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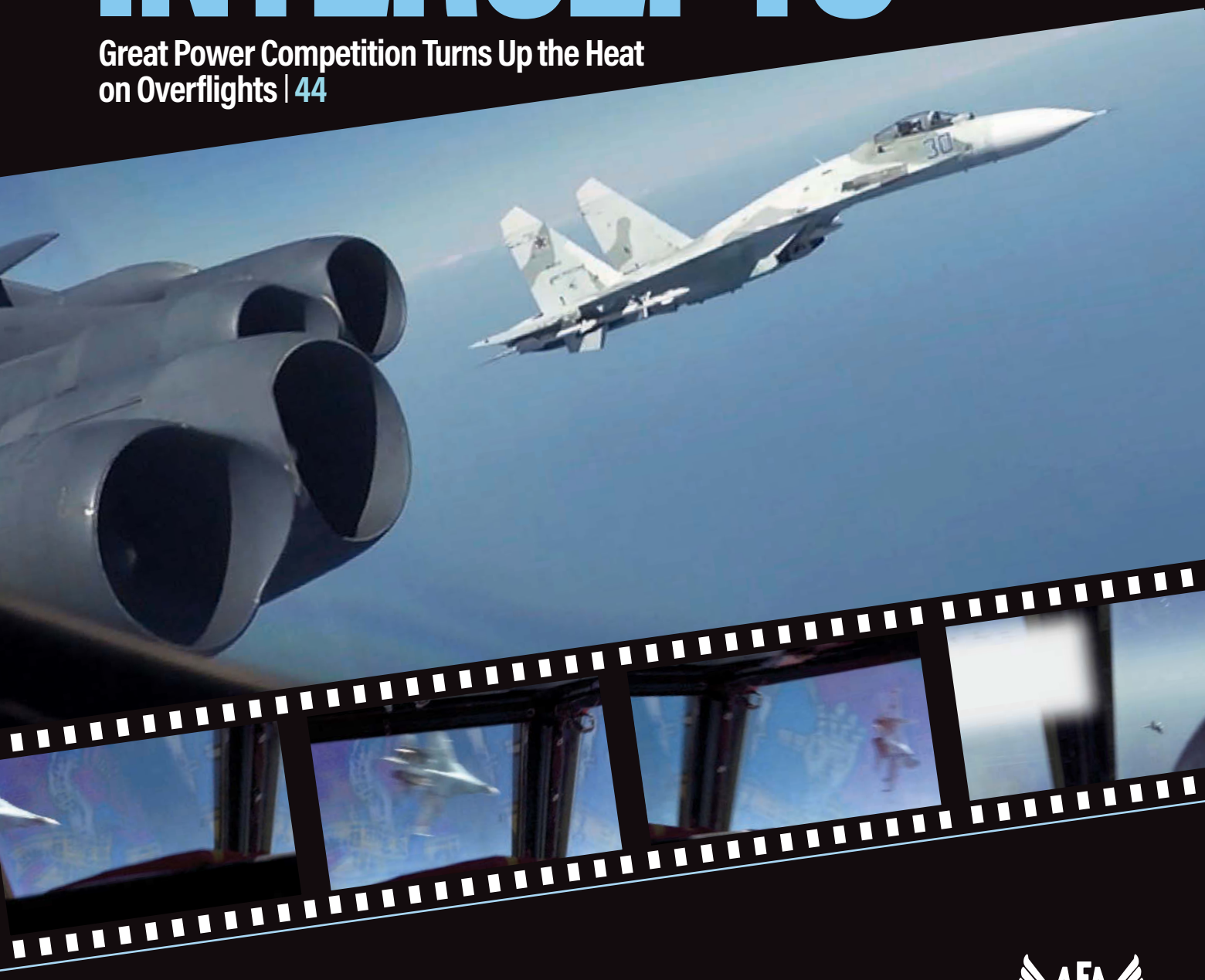

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AIR FORCE

November 2020, Vol. 103, No. 11

Airman 1st Class Bailee Darbasie

Tech. Sgt. Taylor Cifuentes, an instructor at the Weapons School, preps an HH-60G Pave Hawk helicopter for a Gunsmoke competition at Nellis Air Force Base, Nev., in 2019. See "Humble, Approachable Experts," p. 47.

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ON THE COVER

Staff Sgt. James Cason

A Russian fighter buzzes a USAF B-52. See "Close Encounters of the Familiar Kind," p. 44.

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By Tobias Naegele

Generating Fires, Not Hype

The U.S. Army is developing long-range missiles and artillery to extend its reach for great power competition.

It's a bold play for relevance at a time when the United States is shifting its focus from the dirty business of counterinsurgency to the looming strategic threats from peer competitors across the Arctic, European, and Indo-Pacific theaters. But, it is the wrong course for a modern joint force facing growing threats in virtually every domain.

The Army has this much right: The ability to launch long-range precision strikes is critical to deter aggression and hold adversaries at risk. They're right, too, that tightly connected, interoperable systems capable of sharing data in real time will be critical to complicating the threat picture for adversaries and that America's joint force should work together to develop the ability and capacity to shorten kill chains.

That, after all, is what joint all-domain command and control is all about: leveraging connectedness, computing power, and artificial intelligence to automate and accelerate decision cycles.

But the Army is wrong that these factors point to the need for 1,000-mile surface-to-surface weapons—the Army's anticipated "mid-range capability"—or long-range hypersonic surface-to-surface missiles that can travel thousands of miles, a throwback to the Army's Cold War-era strategic force, when it had Pershing II intermediate-range nuclear missiles.

"It's a strategic weapon," says Lt. Gen. Neil Thurgood, of the Army's Long-Range Hypersonic Weapon. "It's not long-range artillery."

The Army is missing the point. This is not efficient—or stealth.

But does it add value to U.S. defense? Or is this really just about seeming relevant and winning the fight for resources rather than deterring and defeating adversaries?

Army leaders cite three reasons why launching long-range missiles from mobile land-based launchers is advantageous:

■ **Range.** They see a need for missiles that can counter the anti-access/area-denial ranges of Chinese and Russian weapons.

■ **Stealth and mobility.** They argue such missiles and launchers can be inexpensively hidden under camouflage or in tunnels.

■ **Cost.** A mobile launcher is more affordable than a ship, submarine, or bomber aircraft.

All three fall well short of the target.

True, mid-range 1,000-mile missiles would extend the Army's battlespace—but to what end? The Army can't maneuver over that distance, which is more than twice the range of a Black Hawk helicopter and a week's drive in typical combat vehicles. To fly that distance would require multiple aerial refuelings by helicopter or a formation of Air Force C-17s.

More to the point, shooting guns and missiles at that range can be done more efficiently and effectively from the air. Worst case, one could use Tomahawk land-attack cruise missiles fired from ships or submarines at sea. Operating from international waters, they need no permission and put no forces at risk.

By contrast, the Army's solution requires the capacity to get that heavy, wheeled launch platform onto land within 1,000 miles of the target. That means prepositioning it on ships or on foreign bases (which may refuse permission to fire from their territory). It means moving those weapons on ships or trains at minimal speed. It means everyone knows what you're moving, when, and where. True, once in theater, you can hide in a bunker, a warehouse, a tunnel, or under a bridge. You can dart out, fire a few rounds, and then hide again like the Iranians and North Koreans. You'll have to—you won't have much ammunition with you for subsequent fires.

That's not efficient or stealth.

Stealth is flying in, undetected, with a B-2 bomber laden with a bellyful of precision-guided bombs that can obliterate a dozen targets on one run. Talk about efficiency! Need more firepower and can't risk taking on anti-air defenses? Fly in a four-ship of B-1s or B-2s and launch your standoff weapons from afar. You'll have more range, more kinetic firepower, less risk, and greater precision. You'll also have second chances, should initial shots miss. That's not true in the Army scenario.

Think of it: The closer you can get to the target, especially a mobile one, the more likely you are to hit it; the further away, the more time and chance there is for something to change.

The Army's cost argument is similarly specious. These weapons don't exist today; they must be developed, tested, procured, and fielded; doctrine needs to be developed; a logistics chain built; forces need to be diverted and trained to operate and defend it. Then, it needs to be integrated with the other services' command and control architecture to plan and deconflict the use of those weapons. Those are all real costs that must be calculated into the total. And for what? To field a second-rate solution to a problem the Air Force and Navy have already solved.

Though air defenses have gotten better, so has Air Force stealth. Low-observable aircraft are designed to penetrate and destroy enemy defenses, then pave the way for less costly, more amply armed follow-on forces. They can fly home, reload, and be back on station within hours.

By contrast, a handful of mobile launchers can fire a handful of missiles. Once they do, they'd have to go hide for a while. It's not like they can dash to a mobile weapons dump to restock them.

Army leaders argue that increasingly sophisticated and long-range defenses hold at risk military bases within that range. Last January's Iranian missile attacks on two U.S. bases in Iraq demonstrate how dangerous such attacks can be. Ironically, it's the Army's mission to defend those air bases. The Army could be investing today in base defense but isn't. It's trying instead to replace those bases with its own organic fires.

They miss the point. Mobile launchers can't provide all the other things an Air Force base does—services like moving ammunition, food, and fuel, delivering close air support, and providing theater-level intelligence—and, of course, delivering a devastating volume of ordnance against an enemy, when and where it's needed, with speed and precision.

"Look, we welcome good ideas," notes one Air Force leader at the Pentagon. "The objective needs to be how to most affordably provide fires that hold targets at risk."

No one achieves that objective better than the Air Force. USAF achieves that objective. The Army's new missiles will not. ✪

LETTERS

Doctors in Space

I have read several articles about the Space Force. None have mentioned how medical care will be provided to the Space Force members. Will Space Force be a tenant at whatever base or bases its forces are located? If so, medical care will be provided by the base host. If Space Force will have its own bases, then presumably it will have its own medical staffs. Will physicians, nurses, and [healthcare professionals] have special training, which might be required for the support of Space Force missions? As a former flight surgeon certified in the field of aerospace medicine, these questions interest me.

Edward H. Parker Jr.
Walla Walla, Wash.

Beam Me Up

I believe it was Congressman Ben Crenshaw that stated that Space Force ranking [should] be like the Navy ... because of Star Trek. Seriously? Air Force ranking is similar to Army ranking, since the Air Force has it's roots in the Army. Therefore, it makes sense that Space Force ranking follows the Air Force. Even the Marines don't use Navy ranking.

Mike Hupence
Schnectady, N.Y.

Warskills

Gen. Charles Q. Brown Jr., CSAF, in his document, "Accelerate Change or Lose," August 2020, proposes the need for Airmen to establish a capacity to expand their warfighting skills and to be more flexible in supporting warfighting processes.

I was assigned to the 8th Tactical Fighter Wing (8TFW) at Kunsan Air Base, Korea, in 1977-78 as a captain in the intelligence division of the wing. Although the wing had two fighter squadrons, all intelligence personnel were assigned to the wing. One officer and one NCO were attached to each squadron for training and daily current operations. The intelligence division consisted of 19 personnel under the wing director of operations and had an ops intel branch and a targets branch. The division was not fully manned for war and had to be augmented during inspections and major exercises.

A blessing at the time was the "Warskills Program," in which personnel from noncombat support functions like personnel, finance, engineers, mess, etc., were tasked to augment the combat support functions like munitions, maintenance, command post, air police, and intelligence. We were allowed to scan assigned personnel listings with their training and job backgrounds. We interviewed potential personnel and selected those who were then attached to the intelligence division for training during exercises and pre-operations readiness inspections or [operations readiness exercises].

