula.

North Korea's plan was to seize control of all of South Korea in a month or less, before the United

Except for air power, "the war would have been over in 60 days with all Korea in Communist hands."
—Gen. Matthew Ridgway, U.N. forces commander

States could effectively come to the rescue. But that scheme was spoiled by U.S. air power, which conducted 7,000 close support and interdiction airstrikes in July and slowed the North Korean rate of advance to two miles a day.

That gave U.S. and U.N. forces time to regroup and consolidate their reinforcements behind the defenses of the "Pusan perimeter," 50 miles wide and 100 miles deep. The retreat finally came to a halt on Aug. 4. Gen. Matthew Ridgway, commander of U.N. forces from 1951 to 1952, said that except for air power, "the war would have been over in 60 days with all Korea in Communist hands."

The U.N. counteroffensive began Sept. 15 with MacArthur's dramatic landing at Inchon, behind enemy lines, combined with a breakout from Pusan. Within two weeks, U.N. forces were inside North Korea, eventually reaching the Yalu River. However, China entered the war in November, driving the U.N. back southward. By the spring of 1951, the ground conflict had narrowed to a strip above and below the 38th parallel.

U.S. Air Superiority

Despite China's and Russia's efforts on behalf of North Korea, U.S. air superiority ensured that U.S. forces were safe from air attack, while the North's army and air force was largely destroyed by the time the armistice was reached in 1951.



Photo: USAF

Brig. Gen. Courtney Whitney (left) and Gen. Douglas MacArthur, watch the shelling of Inchon from aboard the *USS Mount McKinley*, Sept. 15, 1950. The landing at Inchon, combined with a breakout from Pusan, put U.N. forces inside North Korea within two weeks. They eventually reached the Yalu River.



Photo: U.S. Army

The Korean War lasted for 37 months, but after truce talks began in July 1951, the last two years were essentially a stalemate with the opponents positioned on opposite sides of the 38th parallel.

All of the big movements were in the first year, when the battlefield shifted between the Pusan perimeter in the south and the Yalu in the north. Most of Korea—including the two capitals, Seoul and Pyongyang—changed hands at least twice.

DIMENSIONS OF AIR POWER

The overwhelming images of the Korean War are of the ground battle: Inchon, Pork Chop Hill, Heart-break Ridge, the “Frozen Chosin,” Imjin.

The role of air power in Korea has never been well understood. Remembrance of it concentrates on the duel of jet fighters in “MiG Alley” along the Yalu, which separates North Korea from Manchuria.

Achievements in MiG Alley were important, but that was the lesser part of Air Force involvement. Far East Air Forces flew almost four times as many close air support and interdiction sorties as it did counter-air. Of total FEAF sorties during the war, only 12 percent were counter-air.

The aerial engagements themselves were a means to achieve greater strategic objectives. FEAF confronted the MiGs on the Manchurian border, which enabled the U.N. to keep control of the air over North and South Korea. Ground forces were free to operate without attack or interference by enemy air power.

FEAF, with headquarters in Japan, had about 400 combat aircraft in Japan, Okinawa, Guam, and the Philippines at the outset of the war. That included a large number of fighters as well as B-26 and B-29 bombers. They were soon reinforced

by additional aircraft from bases in the United States.

Then and later, the Army was reluctant to give the Air Force credit for significant results in Korea. A study for the Army chief of military history in 1966 said that air interdiction had been “helpful during the early months of the war in assisting the ground forces to overcome the North Korean army” but that “the air interdiction campaign was not a decisive factor in shaping the outcome of the war.”

A considerable part of the Army attitude had to do with control. In July 1950, for example, the Air Force sent three additional wings of B-29 bombers to Korea. Army officers in Far East Command wanted them employed exclusively for close air support and reacted badly when they were not.

Army Maj. Gen. Edward Almond, Far East Command chief of staff, concluded, “The only assurance a ground commander can have that any supporting arm will be employed effectively, or at all, is by having operational control over that supporting arm.”

