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# AIR FORCE

MAGAZINE

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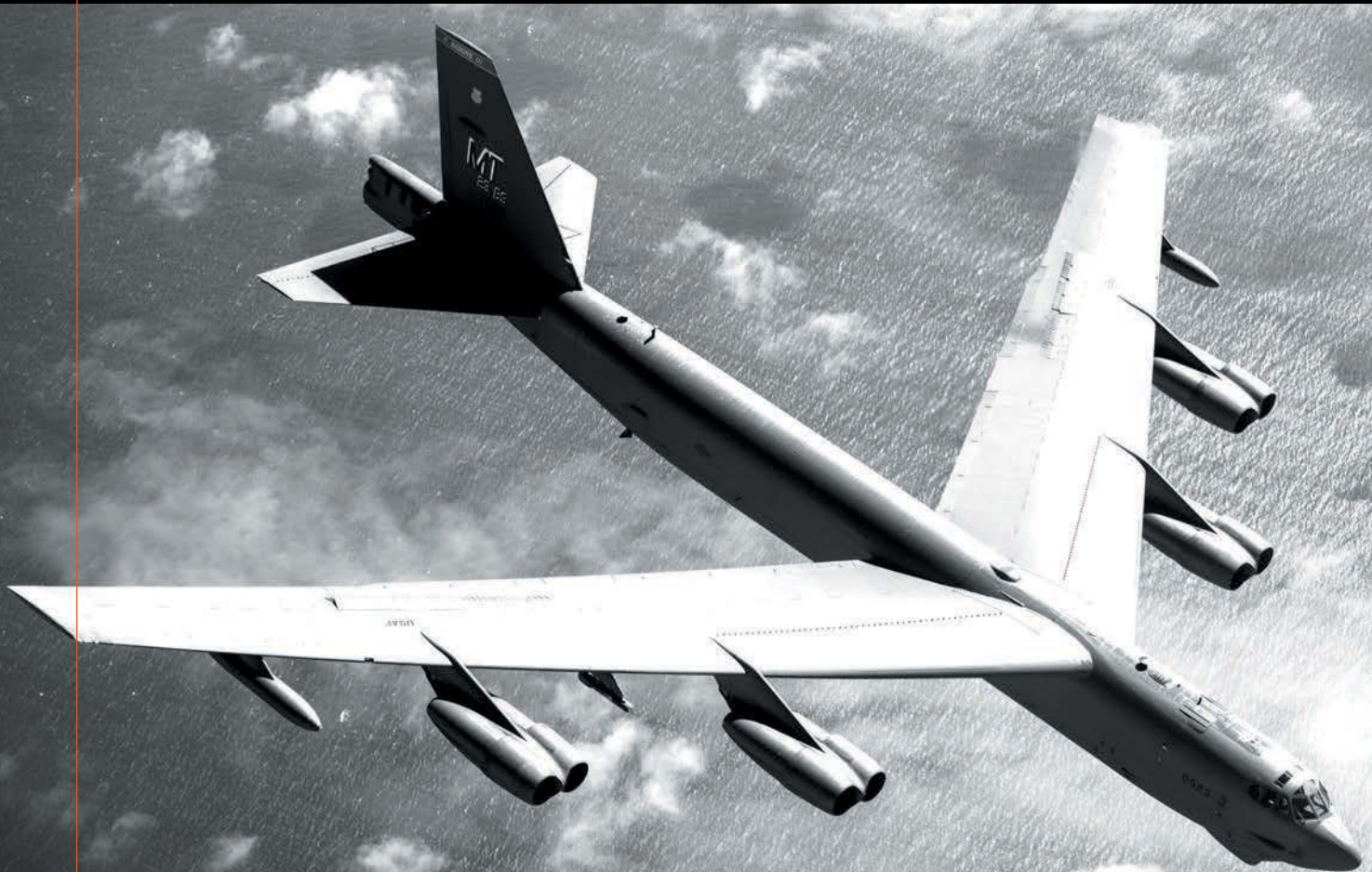


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Joby Aviation

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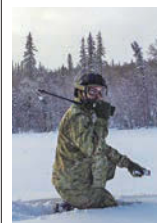
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Alaska ANG Tech. Sgt. Matthew O'Brien during SERE training. See "Cracking the Code," p. 34.

Senior Airman Kelly Willard/ANG

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# Go All In

**D**ecisions have consequences. Planning inevitably means making choices, and while some choices can be revisited later, the cost is almost always greater after the fact.

Case in point: The F-35 Lightning II. All who fly this exceptional stealth jet extol its virtues. But critics rage over its sustenance cost. The engines run so hot the special coatings on their turbine blades are burning off, creating a sudden and severe shortage of F-35 engines.

The F-35 was originally supposed to have an alternative to the Pratt & Whitney F135 engine, but the Pentagon canceled it, even though it had cleared all its technical hurdles. Now, if we could rewind the clock, we'd choose differently.

Similarly, then-Secretary of Defense Robert M. Gates chose to cut short the purchase of F-22s because he deemed the jets too "exquisite" for dropping bombs on insurgents. This, too, was shortsighted. Within a decade, the National Defense Strategy would identify China and Russia as the chief threats to U.S. interests around the globe, and stealth platforms like the F-22 as critical to countering that threat. By then, however, it was too late to buy more F-22s. Now, we face a yawning gap between the force we have and the force we need.

We didn't build enough B-1Bs or B-2s, either, which is why we're still flying B-52s from the dawn of the jet age. We didn't build enough C-17s and even though they're the most flexible of transports, there's no way to build more. The Air Force waited too long to develop and buy a new tanker and though the KC-46 issues will eventually shakeout, the lack of alternatives makes the wait even more galling.

There are tactical and strategic implications for these past decisions. One problem is that war games are fungible. Maintenance problems can be imagined away. Those assumptions come back to haunt you when breakdowns leave commanders short of airplanes in combat.

War strategies, too, must be examined with hindsight. A new report from the RAND Corp. examines the role of air power in the campaign against the Islamic State group in Syria, or Islamic State group. "Air power was indispensable to defeating Islamic State group," the report declares, but the authors accept the strategic limitations imposed on the war planners and accept them as inevitable. Unaddressed is the central question: Had air power been used strategically, would it still have taken longer to negate a self-proclaimed caliphate in the desert than it did for the Allies to defeat Germany and Japan in World War II?

The United States went into the war against Islamic State group with at least one hand tied behind its back. President Barack H. Obama "wanted a limited liability, limited risk approach," the RAND authors say, yet the strategy relegated air power to a secondary role: providing close air support to a proxy ground force. In fact, this continued the failed strategy that proved indecisive in Iraq and Afghanistan. The only difference is that this time they didn't commit large numbers of U.S. Army or Marine forces to the fight.

Even as the study notes "the physical caliphate was Islamic State group's center of gravity, as control of territory was critical

to the group's strategy," it accepts without question that "strategic air strikes against Islamic State group's oil business and its cash reserves ... were a small part of the overall air operations."

There's the rub: If strikes had been designed for strategic effects, this war would not have dragged on for five years.

To learn this lesson, we must ask the right questions. We won World War II because, despite political divisions, we were fully committed to victory and our leaders demanded unconditional surrender—no matter the cost. We stalled in Korea and later gave up in Vietnam because leaders lacked that commitment to win.

Today, as we approach the 20th anniversary of 9/11, we must ask ourselves if we haven't experienced the same thing over two decades of war in Afghanistan and Iraq. Unlike Vietnam, the public doesn't blame our troops for the failed military strategy. But like that war, presidents from both major political parties have taken turns as commander in chief without changing the central strategy or outcome.

What if we had taken a different tack?

RAND acknowledges that constraints on air power and the lack of air power expertise at the top of the command chain were issues, but the authors decline to speculate how that might have played out differently. Instead, they assert that a lack of targeting intelligence kept commanders from making better use of air power early in the war because so little was known about Islamic State group.

Here, Operation Desert Storm offers a worthwhile comparison. In those days before ISR drones, timely overhead intelligence was nonexistent. Yet our strategic air campaign delivered victory in just 43 days. If only RAND had compared these two conflicts. Then we

might have learned something.

Against Islamic State group, the United States waged war on the cheap. The air campaign flew less than one third as many sorties in the opening weeks against Islamic State group as it did in the 1995 air campaign against the Serbs in Bosnia. We lacked effort. From August 2014 to July 2016, we averaged just six U.S. strike sorties per day. Finally, our fear of civilian casualties reached an illogical extreme. We held off on attacking the Islamic State group oil distribution network for 15 months out of concern that targeting Islamic State group oil trucks was uncivilized, because the drivers were simply trying to earn a living. Yet that unconscionable delay allowed \$700 million to flow into Islamic State group coffers, funding their slaughter of thousands of innocent civilians.

Yes, decisions have consequences. The failure to effectively use air power to rapidly achieve strategic effects ensured the campaign against Islamic State group would be yet another long, slow war against a lesser foe.

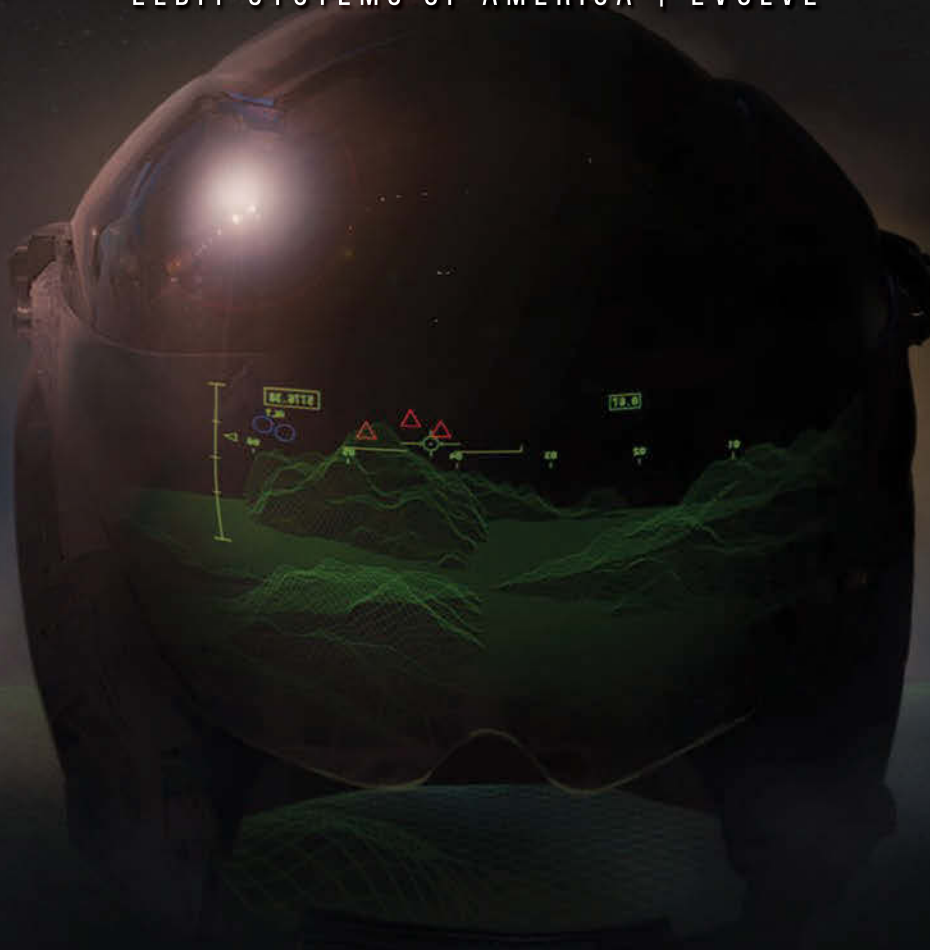
Analyzing what happened next can certainly highlight things the Air Force can do better next time. But the bigger question—the one our national and military leaders must reckon with—is this: How can we use air power to achieve greater results in less time? Had we done so Syria, we might have destroyed ISIS in a matter of months, not years.



**It should not have taken longer to defeat ISIS in the desert than Germany and Japan in World War II.**



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## F-22 in the Wind

The B-1 was designed, dropped, then re-adapted. Today it's treated like the bastard child of USAF bombers. I still maintain that the answer to USAF efforts to not be "peers" with our enemies (I use that term correctly) is not to create another wonder weapon, but to build out the [fifth-gen] aircraft we already have—the F-22 [See "How Long Will the B-1 Last," January/February, p. 30].

But, I fear that is a word into the wind now. Let's see how long it takes any real numbers of this new super-secret fighter we've prototyped to actually reach front-line service. I'm betting a decade, minimum.

Norman E. Gaines  
Hartsdale, N.Y.

## Boomer Heaven

I was a boom operator for over 30 years, from 1954 to 1984. I flew in KB-29Ps, KC-97s, and KC-135As. I agree the fiasco of the KC-46 tells us, as retired Colonel Samuel writes in your November issue [p. 6], that it's time to get the boomer on his belly again, or at least back in the rear of the tanker. In the KB-29P days, for refueling the boom had to move from the aft fuselage area back to the tail compartment after the plane was depressurized. On the way back, it was always a good idea to grab the APU (auxiliary power unit) gas can as you went by ... you never knew if you would be isolated in your refueling compartment for 40 minutes or four hours.

Refueling F-84s was not on the strict timetables of today's refuelings. You did your work seated on a uncomfortable plywood-type seat. You had excellent vision looking down over the top of the flying boom, which was similar to the ones used today. Of course the aircraft would have to be depressurized again for you to return to your scanner position carrying your walk-around bottle of oxygen, and that APU gas can that you might have made use of!

When I eventually moved into the KC-97s, I figured to be in "hog heaven" for the newly discovered comfort and ease of operation. And that got ever better in the KC-135. I can't imagine that the general in Colonel Samuel's experience might have thought laying down refueling might be uncomfortable. To me, it is the preferred

position. In times during SEA (Southeast Asia) operations, the boom pod, with its three pallets (KC-135) was akin to a bed away from home. It was an honor and a privilege for me to have such a great Air Force job for over 30 years.

CMSgt. Richard P. Hoff,  
USAF (Ret.)  
LaVista, Neb.

It is clear to see that "Belly-Flop" was not part of the KC-10 boomer's life ["Letters: Belly-Flop," November 2020, p. 4]. They had *three* first-class lounge chairs to use—center was the boomer, with the student, visitor, or friend right alongside. They sat in front of a world-class picture window of the action. I wish Colonel Samuel could see one. My wife and I agree that the lounge chairs are very comfortable during refueling operations!

TSgt. Reginald E. Holden,  
USAF (Ret.)  
Tarboro, N.C.

The saga of the KC-46 reminded me of a little-known bit of C-17 drama. Late in development and before the merger with Boeing, McDonnell Douglas (MD) offered a series of cost and weight savings options to the Air Force. One involved the ditching latches, which need to be in place in the event of a water landing to keep the large cargo door from opening. These were designed to be activated by a switch on the loadmaster's station in the forward cargo compartment. MD suggested changing these to manual—saving weight, software, and other costs.

As the assistant deputy chief of staff for requirements at Hq. Air Mobility Command, I thought this made some sense, since in the event of a possible ditching I thought a visual check on the latches

## WRITE TO US

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

would be in order. As we dug into this issue further, we learned that there was not a single case of an Air Force four-engine jet (some C-130 turboprops had fared better) aircraft going into the water that was considered a survivable impact! The implication was that all the water life-support equipment, including rafts, had not saved a single life! Perhaps the time had come to eliminate the life rafts in the C-17.

These rafts were particularly complex, involving pyrotechnics to cut away upper-wing skin and catapults to pitch them free of the hopefully floating aircraft. Considering the initial cost, maintenance costs, life-support manning, and significant lifetime fuel burn hauling the rafts around, a case could be made to eliminate them. Alas, although considered at the highest levels of the Air Force, the decision was made to retain them, where they remain to this day unused. Perhaps the next generation will re-look [at] the raft issue.

Col. Michael R. Gallagher,  
USAF (Ret.)  
Hillsboro, Ore.

I first piloted KC-135s back in the days of Strategic Air Command alert, when they were only about 17 years old. Now, the airframes are approaching 65.

Despite our affection for the sterling performance of our old Stratotankers, it's time for the Air Force to accelerate efforts to effectively replace them, before their history is forever tainted by catastrophe. Sixty-five years before the first KC-135 flew, the airplane had yet to be invented.

Col. David R. Haulman,  
USAFR (Ret.)  
Ridgeland, Miss.

## Desert Rivet

There is a glaring omission in the ISR section of John A. Tirpak's "Desert Storm's Unheeded Lessons" [December 2020, p. 30]. There is no acknowledgment of the contributions of the RC-135V/W Rivet Joint. The airplane(s) and crews arrived within two weeks of Saddam [Hussein's]

invasion of Kuwait and are still serving in the area. The unit is the longest continuously deployed organization in the theater.

Maj. Pete Siegel,  
USAF (Ret.)  
San Antonio

■ *"Desert Storm's Unheeded Lessons" wasn't intended as a comprehensive history; it was, rather, an examination of current capabilities in comparison to a comparable, but more modern threat. For a thorough examination of the RC-135's role in Desert Storm, search our online archive for "Ears of the Storm," from 1992 (<https://www.airforcemag.com/article/0292ears/>).—THE EDITORS*

## Mod BUFFs

A few suggestions for the B-52 mods in the future [See "BUFF Up," October 2020, p. 36]:

First, in the space where the tail gun used to be, install a powerful, off-the-shelf APU, perhaps from the 747-800 or 777 programs. The fuel intake could be from the aft tank, the bleed air line could be run in a dorsal fairing outside the fuselage on top, up to the wing leading edge. This would allow B-52 ops globally without ground support equipment, along with possibly extra electrical power for directed-energy weapons to be fitted in the future.

Second, the aft end of each underwing fuel tank could be removed and replaced with a hose-and-drogue assembly, allowing the future "B-52K" to refuel probe-equipped aircraft while on the way to the target. This would allow, for instance, a fighter escort to accompany the B-52K almost anywhere on the globe's surface, even over the North Pole. Consider that Sargent Fletcher had developed, years ago, fuel tanks for the F-16 that contain an extendable probe, enabling an F-16 to take fuel from drogues as well.

Third, a rear-facing tail, warning active electronically scanned array (AESA) radar could be installed, along with a rear-facing launcher, similar in concept to the RIM-116 launcher on Navy ships. The RIM-116 could be fitted with an AIM-120 compatible data link and directed onto trailing aircraft or even possibly large surface-to-air missiles. It would nevertheless provide rear hemisphere situational awareness.

Fourth, the external fuel tanks could also be modified so that the front or rear section contained a high-gain, data link antenna for control of man-in-the-loop missiles, such as the AGM-142, SLAM-ER, etc. The data link antenna module or the hose-and-drogue modules could

be installed or removed as required, with no disturbance of center of gravity or aerodynamics. Some wiring would have to be run up the leading edge to the fuselage.

Fifth, instead of mounting a pod in a non-optimum position underwing, why not take an off-the-shelf, large electro-optical turret, such as the MX-20, and make the necessary physical mountings to put two in place of the enhanced flight vision system (EVS) blisters. The current EVS is pretty much useless in the B-52's high-altitude mission set. This would allow, for instance, the two weapon systems officers in the back to sequentially laser designate vehicles in a column and wipe out an entire mechanized battalion in one run from 40,000 feet with, say, Griffin A-type weapons.

Sixth, design conformal ejector fairings to allow perhaps a half-dozen AIM-120 type air-to-air missiles to be fitted under each external fuel tank for launch against forward hemisphere targets assigned by the new AESA radar. This would be a convenient place to hang them.

The B-52 could become a true "Stratofortress" and shoot its way into a target area, destroying everything around and under it.

MSgt. Chris Dierkes,  
NYANG  
Westhampton Beach, NY.

## MiG, not Raptor

Not to be overly picky, but the photo on p. 40 of the latest issue (Jan/Feb 2021), purported to depict "two USAF F-22 fighters", actually depicts two MiG-31s escorting one of their own—and probably not "approaching Alaska" (MiG-31s don't often escort Tu-95s on EW and recce missions of this type; the MiG-31 is a defensive and not an offensive weapon by its very nature).

Jay Miller  
Fort Worth, Texas

■ *Mr. Miller is correct. The photograph on p. 40 of the January/February issue shows two Russian MiG-31 fighters, not USAF F-22 fighters, escorting two Russian Tu-95 bombers. We regret the error.—THE EDITORS*



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Air Force Global Strike Command bombers perform the Super Bowl LV flyover as fireworks go off at Raymond James Stadium in Tampa, Fla., Feb. 7, 2021. The trifecta was the first of its kind as it included a B-1B Lancer from Ellsworth Air Force Base, S.D., a B-2 Spirit from Whiteman AFB, Mo., and a B-52H Stratofortress from Minot AFB, N.D.

Mike Killian Photography





The first snowfall in two years at Davis-Monthan Air Force Base, Arizona, led to an early, but safe, landing for an A-10 Thunderbolt on Jan. 26, 2021. The All-Weather A-10s is perpetually on the verge of being retired by the Air Force, but remains a favorite of ground troops and well-protected by Congress.

Staff Sgt. Sergio A. Gamboa





An F-15E Strike Eagle peels away after receiving fuel from a KC-135 Stratotanker over Southwest Asia. To keep some of its most battle-weary Strike eagles flying to 2040, the Air Force is acquiring up to 50 sets of second-hand F-15SA wings from Saudi Arabia. The Saudis are upgrading their F-15s to a more advanced configuration, so their wings were available, while ordering new F-15 wing sets would have taken five years and cost five times as much, the Air Force says. All told, refurbishing the used wings could save \$250 million.



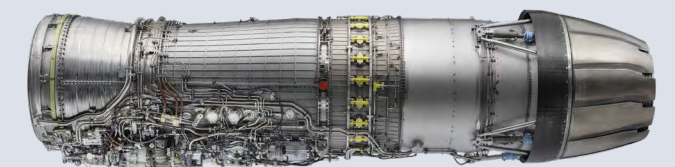


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# Humans in the Loop

*Richard J. Joseph is Chief Scientist of the Department of the Air Force, advising the Secretary and Chiefs of the Air Force and Space Force on their \$2.8 billion science and technology enterprise. He directed the development of the Air Force's 2030 Technology Strategy for former Air Force Secretary Heather Wilson, completed in 2019. On Jan. 28, he spoke with Air Force Magazine Editorial Director John A. Tirpak about the structure of the S&T enterprise, emerging game-changing technologies, and the future of humans in the loop. The conversation has been edited for length and clarity.*

**Q. You argued that the Air Force should create a Chief Technology Officer position, but that hasn't happened. Why not?**

A. We took that cue from conversations with industry, and it's also just good sense. You want someone who is deeply in touch with technology development but is also in touch with the customer; with the product centers. And in our case that would be the MAJCOMS and the COCOMs, and also industry.

And we said, this has to be somebody who controls the science and technology program, and maybe the RDT&E program, and it needs to be somebody who reports to the Secretary, somebody at a high level, like an assistant secretary, and there needs to be a counterpart on the Air Staff.

There was a lot of opposition to it. And the acquisition office was the strongest opponent of that because they felt it was still important to have that "birth to death" oversight of systems development.

I understand that, but I didn't think—we didn't think—it would work. ... And we think the laboratory system could produce better work if it was more focused on the research and development, science and technology area, rather than contract management of things that were supposed to become programs of record.

**Q. How about for the Space Force?**

A. In the early formation of the Space Force, I asked Gen. (John W.) Raymond, actually before he was designated for his current job [chief of space operations], have you thought about a chief technology officer? And he said, no, what would that person be? And so I explained.

Months later, he had created this chief technology and innovation officer on his staff, and I congratulated him on that. He said, 'the more I thought about it, the more sense I realized it made.'

That wasn't my original idea, that was people on our executive review panel for the 2030 Technology Strategy.

**Q. How would you break up the S&T responsibilities to work better?**

A. (Gen.) Jimmy Doolittle and Gen. (Hoyt) Vandenberg got the idea that doing research under the direction of people who buy systems wasn't the best way to do it; that the acquisition system tends to be 'now' focused: what can we do now, what can we work on now, what can we start now. Vandenberg and Doolittle felt that was too confining, that we would not really be able to harvest the gains in technologies made in both the commercial and academic area.