Based on our personnel strength and the standard for most fighter wings, we were authorized four Warskills personnel. We always had five [or] six personnel identified, and four fully trained. We were extremely fortunate to have former intelligence personnel who had lost top-secret clearances in previous assignments because they had gotten married to foreign nationals. We were lucky to have a staff sergeant who was a RIFed (reduction in force) captain and former Air Force navigator who we used in the targets office to help aircrews do their combat mission planning. We also found a mess sergeant in our wing who was a former Korean linguist and intelligence analyst in the Army. We used him to brief threats to both American and Korean aircrews, as well as to our command post. Others helped us in briefing and debriefing aircrews during training or combat mission exercises. Others helped us in "ripping and stripping" charts for drawing combat routes during conventional and special exercises.

I believe the Warskills Program was a benefit to our fighter wing, using assigned personnel to immediately augment combat support functions as required.

Lt. Col. Russel A. Noguchi,
USAF (Ret.)
Pearl City, Hawaii

Confuse-a-SAM

One important aspect of future offensive air campaigns that was not mentioned at all in the article was the use of decoys ["A Better Way to Measure Combat Value," September, p. 60]. I believe it will be highly advantageous to launch as many decoy systems at a future enemy's A2/AD (anti-access, area denial) complex as possible. Additionally, each decoy, using the Miniature Air-Launched Decoy (MALD) as an example, should have some type of small warhead—10 lbs. would be enough—say, to damage an antenna or a SAM (surface-to-air missille) on its launcher, and some basic type of passive radio frequency (RF) seeker. In that way, the enemy is forced to go after each and every single decoy, because they won't know whether it is a high-quality weapon or a cheap one. Another thing that would help to confuse the enemy and cause them to waste SAMs would be to give all the decoy missiles a variable radar cross section (RCS) capability and artificial intelligence communications with each other, such that a spread out formation could essentially 'blink' the largest RCS back and forth around the sky, drawing the SAM's aimpoint all over the sky, kind of like a piano player stroking his fingers over the keys from side to side, with targets appearing and disappearing in various patterns designed to cause the SAM to blow it's energy maneuvering and miss.

Meanwhile, the good stuff sneaks in from unanticipated directions and knocks out the targets. In other words, design the decoys essentially as very cheap, low-peacekeeping cruise missiles, which have a basic low RCS that can be increased or decreased by computer control. Give the MALD a small warhead and dirt cheap RF homing, and build many thousands of them, like Khrushchev's sausages, so they will be cheap. Call it MALD-K, for Kill. It doesn't have to be good at all, just cheap and numerous. Maybe we could license this to Taiwan and prepare thousands ready in launchers all over the island. Same on the Japanese Southwest Islands, and Eastern Europe too. Deploy thousands in Poland and Romania.

A version of this technique was used by Israeli pilots in the Mideast wars, getting the SAM site to fire over and

over at circling fighter aircraft that would then dip away just out of the envelope. When the SAMs were all expended, the Israelis could then attack the site.

MSgt. Christopher Dierkes,
106th RQW
N.Y. ANG

With deference to Lt. Gen. David Deptula and Douglas Birkey, their espousal of combat value is an outgrowth of two larger factors that have plagued U.S. air power for years. When faced with the massive cost-to-kill issue, it is only natural to go off on an exercise to prove that your suggested employment of air power is proper and justified. In fact, they did a marvelous job. I would like to address the reason the authors felt compelled to compile and compare air power options with various aircraft and, to use the oxymoron, less is more, when talking about numbers of aircraft.

The reason is risk avoidance. (1) Let's not endanger our pilots, and; (2) limit damage lest a noncombatant is killed. Does anyone really believe the Gulf War enemy defenses justified using F-117s to strike 40 percent of the fixed targets? No, of course not, the real effort was justifying the large, very expensive classified program to develop stealth aircraft. The air defense environment was avoided so as not to risk a loss, thus casting stealth in doubt since a Third World defense would've triumphed. Precision weapons do destroy the target, but they are expensive to develop and expensive to replace when compared to more conventional weapons. Think of buying printer ink when looking at the cost of replenishment—pretty expensive, isn't it?—and it always seems you need it. The goal of not endangering pilots is met by evermore expensive aircraft with enhanced situational awareness, communication networking, defensive weapons, etc.

Bombing and damage were beautifully articulated by retired Air Force Lt. Col. Perry Clausen in an article for the Naval Institute's Proceedings in January 2005. "'Shock and awe' require someone to be shocked. Instead of killing the enemy, some buildings and rusty tanks were destroyed for television viewers, while thousands of enemy soldiers simply went home—many to fight another day." The Air Force exists today as the most expensive option available to support ground forces and take out specified, limited-value targets. It flies and fights in Third World countries with no air defense or counter-air, yet its supporters feel obligated to justify the evermore expensive way the Air Force spends tax dollars.

At the end of the article it states, "Threats posed by Russia, China, and a host of other nations like Iran and North Korea are very real." Certainly, the first response to Russia or China is a missile attack—standoff, of course, or ballistic. Iran and North Korea should not be in the same threat sentence as Russia and China. The bottom line now is we have an Air Force that saves U.S. lives and enemy lives and prolongs their will to fight. Shouldn't the alternative be considered? Employ the Air Force for the required death and destruction to quickly end to the conflict at hand.

Lt. Col. Greg Moyle,
USAF (Ret.)
St. Petersburg, Fla.

Belly-Flop

The KC-46 saga: I can't get it out of my mind ["Letters: Look a Boomer in the Eyes," June, p. 7]. Some months ago, I was invited to a formal function that included our then-Chief of Staff, General [David L.] Goldfein, and of course a bevy of lower ranking four-, three-, and one-stars. I made polite conversation with many, but one conversation sticks in mind. It was a three-star I was talking to, not in a flight suit, for a change, but in Air Force blues. The ribbons told me everything I needed to know. It turns out the KC-46 was on the general's plate. I am a pretty-much-to-the-point kind of guy, and asked why the boomer in the front cockpit? After all, we've fielded generations of tankers from the KB-50 to the KC-97 to the KC-135 to the KC-

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10, and the boomer has done his job lying on his belly—flying the boom, or drogue—and got the job done.

The general's response took me aback, "Don't you think that is a rather uncomfortable position?" I never thought of our boomers that way. After sitting for 12 to 14 hours in an ejection seat in an RB-47, I knew for sure that comfort was not something the builders had in mind when they developed that lifesaving seat. The boomer's prone position seemed absolutely luxurious to me. This may have been a flippant remark by the general ... but, maybe not. If I am going to go out and die for my country, that is a decision I have made a long time ago as a man. I expect not comfort from my weapon system, but efficiency and the greatest possible chance an engineer can give me to kill the other guy before he gets a chance to kill me. Our boomers, lying on their bellies, have no trouble refueling any aircraft we manage to put into the sky. They have good depth perception, they have peripheral vision, they know where the refueling receptacle is on whatever aircraft they are tasked to refuel. That's their job, and I have never, ever had a refueling terminated or not completed because the man—today, women of course, as well—couldn't handle his boom or the basket if it was drogue and probe.

The KC-46 problem is a self-induced problem and possibly representative of a fast-burner type of officer corps that no longer can distinguish between what is essential to survival and what is nice to have. Political issues aside, the Air Force acquisition office had to sign off on the boomer concept in the front cockpit, relying on software to give the boomer what he possesses naturally. I would have fought that concept tooth and nail, damn the promotions. I cannot think of an operational requirement for that change. That Boeing sold the Air Force a bill of goods with a second-rate software package, and was able to get away with it, is another mystery to me, and I know what I speak of as a former program manager for a major defense contractor, who is still around. Bad decisions, for whatever reasons, are made all the time, at all levels of government. They are made by good people who, at the time, for whatever reasons, thought it was the way to go. We know better today. Years ago, when a flight safety officer at USAFE Headquarters, I had some C-118 drivers at Wiesbaden Air Base, Germany, lodge a formal complain about having to wear Air Force blues—they wanted to wear flight suits like the fighter jocks. General Jones was CINC USAFE at the time. He decided the solution to the problem was to get rid of the C-118.

Problem solved.

Let's get rid of the KC-46, which has a tanker designation but really isn't a refueling tanker. Can't do the job.

I assure you that the new software package proposed by Boeing will have as many issues as the old—I grew up on software and think I know what I am talking about. The KC-46 is not a weapon system, to earn that designation it has to be able to perform its design functions. This airframe is something neither General Goldfein, nor the commander of Air Combat Command, are prepared to send into 'real' combat where not only mission accomplishment, but peoples lives, are at stake. We always have, and always will, care about the lives of our aircrews, written plainly into the tasking statement by General Arnold to his technical adviser, Dr. Theodore von Kármán, when Kármán was asked to come up with a report to define the air power needed for the future: "It is a fundamental principle of American democracy that personnel casualties are distasteful. We will continue to fight mechanical rather,

than manpower, wars," part of Arnold's tasking statement.

Nothing has changed since 1944. Our Airmen deserve something better than the KC-46. Money spent is water under the bridge—an old accounting slogan—and should not be a consideration at all. There are hundreds of commercial aircraft available at the present time at really good prices. Buy a bunch of them with the software money we are going to waste to make the front-seat boomer a reality, and turn them into old-fashioned tankers. It just takes a bunch of belly tanks, a refueling boom, and—you guessed it—the boomer lying on his belly doing his job.

We have not fought a 'real' war in years, where the bad guys are nearly as good as we are. We not only need quantity but we need quality that we can count on. No one can jam the boomer—but if it's software and designed by man, not avatars, then man can make it inoperable. The worst combat scenario I can think of is a hungry multimillion-dollar fighter sitting behind a tanker fully loaded who cannot transfer his fuel. Let's get hungry again and build weapons that will assure our survival.

Oh, as for those surplus KC-46s? They were transports to start with. I am sure we can find a use for them.

Col. Wolfgang W. E. Samuel,
USAF (Ret.)
Fairfax Station, Va.

Would it have not been cheaper, faster, and the KC-46 would be mission capable now to just have grafted the KC-10 boom and pod onto the aircraft rather than going through the "state-of-the-art" gambit and failing? Much different in the real world, when you need gas and the system is unreliable. I have been both a fighter back seater and tanker nav. Sometimes, tried-and-true beats erratic state of the art.

Lt. Col. Mike Wilmore,
USAFR (Ret.)
Driftwood, Texas

On Race, Unrest, and USAF

I read in earnest the many letters in the September Air Force Magazine, "On Unrest, Race, and USAF." As a retired colonel with nearly 28 years in uniform, plus an additional eight years as a government civilian on the SAF staff (now an OSD government civilian), I looked back over my career with alarm—was I part of the solution, or was I part of the problem? I confess that I have very seriously wrestled with this question almost daily since it thrust upon the front page. Reading those stories clearly points to a situation over the decades that finally exploded. Every day of my career, I have worked side-by-side with African Americans, had African Americans under my command and supervision, and have been directly supervised by African Americans who were some of the best leaders and mentors anyone could have asked for. Our mission is challenging enough, and introducing friction and pain points caused by nothing more than the color of one's skin is unfathomable. It honestly hurts to know that I could have helped more of those African American heroes who voluntarily put on the uniform to serve, and serve without being marginalized. This is one item where everyone is an action officer to be part of the solution ... right here, right now.