Far East Air Forces Sorties June 1950-July 1953

Close air support	92,603
Interdiction	221,162
Counter-air	86,818
Reconnaissance	60,971
Combat support	249,332
Total sorties	710,886

Source: USAF Operations Statistics Division

POLICE ACTION

At the end of World War II, the U.S. accepted the Japanese surrender south of the 38th parallel and the Soviet Union accepted the surrender north of that line, which became the arbitrary boundary between North and South Korea. In 1949, the last U.S. troops departed Korea, leaving only a military advisory group.

South Korean armed forces had 100,000 soldiers, but lacked tanks and heavy artillery. The air force consisted of 20 liaison aircraft or trainers. North Korea had an army of 130,000, supported by 500 tanks and artillery pieces and 132 combat airplanes supplied by the U.S.S.R.

The U.S., in 1950 did not regard Korea as being of great

strategic importance—but believed the Soviet Union was behind the invasion, making it a challenge by world communism that had to be met.

Truman, hoping to head off alarm that Korea was a major conflict, declared June 29 that the United States was “not at war” and that the combat operations were a “police action” on behalf of the U.N.

The first engagement of U.S. ground forces was a disaster. “Task Force Smith”—a cobbled-together battalion of about 400 men, commanded by Lt. Col. Charles Smith, with no tanks or effective anti-armor weapons—took a defensive position just north of Osan on July 1. The North Koreans routed them in a matter of hours, inflicting casualties of almost 50 percent.

B-26s, along with Air Force and Navy fighters and B-29s flying from Okinawa, bombed airfields and railroad yards in North Korea, then patrolled the major routes over which the enemy was advancing.

U.N. forces fell back toward the Pusan enclave. With more American reinforcements pouring in by the day, the North Korean advance came to a halt on Aug. 4. By then, air power from FEAF and the U.S. Navy’s Task Force 77 had severely reduced the troops and tanks of the invasion force and made a shambles of the supply system. The North Korean air force was effectively destroyed, with only about 20 airplanes remaining.

Most of the major industrial targets in North Korea had been destroyed by air power and early September marked the end of the North Korean People’s Army as a fighting force.

FROM PUSAN TO THE YALU

MacArthur delivered his boldest stroke of the war Sept. 15, an amphibious landing behind enemy lines at Inchon, 25 miles west of Seoul. The North Koreans were not ready to defend the position.

Two U.S. Marine regiments led the assault, meeting little resistance and incurring fewer than 200 casualties in capturing Inchon. In less than two weeks, U.N. forces were again in possession of Seoul and astride the North Korean route to the south. FEAF air power, which slowed the effort to reinforce Inchon and Seoul, contributed to the operation’s success.

Concurrently, U.N. forces broke out of Pusan and surged northward against the weakened enemy. They were soon across the 38th parallel and reached the Yalu on Oct. 26.

In October, four months after the invasion, it appeared that the war was almost over. MacArthur told Truman that North Korean resistance would be ended by Thanksgiving and that he hoped to withdraw the Eighth Army by Christmas. Two of the B-29 bomb groups were sent back to the United States.

The course of the conflict changed overnight when China intervened with 300,000 troops, outnumbering MacArthur’s U.N. force by almost 2-to-1. The Chinese were not just reinforcing the North Koreans. They were taking over the war. U.S. and ROK ground forces were stopped and thrown backward.

MIG ALLEY

The Chinese intervention brought a big change in the caliber of enemy air power. Russian-built MiG-15 interceptors, first seen on the Korean side of the Yalu on Nov. 1, were 100 mph faster than FEAF’s best fighter, the F-80 Shooting Star.

The MiGs had Chinese markings, but they were flown by Russian pilots. It was not until later in the war that Chinese and North Korean pilots began to fly some of the missions.

Ironically, in the first all-jet engagement on Nov. 8, an F-80C shot down a MiG-15. Various kinds of U.S. aircraft defeated MiGs on occasion, but no American fighter could match the



Photo: USAF

The torii gate leading to the Sabre flight line at Kimpo Air Base in South Korea. Counter-air missions from MiG Alley were vitally important, but FEAF flew almost four times as many interdiction and close air support missions during the conflict.

capabilities of the MiG-15 until the arrival in December of the swept-wing F-86 Sabres.