That was changed in about 1950. They created an assistant secretary for research and development, and a deputy chief of staff for development. And what followed was almost three decades of really strong innovation. In the 1990s, the Air Force decided to consolidate research under the acquisition system. Since then, we've had less aggressive science and technology research and exploitation of new ideas, and acquisitions have taken longer and longer and been more expensive. And I think those are related.

This is just me speaking, but I would ... [suggest] having breathing room between the people who do programs and [those that] do... program management ... of contracts with industry.

There are three real important things the [Air Force Research Laboratory] does.

No. 1, they address short-term needs that the MAJCOMs come up with, and some mid- and long-term needs. And those are real important and serious. Most of that, by the way, is done by managing contracts and industry.

The second one is to do the research. Somebody needs to keep us on the cutting edge of science and technology. That is typically done by the AFRL staff as well. However, the people who are managing these contracts with industry ... are the same people who are supposed to be doing the research.

Now, everybody has collateral duties. But if you are managing \$20 million a year in contracts and you're doing part of a \$5 million a year research effort, you know where the emphasis is going to go.

So I would advocate splitting those a little bit. Meaning, we set up a program management operation, and it can have people in it who have been in the research and development area for a long time; sort of like the DARPA model. They are running these programs, they're not actually trying to do research themselves, but they are knowledgeable about the research because they have strong backgrounds in it.

Some are doing research and some may cross over and become program managers. And we could build a sort of firewall—a soft firewall—between the program management people and the research and development people. They talk to each other, they use each other, but we don't have researchers who are



Richard Joseph, USAF's Chief Scientist, serves as the chief scientific adviser to the Chief of Staff and Secretary of the Air Force.

doing program management. And by the way, most of them really don't like doing that, so it's a retention and a recruiting issue. That's my prescription.

**Q. We've been talking about hypersonics, directed energy, smallsats, etc., for 40 years. Those things seem to be close to fruition. What will be the defining Air Force technologies 40 years from now?**

A. Well, I hope that in 40 years we'll have those things you mentioned, taken even further.

I think the big things that are coming, is materials by design. Which means we'll have tools that allow us to formulate and fabricate materials, their structure and composition, in ways that we could never do before. I think that's going to substantially change things.

The last 50 years have been the decades of physics; the next 50 years will be the decades of biology. We need to really exploit that. Synthetic biology will result in new materials, new understanding of the human, and it will hopefully also address a new understanding of our cognitive processes.

For instance, who owns your cognitive profile? The way you think, the way you see things? What you see when you look at a scene, or when you read something?

When you talk to a used car salesman, he'll ask you a few questions and develop a profile of you based on how you answer the questions. If someone can screen your emails and phone conversations and speeches and the articles you write, and they develop a pretty detailed understanding of how you think, do you own it? Or do they own it? Do they get to do what they want with it because you freely offered up the way you think?

That's the cognitive side. The cognitive side will also benefit things like artificial intelligence (AI). For example, when a pilot puts their CAC (Common Access Card) into the slot, it will identify who they are but will also identify their cognitive profile. Things they see well, and things they do not see well. And then the system adapts to that pilot. The next day, it could be a different airplane, a different pilot, and it adapts to that person.

And, in a broader sense, we will have better ways of predicting societal actions, including ... leadership decisions, and maybe even political decisions.

**Q. What about propulsion, things that fly, things that fly in space? Is hypersonics the end of the line? And are we "there yet" in directed energy?**

A. Well, I don't think hypersonics is quite hyper enough. To really have some differences we will continue to push that envelope: higher and higher speeds, as well as the ability to maneuver. This is contingent on new materials, and our ability to model the dynamics of those systems. Such as, how do the forces come into play when they change the direction of a missile? I think that's going to continue to develop. There are many more development cycles to come.

Directed energy is really at a point where we can make use of it, and not just for weapons, but also for sensing. We've been driving so hard to get very high power levels out of compact lasers, we sort of missed that there are a lot of things we can do in really small packages that are really useful. Sort of like—but not—the LiDARs (light detecting and ranging) that are in cars today, and are being talked about for autonomous vehicles. But maybe much more sophisticated than that.

**Q. For example?**

A. The LiDAR that is used for collision avoidance in your automobile—which can be used as a target designator—really

just calculates how far away things are, by knowing the transit time of the signal going out and coming back.

But lasers can also interact with a material and tell you something about what it's made of. We've been trying to exploit that for a variety of things over the years. One was for spotting clouds of biological organisms and identifying them from unique signatures. Very hard to do; they were relatively heavy if we wanted to do it at long ranges, and it was hard to put them in a helicopter or in an airplane.

But then it shrunk, and it will continue to shrink. And as it does, we will exploit other signatures. So, lasers will be big in the sensing area.

The same with microwaves. We already have more information than just the distance and location from radars, but we may push that dimension even harder.

**Q. Not long ago, the Pentagon said it was shifting its top priority from hypersonics to microelectronics. What's the long view there?**

A. Most of our advancements in AI and machine learning have come about because the microelectronics community did their job superbly. They stayed on the path of Moore's Law for decades. And there were times when it looked like they had hit a serious dead end, but they've somehow always come through with a way to get by it. They deserve a big part of the credit for any successes that AI is having.

We will continue to research microelectronics. We will go way beyond, I believe, some of the approaches that we've taken to date; neuromorphic computing just being one of them. And that's where the biology comes in.

**Q. Are we going to have a jack in the back of our skull where we'll plug into our computer or airplane?**

A. God, I hope not. I'm not going to do that.


AI is going to be important. But it is an enabler. It's not a panacea, there's no magic. But it will get better and better.

**Q. The Air Force is already using AI on airplanes, for mission planning and execution. We're on the cusp of the robotic "loyal wingman." Are we coming to the end of the period where we have human beings in the airplanes? Are people just going to provide guidance for the machines from a rear location?**

A. I've thought a lot about that, and I don't think so. It's not because I don't think AI or a lot of those things will become really capable. It's because all those advantages we talked about—hypersonics, electronic warfare, etc.—they all have a big machine learning and network component to them.

But networks are vulnerable. Computer systems are vulnerable, and what happens if we have a conflict where these advantages are challenged? What if we lose some of our advantages through cyber [attack], and through kinetic kills in the air on the ground and in space? If this happens on both sides, who has the advantage then?

If you have people in the system, then you have a pretty good computer in there. And if you've had experience and you've been trained well, then you aren't bereft of all of your advantages.

So, I don't think manned systems are going away completely. I think there's still an important future ... maybe even a more important future for manned systems, so pilots can rest easy. But not too easy. I know we can do wondrous things and that will augment our capabilities, but it also creates vulnerabilities. I think manned systems are with us for a while. 



By John A. Tirpak

# The Austin Era

**D**efense Secretary Lloyd J. Austin III—and the Biden administration—is likely to refresh alliances during his tour at the Pentagon, but probably won't make drastic changes to the National Defense Strategy (NDS) and won't try to dissolve the fledgling Space Force. While he personally supports the NDS and the nuclear triad, he will preside over a new review of nuclear posture. Competing effectively with China and Russia, at flat or lower levels of defense spending, will likely occupy much of his attention.

President Joe Biden's only reference to the military in his Jan. 20 inaugural speech was directed to allies, and could be interpreted as Austin's marching orders. "We will repair our alliances and engage with the world again," Biden said, pledging that the U.S. will be a "strong and trusted partner for peace, progress, and security."

President [Donald J.] Trump's "America First" approach to alliances unsettled some allies and raised doubts as to how strongly the U.S. would honor its mutual defense treaty obligations. Under his administration, Biden promised, the U.S., will "lead by the power of our example."

Not surprisingly then, Austin's first official calls after his swearing-in were to the Secretary General of NATO and the defense ministers of Japan and Korea.

A former four-star Army general, Austin was confirmed by the Senate Jan. 22 by a 93-2 vote. The Senate had already waived the statutory rule that a former officer be out of uniform seven years before taking the top Pentagon job. Austin retired in 2016 after heading U.S. Central Command for three years. He previously served as the Vice Chief of Staff of the Army, commander of U.S. forces in Iraq, and director of the Joint Staff.

Austin and Biden met when Biden's son Beau was on Austin's staff; the two attended Catholic services together. As CENTCOM chief, Austin was a trusted general during the Obama administration, his "strategic patience" mantra resonating with the White House. Austin advised an arm's-length involvement in support of Saudi Arabia's war in Yemen, and quietly urged diplomacy over military action whenever possible. A 1975 West Point graduate, he's regarded as having been an effective field commander.

In his confirmation hearing, Austin pledged to surround himself with "empowered, experienced, capable civilian leaders," and not be unduly influenced by uniformed leaders. He said he will work hand-in-glove with the State Department and promised to be "transparent" with Congress.

Austin voiced agreement with the 2018 National Defense Strategy, which reset the U.S. strategic priority away from the fight against violent extremism to "great power competition" with China and Russia. During confirmation testimony he called China America's "pacing threat."

Austin promised a new national defense strategy review in 2022. "Our resources need to match our strategy and our strategy needs to match our policy," he said. Future defense spending is anticipated



Staff Sgt. Brittany Chase/DOD

**Secretary of Defense Lloyd J. Austin III speaks with a Indiana National Guardsman during a visit to the U.S. Capitol building, Jan. 29, 2021.**

to hold flat or decline in the coming years as Congress seeks to balance security investment with COVID-19 relief.

After retiring from the Army, Austin served on several boards, including that of Raytheon Technologies, the Pentagon's No. 2 contractor. He has promised to recuse himself from decisions involving the company throughout his tenure.

## FIRST ORDER OF BUSINESS

The Pentagon's synopsis of Austin's call to NATO Secretary General Jens Stoltenberg said the two discussed "the importance of our shared values," the current security environment, NATO deterrence and defense posture, and "the ongoing missions in Afghanistan and Iraq."

In the call with Japanese Defense Minister Nobuo Kishi, Austin promised to maintain the readiness of the nearly 55,000 U.S. troops in Japan, and that the U.S. would respond militarily to any attack on the Senkaku Islands in East China Sea, controlled by Japan but claimed by both China and Taiwan. Kishi told reporters afterward that the two nations will "oppose any unilateral attempts to change the status quo" in the East and South China Seas.

In his call with South Korean Defense Minister Suh Wook, the two agreed on "the need to maintain the readiness of alliance combined forces," the Pentagon said in a summary. Austin noted the "ironclad" nature of the two nations' relationship. No mention was made of whether the U.S. and South Korea would resume large-scale exercises, discontinued by Trump in an agreement with North Korean "supreme leader" Kim Jong Un.

Austin's other first order of business was to meet with senior Pentagon leaders, including Joint Chiefs Chairman Army Gen. Mark A. Milley, on DOD response to the COVID-19 pandemic. He told the

Senate Armed Services Committee (SASC) that supporting vaccine distribution would be a top priority upon taking office.

Austin told the committee he “personally” supports the nuclear triad and opposes unilateral reductions to the U.S. strategic arsenal. He promised to review strategic modernization efforts, of which the Air Force is pursuing three simultaneously: the Ground-Based Strategic Deterrent, the B-21 bomber and the Long-Range Stand-off weapon.

Austin said he would study the Navy’s recommendations to sharply increase its size.

## ON KEEPING SPACE FORCE

In written questions from the SASC before his confirmation hearing, Austin was asked whether he thought the creation of Space Force was warranted, and his response was noncommittal. The defense space enterprise, he wrote, is “still not well-integrated with other services and terrestrial commands,” and there are “several other challenges that will need to be addressed—as would be expected”—when standing up a new service, Austin wrote.

Yet that lack of a clear endorsement should not be seen as a change in direction, said Todd Harrison of the Center for Strategic and International Studies (CSIS). The chances of the new service being unmade are “close to zero,” he told the Associated Press. The push to create a Space Force had congressional backing even before Trump came to office, and its bipartisan support signals that Congress perceives a U.S. vulnerability in space. Pushing to repeal the Space Force would be an unwanted point of conflict.

Retired Lt. Gen. David A. Deptula, head of AFA’s Mitchell Institute for Aerospace Studies, said the Space Force is “underfunded and undermanned.” It lacks the authorities to “consolidate the more than 30 other organizations” with a role in force design and architectures of military space capabilities. “To reduce costs and duplication of effort, these organizations must be consolidated under the Space Force,” Deptula said, arguing that this should be a goal for the new administration.

Byron Callan, defense analyst with Capital Alpha partners, wrote to investors that they shouldn’t conclude that Army programs will disproportionately benefit from Austin’s background.

“We observe that the most senior DOD leadership generally thinks of the joint force, rather than promote service-parochial interests,” Callan wrote.

However, a former senior Pentagon official countered that “there are now two Army four-stars at the top of the Pentagon and that’s not conducive to diversity of perspective on advice rendered to the President from a military viewpoint. They’ll need to broaden their view.”

Austin marks the third, ground-oriented career military officer to lead the Pentagon in four years, following former Marine general, Jim Mattis and Mark Esper, a former Army officer.

Kathleen Hicks, recently of the CSIS, will be Austin’s deputy. As principal deputy undersecretary for policy in the Obama administration, she oversaw the 2012 defense strategic guidance, which sought to align military strategy with the looming defense spending restrictions imposed by the Budget Control Act. That guidance—which emphasized preparation for future wars, a focus shift from Europe to the Pacific theater, “freedom of navigation” operations, and greater emphasis on special operations forces and advanced technology—was mirrored by the 2018 NDS in all ways, except its push to shrink the Army and Marine Corps. Hicks was also the main architect of the 2010 Quadrennial Defense Review; criticized in some quarters for a “do-everything” approach detached from resource limits.

Hicks “has the discipline, intellect, and organizational skill to make the Department work effectively,” said former Deputy Defense Secretary and CSIS President John Hamre, in an interview with Breaking

Defense. She served on the board of the U.S. Naval Institute and as a trustee for the Aerospace Corp.

Callan wrote that Hicks’ public comments on defense indicate she’ll bring “a sharp focus” to “alignment between budgets and military concepts of operations vs. China and Russia,” as well as a “closer examination of those concepts and theories of victory.” He added that she will likely lead “a bigger push on DOD innovation and experimentation” and “work within DOD budget resources and not simply ask for more that’s unlikely to be realized.”

## DIVESTING LEGACY SYSTEMS

Callan is less confident that under Austin, the Air Force will be allowed to follow its stated plan to divest older systems and apply the savings to new gear and capabilities.

“The A-10 was the poster child” for the Air Force being rebuffed on that approach, Callan said. Especially in a time of high unemployment driven by the pandemic, members of Congress will be loathe to agree to anything “that potentially cuts jobs in their districts or constituencies,” he said. While the Air Force has kept mum about such retirements beyond reducing the size of the B-1B bomber fleet—which Congress approved—further cuts are likely to be seen as having “immediate detriment” to local jobs, Callan observed.

Callan doesn’t see a big reduction in arms sales under the new administration. Countries that may have held back requests for systems like the F-35 because of their “concern about U.S. commitments” to mutual defense under the previous administration may feel more inclined to move ahead, he said. Biden’s defense team will be cooler to sales of precision weapons to Saudi Arabia, given concerns over their use in the Yemen war, but it is unlikely to do “an about-face on Taiwan,” he added. Trump’s move to lift restrictions on foreign sales of unmanned aerial systems is also unlikely to be reversed “because of market realities,” Callan said. If the U.S. withholds those systems, China and others will willingly fill the void, costing the U.S. influence with customer countries.

Biden’s defense picks are “solid,” Deptula said, calling them “effective advocates” for a strong defense. That said, the defense budget in the Biden administration will be lower than current levels. That’s of great concern to the Air Force and Space Force, because they both face daunting demands.

The Air Force particularly is facing “immense pressures” due to having the “oldest and fewest” aircraft it’s ever fielded, and having taken more budget reductions than any other service “since the Cold War ended,” Deptula said. Austin and Hicks will have to be “transparent regarding what they need and what they can afford.” He added that “it’s okay to have a gap, as that’s a way to measure risk, but they shouldn’t pretend the problem doesn’t exist.”

## JUST PASSING THROUGH

Deptula urged that Austin’s team finally do away with the “pass-through” budget idiosyncrasy that makes it look like the Air Force budget is as much as 20 percent larger than it really is.

“Money over which the Air Force has no control must be separated from its budget to ensure accurate understanding of its actual budget,” Deptula asserted. Most of the pass-through goes to the Intelligence Community, but “the negative effect” of the pass-through “is real and must be stopped to ensure transparency in defense spending.”

Callan predicts even greater emphasis on experimentation and prototyping under Austin.

“I think that’s where they’re going to put their eggs,” he said. The approach will be, “let’s see how we can use technology to substitute for capacity, or use technology to make trades at the margin for force structure, or different kinds of force structure ... to plug those gaps.”





## Really, Mom.



Mike Tsukamoto/staff; Pixabay

"My own mother called me a couple months ago, after watching a television segment about GPS, and she said, 'Hey, Jay, do you know that ... the Air Force and Space Force do things with GPS?' I'm like, 'Mom, that's kind of what I do.' So, you know, it's just hard to understand."

—Chief of Space Operations **Gen. John W. "Jay" Raymond** on public awareness of the Space Force, during a Feb. 3 Defense Writers Group discussion.

## The Future is NOW

"We have the technological artifacts of the information age all around us. Many agree that incorporation of Artificial Intelligence is our military future. It is time to make AI our military present."

—**Marine Lt. Gen. Michael Groen**, director of the Joint Artificial Intelligence Center, in an op-ed for Breaking Defense [Jan. 11].



Sgt. Charlotte Carulli/DOD

## 'America Has Been Tested'

"My message to those beyond our borders: America has been tested. And we've come out stronger for it. We will repair our alliances and engage with the world once again, not to meet yesterday's challenges, but today's and tomorrow's challenges. And we'll lead not merely by the example of our power but by the power of our example. We will be a strong and trusted partner for peace, progress, and security."

—**President Joe Biden**, inaugural address, Jan. 20.

## Who's Thirsty?

"As I look over the 10 years, I have to say ... right now where we're at in the program is we're making lemonade out of lemons."

—**Air Force Gen. Jacqueline Van D. Ovost**, head of Air Mobility Command, during a Feb. 1 Defense Writers Group meeting.



Mike Tsukamoto/staff; KC-46 courtesy; lemon Jill Wellington/Pixabay

## Enemies in the Ranks



Lisa Ferdinando/DOD

"I will fight hard to stamp out sexual assault, to rid our ranks of racists and extremists, and to create a climate where everyone fit and willing has the opportunity to serve this country with dignity. The job of the Department of Defense is to keep America safe from our enemies. But we can't do that if some of those enemies lie within our own ranks."

—**Defense Secretary Lloyd J. Austin III**, testifying before the Senate Armed Services Committee during his confirmation hearing Jan. 19.

## 1/6 and 9/11



Joshua Nathanson

"9/11 was horrible, but it was never a threat to our democratic republic. Only we can be the authors of our last chapter, and we are well on our way. To be clear: It is my personal opinion that we are in danger of losing our Republic. Real danger. .... As bad as 9/11 was, I feel that our situation today is worse."

—**Lt. Gen. S. Clinton Hinote**, Deputy Chief of Staff for Strategy, Integration and Requirements, Headquarters U.S. Air Force, Jan. 7, on Twitter.

## Deterrence in the EMS Domain

"Historical approaches [to] deterrence... don't work the same ways in cyberspace or the electromagnetic spectrum. Bottom line, we are not deterring adversaries like we need to. The PLA [People's Liberation Army] and the Russian forces have invaded the U.S. without a declaration of war."

—**Gen. Charles Q. Brown Jr.**, USAF Chief of Staff, during an Association of Old Crows streaming discussion of warfare in the electromagnetic spectrum [Jan. 27].



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







A General Dynamics Company



## U.S. Space Force Names Guardian Ranks

The Space Force rank structure is very similar to that of the Air Force. Space Force Guardians will continue to wear USAF insignia until new USSF insignia are approved. The ranks and grades:

GRADE	RANK	ABBREVIATION	TERMS OF ADDRESS
E-1	Specialist 1	Spc1	Preferred term is Specialist but Spec1 or Specialist 1 are acceptable
 E-2	Specialist 2	Spc2	Preferred term is Specialist but Spec2 or Specialist 2 are acceptable
 E-3	Specialist 3	Spc3	Preferred term is Specialist but Spec3 or Specialist 3 are acceptable
 E-4	Specialist 4	Spc4	Preferred term is Specialist but Spec4 or Specialist 4 are acceptable
 E-5	Sergeant	Sgt	Sergeant
 E-6	Technical Sergeant	TSgt	Sergeant or Technical Sergeant or Tech Sergeant
 E-7	Master Sergeant	MSgt	Sergeant or Master Sergeant
 E-8	Senior Master Sergeant	SMSgt	Senior or Senior Master Sergeant
 E-9	Chief Master Sergeant	CMSgt	Chief or Chief Master Sergeant
 E-9	Chief Master Sergeant of the Space Force	CMSSF	Chief or Chief Master Sergeant of the Space Force
 O-1	Second Lieutenant	2d Lt	Second Lieutenant or Lieutenant
 O-2	First Lieutenant	1st Lt	First Lieutenant or Lieutenant
 O-3	Captain	Capt	Captain
 O-4	Major	Maj	Major
 O-5	Lieutenant Colonel	Lt Col	Lieutenant Colonel or Colonel
 O-6	Colonel	Col	Colonel
 O-7	Brigadier General	Brig Gen	Brigadier General or General
 O-8	Major General	Maj Gen	Major General or General
 O-9	Lieutenant General	Lt Gen	Lieutenant General or General
 O-10	General	Gen	General

# Space Force Adopts USAF-like Ranks

## Four grades of 'specialist'—plus no staff sergeants.

By Rachel S. Cohen

**T**he Space Force will drop the rank system it inherited from the Air Force for a new set that combines Air Force and Army names, as the new service also looks to start transitioning new members in from other services.

The decision to adopt its own rank system is the latest move to forge the new service's path forward as it tries to establish a culture separate from the Air Force it came from in December 2019.

Changes to the rank structure only affect enlisted troops, while officers will retain the same career

**Active-duty Soldiers, Sailors, and Marines will soon be able to apply to join the Space Force.**

ladder from second lieutenant to general.

Enlisted Guardians from E-1 to E-5 will be known as specialist 1, specialist 2, specialist 3, specialist 4, and sergeant. That's a switch from airman basic, airman, airman 1st class, senior airman, and staff sergeant.

The Space Force said people should address troops in the first four ranks as "specialist," though abbreviations or the full title are also acceptable.

The enlisted system continues on to technical sergeant and then chief master sergeant. There is no command chief master sergeant on the list of new ranks. The top enlisted member will be known as

Chief Master Sergeant of the Space Force (CMSSF).

While ranks will stay the same on the officer side, the Space Force has decided to call its top brass “Chief of Space Operations” and “Vice Chief of Space Operations” rather than Chief and Vice Chief of Staff as in the Air Force.

Guardians will continue wearing the same Air Force rank insignias, like the chevron patches, while the Space Force finalizes new designs “sometime in the coming months,” according to a Jan. 29 release. Troops will get to weigh in on their future insignias.

Official military documentation like forms and websites will reflect the updates beginning Feb. 1, the Space Force said in the release, cautioning that “it may take time for all systems to reflect the change.”

“There are no changes to military benefits or entitlements,” according to the service’s memo, signed by Patricia Mulcahy, the Space Force’s deputy chief of space operations for personnel.

The decision comes shortly after the Space Force’s first birthday, as well as a previous announcement that the service’s members will be known as “Guardians.” As it did when picking that name, the Space Force considered crowdsourced input from the field while mulling its options for new ranks.

Congress created the Space Force during the Trump administration after years of discussion about the best way to handle new forms of aggression on orbit, such as anti-satellite missiles and signal jamming. The new service is a separate branch under the Department of the Air Force that is now in charge of training troops, buying hardware and software, and providing those resources to military commanders around the world.