Col. Jim Holland,
USAF (Ret.)
Alexandria, Va.

It's OK, you can be a racist. Actually, our Constitution protects your right to be one. For years, I have told people that I have spent 24 years in the military to protect your right to be anything you want to be. That usually happens after you make some stupid racist remark, so you know what I'm referring to.

For years, we, as a nation and as the military, have progressed to protect minority rights, for individuals of any race or religion or sex to fairly compete for promotions. But, that doesn't mean we have become less racist or bigoted. Racism and bigotry went underground. You heard it—at a bar, after a few drinks, how that "Black blankety-blank" got elected President. How could general so-and-so get a fourth star? He's (fill in your religious, sex, or racist bigotry). We will break bread but only for "official" reasons. We really could care less about your background and experiences. Just don't let him move next to me after I retire.

What's different today is we have a Commander in Chief who gives you permission to express your true feelings. He tells you that he will protect YOUR suburban home from "those people." And, to think, you just might be a "sucker" or "loser" too.

Oh, I could go on and on, but I promised this would be short. Be the person you want to be. This is America (at least for a while longer).

Wayne P. Grane
Hobe Sound, Fla.

It appears to me that we are in a race to the bottom in the name of political correctness, at a time when we are facing perhaps the largest threat to democratic government in my lifetime in the form of a rising, aggressive, totalitarian China.

Did it ever occur to the authors to look at underlying factors such as comparative test scores and job performance reports rather than implying unfairness, racism, and discrimination?

And, I was shocked to see that we have eliminated below-the-zone promotions because apparently they are too white. These highly talented individuals often end up in key command positions and are precisely the type of people we need at the top.

If and when the war flag goes up, we want the best and brightest leading our military. Promotions should be based on merit and performance and not on politically correct factors. You can get away with aircraft carriers without urinals and assignments and promotions based on establishing racial and gender "fairness" because it looks and functions OK in peacetime when there are few consequences. But not against a first-rate military like China when our very survival will be on the line.

Col. Michael D.D. Madden,
USAF (Ret.)
Redding, Calif.

I was offended by the implications that the U.S. Air Force treats our Black

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Airmen different than anyone else. I entered basic training in April of 1980 and we were all Airmen. We had written rules and regulations with penalties for breaking the rules. There was a process for pleading one's case if there was a perception of, or an actual, injustice. We also had Social Actions as an avenue to deal with grievances that were ignored by our supervisors and/or leadership.

"Leveling the Field:" The graphs on pp. 28 and 29 show average promotion rates. The ethnicities were mentioned but was schooling considered? I had nearly zero study habits when I entered the military and may have lagged in promotions, too. There are a lot of variables to consider. Were the Airmen placed in the correct career field? I met Darlene when I was stationed at Osan [AB, South Korea]. She was a jet engine mechanic who was allergic to jet fuel, engine oil, and hydraulic fluid. She could only fill clerical positions, so career progression was unlikely. With regard to discipline, I served as a correctional custody duty NCO in Europe and in upstate New York. The resident population was a good representation of the Air Force population.

"Black Airmen Speak:" This left me shaking my head. Are people offended because someone pointed out a reserved parking spot? Ever hear someone say, "That's a handicap spot" before realizing the person is authorized a handicap spot? When was the last time a person of color was followed through AAFES or an unarmed Black person was shot by security forces on base during a traffic stop? Lt. Gen. Anthony Cotton mentions George Floyd and others and uses these as making a case for racism. Each individual he named committed a crime resulting in a law enforcement response. Their demise isn't the result of racism, but more to their actions during the encounter. Take Freddie Grey for example. Stephanie Rawlings-Blake, Mayor of Baltimore; Anthony W. Batts, Police Commissioner; Jack Young, City Council President; Barry Williams, Judge; Marilyn Mosby Attorney for Baltimore City; Loretta Lynch US Attorney general; President Barrack Obama, and three of the six police officers are all Black.

We are Airmen and a family. The never-ending surveys costing thousands of dollars referencing "diversity" and "inclusion" put us in segregated boxes.

Can we, for once, be Americans and do the important mission we are here to do?

MSgt. Stuart M. Oberdeen,
USAF (Ret.)
Dayton, Ohio

The tactless conclusions Maj. Patrick J. Hoy (USAF, retired) draws in his October commentary about racial incidents are staggering, and too numerous to address entirely. So I'll just address his statement that George Floyd, Michael Brown and Trayvon Martin were "thugs and bullies who reacted violently," implying they received what they deserved. This attitude misses the point. Whatever their transgressions (none of which involved a weapon), should have resulted in due process and jail time, not a summary trial and execution by their apprehender. Floyd died with a knee in his neck, Brown was shot multiple times from several feet away, and Martin was stalked in his own neighborhood while walking home. I recognize the controversy of many of the political positions of Black Lives Matter, but Major Hoy's attitudes go far in highlighting the diminished value many place on Black lives, and his attitude actually underscores the problem in his attempt to dismiss it.

Col. Keith W. Reeves,
USAF (Ret.)
Gainesville, Va.

During my 52 months in the AF (1964-68), I neither witnessed or heard of any racial bias incidents. The only color that counted was blue. I hope that's still true. The charge of systemic racism is nonsense.

What we really have is systemic political correctness and a tidal wave of "wokeness" that is destroying our nation. Here are two toxic examples: 1. Critical Race Theory (CRT), a doctrine that claims all White people are inherently racist oppressors, and all people of color are inherently victims of racial oppression. President [Donald J.] Trump canceled CRT courses that were conducted at federal agencies, including the Air Force. But they're still taught in the business and academic worlds. 2. A cancel culture in the media and academic life that stifles free expression and shatters careers. Harper's Magazine posted a letter signed by 150 writers, artists, and academicians that condemned the cancel culture as a threat to our democracy.

Richard Reif
Flushing, N.Y.

Historical Oops

There is an error on page 68 in the very interesting John T. Correll story "Rise of the Air Corps" [September], the article erroneously states "... the Curtiss P-36 Hawk, forerunner of the P-36 Warhawk ...." It should have stated "the Curtiss P-36 Hawk, forerunner of the P-40 Warhawk ... ."

In the July/August issue of Air Force Magazine, the captions for the pictures on pp. 58 and 59 in the "The Spaceplane: 60 Years On" are reversed.

Lt. Col. Ed Sienkiewicz,
USAF (Ret.)
Bonaire, Ga.

Editor's Note: In the article "Airman for Life: Preserve Renamed for WWII Combat Flier" [October, p. 61], the name of the New Jersey Chapter "Shooting Star" Vice President, Jim Morgan (pictured 3rd from the right) was inadvertently omitted from the caption. We regret the omission.

Balancing Act

Lt. Gen. David S. Nahom is the Air Force Deputy Chief of Staff for Plans and Programs; the "A8." He programs the flow of systems entering and leaving the force. He spoke with Air Force magazine Editorial Director John A. Tirpak on Sept. 24 about how the service is accelerating change, balancing immediate and long-term readiness, and adapting to new threats.

Chad Trujillo/USAF

Lt. Gen. David Nahom leads the development and integration of the Air Force resource allocation plan as USAF's "A8."

Q. Gen. Charles Q. Brown Jr.'s "Accelerate Change or Lose" paper has injected new urgency into Air Force transformation. How has the threat changed since the National Defense Strategy came out in 2018 to drive this new urgency?

A. The National Defense Strategy is a very well-written document. I believe it correctly pivots not only our Air Force but our entire joint force toward peer competition to make sure we're ready for what is next.

I believe it got the threat right. … But I also believe the threat is accelerating. Our peer competitors have really hastened their transformation and are bringing new capabilities to the field sooner than we would have expected. We in the Air Force really believe that this necessitates our need to accelerate change, as well.

Q. How do you do the calculus that tells you what capabilities the Air Force needs, and when?

A. In the last two years, the Air Force, correctly, split the A5 (strategy, integration, and requirements) and the A8 (plans and programs). Why is that important? On the A5 side, we now have a very smart crowd that looks strictly at the design, the strategy, the threat, how it's all going to come together, not only with our joint partners but with our coalition partners.

That cleans up the plate for me to look at ways to actually get the Air Force to that design, and frankly, in an affordable manner. So we look very closely with the A5 not only at the design—what the Air Force should look like—but about how we get there. … To make sure we're correctly addressing the threat and mitigating any deficiencies.

It's a very difficult balance because the resources needed to modernize—the money and manpower—are the same resources I need now for day-to-day operations.

That's where the art of this comes in. The balance of maintaining a credible defense and deterrence today, but also in the future … designing a force that can win against a peer competitor.

In a perfect world, you could shut down the U.S. Air Force for a couple of years so we can modernize. But we all know, with the world we live in, that's not possible.

Q. How do the other services' programs affect yours? The Navy and Army are pursuing long-range strike. In your planning, are you counting on their capabilities to come about?

A. There are a lot of healthy discussions going on right now about long-range fires.

In a potential peer fight, volumes of fires, long-range fires, are going to be very important. It's useful having the other services look at different ways of doing it.

For me, it always goes back to the kill chain. And the part that's so important is to 'find and fix.' That's one thing if the target's stationary, but it's a whole other thing if the target's mobile.

We in the Air Force … are often in a better position for that find and fix. In terms of fires in general, not just long-range, we bring something that the other services will never be able to bring. That makes us unique. Not to mention, we can be ready at a moment's notice, just because of the nature of our bomber force. We can be ready here in the continental U.S., and not have to worry about permission to use airspace of other nations, etc., and we can be anywhere very quickly. That makes us different.

The other thing is the networks we're building.

In the joint world, the word is JADC2, or joint all-domain command and control. In the Air Force we talk about our Advanced Battle Management System—ABMS—but really it's how we bring together not just the Air Force sensors and shooters but all the joint partners, and how we share data and targeting information. That's very important because shooting a projectile a long distance is impressive, but what's *very* impressive is hitting what we need to hit at a time and place of our choosing.

Q. Will Roper, the Air Force acquisition executive, was very excited after the early September ABMS experiment, in which a cruise missile was shot down with an artillery round. How does this feat affect your planning for air base defense, when the Air Force is planning to rapidly move around among various austere bases in wartime?

A. Those are very attractive options to defend your stuff when you're operating in places potentially in range of enemy fire.

The excitement you heard was that this represents a way to get on the correct side of the cost curve. It's hard to win a long fight when what I'm using to defend myself is more expensive than what they're shooting at me.

More important than the projectile, is the 'finish' part of the kill chain; the entire 'find and fix,' that entire JADC2 ABMS network that came together that day, to allow us to aim that projectile at that incoming cruise missile at exactly the right time.

That is not going to happen by accident. We're going to have to build this network, take advantage of data at machine speeds, and give decision-makers the tools they need to make these decisions very quickly. Because an enemy attack in a peer competition, 5 to 10 years from now, is going to be happening very fast. We have to be able to move information and data much quicker than we do right now.

Q. But what's the practical result? Do you buy artillery pieces? Does the Army go with you when you go to austere bases?

A. It's not just about defending air bases. … This was showing us ways that we can look differently in the future. I think that exercise opened a lot of doors for the joint force.

Q. There's a lot on the Air Force's combat aircraft plate: the F-35, the F-15EX, the Next-Generation Air Dominance aircraft, Low-Cost Attritable Aircraft, an MQ-X. What are the priorities, and how do you match them to an adversary's calendar of fielding new things in five, seven, 10, 15 years? What are the off-ramps if a program is overtaken by events?