MiGs remained dominant through the winter of 1950-51 because of their greater numbers and because the U.N. retreat into South Korea forced the F-86s to abandon their forward airfields and pull back to Japan, from where they could not reach the MiG stronghold on the Yalu.

The Sabres returned to their Korean bases in the spring counteroffensive and soon established air superiority. Navy and Marine Corps aviators got some of the MiGs but their best fighter, the Grumman F-9F Panther jet, was outclassed by the MiG-15, so they put most of their effort into air-to-ground sorties, leaving the counter-air mission largely to FEAF.

According to the Air Force’s assessment immediately following the war, U.S. fighters shot down 14 enemy aircraft for every USAF aircraft lost in battle. After further examination of the claims, the ratio was dropped to 10-to-1. Other studies suggest that a 7-to-1 ratio—or even lower—would be more accurate.

Whatever the actual ratio was, a force of F-86s that never exceeded 150 outperformed the MiG-15s in theater, which numbered more than 900 at their peak. The Chinese were never able to project air power against U.N. targets or forces.

RETREAT AND RECOVERY

Chinese and North Korean forces crossed the 38th parallel on Christmas Day and reached their deepest penetration at Wonju, southeast of Seoul, on Jan. 14, 1951. As U.N. armies struggled to gain traction, air power carried the fight to the enemy.

The deputy commander of Chinese forces in Korea said later that in the early stages of the war, American aircraft and artillery had destroyed 42.8 percent of Chinese trucks.

Airstrikes did not interdict the invasion completely. One reason was that the enemy’s supply requirements were minimal.

U.S. and North Korean military members initialed maps showing the north and south boundaries of the Demilitarized Zone during peace talks on Oct. 11, 1951, but it took two years to agree on an armistice.



Photo: U.S. Navy via National Archives

A Chinese division could get by on 40 tons of supplies a day, compared with the 500 tons needed to sustain a U.S. division. Furthermore, the North Koreans and Chinese could bring in massive labor resources to keep their lines of communication.

The U.N. counteroffensive began, and gained strength, recapturing Seoul on March 18, the fourth and final time the south Korean capital changed hands.

The rift widened between MacArthur and officials in Washington. In defiance of Truman and the Joint Chiefs of Staff, MacArthur called for attacks into China unless a peace settlement was reached. Truman fired MacArthur on April 9 and replaced him with Ridgway.

By July, the battlefield—which had rolled up and down the peninsula like a window shade in the first year of the war—settled down to a stalemate. The dividing line ran across the two Koreas from southwest to northeast at an oblique angle to the 38th parallel.

STALEMATE AND TRUCE

North and South Korea “were ready to fight to the death,” but China, the U.S.S.R., the U.S. and the U.N. were not, said Army historian Andrew Birtle. “Twelve months of bloody fighting had convinced Mao Tse-tung, Joseph Stalin, and Harry S. Truman that it was no longer in their interests to try and win a total victory in Korea.”

“Since the political leaders of the two warring factions had signaled their willingness to halt the fighting, generals on both sides proved reluctant to engage in any major new undertakings,” Birtle said. “The two sides exchanged artillery fire, conducted raids and patrols, and occasionally attempted to seize a mountain peak here or there, but for the most part, the battle lines remained relatively static.”

During the three years of war, U.N. air forces flew 1,040,708 combat and combat support sorties. The U.S. Air Force flew the majority of them (69.3 percent), followed by the U.S. Navy (16.1 percent), the U.S. Marine Corps (10.3 percent), and other allied air forces (4.3 percent).

Formal truce negotiations began at the village of Panmun-

jom in October 1951, but it took two years to agree on the armistice, which went into effect July 27, 1953. The truce line and the corollary Demilitarized Zone ran east to west from Kaesong on the Yellow Sea to Kosong on the Sea of Japan.

SPARSE CREDIT

The popular interpretation is that air power in Korea was a sideshow, if that. “In Korea, the USAF belief in ‘victory through air power’ was put to the test and found sorely wanting by many of those who were promised so much from it,” said British historian Max Hastings.