Space Force missions span ballistic missile warning, GPS guidance for personnel and weapons, satellite communications, and more that have been around for years under the Air Force. Proponents say those jobs will become increasingly important and difficult as countries jockey for free rein in space.

Active-duty Soldiers, Sailors, and Marines will soon be able to apply for jobs in the Space Force, as the new service begins to include people outside of the Department of the Air Force for the first time.

The Space Force is looking for about 30 members of the Army and Navy departments to come on board this year, before ramping up to several hundred next year, Chief of Space Operations Gen. John W. “Jay” Raymond told reporters Feb. 3.

Military employees recently outlined the plan for transferring those troops, the majority of whom will come from land- and sea-focused backgrounds in ballistic missile defense, space surveillance, navigation, and satellite communications—missions that now largely fall under the Space Force.

“We’re going to need that joint expertise,” Brig. Gen. David N. Miller Jr., the Space Force’s deputy chief operations officer, said in an online town hall Jan. 28. “You have an advantage, coming from another service, that we need to latch onto. We value that warfighting experience that you may bring from the Army, from the Navy or the Marine Corps. We need you to stay focused on building that warfighting mentality into the space cadre.”

The application period opens in early spring, followed by a review of applicants’ performance records late that season. Those chosen to transfer will hear back early this summer, and the Space Force hopes to start welcoming troops from the Army and Navy in late summer or early fall. Officials did not provide specific dates for each part of the process.

Troops who volunteer to join the Space Force under the limited interservice program are separate from the organizations

within the Army and Navy departments that the Pentagon is planning to move into the Space Force starting in fiscal 2022, as dictated by Congress. Military officials have said for months that they are nearing a decision on those groups that will fall under the Space Force, but have not announced a final plan.

“We’re looking to bring individuals ... that are not necessarily in those units or missions that are planning to join Space Force in FY22,” said Matt Jobe, a senior policy analyst in the service’s personnel branch. “Those individuals that are in those signal battalions or satellite operations centers, those will have opportunities in ‘22.”

Service members who are part of units that are moving under the Space Force won’t automatically transfer—they must volunteer to join on their own.

Air Force members, largely from Air Force Space Command, started formally becoming Guardians last year. As of this spring, the Space Force plans to have around 6,400 Active-duty uniformed members across the globe and will total around 16,000 military and civilian employees.

Space Force career experts outlined potential job paths for Guardians during the Jan. 28 presentation, pitching positions that can take service members around the world and job stability as people stay in one line of work for years at a time. Many transfers will need to go through at least some mission training once they join the service, they said.

When newcomers from the Army and Navy arrive to the space operations field, they’ll likely start in two areas: orbital warfare and space electronic warfare (EW), said Col. Chris Putman, a career field manager in that area.

Orbital warfare entails commanding satellites and “moving the spacecraft on orbit, both to protect the missions that they perform ... or to prevent the adversary from taking actions on orbit,” he said. Space EW personnel jam electronic signals to stop others from using the electromagnetic spectrum in space, and protect those same wavelengths that U.S. assets need to communicate.

The Space Force also wants to train experts in space battle management—the people who direct on-orbit operations more broadly—and space access and sustainment, or the people who handle rocket launch ranges, testing, network management, and more. Troops can pursue careers in intelligence, surveillance, and reconnaissance, cyber operations, and acquisition as well.

“You will see two primary career fields that we need and that is network operations and defensive cyber operations,” said Col. Jon Smail, the Space Force’s senior cyber officer. “We won’t be doing expeditionary [communications operations], and we won’t start with offensive cyber operations, but we are planning in the future to have that capacity.”

The Space Force isn’t necessarily off-limits for troops in jobs that don’t fall in the space lane—say, an Army infantryman or a Navy drone pilot. USSF in fiscal 2022 will start considering how to bring those people in, and hopes to have a firmer plan in 2023 to open the Space Force to anyone who wants to join, according to Jobe.

Officers and enlisted members who sign up for the Space Force start the clock on a three-year service commitment, Jobe added. That’s long enough to complete fresh training, make sure people have adjusted to their new work, and set them up for future promotions.

“We want to do very deliberate development with each individual that joins Space Force,” Jobe said. “We are not looking for box-checking.”

Soldiers, Sailors, and Marines who transfer in will keep



their same grade, said Rob Romer, the Space Force's deputy for strategic human capital planning. A pending promotion that is finalized "should travel with you," he said, though it may delay the transfer process. Retirement plans would remain the same as well.

Officials are still ironing out the details of how to move people across the Defense Department, as top Space Force

leaders reiterate they don't want to "break" the other armed forces to build their own.

"We're trying to do what we can to smooth this process out," Romer said. "I know that one service goes a lot faster than the other service, but we're going to work with all of the services to be sure that we understand the timelines, and if there's a way to ... speed things up, we're all for that." ★

# Brown Presses for More Aggressive EMS Strategy

## As the U.S. slept, China and Russia 'invaded' U.S. infosphere.

By John A. Tirpak

**A**ir Force Chief of Staff Gen. Charles Q. Brown Jr. is pressing the Air Staff to complete a new electromagnetic spectrum (EMS) warfare strategy this spring, saying the U.S. has been "asleep at the wheel" while rivals have only become more aggressive.

The strategy will lay out "where we're headed and where we're taking the Air Force" in EMS warfare, Brown told a virtual gathering of the Association of Old Crows on Jan. 27. It will include "the operations we need to do in that area, and how we fund it."

The strategy, which will interlock with a defense-wide EMS strategy that is also due out in the spring, will break with decades of "neglect" in the electromagnetic spectrum, Brown said. The service

**"We are not deterring our adversaries like we need to."**

—Gen. Charles Brown Jr., USAF Chief of Staff

will shift from being entirely defensive in EMS operations to offensive as well, and plans to make major shifts instead of incremental improvements.

"Bottom line, we are not deterring our adversaries like we need to," Brown asserted. Chinese and Russian cyber forces "have invaded the U.S. without a declaration of war," and the U.S. posture "hasn't deterred them from using influence operations and misinformation to change the narrative," he added.

"We cannot continue to let this happen. We must make significant changes," he said. If the Air Force continues to just incrementally change, "it will not be 'accelerate change or lose,' it will simply be 'lose.'"

The threat is far more "dynamic" and rapidly evolving, and the Air Force has not kept up, according to Brown.

Providing EMS capabilities to the joint force is an "absolute prerequisite" for any deterrence or combat



Staff Sgt. Devin Boyer

Senior Airman Rose Li, left, and Airman 1st Class Eric Gardella, cyber readiness technicians, monitor malicious network activity during exercise Tacet Venari at Ramstein Air Base, Germany, July 2, 2020.

victory, Brown said. If the Air Force fails to do so, “it will be on me,” for not having provided the equipment and training necessary, he added.

The fight is a never-ending one, Brown said, noting that EMS superiority isn’t really possible anymore. He compared it to trying to achieve air superiority in the Pacific theater—Brown previously commanded Pacific Air Forces—which, Brown said, can only be achieved in a “localized” fashion given the size of the theater.

“We must provide EMS capabilities at the right time, and the right place,” he said. “There is no end state. It is an endless game” with “many waypoints,” but “no finish line.” Rather, the goal will be to maintain “our advantage” and not seek vainly for EMS superiority.

“We can no longer solely depend on defensive capabilities” like stealth and jamming, merely to ensure that forces get home, and expect to be successful, Brown asserted. “We’re using the same systems that ... we’ve been using over the course of the past 25 years.” That’s “not going to work in the future,” he said.

The Air Force will begin to take an offensive posture “to maneuver and fire in the EMS.”

Brown is “not a real believer” in the mantra of connecting every sensor with every shooter. “I think you have to connect the right sensor to the right shooter to the right decision-maker to be able to execute.”

The biggest investment shift will be away from hardware and platforms to software, Brown said, acknowledging that software and things like “open mission systems” architecture are hard sells with Congress because there’s no physical thing to look at, and no perceived effect “until it impacts you.”

But “an electron is much cheaper than a very expensive

missile,” and USAF will exploit the EMS to achieve nonkinetic effects as one way to reduce “the cost of destruction.”

Software will be the denominator of success, Brown said, asserting that “whoever can write code fastest is going to win.” He added, “We are outnumbered, particularly looking at the Chinese,” who have so many people and look to attack the EMS on so many fronts. He’s looking for EMS capabilities that are “platform agnostic.”

The Air Force will also include allies and partners in its EMS strategy because it will be necessary to have them involved from the beginning, to avoid creating incompatible systems. Allies are “what we have that [adversaries] don’t, ... that’s why we have to work together,” Brown said.

“We’re looking at future force designs [that will] integrate all these capabilities.” He also expects that Air Force and Joint Force Air Component Commanders will have the duty to “be the integrator for all the kinetic and nonkinetic” approaches to EMS operations.

The Air Force will be embarking on a series of experimental war games and prototyping to flesh out its EMS concepts and how they will integrate with kinetic forces, Brown said.

Congress included language in the 2021 National Defense Authorization Act (NDAA) to make EMS warfare a priority, Brown said.

“We’re not where we need to be. Every so often Congress needs to light a fire under us to get us to move a little bit faster,” he acknowledged. This was one of the reasons he’s pursuing “accelerated change across the Air Force.” The service should “be embarrassed sometimes that Congress has to tell us to do some of these things and move faster,” but the NDAA is a good “forcing function” to achieve that. ✪

# Boeing, USAF Report Progress on Troubled KC-46 Tanker

## But boom and Remote Vision System fixes are still years away.

By Brian W. Everstine

**T**he Air Force recently resolved two Category 1 deficiencies on the troubled KC-46 tanker, both problems with the aircraft’s auxiliary power unit (APU) that could impact the safety of flight. However, the four remaining issues are still years away from being solved.

The KC-46’s APU, located in its tail, developed two serious problems, one with a duct clamp that was moving excessively and another with a drain mast on the outside of the tail that could potentially break loose. As of the end of January, both problems have been addressed, with one closed and the other downgraded to a Category 2, or less serious, deficiency, AMC boss Gen. Jacqueline D. Van Ovost told reporters Feb. 1.

Boeing engineers developed a fix for the duct clamp problem, tested it, and now about 70 percent of the fielded KC-46s have been retrofitted, with the rest to be fixed “very shortly,” she said. The correction is similar to an approach Boeing used to address comparable issues on other aircraft.

“We’re confident that the clamp fix is the final fix based on their experience with the commercial aircraft and how they



Senior Master Sgt. Vincent De Groot

The boom of a KC-46 Pegasus is tucked under the fuselage at Sioux City Iowa’s airport. The tanker operated as a transport to move Airmen and cargo for a mobility exercise in September.

did the redesign on that,” she said.

For the second problem, there were quality issues with a spot weld on the part, meaning it could potentially break loose. Boeing redesigned it and is working through a retrofit option.



A final fix for the deficiency is in the works and it will remain a Category 2 problem for now, the company said in a statement.

"All of the airplanes that are flying right now and doing our testing, they all have that modification and everything seems to be going well," Van Ovost said.

Of the four remaining deficiencies, three have to do with the aircraft's remote vision system (RVS) and one with the refueling boom itself. Boeing and the Air Force announced in April 2020 they had reached a deal on the redesigned remote vision system, known as RVS 2.0, with final selection of the fix in the works. The Air Force expects the updated RVS to begin to be delivered in 2023, with the fix added to the production line the following year. Boeing will address the "stiff boom" deficiency by installing a redesigned actuator for the boom itself beginning in fiscal 2024.

The company is responsible for all cost overruns, which have already outpaced the initial contract award for the new tanker.

Boeing on Jan. 27 reported another \$275 million charge to its KC-46 program, pushing the total cost overruns it is responsible for to more than \$5 billion over the past six years.

The fourth-quarter total means 2020 saw more than \$1.3 billion in overruns for the program, a cost the company said in its earnings report was "primarily due to production inefficiencies, including impacts of COVID-19 disruption." The 2020 total is more than any previous year, according to a review of the company's prior year earnings reports.

Because of the nature of the contract, Boeing is responsible for all costs above the \$4.9 billion award.

The year wasn't all bad news for the KC-46, however. The company delivered 14 of the new tankers in 2020 and received \$3.8 billion for production lots five and six in January.

On Jan. 20 the Air Force awarded Boeing a \$2.1 billion contract for the seventh KC-46 production lot, covering 15 aircraft, meaning there are now 94 KC-46s on contract. It comes just eight days after Boeing received \$1.7 billion for production Lot 6. The two lots were negotiated at the same time, according to Boeing.

The Air Force plans to buy 179 of the aircraft, and after several delays, the KC-46 now will likely become fully mission capable in 2024, Van Ovost said.

The Air Force has received 42 KC-46s at four operating bases, and the Total Force aircrews are integrating the aircraft as much as possible. In early February, multiple KC-46s were deployed to Pacific Air Forces to take part in the Cope North exercise at Andersen Air Force Base, Guam, during which they were expected to refuel F/A-18s with the drogue system and C-17s, while also providing advanced communications capabilities.

"So as we keep our eye on a fully operational and capable KC-46, we're taking the time now with our crews who are transitioning into this airplane to learn more about the airplane and to learn about the new concepts that we're going to be executing in that airplane so that we can become more capable to the joint force," she said. "We're going to take every effort to wring out this airplane so that it becomes fully capable."

Because of the number of fielded KC-46s and delays to operational capability, the Air Force is slowing the transfer of aircrews, maintainers, and logistics Airmen from operational legacy tankers such as the KC-135 and KC-10 so AMC can meet the current tanker need.

Additionally, the Air Force is working with the Guard and Reserve, which makes up about 55 percent of the tanker capacity, to fund more crews and more volunteers to meet the need.

For the foreseeable future, the Air Force will only take delivery of about two planes per month even though there are more waiting at Boeing's facilities, because of the smaller number

of crews and the fact that the new tanker is not yet flying operationally, Van Ovost said.

"As we bring them on, we're going to do our due diligence at the different bases, but for right now, I don't need to be in a hurry to take them at a faster rate than about two a month," she said. ★

## Germany Drawdown on Hold

By Brian W. Everstine

Plans to significantly reduce the U.S. footprint in Germany are now on hold as the new administration reviews the decision and its impacts, the head of U.S. European Command said Feb. 3.

In July, then-Defense Secretary Mark T. Esper and EUCOM boss Gen. Tod D. Wolters announced that DOD would remove nearly 12,000 troops from Germany, shift F-16s from Spangdahlem Air Base (the base's only flying mission), and halt plans to move tankers and special operations forces from England to Germany, among other changes. The announcement came after former President Donald J. Trump repeatedly stated his desire to reduce the number of U.S. troops in Germany.

Wolters told reporters in a teleconference that planning for the moves immediately stopped once new Defense Secretary Lloyd J. Austin III took charge. Wolters would not say how far along the changes were in planning.

"There were so many pieces and parts to the plan, we could



Senior Airman Chancellor Nardone

**Four F-16s return to Spangdahlem Air Base, Germany, after participating in "NATO Days 2020," Sept. 19, 2020. Fighting Falcons will, for the time being, remain at Spangdahlem.**

probably sit here for weeks and guess on the depth and how far along we were," Wolters said. "But in all those cases, there were branches and sequels with multiple options. So, I will just tell you that the new administration has comfortably stated to us that we need to conduct a thorough review, cradle to grave, in all areas. And then after they're allowed to conduct that review, we'll go back to the drawing board."

Austin has hinted at making changes to the plan. According to a Pentagon summary of a Jan. 28 call with German Defense Minister Annegret Kramp-Karrenbauer, Austin said Germany is a "great host for U.S. forces" and "expressed his desire for a continued dialogue on U.S. force posture in Germany."

Wolters said the DOD review will provide a "comprehensive look at all of the options, from A to Z, and [then DOD will] take

a strategic and operational examination of each and every one of those impacts.”

When the move was announced, it drew immediate criticism from lawmakers, and the fiscal 2021 National Defense Authorization Act aimed to block funding for the change until the Defense Department provided details on the timeline and justification. ★



37th Training Wing Public Affairs

Upon publication of the new standards in Air Force Instruction 36-2903, Feb. 10, 2021, female Airmen will be able to wear their hair in up to two braids or a single ponytail with bulk and length restrictions.

## USAF to Let Women Wear Longer Ponytails, Braids in Uniform

By Amy McCullough

Female Airmen and Guardians will soon be able to let their hair down—at least a little.

Air Force Chief of Staff Gen. Charles Q. Brown Jr. recently approved a recommendation by the Air Force uniform board to allow women to wear a single ponytail, or single or double braids, as long as the hairdo reaches no farther than their upper back and doesn't exceed the width of their head. Eyebrow-length bangs are now fair game as well, according to a Jan. 21 release.

The decision comes after the uniform board—a diverse panel of 19 Airmen—met online in November to consider crowdsourced ideas for changes to the Department of the Air Force's dress and appearance standards. Current rules allow ponytails, braids, locks, and other hairstyles no longer than the bottom of a person's collar.

Female service members often lament having to wear their long hair in tight buns, pointing to migraines and sometimes even hair loss. Broadening the range of possible hairstyles also acknowledges that different hair types and textures can make it difficult to meet a one-size-fits-all standard.

“In addition to the health concerns we have for our Airmen, not all women have the same hair type, and our hair standards should reflect our diverse force,” Chief Master Sergeant of the Air Force JoAnne S. Bass said in the release.

The new grooming standards will take effect in February after the Air Force officially updates its regulation.

“This decision is a commitment to supporting the Airmen

we need and sustaining the culture and environment of excellence that will continue to make the Air Force an attractive career choice for Airmen and families,” Brown said. “I'm thankful for the feedback and research conducted from a number of women leaders, the Women's Initiative Team, the Air Force uniform board, and our joint teammates.”

Lt. Gen. Brian T. Kelly, Air Force deputy chief of staff for manpower, personnel, and services, said the move removes a barrier to service and can make the Air Force more welcoming to women.

“In an all-volunteer force, we want fully qualified volunteers who are representative of the nation to see us as a great opportunity to maximize their talent and service,” he said.

Depending on their job, women should make sure that a longer ponytail or braids would not pose a risk when working around “machinery, equipment, power transmission apparatus, or moving parts,” the Air Force said.

Women in the Space Force can follow the updated guidelines for now, but the new service is expected to eventually adopt its own uniform and grooming standards.

The Air Force isn't extending the same coiffure options to men, however.

“Unlike with women's hair standards, there are no known health or hair loss issues associated with current male grooming standard compliance,” the release said. ★



Capt. Anna-Marie Wyant

The E-11A is a modified Bombardier 6000 business jet that provides digital connectivity on the battlefield. Investigators concluded that pilot error led to a January 2020 crash that killed two.

## Aircrew Mistakes Caused Fatal E-11A Crash in Afghanistan

By Brian W. Everstine

E-11A aircrew shut down the wrong engine during an in-flight emergency and were unable to restart the aircraft's power plants, causing the Jan. 27, 2020, crash that killed both pilots in Afghanistan, an Air Force investigation found.

The crash killed Lt. Col. Paul K. Voss and Capt. Ryan S. Phaneuf, both assigned to the 430th Expeditionary Combat Squadron at Kandahar Airfield, Afghanistan. The E-11A Battlefield Airborne Communications Node, a modified Bombardier Global Express business jet, serves as a “Wi-Fi in the sky,” connecting troops using multiple communications platforms.



"This tragic accident and the loss of these two Airmen will not be forgotten," Gen. Mark D. Kelly, commander of Air Combat Command, said in a release. "These Airmen [made] the ultimate sacrifice in service to the nation while deployed supporting an overseas combat mission. They should be recognized and remembered for their dedication and bravery."

Around 11 a.m. local time, the pilots took off in the E-11A, tail number 11-9358, from Kandahar for a combat sortie that also served as a mission qualification flight for the co-pilot. About 1 hour and 45 minutes into the flight, the left engine catastrophically failed as a single fan blade separated and was ingested by the engine, according to an Air Force Accident Investigation Board (AIB) report released Jan. 21.

The pilots heard a violent bang and the plane started to shake. The aircraft's Full Authority Digital Electronic Control system sensed the engine's problem and initiated a shutdown. This notified the aircrew through both an indication system in the cockpit and a caution light on the pilots' glare shield.

The flight crew then improperly assessed that the aircraft's right engine had failed or been damaged, not the left, and shut down that power plant. This caused a dual engine out emergency, when the aircraft was about 38 nautical miles from Bagram Airfield or 17 nautical miles from Kabul International Airport, 28 nautical miles from Forward Operating Base (FOB) Shank, and 230 nautical miles from Kandahar, according to the investigation. Because both engines shut down, the aircraft's Digital Flight Data Recorder stopped recording.

The aircraft, flying at about 41,000 feet, could have made it to any of the closer locations, but Voss attempted to fly back to Kandahar and radioed air traffic control. "Mayday, Mayday, Mayday, ... it looks like we have an engine failure on both motors, we are proceeding direct to Kandahar at this time," he said, according to the AIB.

The aircrew tried to airstart the engines, but they could not provide any usable thrust, meaning the plane could not make it back to Kandahar and was then out of glide distance to the other bases.

This meant the crew had few options, and they attempted to then glide to FOB Sharana in Ghazni Province. The plane did not have enough altitude and airspeed to make it, and the crew tried to land on rough terrain about 21 nautical miles short of the FOB. The E-11 was damaged significantly when it touched down, skidding about 340 meters. The aircraft was destroyed, and the pilots were fatally injured.

After the crash, the aircraft's emergency locator transmitter activated and nearby A-10s diverted to try to locate the downed plane. They found it, but weather obscured the area and prevented a search and rescue team from recovering remains the day of the crash. The next day, crews were able to recover the pilots' remains, the cockpit voice recorder, and the digital flight data recorder. U.S. assets destroyed the plane in place.

The Air Force AIB states the main cause of the crash was the aircrew mistakenly determining the right engine had failed, shutting it down, and causing the dual engine out emergency. Investigators also found the decision to try to make it back to Kandahar contributed to the mishap.

The E-11A is a small, unique aircraft in the Air Force's fleet. Before the mishap, the service had four based at Kandahar to help troops communicate on the ground using

what previously were incompatible systems. The Air Force developed the aircraft as an urgent operational need after communication problems were identified in Operation Red Wings in 2005. ★



Trevor Cokley/USAF

The Air Force Academy expelled one student and another resigned after 249 cadets were implicated in an online cheating scandal.

## Widespread Cheating at USAFA

By Rachel S. Cohen

The U.S. Air Force Academy (USAFA) has kicked out students and reprimanded others after nearly 250 cadets were suspected of using online learning to cheat on tests and plagiarize assignments last spring.

USAFA sent freshmen, sophomores, and juniors home from the Colorado Springs, Colo., campus in March 2020 as the new coronavirus spread across the U.S. For the first time, the school of more than 4,000 students pivoted to distance learning to finish out the semester.

But that presented opportunities for students to game the system, away from the watchful eyes of professors, other cadets, and a wall bearing the school's honor code: "We will not lie, steal, or cheat, nor tolerate among us anyone who does."

"Infractions ranged from failing to properly cite sources, to using unauthorized online tutoring websites to receive solutions to exam questions in real time, to completing final exams in small groups," the school said Jan. 29.

They were caught through "existing Dean of Faculty academic safeguards," and most of the 249 students admitted to cheating, USAFA said.

One student was expelled and one resigned from the service academy because of their misconduct, spokesman

Mike Slater said. Others must complete six months of probation and remediation, while some cases are still under review. The school hopes remedial measures will dissuade students from violating the rules again.

"Remediation is a consequence and not an act of leniency," USAFA Superintendent Lt. Gen. Richard M. Clark said. "If earned, remediation provides an opportunity to reset the moral compass."

The school waited for students—who run the process of holding fellow cadets accountable for honor code violations—to return to campus for the fall semester before taking punitive measures.

"The process is currently progressing slower than normal, primarily due to COVID restrictions, but the academy is dedicated to ensuring cadet accountability throughout the entire honor process," the school said. "Cadets in violation of the honor code are not allowed to represent the academy until they complete the required remediation."