A. We have a lot of legacy systems in our Air Force. Meaning, 'old.' And we have to refresh a lot of them.

The cost to sustain and modernize is just eating us up. My weapon system sustainment costs right now are far outpacing inflation. Bringing in new systems to refresh our Air Force is critical.

You have to look at the systems we need to move out first. Because not only are they costing us too much money, but they're offering us too much risk. You're seeing that right now with the F-15Cs. You're going to see us moving them out quickly and bringing on the F-15EX as quickly as we can to recapitalize those units, where and when we can.

And when we bring systems out, you may see some gaps in certain areas. And that's the risk piece we're going to have to have.

We don't have money and manpower to have overlapping systems. We just don't. If you have a fighter flying right now, the money and manpower to operate that fighter is the same money I need to operate a new fighter. If you bring the new one on, you can't overlap them for a couple of years until you're completely comfortable.

But, certainly in the prioritization, we're looking first and foremost at the lethality.

Also, there may be other platforms that can backfill [a capability] in a different way. You may be able to achieve [intelligence, surveillance, and reconnaissance] with a different platform; differently, but get the same result. So, to mitigate the risk, we may be looking at other platforms to pick up the slack.

We also may be working with some of the other services, or working with coalition partners to help us out, maybe mitigate some of the risk, while we modernize a platform or a capability.

In some cases, we can take an older platform and we can modernize it, like the B-52. But, in some cases, it's actually better to look at a new platform. Look at the [shift from] B-2 to the B-21: It's more cost-effective, and you get a much better capability to take us into the future.

Q. In the last few months, many senior leaders, including yourself, have suggested the Air Force really needs 220 bombers, vice the 158 it has today and a notional 175, ultimately. Why not simply—officially—state that requirement?

A. My biggest concern with bombers is not the numbers right now. We have a three-bomber fleet with the B-1, B-2, and B-52. In a matter of years, we're going to go to a two-bomber fleet: the B-21 and a very modernized B-52.

Between now and then, we're going to go through a period where we'll have a four-bomber fleet. My biggest concern is minimizing that overlap. How quickly can we get the B-21 in and operational? How quickly can I get the B-52s modernized so then we could correctly divest out of the B-1 and the B-2? That is the big trick.

Do we need to grow beyond that, to a larger fleet? "The Air Force We Need" very clearly stated that, and we actually have analysis that shows that we need a larger bomber fleet.

But when we grow, we need to grow with the B-21 in mind, not maintaining legacy [aircraft] longer. Keeping the legacy longer is going to cut into the resources we need to modernize.

Q. Discuss your planning horizon. When it's year-to-year, that tends to drive small adjustments. Where are the break points for the big changes?

A. The threat never sleeps, and conditions are always changing, so we're constantly assessing where we need to go. We're obviously always looking long-term, with the A5. We also plan in a cycle of five years, the [Future Years Defense Program], so we're always assessing five years out, but, at the same time, I have a planning cell that's looking one FYDP past that, as well.

Our newest fighter, the F-35, and some of our previous platforms, had really long development cycles. There's new technology now that we're hoping really changes that. You've heard Dr. Roper talk about digital engineering, and the potential to get on a much tighter timeline for how we develop new platforms and capabilities.

We're really excited that we can potentially plan in much shorter timelines in the future. There's just a lot of hope for this, bringing new systems like the T-7 trainer into service much quicker than we would have in the past.

Q. The Chief and others have said the Air Force probably has to give up the idea of having air superiority everywhere, all the time, because peer competitors are catching up. How does that affect how you plan?

A. First of all, we as an Air Force must always be able to achieve air superiority at a place and time of our choosing. There may be a temporal aspect to that in the future, but if we need air superiority for an operation … we need to have the ability to do that. And over the next four or five years, I think everyone will see that we're absolutely committed to that.

Since 9/11, we've been operating in a permissive environment, where we really had freedom of maneuver in the air all the time. With peer competition, that's not always going to be the case. We're going to have to work for it.

Q. How much more does the Air Force need to do everything it's been asked to do?

A. I don't want to put a number on it. Let's just say we have a flat topline going forward, and look at what that does to our service, when you have inflation. I have weapon system sustainment costs going up, manpower costs going up. Even if [the budget stays] flat, my buying power changes, in a negative direction. So we're not always going to have the resources we want. It's a delicate balance. ✪

VERBATIM

War Room

Lisa Ferdinando/DOD

"I'm not going to engage in speculation. I'm going to engage in the rigorous analysis of the situation based on the conditions and the plans that I am aware of and my conversations with the President."

—Chairman of the Joint Chiefs of Staff **Gen. Mark A. Milley** on the possible withdrawal of 2,500 American troops from Afghanistan by early next year [NPR, Oct. 12].

Round Trip

"We're excited to see what you would pack for the ultimate adventure—a trip to the Moon."

—Bettina Inclán, NASA's associate administrator for communications, inviting citizens to describe what they would pack in a 5-by-8-by-2-inches "personal preference" bag on a trip to the moon, Oct. 6.

NASA

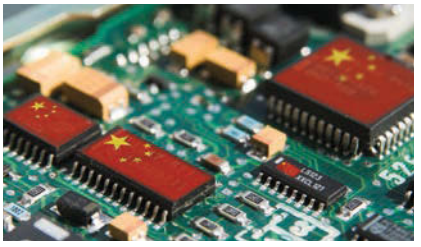
Not Today

Mike Tsukamoto/staff

Threat Pictures

"If you visit my office here in Omaha, you will notice that I keep pictures of Xi, Putin, the Ayatollah, and Kim on my wall, under the words, 'Not Today.' They are a constant reminder that we must remain inspection ready, and keep us intently focused on the threats we face."

—**Adm. Charles A. Richard,** commander of U.S. Strategic Command, in an Oct. 21 message to the Center for Strategic and International Studies' virtual conference on International Security at the Nuclear Nexus.



Mike Tsukamoto/staff; Pixabay

Cyber Insecurity

"China has effectively seized considerable market share in several critical technologies and components through a mix of investments; engagement ... [and] protectionist policies. ... The reality is that the United States has lost much of its market share for the manufacture of electronics components and nearly all of its market share for the manufacture and assembly of finished electronics products."

—**The U.S. Cyberspace Solarium Commission,** co-chaired by Sen. Angus King (I-Maine) and Rep. Mike Gallagher (R-Wis.), on the vulnerability of the U.S. information and communications technology supply chain.

Prepositioning

"The foremost family of threats to the United States stem from China and the challenges it is offering in every domain from cyber to conventional military to a kind of a novel approach to expanding influence through ... apparently benign offers to build things. ... It doesn't take very long before gradually China becomes the owner of the port or the highway or the power plant ... and begins to have enormous influence over that government's policies. ... China's goal in all this is to ... gain resources like cobalt in Congo, or lithium in Chile, [and] key locations, such as Suez Canal, Djibouti ... Malacca, [or] Gibraltar—strategic locations that enable them to function in the event of conflict and to project their forces with confidence."

—Former National Security Advisor **Bud MacFarlane** at the Atlantic Council [Oct. 19].

Whose Authority?

"Until recently, you needed the permission of the President of the United States to come close to another satellite. But given the right guidance, an 18-year-old can kill someone on his own authority in the middle of a war zone. Those are interesting, centralized controls for some things, and very decentralized in other circumstances. Getting that balance right will be difficult."

—Former **Air Force Secretary Heather A. Wilson,** speaking at an Oct. 22 Center for Strategic and International Studies event.

Navel Gazing

"The F-22 is a state-of-the-art aircraft. With joint all-domain command and control, the Navy can actually leverage a fifth-generation aircraft. It becomes a force multiplier for all the services being integrated."

—Rear Adm. James Aiken, Carrier Strike Group 3 commander, told reporters on a Sept. 24 call about the third Advanced Battle Management System experiment, the first in the Indo-PACOM region.

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THE ART OF EXCELLENCE™

By John A. Tirpak

Brown's A-B-C-Ds for Accelerating Change

The Air Force's new Chief of Staff has an easy mnemonic of how he'll move the service to "accelerate." He calls it the "ABCDs" of change: a focus on Airmen, bureaucracy, competition, and design implementation. In pursuit of rapid change, though, he's worried that a USAF "culture of consensus" is hampering top-level debate and decision-making.

Gen. Charles Q. Brown Jr., in an October streaming event with AFA's Mitchell Institute for Aerospace Studies—his first extended public conversation about how he's approaching his goals—said the ABCDs are the "what" to go with the "why" he outlined in his 14-page coming-in manifesto, "Accelerate Change or Lose."

That document argued that USAF is facing "accelerants" in the form of rapidly advancing peer adversaries, the stand-up of Space Force, the COVID-19 pandemic, and racial disparities, to name just a few. The Air Force must speed up everything from command and control to how it buys hardware to keep up.

"This is about ... taking a hard look at yourself," Brown said. Part of that will be recognizing, "no matter what happens to our budget, we're going to have to make tough decisions. We always have more requirements than money."

The "A" is no surprise. Brown said the top priority must be taking care of Airmen and their families, and assuring their quality of life.

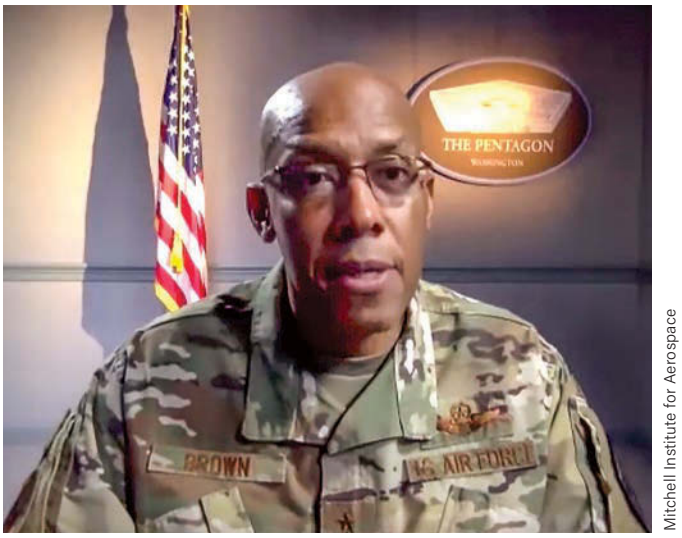
"They have to appreciate coming to work each day," he said. Airmen need the right training and guidance, and should enjoy their jobs. "We have to take care of them in their off times," and "retain the families," who usually get the biggest vote on whether someone remains in the service, Brown observed. Airmen must also accept responsibility and take risks, and under his watch, "they can't always wait and ask for permission" to do things that need to be done.

"We have to ... let them know we trust them to do their job, at the same time they trust their leadership." He'll be focused on making sure Airmen can reach their full potential, are empowered to handle complex situations, and have "all the tools" they need.

"I hate bureaucracy," he said; "I like cutting to the chase and getting things done." While some bureaucracy is necessary, he's convinced "we can do things a little bit faster. There's a bit of redundancy [in the process], things we could do differently."

Brown is looking to flatten the organization, especially in Washington. "We have so many government structures," each requiring its own decision chain, that "we may be ... canceling ourselves out," he stated. "We tend to try to blame it on someone else," he added, but USAF is going to "get on a timeline" for changing the bureaucracy and speeding things up.