It is valid to say that air power was not decisive in Korea—but then, nothing else was decisive either. It was stalemate after the first year, and the conflict ended in a truce.

- Without FEAF air power, North Koreans would have captured all of South Korea in a month, driving out U.S. and South Korean forces.

- The Air Force held control of the air over North and South Korea. Enemy aircraft were seldom encountered south of Pyongyang. U.N. ground forces were free from air attack. Their supply lines and infrastructure were not bombed.

- North Korea had 75 airfields that could have supported MiG-15s, but U.S. air power put them out of business. After 1951, the enemy abandoned any serious effort to operate air bases in North Korea.

- Air attacks destroyed every vestige of industry in North Korea, although armaments still came from outside nations.


- FEAF air power killed as many as 150,000 enemy troops and destroyed large numbers of tanks, trucks, trains, bridges, and buildings. Navy and Marine Corps airstrikes added to the totals.

All that adds up to something better than the sparse credit usually acknowledged for air power in Korea. ❖

John T. Correll was editor in chief of Air Force Magazine for 18 years and is a frequent contributor. His most recent article, “Hitler’s Buzz Bombs,” appeared in the March issue.

The Air Force Association Promotes STEM Abroad

In Germany, the local Kaiserslautern Air Force Association in collaboration with the Kaiserslautern High School Science, Technology, Engineering, and Mathematics (STEM) program supports aerospace education for students through partnerships and participation in their Junior Reserve Officer's Training Corps.

Kapaun Air Station hosted a STEM event in December 2019 that allowed students and Kaiserslautern teacher Ken Robinson to hear STEM presentations and to engage in hands-on activities. Former CIA Technical Director and Program Manager, Jay Simpson, was in attendance and is now an AFA special advisor to all STEM programs in the area. He has written several books on optical fiber technology, is responsible for 80 publications, and has 15 patents in the science field. Aaron Williams, who serves as AFA's European Special Assistant and oversees these efforts, continues to advance AFA's presence in Europe. 



Former CIA Technical Director, Jay Simpson, speaking to Kaiserslautern High School students about STEM.

Photos: Airman 1st Class Taylor Slater

San Diego AFA Chapter Renamed for USAF Hero

AFA's San Diego Chapter was renamed the Brig. Gen. Robert Cardenas chapter in honor of the former combat and test pilot's military and post-military contributions.

The change became official Jan. 30 at a celebration with Cardenas and members of his family as the guests of honor. Born on Mexico's Yucatan Peninsula and raised in San Diego, Cardenas enlisted in the California National Guard in 1939, transferred to the Army Air Corps Aviation Cadet program, and was commissioned as a second lieutenant and awarded his wings in 1941. During World War II, he successfully completed 19 combat missions in the European Theater as a B-24 pilot before being shot down on his 20th mission in 1944.

Following the war, he was assigned to Test Pilot School, and during an assignment at Muroc Field, Calif., was mission commander and pilot of the B-29 that carried Chuck Yeager and the Bell X-1 aloft for the mission that broke the sound barrier for the first time. Cardenas also served as a test pilot at Wright Field, Ohio.

During the Korean War, he commanded the 51st Fighter Interceptor Wing at Naha Air Base, Okinawa. He commanded the 18th Tactical Fighter Wing at Korat Air Base in Thailand during the Vietnam War and flew F-105s. In 1970, as Vice Commander of 16th Air Force, he helped negotiate the closure of Wheelus Air Base, Libya, with Muammar Gaddafi. He retired on July 1, 1973, after more




Retired Brig. Gen. Robert Cardenas (left) with Dick Jeffreys, president of the AFA chapter named in Cardenas' honor, at the dinner event where the chapter was officially renamed.

Photo: courtesy Dick Jeffreys

than three decades on Active duty.

Cardenas served on the Veterans Affairs Memorials and Cemetery Committee, where he campaigned for a new national cemetery to serve San Diego's large military community, resulting in the opening of the Miramar National Cemetery.

Changing a Chapter's name is unusual. But then again, so was the remarkable career of Brig. Gen. Robert Cardenas. 