The incident highlights the challenges of increasingly digital education, particularly as the pandemic has forced schools across the globe to go virtual. Though all USAFA cadets are back on campus for the 2020-2021 school year, classes are still a mix of in-person and online instruction.

USAFA isn't the only service academy to run into misconduct issues during remote learning. Last year, 73 cadets at the U.S. Military Academy at West Point were accused of cheating during an online calculus final—the largest cheating scandal in the school's recent history.

The Air Force Academy has dealt with its own spates of cheating in the past, including a 2019 incident when 10 cadets were suspected of cheating on final exams, and in 2014 when 40 freshmen were investigated for copying lab work for a chemistry class.

The 2014 investigation was the "fourth probe of cheating involving a group of cadets at the Air Force Academy since 2004," according to the Associated Press.

USAFA is taking the latest cheating as an opportunity to overhaul its honor code for the first time in several years.

"The purpose of the review is to provide findings and recommendations for improvement to the Honor Program, ensuring the Cadet Honor Code and Honor Program relevantly and effectively achieve cadet character development," the school said.

A review committee will discuss ways to better encourage "living honorably" with senior leaders, school alumni, cadets, and other stakeholders. There is no set timeline for finishing the review or implementing its findings.

Clark acknowledged the probe during a Jan. 21 AFA Mitchell Institute for Aerospace Studies event, but did not say what happened last spring to prompt a new look at the entire honor system.

"We recognize that we need to take a look at the honor code, and make sure that we're serving these cadets well, so that they are internalizing it and understanding what it means to live honorably," Clark said.

The point is not to threaten a cadet's career, he said, but to put them back on the right track if they do violate the school's trust. Still, students need to take misconduct seriously: "It could have a pretty significant impact on your career, if your career gets to continue," he said.

"The honor code is there to develop these folks that we bring in from all different walks of society, from all different places, and develop them so that by the time they graduate, ... they are committed to that honorable living, not only as graduates, but for the rest of their lives, that it is something that they actually believe in," Clark said. ★

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Boeing

The first F-15EX flew a 90-minute sortie around St. Louis on Feb. 2 to test out the aircraft's basic handling qualities.

## Boeing F-15EX Makes First Flight

By John A. Tirpak

Boeing flew the first F-15EX Eagle on a 90-minute hop around the St. Louis, Mo., area Feb. 2, signaling that the jet will soon be ready for flight-testing at Eglin Air Force Base, Fla.

Boeing test pilot Matt Giese flew the jet, with Boeing test pilot Michael Quinitini in the back seat. The flight, which began with a max-performance vertical climb from St. Louis Lambert International Airport, abutting Boeing's combat aircraft plant, was meant to test out basic handling qualities, "avionics, advanced systems, and software," and all went as expected, a Boeing spokeswoman reported. "A test team monitoring the data collected during the flight in real time confirmed that the aircraft performed as planned," according to a Boeing press release. The test card for the flight is not being made public.

The jet, tail number 20-0001, is the first of two that are to be delivered for testing at Eglin by the end of March. A formal "rollout" of the second aircraft or an arrival ceremony at Eglin is slated to occur in March or April, months ahead of schedule. The Air Force awarded the formal F-15EX contract for the first eight airplanes in July of 2020.

The aircraft is powered by two F110-GE-129 engines, the only ones so far certified to fly with fly-by-wire Eagles. The Air Force has told Pratt & Whitney it can offer engines for the F-15EX program if it certifies its F100 engines on the type at its own expense. GE Aviation is under contract for 19 power plants for the eight planned F-15EX test aircraft.

The Eagle is expected to reach initial operational capability at Kingsley Field, Ore., in 2024. The F-15EX will have sufficient structural life to serve through 2050.

The fighter has two seats and is based on the 1970s-vintage F-15C/D Eagle, but upgraded with a modern suite of flight controls, computers, and defensive electronics. It is equipped with conformal fuel tanks and two extra weapon stations, versus the F-15C. The Air Force is buying it to supplement the fleet of legacy Eagles that are rapidly aging out and can't be economically life-extended. The Air Force plans to buy between 144 and 200 F-15EXs, depending on whether the type will also replace F-15E Strike Eagles, which still have a decade of service life remaining. Despite the second seat, the Air Force intends to fly the F-15EX with only a single pilot.

The F-15EX is based on the F-15QA being built for Qatar,

but embodies other improvements added by export customers over the years. Its fly-by-wire flight controls, for example, first appeared on Saudi Arabian F-15SA aircraft. Boeing estimates the Air Force is leveraging more than \$5 billion of improvements in the F-15 funded by export customers.

Unlike export models, the F-15EX and older USAF F-15C/Ds will be protected by the Eagle Passive Active Warning Survivability System (EPAWSS), a suite of electronic warfare gear and countermeasures to extend the type's combat longevity.

The jet is seen as meeting Air Force capacity shortfalls in air defense and as a standoff weapons-carrying platform that could operate outside contested airspace.

The F-15EX has an open mission systems architecture, allowing frequent, competitive upgrades. Boeing's F-15 Vice President and Program Manager Pratyush Kumar said the EX is "capable of incorporating the latest advanced battle management systems, sensors, and weapons due to the jet's digital airframe design and open mission systems architecture." ★



CM Sgt. Mike Perry/Facebook video screenshot

Air Force First Sergeant Special Duty Manager Chief Master Sgt. Mike Perry, left, and Chief Master Sergeant of the Air Force JoAnne Bass say staying fit is still a requirement, but it's not clear when it will be safe to do PT testing.

## COVID-19 Will Dictate When Air Force PT Tests Resume

By Jennifer-Leigh Ophriory

It's too soon to tell whether the Air Force will delay mandatory physical fitness testing past April, Chief Master Sergeant of the Air Force JoAnne S. Bass told Airmen during a Feb. 1 Facebook town hall.

Bass said she expects the service will examine the COVID-19 situation "at least" 30 days ahead of the tentative restart date before deciding whether to postpone the assessments for the fourth time since the pandemic began.

"Right now, today, every single one of your installation commanders has ... the authority to be able to push it out, but we'll make that determination ... at least four weeks out if we're gonna end up pushing it further," she said.

Air Force First Sergeant Special Duty Manager Chief Master Sgt. Mike Perry, who also took questions during the online event, urged Airmen not to use the possibility of another delay as an excuse to neglect their physical fitness.

"You never know when that call's gonna come in, when you're gonna be wearing all kinds of gear and have to be out there in the austere environments and things like that, so we gotta always remain ready and fit," he said, pointing to recent

Active-duty and Air National Guard support of the presidential inauguration in Washington to illustrate the importance of around-the-clock readiness.

The service's manpower, personnel, and services team is slated to brief her on the findings of their December 2020 Fitness Working Group in the near future, Bass added.

"They are supposed to come to us with options on different ways to be able to assess cardio and strength and all that goodness," she said. "We are also taking a hard look at wearables and technology and using that to be able to help get after that."

Bass said the service wants to examine "second- and third-order effects" since these kinds of technologies "can be resource-intensive," but the service is looking "to bridge the gap" between how it currently gauges fitness and how that might evolve over the next decade.

For example, Bass noted that both she and Perry were wearing rings that measured their sleep levels, joking they both needed to get more rest. ✪

## B-1Bs to Deploy to Norway

By Brian W. Everstine

U.S. B-1B bombers will deploy to Norway for the first time, in both a message to Russia and a sign of the growing importance of the Arctic.

B-1Bs from Dyess Air Force Base, Texas, will fly out of Ørland Air Base on the coast of the Norwegian Sea. While bombers have repeatedly flown alongside Norwegian aircraft, this will be the first time Lancers will operate out of a base in the country, according to U.S. European Command.

More than 200 Airmen will make up the Bomber Task



Master Sgt. Theodore Daigle

**B-1B bombers will deploy to Norway for the first time, the Pentagon said. In September, this Lancer flew over the North Pole for an exercise with the Norwegians.**

Force. The Airmen were medically screened before deploying and will quarantine for 10 days once arriving.

EUCOM did not disclose how long the bombers will be at the base, but they will conduct training with allies, including operating in the "high north" and across Europe.

"Operational readiness and our ability to support allies and partners and respond with speed is critical to combined success," Gen. Jeffrey L. Harrigian, U.S. Air Forces in Europe-Air Forces Africa commander, said in the release. "We value the enduring partnership we have with Norway and look forward to future opportunities to bolster our collective defense."

Last year, B-1s and B-52s flew alongside Norwegian F-16s and F-35s multiple times as part of European deployments and in a long-distance direct flight from their home base. ✪

The advertisement features a large, detailed image of an F-35 fighter jet in flight, viewed from a side-on perspective. The jet is dark grey with some orange and yellow markings on its tail. To the right of the jet is a single PGU-48/B 25 mm Frangible Armor Piercing (FAP) Ammunition round, shown vertically. The background is a light blue sky. The text "www.rheinmetall-us.com" is visible in the top right corner. At the bottom, the words "NEXT-GEN LETHALITY" are written in large, bold, white letters on a blue background.

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# NEXT-GEN LETHALITY

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Rheinmetall's next-generation PGU-48/B 25 mm FAP ammunition is a multi-purpose round specifically designed to provide the F-35 Joint Strike Fighter with superior lethality in air-to-ground combat against hard, soft and urban area targets while remaining deadly against enemy aircraft. The new cartridge contains no explosives, ensuring maximum safety in the aircraft, as well as in storage, transport, and training. The 25 mm FAP round, proudly manufactured in Camden, Arkansas by American Rheinmetall Munitions, is a true all-purpose cartridge that demonstrates Rheinmetall's innovative technology and continued commitment to the US Air Force.

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# Arab-Israeli Accords Unify Mid East Under CENTCOM

By Brian W. Everstine

The Pentagon has changed the combatant command responsible for operations involving Israel, from U.S. European Command to U.S. Central Command (CENTCOM), following White House-brokered accords between the country and multiple Persian Gulf states.

The update to the Unified Command Plan came as the Trump administration finished its final week in office. President Donald J. Trump's White House has touted the Abraham Accords—normalizing relations between Israel, Bahrain, and the United Arab Emirates—as a major shift toward improved relations in the Middle East.

“The easing of tensions between Israel and its Arab neighbors subsequent to the Abraham Accords has provided a strategic opportunity for the United States to align key partners against shared threats in the Middle East,” the Pentagon said. “Israel is a leading strategic partner for the United States, and



Senior Airman Duncan Bevan

**When Israeli and U.S. F-35s trained together in October 2020, U.S. European Command coordinated the exercise, even though the rest of the region was under U.S. Central Command. Now Israel and its neighbors will all be in the Central Command area of responsibility.**

this will open up additional opportunities for cooperation with our U.S. Central Command partners while maintaining strong cooperation between Israel and our European allies.”

The Pentagon did not say how the move will affect operations and planning, noting it is part of a biennial review of its command plan based on assessments of “all boundaries and relationships against the operational environment.”

The U.S. Air Force and Israeli Air Force regularly train together, including in the October 2020 exercise Enduring Lightning III—the third time the two nations have trained together with F-35s. Changing the piece of the military that collaborates with Israel won praise from some defense watchers.

“I think moving Israel to CENTCOM makes sense from a U.S. policy perspective in that many Israeli issues are tied to the other countries in CENTCOM’s [area of responsibility],” retired Army Maj. Gen. Mike Jones, who served as CENTCOM chief of staff in 2011, told Military Times. It’s similar to DOD’s decision to add India to the combatant command overseeing Pacific operations, for example, he said.

In a statement, the Jewish Institute for the National Security of America (JINSA) said moving Israel to CENTCOM sends

a “strong deterrent message of unity and continued U.S. commitment to regional leadership.”

“More concretely, it could smooth the way for the Pentagon to utilize Israel for more regional operations, most directly by updating the prepositioned U.S. stockpile there,” JINSA said. ★

## Biden Drops Transgender Ban, Reversing his Predecessor

By Brian W. Everstine

President Joe Biden on Jan. 25 reversed the ban on transgender individuals serving in the military, opening the door to thousands barred from service and correcting the service record of anyone affected by the ban.

The executive order, announced before Secretary of Defense Lloyd J. Austin III’s swearing-in ceremony at the White House, reverses a 2018 order from former President Donald J. Trump that cited “tremendous medical costs and disruption” from transgender individuals serving in uniform. The order reverts to the Pentagon’s prior position of allowing transgender people into the military, so the DOD can recruit and retain “those who can best accomplish the mission.”

“President Biden believes that gender identity should not be a bar to military service, and America’s strength is found in its diversity,” the White House said in a statement. “This question of how to enable all qualified Americans to serve in the military is easily answered by recognizing our core values. America is stronger, at home and around the world, when it is inclusive. The military is no exception. Allowing all qualified Americans to serve their country in uniform is better for the military and better for the country, because an inclusive force is a more effective force.”

In a statement following the executive order, Austin said the Pentagon will immediately take steps to ensure individuals who identify as transgender are able to enlist and serve in their self-identified gender.

“These changes will ensure no one will be separated or discharged, or denied reenlistment, solely on the basis of gender identity,” Austin said.

Additionally, all medically necessary transition-related care will be available to service members.

“We would be rendering ourselves less fit to the task if we excluded from our ranks people who meet our standards and who have the skills and the devotion to serve in uniform,” he said. “This is the right thing to do. It is also the smart thing to do.” ★



Tech. Sgt. Evelyn Chavez

**The 2018 policy focused on those with a medical diagnosis of gender dysphoria and the associated comorbidities such as depression, adjustment disorder, and suicide.**



Senior Airman Celeste Zuniga

Twenty-seven **Airmen** from Little Rock Air Force Base, Ark.'s 189th Security Forces Squadron were recently recognized with Army achievement and commendation medals for their support of the Arkansas State Police response to civil unrest in downtown Little Rock from May 31 to June 8, 2020. In addition to providing support to local law enforcement, several Airmen were responsible for training hundreds of Soldiers from another task force to effectively integrate with the Arkansas State Police and their request for assistance. "It's a rare achievement to receive sister-service medal recognition," said Squadron Team Supervisor Master Sgt. Matthew Pfleger. "Our defenders [proved] to be the consummate professionals, as expected, the whole time. Their capabilities are limitless, and they're always on alert and postured for anything."



Staff Sgt. Amber Mullen/ANG

For 178th ISR Group Analyst **Tech Sgt. Zachary Evans**, two times was the charm on his journey to the U.S. Army Ranger School. The Ohio Guardsman is among a select handful of ANG troops chosen to attend the prestigious institution in 2021. "The biggest challenge has been answering the hard question of 'Why am I doing this?' while I do the train up," he said. The answer? "I want to leave a lasting legacy for my family."



April McDonald/USAF

**Airmen** from comptroller squadrons throughout USAF—including Oklahoma's Tinker Air Force Base 72nd Comptroller Squadron and the 552nd Air Control Wing Comptroller Office—recently took part in a 5K run to honor the life of late **Col. James "Rob" Culpepper** on Jan. 27. Culpepper, a former Air Combat Command comptroller and director of financial management, died of leukemia last December, and would've turned 49 on the date of the run. "There aren't many of us in our career field of Financial Management and when we lose one, it matters," 72nd CPTS Commander Maj. Benjamin Wright told the runners. "Every one of you matters."



USAF



Master Sgt. Jefferson Thompson/ANG

Two CAP pilots—Michigan Wing **Lt. Col. Robert Bowden** and Illinois Wing **Maj. Rod Rakic**—flew a mission in support of Operation Warp Speed, delivering COVID-19 vaccines to Native American tribes in three locations in Michigan. They also transported pharmacists from the U.S. Public Health Service to ensure the vaccines stayed sufficiently cold. "CAP saved the day," said Daniel Frye, Bemidji Area director for the U.S. Department of Health and Human Services' Indian Health Service. "We had a large geographic territory to cover with several stops for delivery, and there was an urgent time sensitivity balanced with a need to keep the vaccine between 2-8 degrees Celsius." CAP wings from over seven states have helped transport COVID-19 vaccines, and the organization moved over 7,000 vials in the first three weeks of the shots having Food and Drug Administration approval.

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

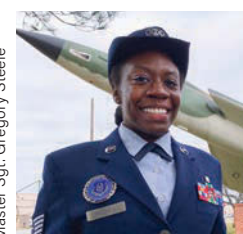


Air Combat Command

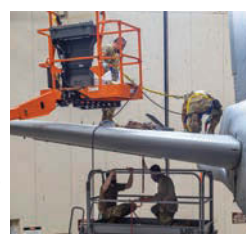
**Col. Barry Crane** and **Chief Master Sgt. Frank Kuba** co-founded a mentorship program for Reservists at Barksdale Air Force Base's 307th Bomb Wing. The program advises enlisted Reservists about key information for different career stages. They first pitched the idea last August, and it launched Jan. 10. "There's always Airmen who don't have the tools or maybe don't know the next steps to take," said Kuba. "We want to touch base with every level, from senior and junior enlisted to Airman."



Master Sgt. Gregory Steele



Air Force Reserve Recruiter **Tech. Sgt. Autayvia Mitchell**'s virtual performance of the National Anthem opened the 27th annual U.S. Air Force Hispanic Games on Jan. 9. The event included over 5,000 high school track and field competitors and over 600 coaches, and the event was broadcast live via social media. "Knowing these young men and women are able to see the Air Force represented in a positive light makes me feel like I'm contributing my part to the United States of America," said Mitchell.



Peter Borys/USAF

Four **Reserve maintainers** from the 512th Airlift Wing at Dover Air Force Base, Del., recently volunteered to help the 914th Air Refueling Wing at Niagara Falls Air Reserve Station, N.Y., perform sheet metal fixes on their KC-135R Stratotanker aircraft. "When you need something, your family will answer," said 914th Maintenance Squadron Noncommissioned Officer in Charge Master Sgt. Michael George. The Dover Airmen have partnered with Reserve maintainers from Tinker Air Force Base, Okla., on the repair effort.



SERE instructors conduct operations around the world to prepare aircrews for survival in diverse climates and situations. Here, Capt. James Gregory, a 510th Fighter Squadron pilot, uses his radio during a Survival, Evasion, Resistance, and Escape (SERE) training event at Rivolto Air Base, Italy, June 10, 2020.



Airman Thomas Keisler IV

# Cracking the Code

**USAF looks to push more Survival, Evasion, Resistance instructors through the pipeline as focus shifts to great power competition.**

By Amy McCullough

**A**irman 1st Class Alexander Smith had always loved the outdoors. Before he enlisted, he ran his own landscaping company, but while he really enjoyed working with his hands, something was missing. He wanted to help people. When Smith considered his options, he realized he could do both as a Survival, Evasion, Resistance, and Escape specialist.

Smith invested nearly eight months preparing for what he knew was going to be an “extremely physically demanding” course, and training went well—until he got to coastal training, not quite halfway through the six-month program. Hunkered down on the beach and shielded from the rain under a one-man life raft, he watched as the wind whipped across the sand, burying his equipment. Though he would eventually find it, he worried he would have to tell the cadre he’d lost it all. The fear, he recalled, “got into my head.”

For Airmen 1st Class Alexis Hataway, on the other hand, it was the rigorous physical requirements, not the mental challenge, that proved hardest to over-



Airman 1st Class  
Alexis Hataway



Airman 1st Class  
Alexander Smith

come. She especially struggled during navigation training, when SERE candidates are required to lug a 70-pound rucksack 50 to 60 miles over the mountainous terrain for five days.

Like Smith, Hataway also spent about seven months prepping for the course. Initially unable to do a single pull up and barely able to do even 10 pushups, she met up with her recruiter about five days a week to work out before shipping off to Basic Military Training (BMT). “He pushed me to be a better person and allowed me to kind of grow in that, so that helped me a lot,” she said.

When it came to the SERE training Apprentice Course, the longest of the three-part journey to become a SERE trainer—and where washout rates historically hover around 50 percent—Smith and Hataway graduated at the top of what turned out to be an exceptional class: Only two of 28 students failed to graduate on Jan. 7, said Col. Nicholas Dipoma, 336th Training Group (TRG) commander.

Of the two who didn’t make it, one remains in the pipeline, having dropped because of an injury, Dipoma said.



The Air Force is the only U.S. military service that specifically trains personnel to teach aircrew or others how to survive in enemy territory. The 336th Training Group, based at Fairchild Air Force Base, Wash., trains the SERE specialists to be the instructors who train more than 6,000 students annually, most of them aircrew members, to survive if they are ever shot down or captured. SERE trainers prepare them to survive in any environment, whether urban, desert, mountains, or the freezing, barren Arctic.

But, there aren't enough trainers to go around. At a time when potential peer conflict with Russia and China make such skills increasingly important, one in five SERE jobs is vacant. And while the field remains "healthy enough to function," Dipoma said, it can no longer sustain 50 percent attrition in the training pipeline.

"Over the next four years, if we don't turn attrition and the pipeline around—while also maintaining the same high standards—the career field would be in a bad place," he added. "Before this class, that trend line was going in the wrong direction."

## REVERSING COURSE

The Air Force has been tracking performance data for years to pinpoint the characteristics that indicate success. They studied everything from pre-accession performance to training improvements prior to shipping off to BMT. In addition, the 330th recruiting squadron—the only squadron solely focused on recruiting Battlefield Airmen and related combat support career fields, such as SERE instructors—is also studying the issue. They're watching medical attrition to better understand injuries and track every failure and success throughout the pipeline.

"That information is used to focus our efforts on recruiting the right applicants later on, and to develop [candidates] into their top potential," said Maj. Mike George, director of operations for the 330th Recruiting Squadron.

In fiscal 2017, USAF sent 990 Special Warfare and combat support candidates to Basic Military Training, but only 145 actually completed their full pipeline. After the 330th stood

up in fiscal 2018, the number of candidates sent to BMT declined to 705, while the number who successfully completed their pipelines rose to 373—a 257 percent increase, said Staff Sgt. Richard Walkowiak, a special warfare recruiter, named Recruiting Command's 2020 USAF Rookie of the year. George said Walkowiak "has had the most success recruiting SERE specialists in the history of Special Warfare."

Walkowiak credits that success to understanding the unique nature of the career field and to making sure the right people are signing up for the job. Before he started recruiting Special Warfare candidates, he worked closely with SERE specialists at Fairchild as a member of the 336th Training Support Squadron.

"When somebody tells me I need to find a SERE instructor, I'm not necessarily thinking that they have to be into the outdoors," Walkowiak said. "By all means, that's a great place to start looking, and I have heavily focused on ... ice fishing tournaments, snowmobile races, outdoor expos, just to kind of name a few. ... But, I would say the key to all of this is you have to be able to confidently speak on what the career field is and about all of what they do."

Before the 330th stood up, too many people were signing up to be SERE specialists without really understanding what that meant. They wanted to, "just kick down doors and go down range," and they didn't know that SERE is an instructor role, Walkowiak said.

It also took time to get an accurate sense of what it takes to complete the course.

Senior Master Sgt. John Conant, the SERE Apprentice Course commandant, said it's now clear that critical thinking and adaptability are keys to successfully completing the course, and that mentoring makes a difference.

"We have adopted a coaching and mentoring approach, instead of gatekeeping," said Chief Master Sgt. Alexander Guerrero, 336th TRG command chief. That worked "20 or 30 years ago," he added, but "personalities have changed. Generations have changed. How you get across to individuals has changed."

While one person may find the physical training too grueling to continue, another may find it difficult to prioritize the many



Staff Sgt. Dillon Harrison graduated with 93 percent of his classmates in the SERE Specialist Apprentice Course, the best graduation rate in years. In the past, as many as half the candidates dropped the course before it ended.

Senior Airman Ryan Gomez





Senior Airman Jesenia Landaverde

Tech Sgt. Jarad Underwood, left, is the only member of the armed forces eligible to teach close combat fighting to members of any military branch. He demonstrated a shield block to Staff Sgt. Corray Valnetine during aircrew SERE training Jan. 31, 2019.

tasks asked of students. Coaching can help candidates work their way through challenges.

"Almost every cadre member ... has talked someone out of quitting training," Dipoma noted.