The National Defense Strategy spells out how USAF must confront peer competition, Brown noted, and while he thinks the service understands Russia, given residual knowledge from the Cold War, with "China, we don't have the same depth of understanding. What makes them tick?" He plans to make deeper study of China—and competitors generally—a bigger feature of professional military education, especially at the upper levels. But "C" for competition will also mean scrutinizing every Air Force action, particularly procurement, through "the lens of what the threat is. It may change how we acquire ... future investments."



Mitchell Institute for Aerospace

The Air Force's "culture of consensus" may be a brake on faster decisions, but Chief of Staff Charles Q. Brown Jr. wants to cut through such delays, hear all sides of a debate, and get to decisions faster, he said in October, during a Zoom call with AFA's Mitchell Institute for Aerospace Studies.

The "D," for Design implementation, focuses on shaping the future Air Force, and following through with the plan. The service is moving to develop a strategy "and then figure out how you fund it, versus the other way around." It also stood up the Air Force Warfighting Integration Center to manage the merging of USAF capabilities.

"That has been helpful," he observed: to "lay out the future design and ... focus" on it. Now it will be up to Brown to implement that design "so that when we get to 2030, and beyond, we have the Air Force we need." But that will "drive us to some tough decisions."

The "Air Force We Need" statement of requirements the Air Force provided at Congress' request two years ago remains a good benchmark, but Brown said that budgets may dictate that he find ways to provide the called-for 386 combat squadrons of capability with a smaller footprint.

CORONA CHOICES

During the Air Force Association's virtual Air, Space & Cyber Conference in September, service leaders waved off questions about new directions in the fiscal 2022 budget, saying those choices would come at a major Corona meeting of top service leaders in October. But, Brown said the Corona produced few of those decisions.

"This is a process. I like to iterate things," Brown explained, saying he'll engage separately with the Major Command commanders

and other stakeholders to "move the ball forward."

The Majcoms need to be adaptable, he said.

As the former top Airman in Central Command and later in charge of Pacific Air Forces, Brown said he understands the pressure on field commanders "to make sure your capability is fully resourced." But "we can't do that for all the good ideas we have, so we have to figure out how to provide the best for the dollars we have available, and make those tough decisions."

Under budget plans discussed at the Corona, not all Majcoms would get their No. 1 budget request, Brown said, but "we've got to look at the entire Air Force." Some of their top priorities, "may not be the Air Force's," he added. He didn't specify any of the systems or capabilities the service may have to give up to afford new investments.

How to minimize the bureaucracy on the Air Staff, and "how we engage" with Majcom chiefs, was another main discussion at the meeting.

CULTURE OF CONSENSUS

Brown expressed concern about the Air Force way of doing things "from the bottom-up," saying its "culture of consensus" may be a brake on the system.

"It's amazing, at this level, how many things come to you, and it's already been decided" in the staff work already done. "I'm not even sure why I'm signing off on the piece of paper because they've already come up with the answer." But he worries, "Is it the right answer?"

This culture slows things down because "you can't get everybody to agree, so you don't agree, and you keep working it until you beat down your dissenters," and only then does an issue go to the boss for approval.

"Sometimes I want to hear what the other side has to say," Brown asserted. He frequently criticizes the "meeting after the meeting," in which those with views varying with the rest of the group hold their comments until the meeting is over.

"If you disagree, speak up," he urged. "Don't go out in the hallway and then disagree, because I'm not going to hear that part. ... The train's leaving the station, and if you have a different view, let's have that conversation."

On the other hand, he expressed impatience with those who offer dissent based only on judgment. "I get that, but there's also got to be some data" backing up a contrary position," he said.

Brown expressed frustration with decisions made before they reached the enterprise-level of debate. He wants to be "included in the conversation ... earlier in the process." If the Chief is not included until "the very end, I have very little wiggle room" to exercise enterprise-wide judgments.

By having more debate within the service, Brown said, "We can have a more consistent message of where the Air Force is headed," for both the internal and external audience of stakeholders, "so we're not fighting among ourselves, or competing among ourselves for dollars and capability all the way to the endgame." This will "help us cut down the friction, maybe move a little bit faster."

USAF must "figure out which [activities are] the most important, and where we take risk," Brown said. He wants these conversations to happen "in front of me," so he can see the impact of decisions on all parts of the force. Decisions for one part of the force, creating an "unfunded mandate" for another, creates problems, because then the "silos ... fight among themselves because 'the Chief said.' I want to get them all in one room, as much as I can, to have these deeper discussions so we can make choices."

Likewise, combatant commanders (COCOMs) will have to constrain their appetites for Air Force capabilities, so the service can invest in the future, Brown asserted.

He said he'll have to "lay out risk" better with them, so they see the need for future capability as well as in the here-and-now.

"No one likes to lose anything," he acknowledged, but COCOMs need to understand "here's what the future looks like," and "your successor is going to need" advanced capabilities. There needs to be "balanced risk," he said. "I'm not asking the combatant commanders to take all the risk. I don't think I should take zero risk. I think we both have to take a share of the risk."

EXTERNAL STAKEHOLDERS

It's a challenge convincing Capitol Hill and other stakeholders to think in terms of capabilities, which can be hard-to-visualize things such as networks, and not platforms, which have obvious constituencies, Brown said.

"We've got to get ... our house in order to talk about capability, less about platforms, and really focus on mission areas," he asserted.

Focusing on platforms is problematic, because each may have a suite of capabilities and requirements—sensors, weapons, manpower—that may not be obvious.

Changing a platform "may have some second or third-order impact on some new capabilities we're trying to get done," Brown said.

At an enterprise level, removing a capability here and there is "like a Jenga puzzle. You start pulling pieces out, that capability starts to go down. You may not see it for that particular platform," but do it often enough, and a real deficit develops.

He pledged to engage "early and often" with Capitol Hill, the other services, the Office of the Secretary of Defense, industry, and others "so they have an idea of where we're going." He wants to know early if "I have a blind spot" or "if we're talking past each other."

He doesn't want to "wait for the very end to find out we have a major issue with a key stakeholder ... that we could have mitigated if we'd taken the time to engage with them early," he noted.

GAPS AND SEAMS

Brown said it will be essential for all the services to look at their combined capabilities under the Joint Warfighting Concept (JWC). If they don't, they may not see "the gaps and seams, or the redundancies." He has previously said he would push for more discussion of roles and missions, as the Army and Navy are pursuing long-range fires—an Air Force role—with hypersonic missiles.

The JWC will "give us an opportunity to look at how we are doing as a joint force, not just an Air Force," Army, Navy, Marine Corps, or Space Force, Brown said.

Asked if there should be a roles and missions discussion on air defense—traditionally an Army role—Brown said, "We all have a responsibility for force protection," and that it will be impractical to rely on Army Patriot and Theater High-Altitude Air Defense systems, because "there will not be enough [of those] to go around."

"We need to have a conversation about who has responsibility for force protection ... from the fence line to hypersonics," inclusive of cruise missiles, ballistic missiles, and unmanned aerial systems.

The services also need to build into that thinking "the systems we'll use in the future that are not the systems we have today," Brown said. Those will include deceptive counter-C4ISR systems, "directed-energy, high-powered microwaves [and], high-velocity projectiles," the latter of which, fired from a Paladin vehicle, shot down a cruise missile during the Advanced Battle Management System experiment in September.

Brown acknowledged his stated solution to most of the issues he raised in the event is to "have a lot of conversations," but "that's the way you get past some of the friction points ... is to deepen your understanding. That's the way I operate. ... And that, to me, is going to help us accelerate." ✪

A World War II-era C-47 Skytrain leads C-130s from Little Rock Air Force Base, Ark., in a celebratory flight honoring the 65th anniversary of air operations at the Little Rock base. The Oct. 8, 2020, aerial demonstration was a comedown from the original air show that had to be canceled after two years of planning due to the COVID-19 pandemic. The base opened as part of Strategic Air Command in 1955 and operated as a bomber base until 1970, when its first C-130s arrived and tactical airlift became its primary mission.

Staff Sgt. Jeremy McGuffin

The U-2 Dragon Lady turned 65 in August, but it turns out you can still teach an old bird new tricks. In September, this U-2 completed a test flight while using Kubernetes, the Google-developed, open-source software architecture to automatically manage workload demands for on-board computing resources. Named after the Greek word for helmsman, or pilot, Kubernetes enabled the U-2's legacy computer system to run advanced machine learning algorithms without adversely affecting flight or mission systems, "a critical milestone for the development of software containerization on existing Air Force weapon systems," said Nicolas Chaillan, Air Force chief software officer.

Airman First Class Luis Ruiz-Vazquez

Johnny Saldivar/USAF

Decisions on which Army and Navy functions will join the Space Force are expected by year-end, says Vice Chief of Space Operations Gen. David D. Thompson, shown here before his Oct. 1 promotion.

Space Force to Lay Long-Term Groundwork in Second Year

USSF is already planning for what it wants to be in 30 years.

By Rachel S. Cohen

Charting a long-term vision will be a main focus of the newest service in its second year, Pentagon space policy boss Justin T. Johnson said during an Oct. 7 Heritage Foundation event.

Congress approved the creation of an armed force dedicated to space in December 2019. The Space Force is now breaking out from the Air Force to oversee personnel, equipment, and training for missions such as rocket launches, GPS satellite operations, cybersecurity of space assets, ballistic missile tracking, and more. U.S. Space Command and the other global command organizations use these capabilities daily.

"They have a lot of work across all their lanes, organizing, training, and equipping," said Johnson, who recently became acting deputy assistant secretary of defense for space policy. "Probably the biggest single thing that I know [Chief of Space Operations Gen. John W. "Jay" Raymond] is working on … [is] really fleshing out that long-term vision for the Space Force. What's the force design, force development elements of the Space Force? What does that future vision in 10, 20, 30 years need to look like?"

"What does that [USSF] future vision in 10, 20, 30, years need to look like?"
—Justin Johnson, Pentagon space policy boss

Broadly, the Space Force is considering how to fend off other spacefaring nations that may try to harm U.S. satellites and other assets, while accompanying American companies and NASA into orbit, to the moon, and beyond. Service officials are making the argument that the Space Force must defend U.S. economic, as well as military, interests in the modern Space Age.

It must also make progress in its second year toward streamlining and deconflicting the multiple organizations that handle space acquisition and maturing its various offices and commands.

Heading into the coming year, Vice Chief of Space Operations Gen. David D. Thompson is focused on building out Space Force headquarters at the Pentagon and its staffs that will handle operations, analysis, and future planning.

A Space Force press release said the service is ready to transition its headquarters work from the former Air Force Space Command hub at Peterson Air Force Base, Colo., to the Pentagon.

Thompson will also oversee the creation of the Space Warfighting Integration Center (SWIC), the Space Force equivalent of the Air Force Warfighting Integration Capability group that explores what resources the service might need in the coming decades. The SWIC may directly report to the Chief of Space Operations, pending congressional approval in fiscal 2022.

"We have conceived of SWIC as a key feature of force design and integration, not just internally, but with the rest of the force," Thompson said in the release. "What we now need to do is the hard work of defining exactly what it's going to do, exactly what its resources need to be, and exactly what its interfaces are going to be within the Space Force and the Joint Force."

Raymond and Thompson's decisions will shape how the rest of the Pentagon builds the Space Force into future strategy and adapts high-level policy to match the service's needs.