Moviegoers in Piqua, Ohio—Pitsenbarger's hometown, enjoyed a day full of events in town and at the local mall, ending with a packed movie premier.



Gerrity Oklahoma Chapter President Scott Wilson honors the PJs in attendance with movie posters signed by the producers.



Retired U.S. Army Master Sgt. Fred Navarro spoke in Ohio about AIC William Pitsenbarger, the hero.



At the Oklahoma Gerrity Chapter pre-movie event, the crowd gathers for a group shot before entering the show.



Susan Loricchio, air power advocate (third from left), veterans, along with family and friends in New Jersey, after viewing "The Last Full Measure."

Photos: courtesy

AIRMAN FOR LIFE

Updates on AFA's activities, outreach, awards, and advocacy.

AFA Chapters Celebrate Pitsenbarger Movie Premier

AFA chapters gathered at local theaters across the country to celebrate the movie premiere of "The Last Full Measure," which opened nationwide in January.

More than 70 members of the Central Oklahoma Air Force (Gerrity) community gathered together on Jan. 24 to honor local Vietnam-era pararescuemen (PJ's) during a reception prior to the showing of the movie "The Last Full Measure," written and directed by Todd Robinson. The movie examines the story behind Medal of Honor recipient Airman 1st Class William Pitsenbarger, who was posthumously awarded the honor 30 years after he was killed in action in Vietnam.

During a reception, hosted by the AFA Gerrity Chapter, attendees also celebrated with families in attendance upon the administering of the Oath of Enlistment to 10 new Air Force recruits by the Oklahoma Cabinet Secretary for Veterans Affairs retired Brig. Gen. Ben Robinson. Chapter President Scott Wilson presented each of the three PJs (one of whom was in the movie) with a signed movie poster.

Other groups represented included 13 members of the Arnold Air Society from the University of Oklahoma, representatives of the Oklahoma Aeronautics Commission, the Oklahoma Department of Commerce ACES program, AFA Gerrity Chapter Community Partners, and Active military.

At the New Jersey movie premier, air power advocate Susan Loricchio introduced the special attendees to the audience, which included about 50 veterans representing all branches of the services, and she also spoke on the importance of the film.

At Pitsenbarger's hometown of Piqua, Ohio, the screening sold out in less than 35 minutes. In attendance were members of Piqua High School, his alma mater; the movie's producer, Sidney Sherman; movie director Robinson; Piqua Mayor Kris Lee, as well as four of the "Mud Soldiers" who were with Pitsenbarger on that day of valor April 11, 1966, depicted in the movie. Retired U.S. Army Master Sgt. Fred Navarro recalled to the audience how Pitsenbarger saved his life that day. Various events took place all over town, coordinated by the President of the Piqua Chamber of Commerce, Kathy Sherman. At a Piqua Museum and also in the National Museum of the United States Air Force this quote from one of the "Mud Soldiers" is on display:

"There was only one man on the ground that day that would have turned down a ride out of that hellhole—and that man was Pitsenbarger," F. David Peters, Charlie Company, 2nd Battalion, 16th Infantry, 1st Infantry Division, said.

For all, it was a night to remember in celebration of selfless heroism and U.S. Air Force history.

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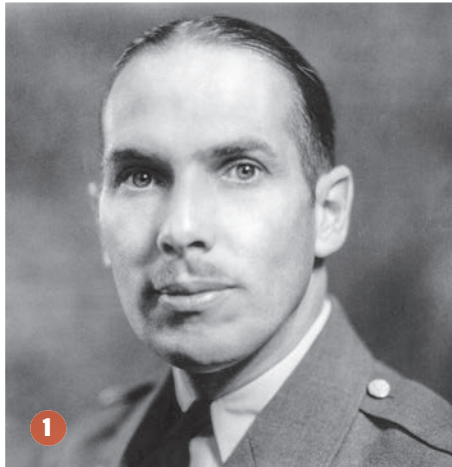
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1 Maj. Ployer Peter Hill. **2** F-35A Lightning II at Hill Air Force Base, Utah. **3** Burning wreck of Model 299, Oct. 30, 1935.