Conant said it's important for the cadre "to treat our students as if we would want to be treated," while simultaneously showing them "through our actions, that the journey is not impossible." When students work out at the gym, so does the cadre. When they are getting pelted with sand on a barren beach in the middle of the night, so, too, is the cadre. When they are carrying a heavy ruck as they hike up a mountainside, so is the cadre. And, when they make a shelter out of snow in the freezing Arctic, so does the cadre.

"I'm an instructor, but I can be a mentor also," Conant said. "I can evaluate, but I can also be involved. For a student to look over and see their cadre member, or their instructor, in that capacity, you know, willing to do everything that we're asking them to do, it goes a long way, culturally speaking."

## PREPARING FOR PEER CONFLICT

Dipoma, a former pilot, said SERE is a "growth enterprise" for both the Air Force and the joint force as the Defense Department shifts its focus from years of counterinsurgency operations toward great power competition. Chief of Staff Gen. Charles Q. Brown Jr. has challenged the force to adjust the way it trains Airmen, warning the nearly uncontested air superiority the United States has enjoyed for decades can no longer be assumed.

"Tomorrow's Airmen are more likely to fight in highly contested environments and must be prepared to fight through combat attrition rates and risks to the nation that

are more akin to the World War II era than the uncontested environments to which we have since become accustomed," wrote Brown in his "Accelerate Change or Lose" white paper, issued shortly after he became the service's top uniformed officer. "The forces and operational concepts we need must be different."

Dipoma said the possibility of conflict with a peer adversary "demands that Airmen be able to survive" in mountainous or woodland environments, but also how to act if captured in urban terrain, whether "in a wartime environment or hostage situations, [or to survive] peaceful detention, perhaps by a less-than-friendly government," he said.

Lt. Col. Ana-Maria Ehrler, commander of the 22nd Training Squadron, which conducts SERE training for aircrews, said that as a pilot flying in Iraq and Afghanistan, she did not have to worry about getting shot down in air-to-air combat, and that if something did happen, rescue forces were "no more than 45 minutes or an hour away." But that may not be true for Airmen going through the training course today.

They may need to be able to survive in open ocean, in jungles, in mountains, or the Arctic, and they may have to do so for "days, weeks, or months," not just hours, she added.

"It's completely changed how we're training the aircrew in order to prepare them for those environments," Ehrler said.

Instructors need to understand what SERE students are going through, so they can impart those lessons to their future students. One day, those skills might help keep a downed pilot alive.

"They're not just survival instructors," Walkowiak said. "There's a lot more to it than that. They save lives with the things that they know and teach."



# THE RAIDER COMES OUT OF THE BLACK



**The B-21 is progressing to roll out and first flight, as the Air Force wrestles with how many to buy.**

By John A. Tirpak

**T**he first B-21 stealth bomber will roll out of its California factory in early 2022 and make its first flight a few months later. The second, nonflying test model is also in assembly. Contracts should be coming soon for constructing hangars and maintenance facilities at operating bases. Despite the COVID-19 pandemic, the project appears to be on track. But how many Raiders will be built—and at what pace—remains an open question.

The first Raider is “really starting to look like a bomber,” said Randall G. Walden, director of the Air Force’s Rapid Capabilities Office (RCO), which manages the highly secre-

tive program, in an exclusive interview with Air Force Magazine.

The B-21 will come out in the open for engine runs, taxi tests, and other necessary ground checks at Northrop Grumman’s Palmdale, Calif., plant in early 2022. The first flight should follow several months later, Walden said. That first flight will be a short, 36-mile hop from Palmdale to Edwards Air Force Base, Calif. Once there, the 420th Flight Test Squadron will put the bomber to extensive aerial tests.

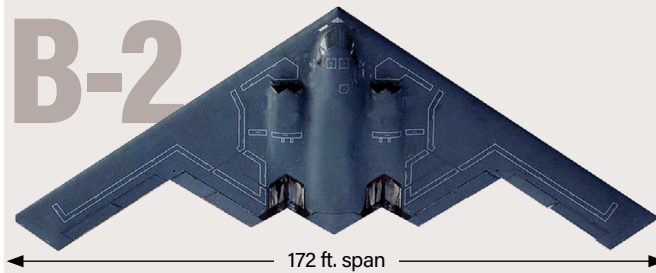
Earlier forecasts of a December 2021 first flight were a best-case scenario, Walden said. The development team now thinks mid-2022 is “a good bet.”

Photo illustration by Mike Tuskamoto/staff, using an image by Airman 1st Class Parker McCauley

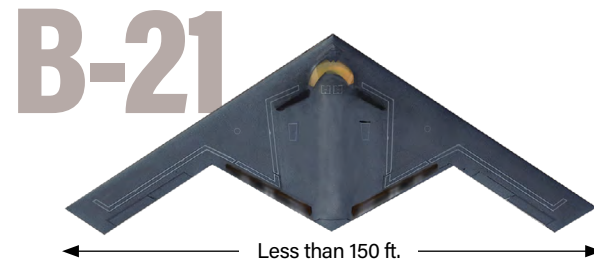


## Comparing Stealth Bombers

The new B-21 Raider bears a family resemblance to the B-2 Spirit, but the two bombers will differ substantially in size, and likely their number of engines and payload. Critically, the B-21 will also be far more advanced in terms of low-observable technology—at least two generations beyond its elder stablemate. Northrop Grumman is the prime contractor for both bombers.



**Payload 60,000 lbs**



**Payload >30,000 lbs**

Graphics: Dash Parham/staff; Illustration: Mike Tsukamoto/staff

The second airplane is “really more about ... the overall structural capability,” according to Walden. “We’ll go in and bend it, we’ll test it to its limits, [and] make sure that the design and the manufacturing and the production line makes sense.”

Lessons learned in building the first airplane—which Walden noted is not yet in final assembly—are paying off on No. 2, he said. Assembly is “going much faster” than on the first one, and the program is seeing “very high percentages of efficiency, as compared to No. 1.”

The progress on Nos. 1 and 2 is making room for more aircraft on the line, Walden mentioned, although the actual production capacity is a secret. There will be more than two test aircraft, but he declined to say how many. The B-21 contract calls for 21 initial aircraft in five lots.

“We want to make sure we’re efficiently using test ranges, and one way to do that is to have multiple test aircraft available,” Walden noted. In 2015, Air Force officials said the first aircraft will be “usable assets,” suggesting some test airplanes will be later reconfigured into operational machines.

Time of the first flight will be “data driven,” Walden insisted, meaning it will take place only when the aircraft is ready, rather than according to the calendar.

Bomber pilots and maintainers are embedded with the development team to provide insights and feedback on every aspect of the design, said Walden. “Building a future stealth bomber is a complicated endeavor, and we’re going to do everything in our power to make sure we do that right.”

### LONG HAUL

The B-21 will be able to carry both conventional and nuclear payloads. “We are building the airplane to have

the access, range, and payload that is needed for the future high-end fight ... as characterized by a highly contested environment,” he said. The goal is to “hold any target at risk,” no matter how well defended. The aircraft must be “effective for a very long time as the threat evolves,” he said, and its open architecture will allow frequent and seamless, “almost ... plug-and-play” updates to the B-21’s capabilities.

Structured from the outset to drive down risk, rather than “inventing on schedule,” Walden described exhaustive testing both on the ground and in an airborne avionics laboratory, hosted aboard a business jet-class airplane. The flying lab will shake out sensors and other electronics to ensure they work individually and cooperatively before being installed in an actual B-21. The concept is similar to the concept of the Cooperative Avionics Test Bed—nicknamed “CATbird”—used by Lockheed Martin in developing avionics, apertures, and sensors for the F-35.

“Not having to have the actual test aircraft up there, but a flight test variant with the same systems, does help on the integration aspects on the article itself,” Walden reported. “In the last few months we did another successful end-to-end demonstration ... to further mature that hardware and software, and it’s working quite well.”

When it’s time to “power-on and operate these systems on the actual B-21 test article,” Walden said, the team will have “a lot of confidence and a lot of experience” with them.

Although the Raider is still in development, “we view the B-21 as really a production program, not so much just a test program,” Walden explained. To the extent possible, the test aircraft are being built on production tooling, using robots, particularly for composite structures, but also with “touch labor.”

To reduce development risk, the B-21 was conceived to be more about integration than invention, Walden explained. “We have not lost sight of the fact that we have to integrate software and hardware. ... We are doing that today.”

The Air Force is “not getting something experimental” in the B-21, former service acquisition chief Will Roper said in a January exit interview with Aviation Week and Space Technology.

The B-21 “is being designed for production innovation, for maintainability and sustainability ... and those are the things I’ve tracked the most,” Roper said. The first flight is “in no way, shape or form ... just to prove out the flight sciences. ... All of that has been worked concurrently.”

The bomber should transition to production at scale “very quickly,” Roper said.

“Stringent nuclear requirements” mean the program won’t move as fast as it might, though. “We are going to try to speed up the nuclear certification process,” Roper told Aviation Week. “Until it’s demonstrated and approved, we simply can’t put the nation’s nuclear deterrent at risk in an experimental prototyping effort.”

### MAJOR REDESIGN

There are likely to be development surprises on the B-21, “just like any other” aircraft development program, Walden said. Additional test infrastructure was added early on to ensure the program doesn’t bog down when they occur, he said. Rep. Rob Wittman (R-Va.), a member of the House Armed Services Committee, revealed in 2018 that the B-21 was having problems with airflow and thrust, related to the bomber’s inlet geometry, serpentine air ducts, and exhausts. Walden acknowledged those challenges, and said they’d required a “major redesign.”

“This is a good example of some of those surprises,” Walden said, adding that it’s typical for a complex new aircraft program to have “installed engine inlet/exhaust integration issues that have to be resolved.”

Walden said the issue—the details of which he would not disclose—is now well understood. Changes have been made, and “it looks like we have solved it, and we are moving forward with that final design.”

There were no hiccups in the program attributable to the takeover of engine maker Pratt & Whitney from United Technologies Corp. to Raytheon Technologies, Walden asserted. The change was “transparent,” he said, adding that Northrop is doing a good job managing its subcontractors, and “in this particular case ... the engine manufacturers.”

### ‘SAND IN OUR GEARS’

The COVID-19 pandemic “threw sand in our gears,” Walden said. Challenges continue, and “we’re still not out of it.”

The RCO and Northrop worked with suppliers to ensure that the flow of parts to Palmdale wasn’t badly disrupted. Essential travel was re-sequenced to “work around state and local restrictions” and quarantine requirements, Walden said. The changes seem to be “working quite well,” he added. The program is also making increased use of secure video teleconferencing where possible. “I think we’ve got a new norm, like everybody else out there,” he observed.

At least one opportunity presented itself due to the pandemic. Boeing had to slash orders from Spirit AeroSystems for 737 work due to the slowdown in air travel and ongoing 737 MAX grounding. Spirit and Northrop proposed shifting many of those aerostructures’ workers to the B-21, and the RCO agreed.

“We knew that having additional folks that would [otherwise] be laid off, would help us,” Walden said. A combination of additional “tooling, funding, and the manufacturing really did make the B-21 line more efficient.” Other pandemic-inspired efficiency efforts have been undertaken, but none as “dramatic” as the Spirit move, which Walden said proved “a huge benefit.”

Generally, “we’ve compensated” for COVID delays, Walden said, and they should pose no significant risk to first flight.

### THE RCO WAY

The RCO specializes in quick-turnaround, super-secret projects. Walden said he’s not collected any metrics about how much time has been saved managing a major project like the B-21 “the RCO way,” and he admits some have pressured the program to “go faster and build.”

But, “You’ve got to get the systems engineering right,” he said. Development will take “as much time ... as it takes.”

As head of the RCO, Walden has direct access to the Chief of Staff, the only person authorized to make changes to the program, and that minimizes the decision time when choices must be made. “We are more streamlined and less bureaucratic,” he said. “Time delays with staffing documents is minimized.”

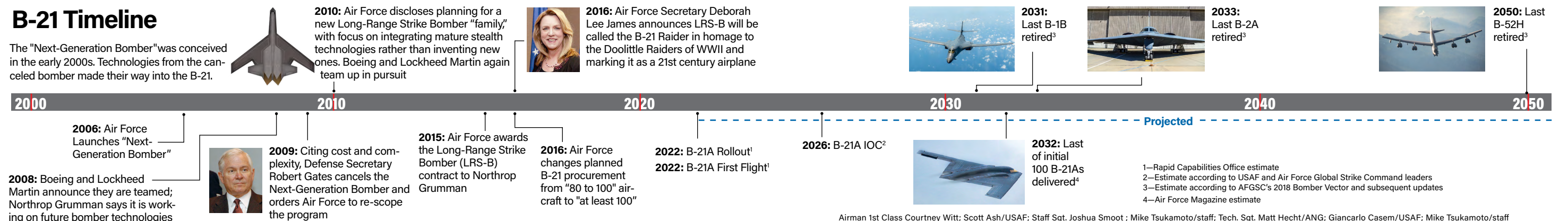
Circulating reports among layers of staff at the USAF and the Office of the Secretary of Defense levels might normally take “months on end,” but the RCO can do it in weeks. “If I can cut that time in half, that’s huge. If I can cut it by a tenth, that’s [still] huge.”

The B-21 employs digital tools, but not to the extent envisioned by the Air Force in its push for “digital engineering,” which employs digital models to work out design and engineering challenges before hardware is physically built.

The project has applied computer-aided design and maintainers try out procedures in a virtual setting, Walden said. But “we’re absolutely looking” at how digital twinning

## B-21 Timeline

The “Next-Generation Bomber” was conceived in the early 2000s. Technologies from the canceled bomber made their way into the B-21.



Airman 1st Class Courtney Witt; Scott Ash/USAF; Staff Sgt. Joshua Smoot ; Mike Tsukamoto/staff; Tech. Sgt. Matt Hecht/ANG; Giancarlo Casem/USAF; Mike Tsukamoto/staff



and other advanced design techniques could be brought to bear on the program. These techniques could be inserted “on a continuum,” he said, “If it is going to save time, and dollars.”

Likewise, Walden said, artificial intelligence (AI) is not included among B-21 baseline features, but could be incorporated over time. The B-21 was intended to be an “optionally manned” system, the Air Force said in 2015. “We are looking for opportunities” to insert AI, noting that it’s important to understand just what that means. The terms AI and machine learning tend to be used “very loosely,” he said.

“We are not solely focused on just trying to put AI [in], where ‘if you don’t have AI, you’re nothing,’” Walden explained. When “the algorithms are written, we may be able to put it on there, and [it will] be least costly ... and not impact any schedule.”

## HOW MANY RAIDERS?

The Air Force says its future force structure requires at least 220 bombers. The service plans to retire the B-1B and B-2 bombers, necking down to just the B-21 and the B-52. There are only 76 B-52s.

But Walden maintains that the goal is to produce “at least 100” bombers, and “right now, no one’s told us to make that change.”

Can the program build more than 100? “Absolutely,” he said, but there is a “maximum” that can be turned out by one production line. If more are desired, Walden needs “some lead time” to add tooling and workers. “You’ve got to factor that in early enough” to anticipate when the planes must be delivered.

He added that while there’s been “a lot of conversation of buying more,” there’s “also been conversations about buying less.”

The future 220-bomber force could include other aircraft. Gen. Timothy M. Ray, head of Air Force Global Strike Command, told Air Force Magazine last year that his command may buy some “attributable aircraft” for long-range strike.

The B-21 production strategy, as it stands, “meets the need” stated by Air Force Global Strike Command (AFGSC), Walden said.

Pentagon and congressional leaders need to understand the limits of B-21 production capacity “so when asked if we [can] do more, we have an answer for the leadership.”

## BEDDOWN MOVES

A “beddown industry day” for the B-21 at Ellsworth Air Force Base, S.D., in January showed “we are on [the] path” to

delivering jets, Walden said. The event launched the process of building the facilities needed to receive and operate the aircraft.

The Air Force announced in 2018 that today’s bomber bases—Ellsworth, Dyess Air Force Base, Texas, and Whiteman Air Force Base, Mo.—will become B-21 bases when they transition from the B-1 and B-2, respectively. AFGSC’s “Bomber Vector” said the B-1 and B-2 would retire in the 2031-2036 time frame. More recent comments suggest it will be sooner.

Walden said the combination of hangar and weapons facilities on the base would cost “roughly a billion dollars ... over the next handful of years,” with “\$300 million through FY22 alone.” Walden noted that Congress included \$10 million to fund a low-observables maintenance hangar at Ellsworth in the fiscal 21 budget; an item that was on USAF’s “unfunded priorities” list.

More industry days hosted by the Air Force and the Army Corps of Engineers are coming, he said.

Walden reiterated the Air Force’s standard line that the B-21 will be available for duty in “the mid-2020s.” However, Lt. Gen. James C. Dawkins, deputy chief of staff for strategic deterrence and nuclear integration, said on Jan. 14 that the B-21 will start coming online in 2027 or 2028.

During a Heritage Foundation event to discuss the Long-Range Standoff weapon, which will equip the B-52 and B-21, Dawkins said the bomber leg of the nuclear triad would be comprised “of B-52s and B-2s, and in another six or seven years, the B-21.”

The program has “stuck to” saying the first B-21 will be delivered in the mid-2020s, Walden noted. We don’t see any delay ... or acceleration” to that.

## THE 80 PERCENT SOLUTION

Walden has said he’s a fan of the “80 percent solution;” wherein a new system meets the majority of operator requirements without expending enormous effort and money to obtain extra performance that may only be marginally useful.

The goal of the B-21 is not to “get the perfect aircraft,” he said. The bomber has been designed to be improved as the threat changes. To try to “get it all done up front” means “you ... never achieve a production-ready platform,” he asserted.

That said, “I believe we’re doing much better than ‘the 80 percent solution.’” He added that, “80 percent on a new platform is infinitely better than legacy platforms that can’t do the job.” The B-21 now being built is “100 percent of what we want it to be.” ★

An artist’s rendering depicts the B-21 at Ellsworth Air Force Base, S.D., one of the bases expected to host the Raider once it reaches the force.



Courtesy graphic/Northrop Grumman





Days after he was sworn in as chief, Air Force Chief of Staff Gen. Charles Q. Brown, Jr., sat in a LIFT Hexa electric aircraft in August. The Air Force is investing in such aircraft in the hopes of helping to spawn a new industry.

Sgt. Sean Kornegay/ANG

# Prime Investments

The Air Force is investing in electronic aircraft, hoping to jumpstart a nascent market.

By Rachel S. Cohen

**J**etsons, meet the Air Force. The flying car is no longer just the stuff of science fiction. Using innovative materials, energy and propulsion systems, and original design concepts, dozens of firms are hoping to get in on the next big thing in aviation.

So is the Air Force. But rather than seeking to create its own breakthrough technology, the service is seeking instead to help jump-start a commercial revolution that will yield new technologies it can adapt for military use. The Air Force calls the effort “Agility Prime.”

Throughout history, military technology has inspired commercial advances, from firearms that also proved helpful to hunters, to military airplanes that spawned the commercial aviation business. At other times, commercial advances have spawned military innovations; in World War I, for example, the military employed commercial automobiles as ambulances for the first time.

**“Electric aviation is the inevitable future of aviation.”**

—Kyle Clark, chief executive officer of Beta Technologies

Agility Prime aims for a middle ground, in which DOD and the commercial sector collaborate to help new ideas mature for mutual benefit: A future electric flight industry that has potential for both military and commercial uses. But while some hail the concept as a new frontier in defense investment, others caution that playing the role of venture capitalist is a risky business.

The initiative began in early 2020 to explore electric-powered aircraft that could take off and land vertically and fly autonomously when needed. Today, multiple prototypes are in the works. The Air Force aims to see if the concept will “revolutionize mobility” through simple, affordable, and flexible design.

“Electric aviation is the inevitable future of aviation,” Kyle Clark, chief executive officer of Beta Technologies, one of the startups pursuing this next-generation transportation technology. “We’re on the cusp of something super interesting, not just for aviation, but for the whole world.”

Hoping to ditch the “flying car” moniker, the Air Force calls the aircraft “ORBs”—a catch-all term it



Elroy Air Chaparral's first flight on August 14, 2019, at McMillan Airfield, Camp Roberts, Calif. The Chaparral will carry payloads up to 300 pounds for 300 miles, according to Elroy Air.



Image from Elroy Air video

says can mean “organic resupply bus,” “operational readiness bus,” or “open requirements bus.”

“ORBs could enable distributed logistics, sustainment, and maneuver, with particular utility in medical evacuation, firefighting, civil and military disaster relief, installation and border security, search and rescue, and humanitarian operations,” the service said last year.

In short, the Air Force argues ORBs could be useful for any mission where roads and runways are blocked or nonexistent, or where an Airman or light loads must be quickly moved from point to point. Those in the emerging industry tout how easy ORBs are to fly, how little training is required, and how they could enable flight even for Airmen without pilot’s wings.

They’re also not far-fetched. USAF leaders believe ORBs could be part of the inventory as soon as 2023.

Air Force Chief of Staff Gen. Charles Q. Brown Jr. and Chief Master Sergeant of the Air Force JoAnne S. Bass visited Texas-based LIFT Aircraft on their first trip together last summer, joining then-Air Force Secretary Barbara M. Barrett for an ORB flight demonstration in August 2020. They were guided by then-Air Force acquisition boss Will Roper, an avid technologist and innovation advocate who fostered the growth of AFVentures, a seed-funding investment arm, and AFWERX, an innovation organization that runs Agility Prime.

Barrett explained the strategy nearly a year ago: “The thought of an electric vertical takeoff and landing (eVTOL) vehicle ... might seem straight out of a Hollywood movie, but by partnering today with stakeholders across industries and agencies, we can set up the United States for this aerospace phenomenon.”

Last year, the Air Force identified six companies with promising designs: Phenix Solutions, Joby Aviation, Elroy Air, Moog, Beta Technologies, and LIFT Aircraft. Twenty-seven companies have submitted ideas for aircraft so far. In total, more than 250 proposals for eVTOL-related technology have secured \$38.5 million in small-business research and development (R&D) funding as part of Agility Prime.

Several systems are at, or approaching, the viable product stage:

- Phenix Solutions’ 7-foot-tall, two-bladed Mono 550 helicopter can fly for 90 minutes at up to 92 mph, and can fly a maximum range of nearly 140 miles.

- Elroy Air’s Chaparral, on the other hand, will “autono-

mously carry payloads up to 300 lbs, up to 300 miles,” the company said.

- Moog’s two-seat SureFly can travel up to 70 mph for 60 minutes, according to TransportUP, a digital publication.

- LIFT’s single-seat HEXA aircraft can carry a “useful” load weighing around 300 lbs, enough to carry a passenger plus light weaponry or medical equipment. The aim is to fly up to 90 mph, said Chief Executive Officer Matt Chasen.

- Joby in December earned a military airworthiness certification from the Air Force—the first to do so—for its S4 aircraft design, which can carry up to four passengers and a pilot. It aims to exceed 200 mph and fly at least 150 miles on a single charge, according to the publication evtol.com. The S4 is on track to fly under an Air Force contract in early 2021, the service said in December.

“Our partnership with AFWERX and the Air Force has been transformative,” Joby’s Chief Executive Officer JoeBen Bevirt said in a release. Agility Prime “has given us access to facilities, resources, and equipment that accelerated testing and allowed us to prove out the reliability and performance of our aircraft.”

Beta is also on track to reach the same certification milestone with its Alia, designed to fly up to six people as far as about 280 miles. The company aims to start flying from Springfield, Ohio, to the former Plattsburgh Air Force Base



Moog Inc.

The Moog SureFly is a two-seat hybrid eVTOL aircraft with four propeller arms, each with two electric contra-rotating propellers powered by a gas turbine or piston engine.



in New York—more than a 700-mile drive by car—by the end of March. The journey will be aided by a chain of charging stations along the route.

Two other companies are nearing airworthiness approval, but the Air Force declined to identify them.

Agility Prime's "air race to certification" is a three-phase path to military certification and potential procurement and will run through mid-December 2021. The Air Force hopes it will provide a long-term model for streamlining flight approvals from both civilian and military agencies.