"How we talk about things, what we're deciding to defend, there's a lot of work to do in the space posture around that, but it really goes back to General Raymond and his team … laying out the really compelling vision for the future of the Space Force," Johnson said.

In the coming year, the Space Force will also take an important step forward in starting to bring in personnel from the Departments of the Army and Navy for the first time. Top Pentagon officials are still hashing out who will move over, though it's unclear when exactly DOD will finalize that decision. All told, the service plans to encompass about 15,000 employees—the smallest military branch by far.

"I think the vision is clear and consistent that we do want the Space Force to be the absolute center of gravity for space. There's some work to do, and that takes time," Johnson said.

Leaders worry that a misstep in the reorganization of military space could interfere with the systems and capabilities service members need to do their jobs each day, like navigation and communications.

"We don't want to drop any balls," Johnson said. "There'll be missteps and small mistakes along the way, but I think we're moving at speed, and General Raymond is the right guy to get it done."

Thompson expects a decision on which Army and Navy functions will join the Space Force by the end of December, so USSF can plan into the next year for transfers to join in fiscal 2022, he said in a conversation hosted by Defense One.

It's taken several months to first identify 23 parts of the Air Force, and now additional organizations elsewhere in the Defense Department, that will relocate. A few more units—such as intelligence workers—that weren't in the initial pool marked for transfer will now join the Space Force. The Space Force will continue to share much of the services offered by the Air Force, such as base security personnel.

"There is a tremendous amount that the Space Force, and the Air Force, and the Army, and the Navy, … working together with [the Office of the Secretary of Defense] have already agreed on," Thompson said, including which space-related personnel and resources will stay where they are, and which are ready to transfer.

"There's a few units and functions left that we haven't reached full agreement on, and we're in the process of finalizing the data and the information that will allow the decision-makers to decide," he added. ✪

USAF Seeks Air-Breathing Hypersonic Cruise Missile

By Rachel S. Cohen

The Air Force is moving forward with a new Hypersonic Attack Cruise Missile (HACM) as one of its top two hypersonic weapons programs, said Weapons Program Executive Officer Brig. Gen. Heath A. Collins.

The service has discussed similar efforts underway in its hypersonic portfolio but has not yet named HACM as a central project. In July 2019, Aviation Week reported on the existence of two classified hypersonic programs that use the acronyms HACM and HCCW, but said the Air Force would not divulge information about either.

Speaking to Air Force Magazine in September, Collins said HACM and the Air-launched Rapid-Response Weapon (ARRW) prototype are "really the two big tickets that we're looking at from a warfighter focus."

"We are the lead development office for the Air Force when it comes to hypersonic weapons," Collins said Sept. 22. "The ARRW program is down here as well. We're also in the midst of starting the new HACM hypersonic cruise missile."

Air Force spokesperson Ilka Cole told Air Force Magazine in an Oct. 13 email that HACM differs from other hypersonic prototypes because it will use air-breathing engine technology for propulsion. An "air-breathing" cruise missile flies lower and over shorter distances than others because it needs to use air currents to keep moving.

In contrast, the AGM-183A ARRW is a developmental boost-glide weapon that would be fired into the atmosphere and then use the energy from its rocket to fly toward its target.

Cruise missiles that can move five times the speed of sound or faster would make military attacks more unpredictable and offer a quicker long-range strike option. The U.S. already owns weapons that fly that quickly, but future hypersonic weapons are expected to maneuver more easily and stealthily in flight.

The HACM is envisioned for use in conventional strike weapons on fighter and bomber aircraft, according to the Air Force Research Laboratory. It appears to be similar to, or the same as, a "solid rocket-boosted, air-breathing, hypersonic, conventional cruise missile" the Air Force solicited ideas for earlier this year.

The service has since started discussing a multimission,

air-breathing missile dubbed "Mayhem" that would be larger than the ARRW and could carry multiple types of payloads for airstrikes, as well as missions such as surveillance.

Air Force Research Laboratory did not indicate whether HACM, the cruise missile described only as "Future Hypersonics Program" on a federal contracting website earlier this year, and Mayhem—officially called the "Expendable Hypersonic Air-Breathing Multi-Mission Demonstrator Program"—are the same effort.

The Air Force plans to hire Boeing, Lockheed Martin, and Raytheon to design a hypersonic cruise missile this fiscal year. Both the "Future Hypersonics Program" and the Mayhem program would reach their preliminary design reviews around the end of fiscal 2021.

When asked about upcoming short-term prototyping goals for a HACM, Collins indicated it is too early in the acquisition process to start setting those dates: "There's no real near-term milestone," he said.

Cole said no other information is available on HACM, including when it could be ready for combat. She did not answer which companies AFRL is partnering with to build it.

Giancarlo Casem/USAF

The Air Force is pursuing two hypersonic weapons, the boost-glide AGM-183A, shown here on the wing of a B-52 Stratofortress before a test flight in August, as well as an air-breathing Hypersonic Attack Cruise Missile that would never depart the earth's atmosphere.

"The AFRL science and technology investment in air-breathing propulsion has provided the foundation for hypersonic cruise missile technology," she said. "This strategic investment is allowing the Department of the Air Force to evaluate the potential of air-breathing hypersonic cruise missile concepts such as HACM."

Collins noted that ARRW is on track for a booster flight-test before the end of 2020 and a full flight-test next spring. That weapon has already flown in tests on the B-52.

"We're in the planning phases to go from that prototyping demo into a production program and start putting capability out in the field," Collins said.

The Air Force's biggest hypersonics challenges are ensuring the defense industrial base has the resources to ramp up production when the military is ready and figuring out how to adequately test weapons that move faster over longer distances than regular munitions, he added.

"This is a new market, a new industry, and right now, there's a lot of fledgling [science and technology-type] companies that we're working with very closely to transition into" production readiness, he said. "This is a unique skill set of people that you require for a hypersonics program that we continue to build and grow." ✪

Multiple Factors Blamed for Eglin F-35 Crash

By John A. Tirpak

Excessive landing speed was the primary cause when an F-35A crashed at Eglin Air Force Base, Fla., on May 19, but faulty flight control logic, problems with the helmet-mounted display and the jet's oxygen system, and ineffective simulator training all contributed to the accident, according to an Air Force investigation.

The Accident Investigation Board (AIB) found the pilot set a "speed hold" of 202 knots indicated airspeed for the landing—50 knots too fast—and also set the jet's approach angle too shallow. After the jet bounced on the runway, the report found, a "previously undiscovered anomaly in the aircraft's flight control logic" conflicted with the pilot's apparent corrective efforts to recover, and the plane and pilot "quickly fell out of sync." The flight computer commanded nose down while the pilot, attempting to abort the landing, commanded nose up.

Sensing that he was being "ignored" by the airplane, the pilot ejected, sustaining significant but non-life-threatening injuries, and destroying the $176 million aircraft.

There were other problems, too. The board's report, released Sept. 30, concluded:

- A misaligned helmet-mounted display "distracted the pilot during a critical phase of flight;"
- The aircraft's breathing system contributed to excessive fatigue leading to "cognitive degradation;" and
- Ineffective simulator instruction left the pilot without sufficient knowledge of the aircraft's flight control system to recover.

Following his ejection, the aircraft rolled and struck the runway. The jet, valued at almost $176 million, was declared a total loss. The pilot had shards of the canopy and other foreign objects lodged in his eye and arm, and a spinal compression injury.

The report did not discuss corrective actions or flight safety restrictions as a result of the accident and neither the Air Force,

Lockheed Martin, nor the F-35 Joint Program Office responded to repeated queries for this information.

NIGHT FLIGHT

The crash occurred at the end of a night mission in which the pilot, an instructor, was leading a student in a second aircraft. Upon returning to base, the instructor set the excessive speed hold at 202 knots, which the investigation said is "not an authorized maneuver," and a shallow angle of attack of 5.2 degrees, instead of the desired 13 degrees. The pilot failed to disengage the speed hold at the appropriate time, and no "audible warnings" sounded, despite the dangerous configuration, the report said. The jet touched down nearly simultaneously on all landing gear with such force that the nose gear pushed back up, causing the jet to become airborne again. As the pilot tried to recover, the jet and pilot got out of sync due to "multiple conflicting flight control inputs."

Airman 1st Class Amber Litteral

A pilot assigned to the 33rd Fighter Wing taxis an F-35A Lightning II on the runway July 10 at Eglin Air Force Base, Fla. The 33rd FW operates five squadrons aligned under the operations and maintenance groups.

The control software "became saturated and unresponsive, and ultimately biased the flight control surfaces toward nose down" at the same moment the pilot was going to afterburner and trying to raise the nose and gain altitude.

"Feeling confused, helpless, and ignored," the pilot ejected.

The investigation determined that three seconds of pilot input "was not enough time to overcome that saturation" and the flight control system failed to reorient the aircraft for a go-around. The entire mishap unfolded within five seconds of the initial touchdown.

The F-35 senses when its weight is on the wheels, and this biases the flight controls to keep the nose down. But this aspect of the flight controls is not in the flight manual or syllabus. "The flight control system is complex; there are too many sub-modes of the [control laws] to describe" in courseware, the report states. "Nevertheless, there exists a deficiency in the depths of the logic and flight control systems knowledge in F-35A baseline manuals and academics."

During the attempted landing, the pilot found the helmet-mounted display (HMD) "misaligned low as opposed to high," which caused the jet to come in too high for landing, conflicting with inertial landing system data and visual cues.

The pilot "fought his own instincts to push further into the darkness short of the runway to correct his trajectory," the report stated. While crews train for HMD-out situations, they don't train for misalignments, so rather than easing the pilot's workload, the helmet seems to have complicated it in this instance.

"The focus required to mentally filter the degraded symbology, green glow of the HMD projector, visually acquire nighttime runway cues, correct and then set an aimpoint, fight the ... darkness short of the runway, and monitor glide path trends, distracted the [pilot] from engaging the [approach power compensator] or slowing to final approach speed," the AIB states. The "green glow" worsens due to feedback as the aircraft descends, and the pilot reported having to "squint through" it to pick up "on environmental cues."

The jet was from Low-Rate Initial Production Lot 6—the only one from that batch at Eglin. There were some corrective technical orders for the helmet system, but they were not deemed urgent and required depot assistance to make, the report said.

The pilot reported that flying the jet was more "draining" than his previous aircraft, the F-15E. The report said the F-35's unique air system, which requires a "work of breathing," has that effect on many pilots. The pilot's experience is "supported by emerging research" on the F-35A's systems that "there appears to be a physiological toll taken on a pilot's cognitive capacities as a result of breathing through the on-demand oxygen system," the report said. The pilot reported that on a scale of one to 10, his cognitive degradation was "four out of 10 on a routine basis," according to the report.

Flying the F-35A in instrument landing system mode is "not a mundane task," which "could have been made more challenging" in the May mishap "by the reported level of cognitive degradation" from distractions, stress, lack of sleep, and the work it took the pilot to breathe. These factors could have contributed to the pilot's "vulnerability to distractions" during the mishap landing, according to investigators.

On the issue of simulators, the report states that the systems "do not accurately represent the aircraft flight dynamics seen in this scenario." In the simulator, the aircraft can be recovered after a hard bounce, and "two members of the AIB team were also able to land" in the simulator under the same conditions.

Lockheed Martin's own report on the incident "verified the disjoint between actual [mishap aircraft] performance and the simulator model," adding that "the pitch rate sensitivity evident in flight was not observed in piloted simulation or initial attempts to match the maneuver with offline simulation."