HILL

Overlooked

Hill Air Force Base, Utah, takes its name from Maj. Pete Hill, a pilot who perished in a 1935 crash. It's no exaggeration to say that that crash, and that death, changed aviation forever.

In the period 1917-35, Hill built a successful career in several aviation fields but was best known as a test pilot. He flew 60 new Army aircraft, but he suffered a stroke of evil luck.

Ployer Peter Hill—he went by “Pete”—was born in 1894 near Boston. A scholar-athlete, he attended Brown University, from which he was graduated in 1916 with high honors in engineering.

In 1917, with U.S. entry into the Great War, Hill enlisted in the Army's Aviation Section, received a commission, and trained as a bomber pilot. The war ended before he could get to Europe.

Hill remained in uniform and steadily advanced. He became an expert in aerial photography, commanding air photo units in the U.S. and abroad. He built a reputation as a test pilot extraordinaire.

In 1932, Hill was named full-time test pilot at Wright Field, Ohio. He soon became a major and chief of the Flying Branch of Materiel Division, testing aircraft such as Consolidated's P-30 fighter and Martin's B-10 bomber. On Oct. 30, 1935, he was to make a flight that might have become the apex of his career.

His aircraft that day was Boeing's experimental Model 299, a prototype of what would later become the famed B-17 Flying Fortress of World War II. It was a test flight.

Hill commanded. Joining him as co-pilot was Lt. Donald L. Putt and Leslie Tower, Boeing chief test pilot, plus two others.



The aircraft blasted down the runway, lifted off, started a climb and, at some 200 feet altitude, stalled, suddenly pitched up, rolled over, and crashed in flames. Hill and Tower died almost immediately from their injuries. The other three survived.

For a while, the crash was cloaked in mystery. Investigators found the 299 to be in perfect mechanical condition, and pilot error on such a routine takeoff was ruled out of the question.

What happened was this: As the crew conducted its preflight, it forgot to check something—the wind-gust locks on the elevators and rudder. These devices, which keep control surfaces from moving when a plane is on the ground, were never disengaged. In flight, they made the ship uncontrollable.

It seemed inconceivable that this slip-up might produce such a catastrophe, but it did. Human memory could no longer be trusted.

As a direct result, Boeing developed a “checklist” to prevent oversights and neglect in aircraft preparation and flight. It was soon adopted by the Air Corps and airlines. Today, no one can take off or land an aircraft without using the checklist.

It came from a tragedy visited on Pete Hill, but the checklist marked a dramatic advancement in aviation safety.

Hill Air Force Base is a major component of Air Force Materiel Command and home to Ogden Air Logistics Center. Principal operational units include the 388th Fighter Wing and 419th Fighter Wing, both F-35A out-fits.

PLOYER PETER HILL

Born: Oct. 24, 1894, Newburyport, Mass.
Died: Oct. 30, 1935, Wright Field, Ohio
College: Brown University, R.I.
Occupation: Engineer, U.S. military officer
Services: U.S. Army Signal Corps (Aviation Section); Air Service; Air Corps
Main Era: Interwar period
Years Active: 1917-35
Final Grade: Major
Honor: World War I Victory Medal
Resting Place: Newburyport, Mass.

HILL AIR FORCE BASE

State: Utah
Nearest City: Ogden
Area: 10.5 sq mi / 6,698 acres
Status: Open, operational
Opened as Ogden Air Depot: July 1939
Renamed Hill Field: Nov. 7, 1940
Renamed Hill Air Force Base: Feb. 5, 1948
Current owner: Air Force Materiel Command
Former owners: Office of Chief of Air Corps, Air Service Command, AAF Materiel and Services Command, AAF Technical Services Command, Air Technical Services Command, Air Materiel Command, Air Force Logistics Command

Photos: 75th Air Base Wing; R. Nial Bradshaw/USAF; National Archives

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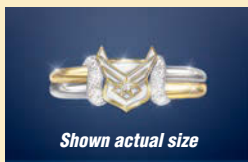
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