The air race is intended to bolster the vertical flight market for three types of ORBs:

- 3-8 passengers, traveling at least 100 miles at speeds greater than 100 mph

- 1-2 passengers

- Unmanned, but rated for a maximum 1,320 lbs gross takeoff weight.

Participants are still studying potential military-use cases and acknowledge there may be missions they haven't identified yet. Troops throughout the Defense Department are working with the program to suggest how the aircraft could help each of the armed forces.

AFWERX, which runs Agility Prime, is working with the Air Force Warfighting Integration Capability group to investigate at least 20 potential-use cases, across five Air Force major commands, the Marine Corps, and the Coast Guard, according to AFWERX Director Col. Nathan P. Diller. Air Education and Training Command is crafting an operations and maintenance syllabus to debut alongside the airframes in 2023.



Tech. Sgt. David Carbajal

**Master Sgt. Bryan Rodvold, 821st Contingency Response Squadron**

"As we get more data on ORB capabilities, we will be able to further refine potential mission sets where these vehicles can add capability to our forces," Diller said. "We fully expect, though, that as ORBs become more commonplace, we'll see new and unexpected applications of the unique capabilities, much like we're starting to see now with [small drones] performing tasks like aircraft inspection."

Master Sgt. Bryan Rodvold, a command and control expert from the 821st Contingency Response Squadron at Travis Air Force Base, Calif., is part

of an Air Mobility Command (AMC) tiger team working on Agility Prime that also includes aerial porters, maintainers, and loadmasters. The squadron handles humanitarian aid missions across the world and can get as few as 12 hours' notice to prepare for a deployment.

The team believes rapid-response forces could use the new aircraft to examine airfield size and safety, and delivery missions, known as "aerial port of debarkation," or APOD, work. ORBs could also help in "logistics under attack" scenarios, where the military cannot rely on cargo convoys or brick-and-mortar installations. Unmanned aircraft could handle deliveries where it is unsafe for trucks, Rodvold said.

"We could use this technology to supplement what we're calling 'last-mile logistics,' getting the cargo to a more forward ... location and deliver aid to whoever would need it," Rodvold said of ORBs. In a crisis, "you don't know what the terrain looks like. ... There could be flooding, downed power lines."

Air Combat Command could use ORBs to create a much larger combat search-and-rescue force, though any mission in austere areas would be limited by the availability of charging



Eric Adams/Beta Technologies via Facebook

Beta Technologies' eVTOL aircraft, Alia, seen here flying last year at Plattsburgh International Airport, N.Y., is on track to receive military airworthiness certification from USAF.

stations. Air Force Global Strike Command is considering their utility for patrolling nuclear missile fields and other strategic assets.

Rodvold noted the aircraft need more time to mature—today, they can't yet carry loads heavier than a life-saving medical aid package. Yet, "these drones are going to prove—we hope—that they are more efficient forms of transport in the uncertain environments that we're constantly going to," added Lt. Col. Lindsey Bauer, chief innovation officer for the 621st Contingency Response Wing at Joint Base McGuire-Dix-Lakehurst, N.J.

The wing plans to start using ORBs for small airfield assessment teams or for limited transportation in exercises by the end of the year. Those training sessions will demonstrate what Airmen need to know to operate and maintain the aircraft, and could indicate whether AMC should start adding drone pilots to its ranks.

"What we're looking forward to seeing is one of the drones or ORBs come down, pick up our cargo, and take it to the forward node," Rodvold said. "Hopefully that whole process is automated."

## BATTERY TECH

Achieving range, speed, and payload requirements ultimately hinges on battery technology, which continues to mature and has gained substantial investment as electric cars grow market acceptance. In the meantime, the question of whether electric aircraft are a reasonable investment—or just a shiny project named for Transformers—gives some aviation experts pause.

Richard Aboulafia, aviation analyst with the Teal Group, says it will take "many decades, if ever," for electric aircraft to achieve the range and power military applications require.

"Electric propulsion isn't a capability in and of itself, it's a means to an end," Aboulafia said. "What is the incremental change that suddenly makes it compelling? ... It doesn't really strike me as a breakthrough technology."

He's open to the idea that eVTOL could be an asset to the Air Force, but suggested this type of technology development seems better suited to the Defense Advanced Research Projects Agency than the Air Force, and questioned whether the





program is essentially trying to recreate the helicopter.

Chasen rebuts that idea, however, saying eVTOL aircraft are safer, don't require years of advanced training to fly, and need less maintenance than conventional military choppers.

Aboulafia countered that Agility Prime isn't much different from other military research avenues: the Air Force is putting money toward an idea to see if it pans out. But he cautioned against investing in nascent aircraft, absent a fleshed-out plan for how to use them.

"This gets to the [concept of operations]—is there really communication between the Air Force and the people it's going to be lifting, that, 'Yeah, we need this?'" he said. "Or is this just an Air Force tech budget grab?"

Air Force reps argue that investing in ideas that already have a good chance of getting to market acts as an accelerant, enabling the military to potentially take advantage of the development sooner.

Jonathan Wong, an acquisition researcher at RAND Corp., sees it as an opportunity for the military to get ahead of the curve in building a supply chain for eVTOL technology.

"That's a really challenging thing to manage when it comes to roping in all these big defense primes and their entire supply chains to get on the same page, to get on the same standard, and to work and communicate seamlessly," he said. "It might be easier to do that when you're building a supply chain from the ground up."

It's also a chance to practice modern digital engineering, by modeling future eVTOL upgrades and potential uses for an ORB fleet, he said.

"I wonder if Agility Prime and some of these smaller efforts are ways where you can expose the acquisition workforce to risk" in a lower-pressure program than something like the B-21 bomber, he said.

Agility Prime is all about keeping up with the pace of innovation. This year, the venture plans to start an experimentation campaign, to secure more airworthiness approvals, expand its small business partnerships, and create an ORB training program. NASA is also looking to piggyback on Agility Prime's eVTOL research for lunar surface transportation as part of the Artemis program.

Getting the Federal Aviation Administration to sign off will be another hurdle, Diller acknowledged.

"As with any groundbreaking technologies, building the regulatory oversight necessary for safe and effective operations

is a challenge," he said. "Agility Prime is committed to helping the companies achieve their commercial goals."

Future "Prime" efforts driven by AFWERX will focus on space, autonomy, energy, gaming, digital engineering, supersonics, and microelectronics. As with Agility Prime, the intent is to invest in near-commercial-ready technologies that offer military potential. These include hydrogen fuel-cell power, training software, and satellite refueling.

At least one Prime venture will launch this year, with space seen as ripe for "Prime" treatment because its commercial market is booming, Roper said in December.

"Just as we've seen in Agility Prime, where our Air Force missions and our airworthiness process are unlocking a new [eVTOL] market for the U.S.," Roper said, "our Space Force missions and our spaceworthiness processes have a chance to do the same for space."

Col. Eric Felt, who runs the Air Force Research Laboratory's space vehicles directorate at Kirtland Air Force Base, N.M., cited a Morgan Stanley estimate that the space economy could grow by as much as \$1 trillion by 2040. That offers plenty of chances to get in on the ground floor of valuable new ideas.

"It has to be an area that has strategic importance, both to the commercial sector and to the government sector," Felt said in December. "It has to be an area where the U.S. government can actually do some good" and offer its own science and engineering assistance.

Space Prime will look past the launch enterprise to consider less-established areas like a space internet, mobility, space debris removal, and data processing on satellites. The Space Force is particularly interested in dual-use ideas that can reach the market within 36 months.

Other research areas may require more convincing.

"There might be careful consideration and interesting new technologies, but not with an eye on the end result," Aboulafia said. "A supersonic Air Force One? ... You just don't get the capabilities of Air Force One in a supersonic tube."

Future Prime branches can benefit from the flying car program's approach: get early input from diverse stakeholders and hope that momentum and user involvement is enough to get through procurement's "valley of death."

"It's a win-win proposition, but I think the jury's still out as to whether they will be able to turn this into a real program of record," said Chasen, the LIFT founder. "I'd like to see ... this R&D phase turn into real contracts." ★



Joby Aviation's eVTOL aircraft has six rotors and seats five, including the pilot. It can take off vertically, like a helicopter, and then shift into forward flight using tilt-rotors. Joby says it can reach a top speed of 200 mph, can travel 150 miles on a single charge, and is 100 times quieter than a conventional aircraft.

Trevor Jolin/Joby Aviation





Chinese pilots have spent years watching U.S. operations and studying USAF strategy and tactics. Now, the Air Force wants U.S. Airmen to deepen their understanding of China, Russia, and other potential adversaries.

# Know Thy Enemy

## USAF wants Airmen to develop a deeper understanding of China and other adversaries.

By Amy McCullough

**C**hief of Staff Gen. Charles Q. Brown Jr. has a challenge for the force: Understand your enemy.

It's not enough to count the aircraft in China's air force. Brown wants Airmen to know what "makes them tick—what drives their intent?" That, he has said, is the only way the U.S. can come out on top in a high-end fight with China, where air superiority is not a given, but must be earned.

Brown's admonition to the force to "Accelerate Change, or Lose," issued shortly after he took the helm as the Air Force's top uniformed officer, calls on the service to "develop and build [a] deep institutional understanding of China and Russia, and reward and retain those Airmen who foster the personal attributes necessary for success in the challenging future ahead."

The Chief is harkening back to the Cold War, when the Air Force developed experts in all things Soviet, from learning the language to understanding the strategic military structure to how they made decisions. Brown wants all Airmen, regardless of rank or Air Force Specialty Code, to understand their role in the great power competition with Russia and China.

"The Air Force must improve its understanding of

**"If you know yourself but not the enemy, for every victory gained you will also suffer a defeat."**

—Sun Tzu, The Art of War

competitors' ambitions and ways of war to inform how it organizes, trains, and equips Airmen," he wrote in new action orders released Dec. 4, 2020.

He seeks to lay a foundation as early as the recruitment process and through Basic Military Training (BMT), and to continue to build on that throughout an Airman's career so Airmen of every rank have deep knowledge of peer adversaries. Air Education and Training Command boss Lt. Gen. Marshall B. Webb said the service will touch on great power competition in BMT, but the focus there will remain on orienting new Airmen and Guardians to combat skills, weapons, and physical fitness. Air University will be the first major area to fully take on Brown's challenge, where the academic curriculum will include a "heavy flavor" of great power competition, he said.

"You can expect to see inside the various colleges, exercises, wargames, a focus on strategic and military leadership, decision-making, etc.," Webb said.

### A STRATEGIC SHIFT

Ever since the National Defense Strategy was released in 2018, Air Force schools and those across the joint force have been adjusting their curricula from a focus on counterinsurgency operations and combat with violent non-state actors to an increased focus on



Understanding how Russia employs its S-400 anti-aircraft missile systems is critical to being prepared to confront Russia, if necessary, Air Force leaders say.



Russian Federation Ministry of Defense

peer competitors, Russia and China. But the Chief's directive accelerated the shift, said Mark Conversino, chief academic officer at Air University.

In July, then-Secretary of Defense Mark T. Esper directed that 50 percent of military academic curricula be focused on great power competition, but the Air Force upped the ante with then-Vice Chief of Staff Gen. Stephen W. Wilson promising the Air Force will aim for 60 percent.

In response, Air University stood up a Curriculum Task Force to conduct a "lesson-level review" of the Air War College, Air Command and Staff College, and the School of Advanced Air and Space Studies (SAASS), as well as squadron officer school and the entire enlisted professional military education (PME) program.

The task force focused on measurable lesson outcomes, so if a lesson did not come with study questions and supported readings, for example, it didn't count toward the 60 percent benchmark. The goal was to ensure consistency across all Air Force Specialty Codes, he added.

"Obviously, both in the enlisted PME and squadron officer school, the emphasis is on leadership and developing them as leaders," Conversino said. "These are much shorter courses, roughly five to six weeks in length, compared to the 10- to 11-months-long officer PME resident courses. So the expectation there was not ... to create a senior Airman or a staff sergeant that endeavored to be an expert in China or Russia, but to provide them, through their PME, a firmer understanding of the environment in which they were operating."

Regardless of any individual's assignment and specialty code, "in the officer schools ... we are striving more for a full understanding of [China and Russia's] strategies, their internal politics, the means in which they employ all the tools at their disposal to enhance their influence and reach around the world," Conversino added.

Airmen must learn not only how to defeat an anti-access, area-denial network erected by the Russians in Eastern Europe or by the Chinese in the South China Sea, but also what they can do to avoid war with both powers, and understanding intent is a vital component. He wants to ensure students know where red lines lie, how to gauge intent, and the difference between deterring and provoking.

Conversino acknowledged that as a military historian, it's easy for him to look back in time and see what the U.S. could have done differently to avoid being strategically surprised. But future Airmen won't have that luxury.

"We want to keep this as competition and not as conflict,"

he said. "To me that is the tougher of the two things."

USAF engineers can look at a Russian S-400 surface-to-air missile system and figure out how it works and what needs to be done to physically defeat it, he said. "The harder issue is, 'If I'm going into the Baltics, and I'm going to take down a Russian SAM system, and I am now kinetically engaging targets on Russian soil—I'm killing Russians on Russian soil—am I not, in essence, mounting the escalatory ladder?' ... There [is]...a big difference between engaging with Russians in Syria and engaging with them on their own territory."

Airmen will have to learn how to defeat the anti-access, area-denial threat without provoking a war with nuclear-armed rivals. "Those are the kinds of things that I see at the War College, at SAASS, and at Air Command and Staff College, that pose the bigger problems," he said, as opposed to, "You know, the Su-35 is a pretty cool airplane. ... How do we deal with it?"

## ASSESSING THE THREAT

The 60-percent benchmark measures input, so what percentage of the overall lesson plan can be directly tied to great power competition. However, the directive came just as Air University was transitioning to an outcome-based model of learning, in other words, students are assessed on total knowledge gleaned from a course. For example, students might be asked to discern the threat China poses to American interests across the spectrum of a specific military power. Students would then be assessed, by means of an exam or wargame, on their ability to work through the problem.

AETC is infusing emerging technologies into its exercises and wargames now to home in on the way artificial intelligence, 5G connectivity, and other cutting edge tech will be applied in great power competition.

"I've had captains ... come up to me and say, 'You know, we scrambled to intercept Russian bombers, but we've never been given this kind of background into what the Russians are really doing,'" Conversino said. Recalling his own days serving as a maintenance officer in Strategic Air Command during the Cold War, he added, "Even our maintenance briefings began every day with the status of Soviet nuclear forces, the location of Soviet nuclear submarines, all manner of things. And the Air Force at the time had an ongoing education effort, where we would get these annual publications on Soviet military power."

## PEER THREATS

The last time a U.S. service member was killed on the ground by enemy air power was April 1953. The attack occurred on an



island off the Korean Peninsula's west coast—in what is now part of North Korea. The United States has maintained air dominance almost universally since then. Brown wants Airmen to see great power competition as more than a buzzword and to recognize that U.S. air dominance is never guaranteed.

"What we don't want to do is ... just think that it's an American birthright that we have air dominance," Brown said in a late-October virtual talk at the Hoover Institution. "We have to actually think about it from an aspect of not the way you've been operating in the past, but how we will operate in the future."

Reforge, Air Combat Command's experiment to develop new pilots and orient them more quickly with fifth-generation fighters, is one way the service is breaking the mold and rethinking traditional models for training, Webb said. ACC and AETC are working "in concert with each other," he said, to ensure new pilots make a seamless and successful transition from initial pilot training to the operational force.

"We're still kind of figuring out ... where the line is," Webb said. "What work does AETC do before it hands [pilots] off to ACC? And of course, the T-7 will be fundamental to that. That's why we're so excited to get that aircraft on board." The T-7A, digitally engineered, and built by a Boeing-Saab team, is the Air Force's new training jet. The Air Force will begin taking deliveries of the first simulators at Joint Base San Antonio-Randolph, Texas, in 2023, and initial operational capability is slated for the end of fiscal 2024.

## MORE THAN A BUZZWORD

In December, as Conversino was preparing to give a somber zoom lecture on Russia at one of the noncommissioned officer academies at Peterson Air Force Base, Colo., he noted that students also would receive a similar lecture on China. The objective of such lessons is to help Airmen really understand the current threat environment.

"I would argue that ... these two countries can literally destroy us," he said. "They can inflict casualties on us in an afternoon that we haven't seen in a good long time. And that's not even going to the nuclear threshold."

Competition with Russia and China is global, taking place in the Arctic, in Europe, in the Pacific, and in Africa. It encompasses economic competition in technology, strategic international investments in infrastructure and medicine, international arms sales, and also diplomacy. As in the Cold

War, competition is not limited to the borders, but takes place in other parts of the world, as well. But unlike the Cold War, potential adversaries now have the ability to attack in surreptitious ways through cyberattacks and social media influence campaigns. "Literally, our opponents can reach inside of [Airmen's] pockets and mess with their heads," Conversino said. "They need to be educated about that, as well, because that's 24-seven, regardless of wherever they are." Significant culture change often takes time to root, but Brown says that's one thing the service doesn't have. The Air Force must move fast to adapt to this new information-age warfare and adjust its policies and practices to address great power competition.

"Our peer competitors ... are challenging us in different ways and challenging how we are able to generate combat power now and into the future," he said during an Oct. 21 virtual Mitchell Institute for Aerospace Studies event. "We're in contested space right now when you think about cyber. We need to be thinking about how we deal in the homeland, as well as ... [thinking] about how we might fight what I call an 'away game.'"

Like Brown, Chief of Space Operations Gen. John W. Raymond has released his own planning guidance calling for speed, saying the new service will be built as the Defense Department's first "digital service," with the goal of accelerating innovation. "The return of peer, great power competitors has dramatically changed the global security environment and space is central to that change," wrote Raymond in the document.

U.S. space assets are more at risk today than ever before. In December, Russia once again tested a direct-ascent, anti-satellite missile in violation of space security norms. China, too, has conducted similar tests, famously blowing up its own satellite in 2007, creating a pile of debris.

Despite these threats, Raymond has acknowledged his job is slightly easier than Brown's because he gets to build a new service from scratch and is not weighed down by decades of history, traditions, policies, and bureaucracy.

"We get an opportunity to start with a clean sheet of paper in the United States Space Force, and to be bold in our efforts, and to start fresh on everything," said Raymond in August at the National Guard Association of the United States' conference. He added, "We're going to increase our accountability and increase our speed, so we're excited about that going forward." 🌟



Air Education and Training Command's new T-7 A trainer will be critical to preparing new pilots for the operational training that follows at Air Combat Command.

Boeing



Agile Combat Employment demands Airmen develop a broader set of skills so smaller teams can accomplish the mission from remote, austere, and temporary operating bases.

Airman 1st Class Jessi Monte

# Swiss Air Force Knives

**Multi-capable Airmen are the key to Agile Combat Employment. Here's how the Air Force is trying to make the force less specialized.**

By Brian W. Everstine

**A**gile Combat Employment (ACE)—the idea that small numbers of aircraft and personnel can quickly move forward and fight from remote and austere locations, with a minimal footprint—is catching on. Born in the Pacific Air Forces when Air Force Chief of Staff Gen. Charles Q. Brown Jr. was in command and also tested in Europe, the concept depends on the idea that Airmen can be trained to do multiple jobs so that fewer Airmen overall need to be deployed for any given operation.

Now the Air Force is developing a program and syllabus for Airmen to be designated “multi-capable,” so that they’re prepared to do things like protect a base, load weapons, marshal and turn aircraft, and other tasks in addition to those jobs defined by their specific Air Force Specialty Code (AFSC).

“The old concept of [mobilizing for combat] is: We roll in a really big package, and we’d have kind

**The concept is for Airmen “to train as a cross-functional team.”**

—Maj. Jeffrey VanGuilder, chief of operations at USAF’s Expeditionary Center

of a permanent footprint,” said Maj. Gen. Mark. D. Camerer, the commander of the U.S. Air Force Expeditionary Center (EC). “And we would expect that we were always assured we can defend the base, and we didn’t have to worry about attack from above or from elsewhere; we can stay there a long time, we can bring 200, 300, 400 people to execute that.

“Now: How do we skinny that down so that it’s a small team of mobile Airmen that can move? Just the capability you need on a moment’s notice ... and ... one step always ahead?”

## HOW THE PLAN BEGAN

The push for making multi-capable Airmen (MCA) began in the summer of 2019, as deputy commanders from across the Air Force met for the “USAF Agility Conference.” Agile Combat Employment was taking hold across the service, and a growing realization was setting in that Airmen needed more skills to make it a reality. At the end of the five-day conference, the deputy commanders tasked the Air Force Expedi-



tionary Center to generate expeditionary combat support training for deploying Airmen for contingency response.

“Since the requirement is really driven between PACAF and USAFE—those operational theaters of war where our near-peer adversaries reside—they’re the ones who are setting out the concept of operation for us,” Camerer said. “And then we helped them write an overall guide to Agile Combat Employment that we gave out to the major commands, who can take their specific requirements and push that down to their wings, and kind of begin training and developing [at] a very tactical level how they would employ it.”

The Air Force Expeditionary Center’s Expeditionary Operations School teaches combat skills to deploying Airmen—skills they will only need if trouble arises at their operating bases.

Airmen in the school spend two weeks learning weapons and medical skills, culminating with land navigation and exercises in which they encounter active shooters, interact with “locals” to develop intelligence, and other scenarios more familiar to Soldiers than Airmen. The baseline training aims to keep the Airmen calm under pressure by providing the basic knowledge they need if things get hairy.

The school already cycles about 10,000 Airmen through per year go, and the Air Force wants to build on that baseline in its quest to train multi-capable Airmen.

The concept is for Airmen “to train as a cross-functional team, enabled by cross-utilization training, and [learn] to operate independently to accomplish those mission objectives within acceptable levels of risk,” said Maj. Jeffrey VanGuilder, the chief of operations in the EC’s operations, logistics, and plans directorate, who is overseeing the creation of the MCA syllabus.

## DEVELOPING THE SYLLABUS

After the initial conference in August, the EC team focused on identifying the skills needed to build a team that could operate expeditionally, the number of Airmen needed for that team, and the training they would need to receive.

The first iteration included 38 Airmen; the latest has

33. The center continues to strive for even smaller teams, perhaps as few as a dozen.

“We need to be as small as possible to keep that light, lean, and agile mentality in place,” VanGuilder said.

Every few months, the Expeditionary Center updates Majcoms and seeks input on the current plan. A beta syllabus was presented in February 2020 and another is expected in early 2021.

Building on the deployment training, the multi-capable Airmen training would add new cross-training objectives into existing events, so that the overall length of the course does not need to change, while the focus and outcomes can, VanGuilder said.

“We owe it to the Airmen to develop a model for the training that is sustainable, so as the PCS they don’t have to re-accomplish task lists every time they move,” he said. “That’s a waste of our time, that’s a waste of their time, and it’s a waste of the installation’s time.”

AMC Commander Gen. Jacqueline D. Van Ovost said not everyone will go through these courses. “Right now, we’re saying a small percent, maybe 10 percent or so. ... But we’ll have to see how that’s done, how quickly we can do that. When you look at the basics of what we have to do, ... we have to have the mindset that we’ve got to be ready for anything.”

With ACE, the number of Airmen deploying to a given location will be fewer than in the past, Van Ovost said, “because you can’t bring a large footprint in.”

For some, the training will be very basic; for others, it will be more challenging. Many Airmen have not touched a rifle since basic training or worked in any sort of austere environment. New skills “can be as simple as how to eat an MRE,” VanGuilder said.

Following “tier one” at Joint Base McGuire-Dix-Lakehurst, N.J., Airmen would return to their wings to train for specific missions and operating areas. Wings will have to assess the skills they need to accomplish their specific missions, Camerer said.

“If we’re going to turn F-22s, with a certain ground time, that’s different than if it’s a B-1, a C-130, or a C-17 that’s coming through the same airfield,” Camerer explained. “If we’re going

Airmen must be well versed in small arms and perimeter defense for Agile Combat Employment to work on a wide scale.