Indeed, had the mishap pilot not experienced"the negative learning from the simulator, he might have been able to recover the aircraft despite the high-speed landing," the report stated, explaining why the simulator was listed as a contributing factor. ✪

Tech. Sgt. John Raven

An inexperienced student pilot flying his first night close-air support sortie strafed the wrong target during a live-fire mission on the test range at Holloman Air Force Base, N.M., in 2017. The F-16 mission here, also over Holloman, occurred in April 2019.

USAF Settles Wrongful Death Suit for Contractor Killed at Holloman

An inexperienced pilot on a night training mission fired at the wrong target.

By Amy McCullough

The Air Force settled a lawsuit filed on behalf of the widow of a contractor killed in a 2017 friendly fire training incident at the White Sands Missile Range near Holloman Air Force Base, N.M.

The widow filed the suit in the United States District Court of New Mexico earlier this year, seeking $24.6 million in damages. The family's lawyer told Military.com in October the settlement was less than what was originally requested, but would not disclose the final amount, saying only it was "enough to take care of them for the rest of their lives."

Retired Master Sgt. Charles Holbrook, a former tactical air control party Airman, was killed on Jan. 31, 2017, when an inexperienced F-16 student pilot strafed the wrong target during a live-fire nighttime training mission. Holbrook was struck in the head with a 20 mm round from the jet's Vulcan cannon, according to court documents. A military member also was injured, according to the Accident Investigation Board (AIB) report.

"At night, in the dark, these two targets would look the same."
—Lawsuit brought by the family of Master Sgt. Charles Holbrook, USAF (Ret.), against the Air Force

Holbrook was a business development manager at Sensors Unlimited, a division of United Technologies Aerospace Division, and was on the range to demonstrate a laser imaging device to members of the Dutch Air Force who also were participating in the exercise, according to the court documents, first reported on by Task & Purpose on Oct 16. The court records claim the Air Force did not provide the proper protective gear to Holbrook before allowing him on the range. However, the AIB notes that he brought Level 3 body

USAF

An unknown number of 20 mm rounds blasted three vehicles at the observation point, killing retired Master Sgt. Charles Holbrook and igniting a fire in one of the vehicles.

armor and a Kevlar helmet with him, but "displayed a level of complacency" by not putting it on.

"The fact that the MC [mishap contractor] has personal protective equipment with him, including a level 3A helmet and level 3 body armor without plates, supports a finding that the MC was aware of the inherent dangers of CAS (close air support) live-fire training … ," the AIB report states. Although the report acknowledged the possibility that personal protective gear could have reduced the severity of the injury, it "could not determine the probability of whether the MC's injury was preventable … ."

The AIB board president, Maj. Gen. Patrick M. Wade, on Sept. 26, 2017, found pilot error to be the cause of the incident, though the instructor pilot's failure to properly supervise the mission and vague, yet "overaggressive," directions were significant contributors.

"The MP [mishap pilot] misperceived that the ground element's location was the intended simulated SA-8 training target. Additionally, the MP misinterpreted his instruments as he failed to follow his on-board systems that were directing him to the proper target … ," wrote Wade.

"I also find, by the preponderance of evidence, the MIP's [mishap instructor pilot] failure to provide adequate supervision and instruction significantly contributed to the mishap. The MIP failed to cross-monitor the MP's performance prior to and during the MP's fatal strafing attack. The MIP exhibited task misprioritization as he focused his attention on Forward Air Controller (Airborne) (FAC(A)) duties while his student, the MP, was performing his strafing attacks. The MIP displayed overconfidence, complacency, and over-aggressiveness during the mishap sortie."

The training scenario involved four F-16 fighters—two flown by instructor pilots and two by student pilots. They were tasked with taking out an enemy position with "friendlies" nearby. There were 10 people on the ground at the time, including four joint terminal attack controllers (JTACs) from the Idaho Air National Guard's 124th Air Support Operations Squadron and the 7th ASOS at Fort Bliss, Texas; two Army ground control liaison officers; and three Dutch JTACs there to observe Holbrook's laser-imaging device.

"The observers and civilian, Charles Holbrook, were placed less than a half mile away from the target in an almost identical configuration as the target—a line of rental vehicles on a dirt circle with a road going north of the circle," the suit charges. "At night, in the dark, these two targets would look the same."

The student pilot was a first lieutenant assigned to the F-16 Formal Training Unit at Holloman, with 86 primary flying hours and 60.9 hours in the F-16, according to the AIB. The training event was the student pilot's first, night close air support mission, first use of night vision goggles while flying, and the first time performing a nighttime high-angle strafe of unlit targets, according to the lawsuit. His instructor pilot—who was operating an F-16D configured the same as the student pilot's aircraft—was a captain stationed at Holloman, with 887 primary flight hours, including 857 in the F-16, and 107 instructor hours, according to the AIB.

The suit said it was "unclear" whether the 10 people on the ground knew they were being used as potential "friendly targets," and they did not participate in the pilots' mission briefing, which outlined the training scenario. However, the AIB said Holbrook did attend a ground mission briefing conducted by the JTACs.

According to the lawsuit, the plan was for the first JTAC—a member of the Idaho ANG's 124th ASOS—to control the first two target runs, then pass control to another Airman, who was still qualifying to be a joint terminal attack controller, but would be supervised by a JTAC instructor. They were not told the instructor pilot might take control and instruct the student pilot to fire on a target, according to court documents.

The mission pilot conducted several bombing runs with both simulated and real inert bombs, the documents claim, and practiced evasive maneuvers, while one of the JTACS set up a red strobing infrared beacon at the observation point so the pilots could locate the friendlies on the ground. The suit alleges that while the instructor pilot confirmed he saw the strobe, the student pilot did not, and he was not asked to verify the target by the instructor.

On the first run, the suit alleges, the mission pilot "mistakenly moved the targeting pod sensor in his jet and was 'tracking' (i.e. targeting) the 10 people on the ground" when he called out "capture target." The student pilot was not asked to describe what he was targeting, according to court documents, alleging that the instructor did not verify he was tracking the right target.

"After pointing his aircraft at the people on the ground at the OP [observation point], he squeezed the trigger to fire his 20 mm cannon on the OP. No rounds were released during this mis-targeting because the MP had inadvertently left his master armament switch in simulation mode, so nothing happened, and he flew over the top of the OP," the documents allege.

Even though the student pilot's instruments showed he was not on the correct target, and the red warning strobe was visible instead of the instructor pilot's laser, the suit alleges, neither the student nor the instructor "realized his mistake."

The suit also alleges that "The MP should have checked in with his student and verified that he had identified and was firing on the correct target, and whether he could safely continue training such a complicated scenario." Instead, the court documents say, "the MIP chewed out the MP for having his master armament switch in simulation mode and, even though [the JTAC trainee] was supposed to be tracking and giving the order to re-attack or fire, the [instructor pilot] immediately ordered the [student pilot] to reengage [the] target."

The student pilot switched from simulation mode to arm mode and reengaged, the documents state, but still didn't squeeze the trigger because he wasn't sure he had the right target.

According to the suit, when the instructor asked him why he aborted, the student pilot said, "'The sparkle just looked different so I did not want to shoot, I wasn't uhh, it wasn't as circular as I thought I saw, it looked like a light maybe on top of a building, I was wrong.'"

What he described, the suit alleges, was "spot on" for the observation point, where the 10 people remained on the ground, because the real target did not have any lights. But because the exchange happened over the private radio, the suit says, the JTACs did not know why the pilot aborted. When they asked why, the instructor pilot informed them the student pilot "was going to setup for a re-attack," according to court documents.

On the third run, the student pilot's aircraft detected the correct target, the documents allege, but the pilot maneuvered the F-16 in the opposite direction back toward the observation point, which he had mistakenly targeted twice before. The instructor pilot, the suit says, took over mission control from the JTAC on the ground and instructed the student to shoot.

"The MP squeezed the trigger while the nose of the aircraft was pointed at the OP and sent 155 rounds of Vulcan cannon ammunition toward the ground crew, blowing up a rental car and striking Chuck Holbrook in the head with a 20 mm round," according to documents.

The 54th Fighter Wing has since implemented several changes to its F-16 Basic Course to ensure a similar incident never happens again, including updating governing procedures when live, inert, or training ordnances are employed during night close air support training. The wing also modified its syllabus and improved course training material, Air Education and Training Command spokeswoman Capt. Lauren M. Woods told Air Force Magazine.

The new policy highlights "the requirement for very diligent preplanning and execution of tactical scenarios with both students and ground parties in the range space," she said. "This is a special interest item briefed before every student sortie during the CAS phase."

In addition, students now are required to fly with an instructor in the rear of an F-16D model for their first night CAS sortie. If there are "resource constraints" and the student must fly solo, they will "perform their first strafe attack without ordinances while observed from close proximity by the instructor," she said.

The Air Force also is working with personnel at the A-10 schoolhouse at Davis-Monthan Air Force Base, Ariz., to review A-10 targeting pod courseware to improve F-16 ground training. "This allowed us to capitalize on existing video, content, and instructional techniques for courseware to improve training for students on CAS," she added. ✪

DOD, SpaceX Explore Shipping Cargo Through Space

By Rachel S. Cohen

A military team is working with SpaceX to flesh out the prospect of shipping routes that pass through space, the head of U.S. Transportation Command said Oct. 7.

That group could demonstrate as early as 2021 whether quickly sending cargo around the globe via space is feasible, Army Gen. Stephen R. Lyons said.

"Think about moving the equivalent of a C-17 payload anywhere on the globe in less than an hour," Lyons said at a National Defense Transportation Association event. "Think about that speed associated with the movement of transportation of cargo and people. There is a lot of potential here."

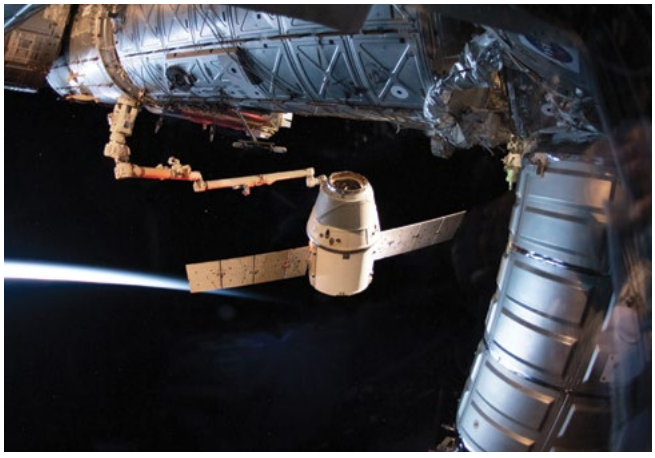
Pentagon officials have publicly discussed the intersection of logistics and space for at least three years, but partnerships between TRANSCOM, SpaceX, and Exploration Architecture Corp. are a formal step toward resolving technical and cost issues, as well as "legal, diplomatic, statutory, and regulatory" hurdles to commercial space transportation, the command said in a release.

"I had no sense for how fast SpaceX was moving, but I've received their update and I can tell you they are moving very rapidly in this area," Lyons said.

Industry is "examining the use cases, technical and business feasibility, and concepts of employing space as a mode of transportation supporting USTRANSCOM's role as the Defense Department's global logistics provider," according to a news release.