Tech. Sgt. Luther Mitchell



Base security and survival skills training are part of the effort to grow more multi-capable Airmen. Airman Marcus Sanchez sweeps a leg from under his partner, Airman Austin Seiffert, during the Phoenix Raven Qualification Course for expeditionary Airmen.

Maj. George Tobias

to reload weapons, if we're going to prosecute operations that are air-to-air vs. air-to-ground vs. ISR, depending upon the mission that's going to come through there, you might need a different set of capabilities on the ground," Camerer said. "So defining how we're going to execute this is key and where we're at now. And after that, you can get into a specific kind of training" to address Air Force-wide gaps.

## BUILDING TIERS IN PACAF

In the Pacific, PACAF has tapped the 36th Wing at Andersen Air Force Base, Guam, to take the lead on theater-specific training. The wing's 36th Contingency Response Group (CRG) is building on the Expeditionary Center's initial syllabus and creating two more tiers of follow-on training to develop the skills needed to rapidly turn aircraft in austere or threatened locations, said wing commander Brig. Gen. Jeremy T. Sloane.

"The Expeditionary Center has long had the lead on what this means," Sloane said. "But their ability to incorporate it into the syllabi [to meet] ... the needs for the theater weren't met until, I think, we started developing these things out here, specific to the theater, through the CRG."

True multi-capable Airmen must be more than defenders, Sloane said. In "tier two" courses, five-level Airmen will learn rapid damage repair, and everyone will need field craft courses and evasion and escape training, Sloane said. Eventually, a third-tier course for seven-level Airmen and higher will teach how to independently create forward air refueling points and mission generation in a semi-permissive or hostile environment and to keep that operating for 12 to 72 hours without resupply or backfill, Sloane said.

"We're excited because we're not just developing the syllabi, but we've got cross-functional teams of Airmen looking at the optimal AFSCs to combine into [small] packages and the optimal skills required for those multi-capable Airmen and teams to be successful in the theater and across our Air Force," Sloane said.

Air Combat Command's 23rd Wing at Moody Air Force Base, Ga., has conducted multiple courses to help commands develop multi-capable Airmen, including flying in Airmen and aircraft to do hot-pit refueling, setting up tents, and doing runway repair.

"Everywhere you go, you're going to see differences, you're going to see change, you're going to see people work differently," said Master Sgt. Christopher West, 23rd Wing MCA program manager, in a release. "Having that opportunity to work with their peers in the same career field, but on a different aircraft, gives them that ability to ... do the job necessary to get our aircraft back in the fight a lot faster."

Bases in Europe are designing their own training events. At Incirlik Air Base, Turkey, for example, the 39th Air Base Wing (ABW) sent Airmen to a three-day course where they learned how to protect, refuel, marshal, and get parts for Army UH-60 Black Hawks that were deployed to the base. Then they went out to the flight line to practice what they'd learned.

"We're trying to make it to where our Airmen own the training, they just go out and have classes on other jobs," said 39th ABW Commander Col. John B. Creel in an interview. "So, if you're a logistical Airman, maybe you go learn how to guard an aircraft. Maybe you're an airfield manager, you learn how to not only refuel the aircraft, but you also know where to go to get parts for the aircraft."

Such events will guide development of requirements and curricula.

Headquarters Air Force is expected to weigh in soon. Their work would make it official policy by modifying or releasing new Air Force Instructions. Funding would follow in or around 2023.

"The cultural shift has to extend across all different stovepipes," VanGuilder said. "We need to break down those barriers. I'm not saying that everyone has to be an expert in everything, but we just need to know how to leverage the skill sets in other career fields a bit better." ★



# Air, Space, and the Biden Administration

Priorities for the Pentagon's new leadership must begin with aerospace power.



Senior Master Sgt.  
Michael Davis/ANG

Eliminating pass-through funding from the Department of the Air Force Budget would expose that the Air Force and Space Force truly are underfunded. One year of pass-funding could pay for 400 F-35As jet fighters or an equal number of rocket launches for space payloads.

By David A. Deptula and Douglas Birkey

**D**efense was not a central topic during the recent election, but nonetheless the Biden administration takes office amid tremendous national security pressures. World events will demand great focus on national security and—in particular—on aerospace power fielded by the Air Force and Space Force, which will prove indispensable as leaders navigate complex geopolitical headwinds.

Circumstances in both branches are fragile after three decades of heavy use, underfunding, and following a string of incorrect assumptions and poor decisions built on the ill-conceived notion that air and space assets exist only to support surface forces. The truth is that no matter what challenges the U.S. faces in the years ahead, air and space capabilities are vital. Air superiority and air mobility are essential for any successful military operation; long-range strike holds at risk adversaries' war-making capacity; space delivers global command and control, communications, intelligence, surveillance, and reconnaissance.

**"The defense of the United States depends on air power."**

—Gen. Mark A. Milley, Chairman of the Joint Chiefs of Staff

Air and space C4ISR enable all military operations.

"The fundamental defense of the United States and the ability to project power forward will always be for America naval and air and space power," Chairman of the Joint Chiefs of Staff Gen. Mark A. Milley said in December. "The defense of the United States depends on air power and sea power, primarily. People can say what they want and argue what they want, but that's a reality."

The demand signal driving defense strategy begins with China and its increasingly aggressive posture in the Pacific; Russia and its intimidation of neighbors like Ukraine, along with opportunism in Syria; Iran and North Korea, pressing their nuclear ambitions; and nonstate actors like the Islamic State and al Qaeda, which remain threats to stability throughout southwest Asia. Those are just the known challenges. As history shows, from Japan's attack on Pearl Harbor to al Qaeda's 9/11 attacks on New York and Washington, D.C., the United States has a spotty track record when it comes to unanticipated security challenges. What is certain, however, is that air and space will be

in demand—no matter what. That cannot be said of the other services. Naval power is of limited use in land-locked regions, which represent more than a quarter of the countries on Earth, and armies are ineffective at sea, but air and space encompass 100 percent of the globe and can access any part of it faster than any other force. Combatant command (COCOM) war plans reflect this.

What follows are four steps that are fundamental for the Biden Administration to implement in order to secure American defense and prosperity.

## GROW AEROSPACE COMBAT CAPACITY

Today's Air Force and Space Force are both undersized. As then-Secretary of the Air Force Heather Wilson explained in 2018, "We are too small for what the nation is asking us to do." Things have only gotten worse since then.

Every piece of the Air Force is undermanned and under-resourced. The bomber force is the smallest and oldest in the Air Force's history; the fighter force has been cut by more than half since the end of the Cold War; the airlift fleet is too small to meet requirements for a major military operation; and the ISR force is a fraction of what it should be to meet everyday requirements. Today's Air Force is "low density, high demand," requiring leaders to cycle and wear out jets faster than intended and run crews ragged.

Worse, the aircraft inventory is old. Airmen learn to fly in T-38s procured during the Kennedy and Johnson administrations. If they become fighter pilots, they may fly jets acquired before the worldwide web was invented. Most of our bombers predate the Cuban Missile Crisis. Three generations of a single family have flown in the same bomber and aerial refueling tankers. News stories may view this in a sentimental light but, in reality, this represents an Air Force in crisis. Modern enemy defenses pose extreme threats to any combat aircraft without stealth, sensors, robust processing power, and digital connectivity—but that criteria is met by only 13 percent of the bomber inventory and 20 percent of Air Force fighters. Converting the Air Force to a majority fifth-generation stealth Air Force remains a distant goal.

Today's Air Force and Space Force budgets combine to account for about 20 percent of the defense budget. Yet some \$40 billion of the Department of the Air Force's total annual budget goes directly to the Intelligence Community without

any input or control from the Department. That is enough to buy at least 400 F-35s or 400 Falcon IX space launches per year. No other service is loaded with such an external burden. This is on top of the Department of the Air Force taking the largest funding hits in the years following the end of the Cold War. From fiscal 1989 through 2001, the Air Force's procurement budget declined by 52 percent. This was 16.1 percentage points more than the cut suffered by the Army and 20 points greater than the cuts to the Navy. In the wake of 9/11, budget increases failed to keep pace with demand. New joint missions like demand for remotely piloted aircraft were funded at the expense of other missions. Ground operations in Afghanistan and Iraq absorbed most defense spending. The Budget Control Act of 2011 made matters worse, driving aircraft procurement funding to its lowest level ever in fiscal 2013.

Things are no better in space. When the new Space Force was established in 2019, reforms needed to consolidate space-related functions and funding from across all the services failed to materialize. Instead, the Space Force was created by carving out its budget from the Air Force, as the other services held fast to their military space programs and dollars. Instead of freeing up resources for defense operations in space, the Air Force and Space Force had to fund the growing bureaucratic and operational requirements of an independent service without additional resources.

To address these concerns, leaders must acknowledge the problem and highlight the disconnect between budgetary resources and mission demand as a risk the nation can ill afford. Air Force and Space Force leaders spend months paring monetary request to the bone before submitting requests to the Defense Department leadership. Those requests get trimmed further by the Secretary of Defense and Office of Management and Budget. By the time that budget is submitted to Congress, the services are already in a compromised position. It is like going into salary negotiations with an employer and starting lower than what's needed to cover rent and food.

The administration must understand the shortfalls and risks to readiness. The Air Force's 2018 statement of need for 386 operational squadrons, up from 312, made clear what was necessary to meet the national defense strategy. That requirement has not changed. While the services must submit budgets in accordance with directed guidance, they also have a responsibility to advocate and articulate what they need to

After 10 years in the desert boneyard at Davis-Monthan Air Force Base, Ariz., this unpainted B-52H went through a complete "regeneration" to return to active service.



Ron Mullan/USAF



execute the defense strategy. Conflating these two can give the false impression that missions can be met no matter how small the budget. Historically, the Air Force recognized a planning force—what it needed—and a programing force—what the budget allowed. The space in-between was a measure of risk. The new administration should reinstate that process.

The 2021 National Defense Authorization Act recognized the risks and specifically cited an aircraft inventory floor and growth targets to restore Air Force readiness. The same issues apply to the Space Force, which, as a new service, should internalize this thinking and make it part of its culture. Congress ultimately has the power of the purse, and lawmakers cannot do their jobs effectively if budgeteers in the Pentagon do not make clear actual needs.

The Navy understands this well and has long signaled the need to grow its fleet, first to a total of 350 combatant ships and more recently to 500. The Air Force and Space Force must likewise stake out their needs.

Department of the Air Force leaders will have to establish that both the Air Force and Space Force have hit bottom, that neither can get smaller, and that they can no longer trade force structure today for capability that may or may not materialize in the future. History teaches that such trades do not deliver. In 2010, the Air Force divested over 200 legacy aircraft to free funding for fifth-generation aircraft. The planes were retired, but the savings disappeared with the 2011 Budget Control Act. Flash forward to 2019. The Air Force announced its F-15C/D force was nearing the end of its service life. The F-35 production rate was less than planned, the legacy fighter force was running out of steam, and it had too few F-22s because that program had been cut short after building just half of the required planes. Too few F-35s were being built to catch up. Now the situation is even worse.

## COMPLETE CURRENT PROGRAM BUYS

The Air Force has multiple modernization initiatives underway. It is buying F-35A fighters, the B-21 bomber is nearing its first flight, KC-46 tanker problems are getting solved, and the T-7 trainer is nearing production. These programs are the Air Force's best hope. The Space Force has its own priorities, many of which are classified. Seeing these programs through

will renew the force. Cutting or delaying them will make matters worse. Leaders must guard against trading today for an unseen tomorrow.

In the rush to harvest post-Cold War budget savings, the Department of Defense canceled the B-2 bomber after building just 21 airframes, far short of the 132 originally planned. Having made a tremendous investment in technological development, tooling, and infrastructure, it abandoned the investment and instead invested further funds in the B-52 and B-1 to extend their lives. Meanwhile, demand for the unique capabilities delivered by the long-range stealth bomber never went away. By the early 2000s, it was clear a new Next-Generation Bomber would be needed. The first effort was canceled in 2009 and a few years later it was reborn as the B-21. If the Air Force had simply been allowed to procure the full buy of the B-2s, the entire ordeal might have been avoided.

Bottom line: if a requirement remains valid, it is more cost-effective to procure the numbers necessary to meet the requirement. Cutting the F-35 buy trades short-term savings for increased risk. By contrast, the Navy has not committed to building a specific number of F/A-18s, but rather has remained open to procure whatever is needed.

Today's Air Force is committed to invest significant sums into Joint All-Domain Command and Control (JADC2) with the technology yielded through the Advanced Battle Management System (ABMS). The goal is to gain increased situational awareness throughout the battlespace—targets to strike, threats to avoid, and other pertinent information—that allows actors to best employ forces to attain desired effects. An aircraft over an enemy target can be out of munitions, but still net results by passing target coordinates to an airplane or ship offshore that launches a missile, with terminal guidance provided by the aircraft or satellite constellation still overhead the target. This is essentially a modern formulation of what the Royal Air Force did during the Battle of Britain, when radars gathered position information for attacking German bombers and passed it to command and control (C2) stations, which fused the data with the relative position of their fighter aircraft. This transformed Britain's extremely limited defending force into extremely effective interceptors.

While developing ABMS to realize this vision will be expen-

A KC-46 Pegasus refuels an F-16 over New Mexico. Solutions to the beleaguered tanker's problems finally look to be at hand, which should go a long way to solving the tanker shortage across the fleet.



97th Air Mobility Wing/courtesy



An Atlas V launch vehicle carrying a Navy payload lifts off from Cape Canaveral Air Force Station, Florida, June 24, 2016. Army and Navy space assets have not been integrated into the Space Force, missing the opportunity to amass more resources in the service.

Rick Naystatt/USN

sive, downsizing to fund that effort is exceedingly risky. JADC2 will be of little use if the force lacks aircraft to meet mission objectives. Airplanes, not networks alone, close kill chains. Aircraft, spacecraft, and ABMS are all required.

### **BUILD THE SPACE FORCE FOR SUCCESS**

The United States possesses the most capable space posture, given its many assets and a newly established U.S. Space Force. This critical lead will be lost, however, unless the new administration moves assertively to complete the transition to a fully independent service branch with full authority for military space.

The first—and greatest—challenge is to expand the resources allocated to the Space Force to design, develop, and build capabilities to deter and, if necessary, defeat any aggression against U.S. assets in space. Because every military service and agency depends on space, all must contribute to its funding and success. Topline space spending must increase significantly for the Space Force to succeed.

The second challenge is unifying the space community. The new service was essentially created by renaming Air Force Space Command (AFSPC) as U.S. Space Force. While that was appropriate, important elements of space expertise across the government must also be brought into the Space Force. A July 2016 Government Accountability Office (GAO) report noted some 60 stakeholder organizations in DOD, the Executive Office of the President, the Intelligence Community, and civilian agencies—all with a role in national security space. GAO's conclusion: Too many cooks are spoiling the broth. Former Vice President Mike Pence echoed that sentiment on March 1, 2019, saying that spreading the national security space program so thin has resulted in "a glaring lack of leadership and accountability that undermines our combatant commanders and puts our war fighters at risk." If the nation is serious about dealing with the threats facing us in space, at least some of those more than 60 government organizations need to be integrated into the Space Force.

The third challenge is personnel. When DOD re-established U.S. Space Command as a separate combatant command in

August 2019, its personnel came largely from Air Force Space Command—the same command that fueled the nascent Space Force. The Air Force must establish a space component to provide representation to U.S. Space Command, just as the other services have done. Where will all these people come from? The answer cannot be to "triple hat" a small number of experts in the Space Force. Critical to maturing a stand-alone space force will be to develop a larger, deeper, and more flexible stable of space talent.

In summary, the new Space Force needs additional resources to develop new capabilities; more personnel must be recruited and trained to fully and separately man the Space Force, Space Command, and individual service space components; and the numerous disparate agencies that each have a role in national security space must be integrated into the Space Force.

### **USE COST-PER-EFFECT TO COMPARE OPTIONS**

The present budget climate clearly will not be able to fund every priority and every wish. To build the most effective, efficient military possible, decision-makers must evaluate programs and solutions in terms of mission value, not just price. Wars are not won by the lowest-cost bidder, but by the best-trained, best-equipped, best-led military; that is, by the side that applies the most capable systems in the most innovative ways to best achieve desired effects.

Sadly, the defense establishment routinely relies on outdated cost metrics, such as unit cost, cost per flying hour, and total sustainment cost over the life of a program rather than a more sophisticated measure, such as cost per mission effect. Indeed, a well-intentioned focus on unit and sustainment costs often yields capabilities that require additional expense not calculated into the original costs. For example, if a given platform is less costly, but cannot achieve the mission alone, then the cost to achieve the desired effect must include multiple platforms, not just one.

This is precisely the purpose of cost-per-effect assessments. By measuring the sum cost to net a desired mission result, a new reality emerges. Stealth weapon systems appear far more costly on a per-unit basis than less-capable legacy aircraft





Boeing

The F-15EX, shown here in a screenshot from a video during February tests in St. Louis, costs close to the same amount as the F-35, but doesn't have the Lightning II's radar-evading stealth or advanced targeting and combat capability.

designs. But because they can penetrate enemy air defenses alone, a few can achieve what would require dozens of less capable aircraft. As such, they are a far more cost-effective option for attacking the most well-defended targets. On the opening night of Operation Desert Storm, a 40 aircraft non-stealth strike package was launched against a single target. Only eight of the 40 aircraft dropped bombs, while the rest focused on keeping those strike aircraft alive. At the same time, 20 F-117s hit 28 separate targets. Which represented the better value?

Thirty years later, this lesson has yet to be learned. Efforts to compare the F-35A and F-15EX miss the mark. Aside from the fact that purchase price for the two aircraft is now comparable, the fifth-generation F-35A holds huge advantages in terms of radar-evading stealth and advanced targeting and combat capability. This is why cost-per-effect is so essential in any comparison. Cost-per-effect should encompass maintenance and sustainment—where concepts like performance-based support may prove more cost-effective than traditional methods. Sustainment comparisons must also include the multiples of support aircraft necessary for comparative mission success. Analysis based on cost-per-effect can also better measure future capabilities, where distributed aviation assets—unmanned, possibly autonomous companion aircraft—combine to execute mission goals. Trying to assess the relative value of these assets absent their teamed operational construct cannot possibly yield accurate results.

The Biden administration has a unique opportunity to embrace cost-per-effect analysis as the central rubric for weapon system comparison. It should do so without delay.

## CONCLUSION

President Joe Biden's defense team can make a lasting impact on U.S. defense policy by focusing on these four critical priorities over the next four years. It can remake its aerospace forces and put them on a sound footing for future growth by addressing the persistent capacity shortfalls that cut across virtually all their highest-priority mission areas. To do so, it must reverse years of underfunding under administrations

of both parties, underfunding that resulted from a lack of transparency about how budget resources are allocated and about how risk, shortfalls, and readiness concerns are calculated and addressed.

To assist in that process, air and space professionals must advocate not for what they perceive can be afforded, but for what they know is needed. They must consistently highlight the disconnect between budget guidance and mission demand and articulate the risks associated with chronic under resourcing of the national defense strategy.

Fortunately, the Air Force and Space Force each have procurement programs underway that can address these shortfalls so long as they are fully funded and allowed to reach their potential. Canceling or truncating these programs to pay for some future capability is a historically discredited strategy the nation can ill afford to repeat, one more likely to result in a future force that is even smaller and older than it is today – and even less capable of meeting national defense requirements.

The new Space Force, meanwhile, must be granted the resources and maneuver space needed to integrate the numerous and disparate organizations and agencies in national security space into a force greater than the sum of its parts; it must receive greater funding to build new capabilities; and it must gain personnel to develop a larger, deeper, and more flexible stable of space talent.

With deficit spending pressuring future defense budgets and paving the way for likely reductions and given the cost of COVID-19 relief and other national priorities, the Department of Defense can no longer afford old ways of doing business. Adopting cost-per-effect force planning analysis to fully understand the relative merits of competing solutions to specific missions is the best and most prudent approach to evaluating its investment decisions. This must be applied across all the services, not just one or two.

Finally, the best way for the Biden administration to boost overall combat capability while garnering fast and lasting efficiencies is to initiate a comprehensive roles and missions review that applies cost-per-effect analysis as the baseline measure of merit.





# Lone Eagle

Over the open ocean, Lindbergh struggled to stay alert. He had not slept for more than two days.

Charles Lindbergh beside his Ryan monoplane *The Spirit of St. Louis*. Lindbergh made the New York to Paris, nonstop flight, May 20-21, 1927.



Bain News Service via Library of Congress

Aviator Charles Lindbergh.

barely clearing the telephone wires at the far end. He was up and away at 7:52 a.m.

## THE MAKING OF AN AIRMAN

At 25, Lindbergh was already a pilot of exceptional ability, having honed his skills in some difficult places. He learned to fly in 1922, but before that he performed as a wing walker on the barnstorming circuit in the Midwest and Great Plains. He bought his first airplane—a war surplus Curtiss Jenny—in 1923 and kept on barnstorming as a pilot.

The opportunity to fly powerful, modern airplanes drew him to the Army flying cadet program in 1924. His instructors were surprised to discover he was almost as proficient as they were. Commissioned a second lieutenant in 1925, he affiliated with the Missouri National Guard in St. Louis, flying with his squadron on weekends. In 1926, he began flying the airmail regularly on the route between St. Louis and Chicago.

“I first considered the possibility of the New York-Paris flight while flying the mail one night in the fall of 1926,” he said. “Why shouldn’t I fly from New York to Paris? I have more than four years of aviation behind me, and close to 2,000 hours in the air. I’ve barnstormed over half of the 48 states. I’ve flown my mail through the worst of nights.”

In 1919, hotel operator Raymond Orteig offered \$25,000 to the first aviator to fly nonstop from New York to Paris or Paris to New York. Nobody rose to the challenge, primarily because airplanes of the day were not capable of it. When Orteig renewed the offer in 1925, technology had improved enough for several competitors to try.

The first serious attempt was by René Fonck of France in September 1926 in a huge Sikorsky biplane with three engines, a crew of four, a bed, and red leather seats. Hopelessly over-

By John T. Correll

**T**he rain on May 20, 1927, continued to pelt Curtiss Field on Long Island, N.Y., through the early hours, even though the weather forecast had predicted an end to the storms prevailing for the past week out to the middle of the Atlantic Ocean.

Charles A. Lindbergh was ready to go. Unable to sleep, he was at the field by 3 a.m., hoping to take off at daybreak. He watched as his airplane, *The Spirit of St. Louis*, rolled out of the hangar and was towed to the adjoining Roosevelt Field, which had a longer, 5,000-ft runway.

Because of the rain, takeoff was delayed until nearly 8 o’clock. Amid the puddles stood some 500

**He saw the lights of Paris a little before 10:00 p.m., circled the Eiffel Tower, and touched down at 10:22 p.m, 33.5 hours after he left New York.**

onlookers who had been gathering since midnight, despite the weather.

Lindbergh was about to attempt the first nonstop flight from New York to Paris. Moreover, he would do it solo: no copilot, no navigator. “I had decided to replace the weight of a navigator with extra fuel, and this gave me about 300 miles additional range,” he said.

To reduce weight further, he would not take a radio, gas gauge, night flying lights, navigation equipment, or parachute. His seat was a wicker chair bolted to the floor. Navigation would be by dead reckoning, relying on compass headings and estimated time between recognized checkpoints on the ground. When he reached land in Europe, he would figure out where he was by comparing the

terrain below with his maps.

He would not be the first aviator to cross the Atlantic. That had been done in June 1919 by two British airmen, John Alcock and Arthur Whitten Brown. However, they flew from Newfoundland to Ireland, just 1,936 miles. Lindbergh’s total distance would be almost double that, 3,610 miles.

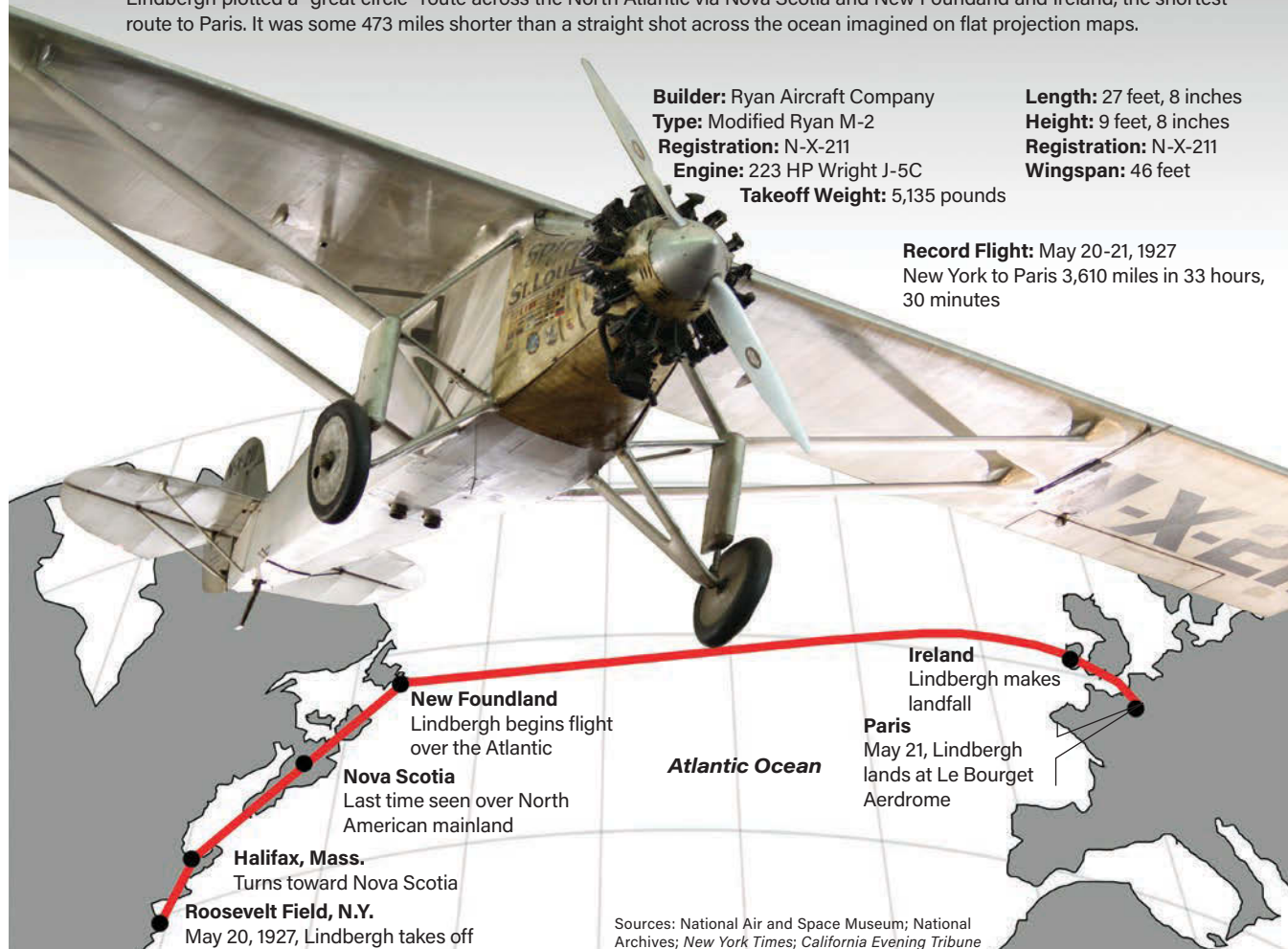
Lindbergh positioned his aircraft west at the end of Roosevelt Field, heading along the east-west runway. The rain persisted until almost dawn, then turned into intermittent drizzle. When the rain slackened, the wind had shifted and was blowing from the west. Instead of taking off into the wind, giving him an advantage in lift, there was a 5 mph tailwind.

The airplane was heavy, the tanks topped off with 450 gallons of fuel, and the runway, which consisted of dirt and cinders, was soft from the rain. When the chocks were pulled, Lindbergh gathered speed slowly. He used every bit of the field,



# Lindbergh's Record-setting Flight

Lindbergh plotted a "great circle" route across the North Atlantic via Nova Scotia and New Foundland and Ireland, the shortest route to Paris. It was some 473 miles shorter than a straight shot across the ocean imagined on flat projection maps.



**Builder:** Ryan Aircraft Company  
**Type:** Modified Ryan M-2  
**Registration:** N-X-211  
**Engine:** 223 HP Wright J-5C  
**Takeoff Weight:** 5,135 pounds

**Length:** 27 feet, 8 inches  
**Height:** 9 feet, 8 inches  
**Registration:** N-X-211  
**Wingspan:** 46 feet

**Record Flight:** May 20-21, 1927  
New York to Paris 3,610 miles in 33 hours,  
30 minutes

Sources: National Air and Space Museum; National Archives; New York Times; California Evening Tribune

Mike Tsukamoto/staff; photot: Andrew Kalat

weight, it crashed and burned on takeoff in New York, killing Fonck's radio operator and the mechanic.

Most of those who aspired to transatlantic flight likewise chose large airplanes with multiple engines. Lindbergh's concept was for a single-engine aircraft that weighed as little as possible. As a basic principle, he said, "I've determined to hold down every ounce of excess weight." He sought to buy an existing airplane suitable for his purposes, but was unable to do so.

## THE SPIRIT OF ST. LOUIS

Lindbergh found the perfect solution with Ryan Airlines of San Diego, which agreed to build an airplane to his specifications. "There were a number of public spirited men in St. Louis sufficiently interested in aviation to finance such a project," Lindbergh said.

The order was given to Ryan Feb. 8, 1927. Lindbergh also persuaded the St. Louis Chamber of Commerce to sponsor the flight. The airplane was named *The Spirit of St. Louis*. Ryan, giving the project a maximum effort, designed and built the Spirit in 60 days.

It was based in considerable part on Ryan's popular M-2 mail plane. *The Spirit* was a monoplane with a highly reliable Wright J-5C radial engine, an all-metal propeller, extended wingspan, extra fuel tanks, and strengthened fuselage and wings.

It would have a single seat. Lindbergh saw no need for a navigator, figuring he could strike the European coastline

anywhere between Scandinavia and Spain and land without endangering himself.

At his insistence, the large main and forward fuel tanks were placed in the forward section of the fuselage, in front of the pilot. This reduced the risk of his being crushed between the fuel tank and the engine in the event of a crash.

Visibility ahead was not that important. "We always look out at an angle when we take off," Lindbergh said. "The nose of the fuselage blocks out the field straight ahead. There's not much need to see ahead in normal flight. All I need is a window on each side to see out through." On his airmail route, he often flew from the rear cockpit and put the mail bags in front. Ryan provided him an option of sorts with a three-by-five inch periscope to see straight ahead. It protruded out the left side of the cockpit and retracted when not in use.

The airplane was assigned tail number N-X-211. Lindbergh took possession May 10 and flew from San Diego to Curtiss Field in New York with an intermediate stop in St. Louis. On the trip, he set a new transcontinental speed record, enthusiastically reported by the national newspapers.

"My critics are confronted with the fact that *The Spirit of St. Louis* has now been more thoroughly tested in long cross-country flights than either the *America* or the *Columbia*," Lindbergh said, alluding to his main competitors for the Orteig Prize.

## ORTEIG CONTENDERS

In the month before Lindbergh departed San Diego, two

more Orteig-related tragedies occurred. In April, Americans Noel Davis and Stanton Wooster were killed when their three-engine Keystone Pathfinder stalled on takeoff and crashed a week before their planned attempt at a New York to Paris flight.

On May 8—two days before Lindbergh left San Diego—France's leading aviators, Charles Nungesser and Francois Coli, took off for New York from Le Bourget Field in Paris in a big PL-8 Levasseur biplane. The airmen, seated side by side in an open cockpit, wore heavy, fur-lined, electrically heated flying suits. They were observed crossing the western shoreline of Ireland and were never seen again.

Two other contenders were already in New York when Lindbergh got there. The polar explorer, Cmdr. Richard E. Byrd, planned to make the trip in a huge three-engine Fokker trimotor, the *America*. He did not register for the Orteig prize money, declaring his flight to be purely for science.

Byrd had leased Roosevelt Field, adjacent to Curtiss, but offered Lindbergh use of the longer runway. Byrd's backers instructed him to wait to fly until the fate of Nungesser and Coli was known.

Charles Levine of the Columbia Aircraft Corp. was sponsoring a Bellanca WB-2 biplane, the *Columbia*, and was holding tight personal control. He insisted on choosing the crew and changing his mind if he wanted to. It was uncertain who the two airmen would be. Ironically, Lindbergh had tried to buy the Bellanca before finding Ryan.

Fonck, who had crashed the previous year, was back from France with two motors for his new Sikorsky aircraft. He declared himself still in the Orteig race, but he was far from ready.

## LONG ISLAND

Lindbergh landed in New York at Curtiss Field, one of a cluster of three on Long Island. The others were Roosevelt Field, from which he would depart for Paris, and the Army's Mitchel Field.

On the day Lindbergh got there, May 12, the western half of the Atlantic was rough with squalls that showed no sign of dissipating. As the airmen waited for the weather to improve, they made adjustments and enhancements to their airplanes.

The internal problems of the Bellanca team worsened. In a contract dispute, Levine fired his copilot/navigator, who



The May 21, 1927, edition of The Chicago Evening Post features news about Charles Lindbergh and his flight from New York to Paris.



Charles Lindbergh was TIME Magazine's first Man of the Year, for making the first solo nonstop flight across the Atlantic Ocean on May 20–21, 1927.

San Diego Air and Space Museum

San Diego Air and Space

got a court injunction blocking the change. It was overturned on appeal, but the *Columbia's* program was off track.

A stamp collector offered Lindbergh \$1,000 to carry a pound of mail, souvenir envelopes, and stamps to Paris. He declined, unwilling to compromise, even by a pound, his principle of no excess weight. However he found room for five sandwiches—two ham, two roast beef, one hard-boiled egg—as travel rations. He took two canteens of water but refused a thermos of coffee.

## OPEN OCEAN

Flying solo was Lindbergh's choice. It was not required by the Orteig rules, but it meant that he had to be at the controls for more than 30 hours despite his lack of sleep the night before.

He plotted a "great circle" route across the North Atlantic via Nova Scotia and Newfoundland, and Ireland. It was the shortest route to Paris, about 473 miles shorter than the straight shot across the ocean imagined on flat projection maps. Given that the Earth is spherical, not flat, the real distance between two points becomes progressively less as the circumference of the globe diminishes in the northern latitudes.

Lindbergh passed over St. John's, Newfoundland, at 8:15 p.m., almost 12 hours after leaving New York. He was seen by hundreds of people as he disappeared seaward. It was his last opportunity for a position check before the 1,850-mile leg over the ocean.

As night fell, lack of sleep caught up with him. *The Spirit of St. Louis* was not an easy airplane to fly, which helped. It required a constant hand on the stick and would awaken him when he dozed off. He left the side windows open, keeping a flow of cold air on his face.

A deep fog reduced visibility, but of more concern were strong headwinds from the north, which blew the airplane to the south. Concurrently, the compass needle spun

wildly, reacting to a magnetic disturbance. Lindbergh maneuvered to recover and made his best judgment on a course correction.

About 2 a.m. New York time, Lindbergh passed the halfway mark of his voyage. An hour later was dawn, local time. Daylight on May 21 would not last that long for him personally, compressed as he crossed half a dozen time zones, leading to an early sunset.



Amazingly, he was only three miles off his planned course when he reached landfall in Ireland, better than expected from dead reckoning under perfect conditions. He located Cape Valentia and Dingle Bay on his maps and renewed his compass course toward Paris.

From there on, excitement overcame his need to sleep.

### 33½ HOURS

As Lindbergh flew at 500 feet along the southern coast of England, he wondered if he had been recognized by anyone below. In fact, *The Spirit* with its distinctive shape had been tracked steadily, and the entire world knew he was within range of the English Channel.

He was several hours ahead of schedule and crossed into France in the dark at Cherbourg just before 9 p.m. local time. He ate one of the sandwiches from his paper bag, the first food since takeoff, and drank some water from his canteen.

He saw the lights of Paris a little before 10 p.m., circled the Eiffel Tower, and touched down at Le Bourget Field at 10:22 p.m.—33½ hours after his departure from New York. *The Spirit of St. Louis* still had 85 gallons of fuel left, enough to have flown another thousand miles.

A crowd of 25,000 had gathered to await his arrival and as he taxied in, broke down the steel fences and rushed out onto the field. Souvenir hunters tore pieces from the airplane and grabbed items from the cockpit. Most of the damage was easily repaired. The only significant losses were the engine log and navigation log, which were carried away.

French aviators rescued Lindbergh from the frenzied mob and the French air force pulled the airplane in to a nearby hangar.

Lindbergh finally got to bed about 4:15 a.m. “It was 63 hours since I had slept,” he said. He had not obtained a visa before leaving the United States, but that turned out to be no problem.

### ACCLAIM

It is difficult to recall any individual—before or since—receiving comparable international acclaim. “Overnight, Lindbergh became the most popular and most recognized person on the planet,” says curator Dominick Pisano of the Smithsonian Institution.

The President of France pinned the Legion of Merit on the lapel of a suit Lindbergh borrowed for the occasion. He was

cheered by half a million well-wishers on a parade down the Champs-Élysées in Paris.

President Calvin Coolidge sent the cruiser *USS Memphis* to bring Lindbergh and the airplane back to the U.S. Lindbergh flew *The Spirit* to England, where it was taken aboard the cruiser. King George presented him the Royal Air Force Cross.

The New York Times “devoted its first five pages to Lindbergh the day after his flight and the first 16 the day after he returned from Paris,” according to Tom Wolfe in “The Right Stuff.”

The crowd lining the route for a ticker tape parade in New York was estimated at 4 million. Lindbergh was awarded the Medal of Honor by special act of Congress. On June 16, he was formally presented with the Orteig prize in New York.

Between July and October, he flew *The Spirit of St. Louis* on a tour of the nation, touching down in 49 states. He subsequently visited Mexico and 12 other Central American and West Indies countries on a 9,000-mile goodwill excursion.

### A PLACE IN HISTORY

Lindbergh’s popularity took a nose dive in the early 1940s as the result of his expressed admiration for the Germans and his regret that the United States was pulled into an alliance against them. [For the full story, see “The Cloud Over Lindbergh,” *Air Force Magazine*, August 2014, online.] That, however, did not change his towering achievement in 1927 and his reputation recovered to considerable degree with passage of time after the war.

Lindbergh wrote several accounts of the flight, notably in two books, both of which are still in print. “We” (referring to himself and the airplane) was published in 1927. He did not choose the title and disliked it. The choice was made by the publisher.

He delivered a more substantial version in “The Spirit of St. Louis” in 1953. It won a Pulitzer Prize and was made into a movie. Jimmy Stewart, 49, was convincing in his portrayal of the 25-year-old Lindbergh.

In May 1929, two years after the Paris flight, Lindbergh and his partners sold *The Spirit of St. Louis* to the Smithsonian for \$1. It currently hangs in a place of honor at the National Air and Space Museum. ★

**John T. Correll** was editor in chief of *Air Force Magazine* for 18 years and is a frequent contributor. His most recent article, “Romance of the Air,” appeared in the January/February 2020 issue.



San Diego Air and Space Museum

A June 13, 1927, ticker tape parade in New York City for aviator Charles Lindbergh, who returned from Europe after his record flight from Roosevelt Field in the U.S. to France.



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## "Aerospace Advantage" Podcast

Mitchell Institute's Aerospace Advantage podcasts offer first-hand experiences and perspectives that focus on making complex ideas, strategies, operational concepts, and technology accessible to everyone.



By Jennifer Hlad

During his time in the Air Force, John "Slick" Baum was a pilot with the 555th Fighter Squadron, an instructor at the F-16 weapons school, a Thunderbird, and an Air Force fellow, among other assignments. But if he had a dollar for every time someone asked him what it's like to land on an aircraft carrier, or walked up to him while he was wearing his Thunderbird flight suit, he would also be a lot wealthier, he said.

"I think from a communication standpoint, [the Air Force] has a lot of work to do," Baum said, noting that most Americans don't understand what the Air Force does for them every day, so explaining the need for a Space Force is a "really hard conversation to have."

To help with that conversation—and to make some of the Mitchell Institute for Aerospace Studies' work accessible to a wider audience—Mitchell in November launched the "Aerospace Advantage" podcast, hosted by Baum. The first few episodes were designed as an introduction to aerospace power, the threat environment, and the state of today's Air Force, with subsequent episodes building on that, explained Mitchell's Executive Director, Douglas Birkey.

The idea, Baum said, is that if someone is "interested in aerospace or what the Space Force is doing, but you work in banking on Wall Street or something like that," and don't have a lot of background knowledge on the topics typically covered in Mitchell Institute reports, for instance, they will still be able to "hop right in" and listen to the podcast. After the first three episodes, "they could listen to anything and understand what's going on."

It can also introduce younger Airmen and Guardians to topics they may not otherwise begin studying until later in their careers, Baum said.

"It's helping introduce a captain to starting to think about, you know, the policy churn and the important budget decisions

that affect him at the tactical level at the squadron," he said. Noting that he was getting ready to interview Chief of Space Operations Gen. John W. "Jay" Raymond, Baum added: "If you're a brand-new Guardian and you want to understand what the top leaders are thinking, I mean, we're bringing it right to you, to where these folks are on the treadmill or driving to work."

In selecting a host, Birkey said he "knew that we needed somebody with operational credibility and with a direct ability to own, and credibly say, 'I've been there.'" Having known Baum for several years, Birkey said, he "thought he'd be a really, really good fit."

A recent episode focused on Desert Storm, and included interviews with retired Lt. Gen. Mike A. Loh, retired Lt. Gen. David A. Deptula, and retired Col. John A. Warden III, covering the foundation of the air campaign, key events, and lessons learned.

"That's what we're doing with this podcast, we're peeling back the layers of the onion and getting to the people, and to the roots of what this history was, if it's a historical perspective," Baum explained. This is critical to making sure good ideas continue to be "pushed forward ... because, you know, we have really courageous Airmen and Guardians out there that have wonderful ideas, and they shouldn't be afraid to push them forward."

The story of Desert Storm is "proof that it is the person with the really good idea, presenting it properly, is what's going to change history."

Mitchell will continue publishing reports, hosting live events, and producing its Aerospace Nation video series even after the pandemic is over—in addition to the podcast, Birkey said. But while the video series is "optimized for people that are really kind of 'in the Beltway' or in the industry," the podcast will "afford you more of a conversational insight, with a lot of the stakeholders that might have been part of our report."

New episodes are posted every other week and occasionally will be supplemented with special episodes.

By John T. Correll

# DOOLITTLE'S TOKYO RAID

**It was the first good war news in months.  
American B-25s successfully bombed the capital of Japan.**

**W**ithin days of the disaster at Pearl Harbor in December 1941, the United States began exploring how to retaliate. What followed, unfortunately, was further losses in the Pacific at Wake Island and in the Philippines.

President Franklin D. Roosevelt pressed the armed forces for a bomb strike on the Japanese home islands. Navy aircraft could not do it. Their operating radius was 300 miles and carriers could not get them that close to Japan. Army bombers, on the other hand, had enough range if they flew from a carrier deck.

The Army Air Forces turned to Lt. Col. James H. Doolittle, arguably their best aviator, to work with the Navy on an operation. Doolittle was already famous, having set numerous aeronautical records in years past. He had been recalled to active duty in 1940.

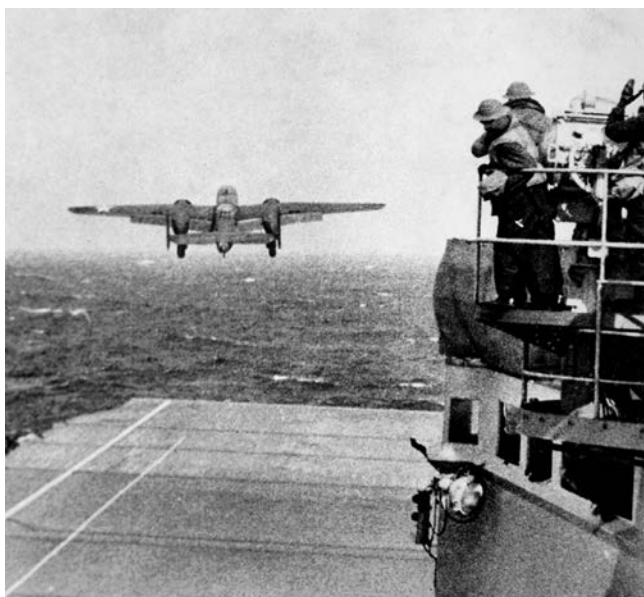
His first task was to choose the airplane. It had to take off within 500 feet and roll down a carrier deck without hitting the superstructure of the ship's island. The wingspan of the B-23 was too wide. The B-26 takeoff roll was too long.

By default, the choice was the North American B-25, a sturdy medium bomber that carried a crew of five. Doolittle drew airplanes and crews for testing and training from the 17th Bomb Group. The B-25s were stripped of nonessential features and given three extra gas tanks to enable them to fly 2,400 miles, if necessary.

The crews trained in secrecy at Eglin Field, Fla. Only five people knew the full plan—which was for the carriers to launch the bombers some 500 miles from the coast of Japan. The airplanes would then continue on to landing bases in China. There is some question about how much Roosevelt was told.

The Doolittle Raiders and their 16 aircraft put to sea April 2 from San Francisco aboard the Navy's newest carrier, USS *Hornet*. They made rendezvous April 13 with the task force that would escort them to the point of launch. The task force was led by Vice Adm. William F. Halsey from his flagship, the carrier *Enterprise*.

The strike was set for April 18. Doolittle, flying the first B-25, planned to launch that afternoon, be over Tokyo at dusk, and drop incendiary bombs as homing beacons for those coming behind him. Things never got that far. Before sunrise that day, the task force discovered a line of



**An Army B-25 takes off from the deck of the aircraft carrier USS *Hornet*, on its way to take part in first U.S. air raid on the Japanese mainland.**

radio-equipped picket boats about 750 miles from the Japanese coast. One of them got off a message: "three enemy carriers." A cruiser sank the picket boat, but the secret was out. Halsey ordered the bombers to launch at once.

Doolittle took off at 8:20 a.m., clearing the carrier island on his right side by six feet. The others followed rapidly, all of them airborne by 9:19 a.m. Doolittle reached Tokyo and dropped his bombs at 12:25 p.m. Close on his tail came the other Raiders, who struck military targets at Tokyo, Nagoya, Kobe, and Osaka.

The Japanese made no use of the patrol boat warning, mistakenly assuming the carriers to have had only short-range Navy aircraft. They later claimed to have shot down nine of the Raiders. In fact, all 16 bombers got through to land or crash in China or, in one case,

divert to the Soviet Union, where the airplane was impounded.

Several raiders were captured by the Japanese in occupied eastern China and executed, but Doolittle and others got back to the United States. Doolittle was promoted to brigadier general—skipping the grade of colonel—while still in China.

The raid is sometimes faulted as unwise because the Japanese inflicted great reprisals on the Chinese. However, fearing more such raids, the Japanese recalled a number of aircraft and ships engaged in their expansion in the Pacific and East Asia and reallocated them to defend the home islands.

News of the raid also had a tremendous uplifting effect on the morale of the American public. Doolittle was awarded the Medal of Honor.

Few of the details were announced. At a press conference, Roosevelt said the bombers had come from "our new secret base at Shangri-La." Shangri-La was an isolated and mystical valley in Tibet, imagined in a popular novel and movie of the time.

Doolittle's star continued to rise. More was revealed in "Thirty Seconds Over Tokyo," a book published in 1943 by Capt. Ted W. Lawson, one of the Raider pilots. It was later made into a movie with Spencer Tracy as Doolittle and Van Johnson as Lawson.

By the end of the war, Doolittle was a lieutenant general commanding 8th Air Force in Europe. He returned to civilian life and in 1946 was elected as president of the newly founded Air Force Association. He was advanced to four-star rank on the retired list by Congress in 1985.







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