If the concept succeeds and is cost-effective, private companies could work with TRANSCOM to ferry cargo to the moon and Mars in support of NASA, the Space Force, and the business sector. The Defense Department is eyeing long-term space transportation agreements that would let the military turn to private companies to rapidly respond to emergencies.

"Commercial space transportation would allow point-to-point rapid movement of vital resources while eliminating en route stops or air refueling," TRANSCOM said. "This capability has the potential to be one of the greatest revolutions in transportation since the airplane." ✪



NASA

The SpaceX Dragon cargo craft, on its 17th contracted mission to resupply the International Space Station in November 2019, is pictured moments before being released from the Canadarm2 robotic arm.

Boeing

The WGS-11+ satellite will be delivered to the Space Force in 2024. Government funding for the satellite communications upgrade program secured an extra $5 million to stay on track.

Congress Approves Extra Funds for Some Aerospace Programs

By Rachel S. Cohen

Lawmakers in October approved a slew of funding shifts the Pentagon requested in June to pay officers, avoid hiring freezes in the Department of the Air Force, and set up U.S. Space Command, among other priorities.

The Defense Department routinely asks the House and Senate Appropriations and Armed Services committees to let the military move money between accounts in a process known as reprogramming. This omnibus reprogramming request looked to shuffle more than $2 billion in fiscal 2019 and 2020 dollars.

For the Air Force, much of the money will go toward congressionally approved pay raises and retirement contributions. "Without additional funds, Air Force will have to institute a hiring freeze and/or furlough civilian employees," the reprogramming document said.

DOD also secured an $80 million plus-up for U.S. Space Command, which is barely a year old.

"These funds support the Combined Force Space Component Command, missile warning/missile defense, Joint Operations Center contractor support, and information technology support across the command," the document states. "In addition, the resources fund other headquarters contractor support, travel, and training necessary to fulfill the [combatant command's] roles and responsibilities within the Joint Force."

USSPACECOM needs additional money so it can keep its growth on track and continue daily operations according to plan, DOD added.

The satellite communications upgrade program known as WGS-11+ secured an extra $5 million to stay on track as well. The Space Force wants to deliver new Wideband Global SATCOM systems, which are twice as capable as the earlier version, starting in 2024.

"Without funds, the program office will be unable to perform the mission analysis, engineering support, anomaly resolution, and systems engineering and integration functions required to support the required WGS-11+ production and launch in 2024, ultimately preventing the program from closing the warfighter operational mission gap that currently exists," DOD argued. "Warfighter demand for the capability provided by the WGS constellation exceeds the current constellation capacity."

Funding stability for some programs comes at the expense of progress for others.

At the same time, the Senate Armed Services Committee postponed a decision to transfer more than $77.5 million into the aircraft procurement account. Those projects would add commercial Wi-Fi to four C-32A and four C-40B planes that ferry around senior leaders, as well as other communications improvements.

The Senate Armed Services Committee also wants to wait on installing Enhanced On-Board Oxygen Generation Systems (OBOGS) into 443 T-6 aircraft. "These funds are required in order to lessen the risk of unexplained physiological events stemming from primary OBOGS system failure while student pilots and instructor pilots are flying the T-6 training aircraft," the document said.

Joint Direct Attack Munition tail kit upgrades are deferred, as well as a project to integrate systems that protect against threatening small drones into the Air Force enterprise.

An effort to design new maternity flight suits for women who are now allowed to fly longer into their pregnancies is also pushed off. The Air Force had asked for $6 million to develop safer flight suits with harnesses that account for the shape and size of women's bodies. Another $5.1 million project to create in-flight bladder relief devices for women was deferred as well.

Lawmakers are letting the Air Force pull funding from several aircraft and ammunition upgrade programs that have saved money or that are not spending as much because they are delayed. They blocked the transfer of funds from certain programs, like the MQ-9 Reaper office, which had wanted to start shutting down production in 2021. ✪

Senior Airman Daniel Hernandez

Airmen monitor computers in support of the Advanced Battle Management System (ABMS) On-ramp 2, Sept. 2 at Joint Base Andrews, Md.

USAF, Army Move Forward Under New C2 Agreement

By Rachel S. Cohen

Air Force and Army leaders recently reached an agreement to partner more closely on joint all-domain command and control over the next two years, hoping that collaboration will help achieve their combat goals faster.

Each military department has its own venture to create a battle network that connects assets such as tanks and aircraft with sensors to track, target, and attack more efficiently. The Air Force runs the Advanced Battle Management System plan, while the Army calls its own work "Project Convergence" and

the Navy has a parallel effort dubbed "Project Overmatch."

"We're trying to build the interconnected digital infrastructure needed to allow individual services to bring their own capabilities and connect to one another, much like we do in our daily lives at home with personal devices," said a Department of the Air Force spokesperson.

Under the agreement, Air Force Chief of Staff Gen. Charles Q. Brown Jr. and Army Chief of Staff Gen. James C. McConville will pursue mutual data-sharing and software interface standards through the end of September 2022. Officials are hailing the Sept. 29 pact as a pivotal move toward breaking down the institutional hurdles that keep the armed forces from working together more efficiently.

The services are still scoping out how to pursue a common data standard, which the Air Force has started requesting for its own programs, and haven't chosen specific systems or platforms to collaborate on.

"With the data-sharing, we intend to start with sharing the most critical mission areas within each particular service as well as sharing the data engineering plans for each mission area," the spokesperson told Air Force Magazine.

The Army will play a bigger role in the Air Force's periodic ABMS demonstrations (known as "on-ramps") as a result of the agreement, and likewise for Air Force participation in Project Convergence events. The Air Force did not indicate it is working on a similar agreement with the Navy and Marine Corps.

The pact hasn't yet launched any new development projects, the Air Force spokesperson said, though they are looking into combined "JADC2 capabilities, data system and automation development, and intelligence collection and technology protection."

By the time the agreement ends, the services hope to have significantly improved the command and control doctrine, organization, concepts, and technologies needed to make combat decisions faster than other advanced militaries such as Russia and China.

"If we're at the end of 2022 and we can witness the Army and Air Force's JADC2 capabilities integrated, and experimenting, and testing globally integrated operations, we would consider that a success," the spokesperson said. "The CJADC2 [combined joint all-domain command and control] partnership agreement is meant to solidify our commitment to connecting the joint force and build [the Internet of Military Things]."

Mike Tsukamoto/staff

Sun Kailiang of China (left) is wanted by the FBI for cyber espionage, and Ivan Yermakov, of Russia, is wanted by the U.S. Justice Department for hacking U.S. businesses and hospitals.

National Strategy: Promote, Protect Critical Technologies

By John A. Tirpak

The Trump administration released a national strategy for high technology on Oct. 15, emphasizing the need to both develop new capabilities and protect them from world competitors seeking to steal them.

The document outlines a common set of 20 technology priorities for government agencies to nurture and protect, while acknowledging the list will evolve over time. They include: advanced computing, artificial intelligence, autonomy, quantum computing, communications and networks, distributed ledger technologies, microelectronics and man-machine interfaces, data science and storage; advanced materials, manufacturing technologies, aerospace engines, advanced conventional weapon technologies; advanced sensing and space technologies; agricultural and bio-technologies; chemical, biological, radiological, and nuclear (CBRN) mitigation technologies; medical and public health technologies.

The strategy comes in response to peer adversaries' ability "to mobilize vast resources in these fields," and steal a march on the U.S., according to a White House press statement.

"The United States will not turn a blind eye to the tactics of countries like China and Russia, which steal technology, coerce companies into handing over intellectual property, undercut free and fair markets, and surreptitiously divert emerging civilian technologies to build up their militaries," the press office said.

Incorporating cybersecurity "early in the technology development stages," is a high priority, as is working "with partners to take similar action," according to the document.

The Pentagon is already implementing many of the approaches laid out in the strategy. It has codified a tiered cybersecurity compliance model, which must be included in proposals for new work. The Pentagon has also embarked on a series of programs to defeat adversary tactics in tech transfer. These include pairing small businesses developing useful new technologies with "safe" investors who won't try to export intellectual property once having acquired a financial stake in the business.

The new policy seeks to "secure our national security innovation base" by "strengthening rules where gaps exist, insisting that agreements be enforced, and working with like-minded allies and partners to promote, advance, and defend our industry, address unfair practices, and level the playing field for American workers," a White House spokesman said.

To promote U.S. dominance in technology, the strategy calls for development of a high-performing technology workforce, increasing government research, development funding, and coaching allies and partners who don't yet have systems in place to guard against technological pillage by adversary investment.

The document details 12 broad initiatives aimed at encouraging and retaining investment and innovation, saying the U.S. should lead the world in setting technology "norms, standards, and governance models that reflect democratic values and interests."

The policy specifically called out Russia for seeking to gain U.S. technology through "dual-use" private partnerships, particularly in the area of artificial intelligence, which Russia "believes will bring it both economic and military advantages."

Meanwhile, China, in addition to "stealing technology" and "coercion" of companies in which it has a financial stake, fails to "provide reciprocal access in research and development projects," uses tactics such as dumping to corner markets, and promotes "authoritarian practices that run counter to democratic values."

First Airmen Get the Nod in New Promotion Process

By Jennifer-Leigh Oprihory

About 1,200 majors earned a promotion under the Department of the Air Force's new process for advancement that judges Airmen based on performance in their career field rather than comparing the force as a whole.

The 2020 lieutenant colonel promotion board is also the first to ditch so-called "below-the-zone" promotions, which offers people a chance to fast-track up the ranks and puts Airmen up for promotion in an order based on merit rather than seniority.

The selection board, which convened in May, considered more than 2,600 Air Force and Space Force members for promotion who work in about 40 specialties that fall into six new categories, Air Force Personnel Center spokesperson Michael T. Dickerson told Air Force Magazine.

A total of 554 majors in air operations and special warfare, 33 majors in nuclear and missile operations, 58 majors in space operations, 197 majors each in information warfare and combat support, and 170 majors in force modernization were tapped to become lieutenant colonels as of Oct. 7, Dickerson said.

The Air Force decided last year to scrap below-the-zone promotions to give officers more time to accrue "insight and experience" they might not get by rushing through the ranks, according to Air Force Deputy Chief of Staff for Manpower, Personnel, and Services Lt. Gen. Brian T. Kelly. About 2 percent of Airmen seeking promotion were typically chosen ahead of schedule.

The change resulted in record-breaking promotion rates for those looking to advance according to schedule or later than usual.

At about 76 percent, nearly 5 percent more Airmen were promoted to lieutenant colonel on schedule—or "in the zone"—than in 2018. At 13 percent, the number of majors promoted "above the zone," or later than usual, was 6.3 percent higher than in 2018, the Air Force said.

Promotion zones are defined by the minimum amount of time an Airman should serve at a certain rank before seeking advancement.

As part of the overhaul, the Department of the Air Force also changed how it assembles the panels who evaluate troops in each category.

Most panelists are part of the career fields they're vetting, while some come from other backgrounds to balance the board's perspective, the service said. All panelists receive backgrounders on the major "milestones and challenges" of each profession.

"This tailored approach ensures panel members consider officers in each category against similar career milestones and expectations," Air Force Personnel Center Commander Maj. Gen. Christopher E. Craige said in a release.

This time around, Airmen were also considered for promotion in order of their merit instead of seniority.

"Performance will be the driving factor in determining when officers pin on new rank," the release stated. "Those whose record of performance place them near the top of a promotion board's order of merit, regardless of zone, will promote ahead of some of their peers."

Senior Airman Jacob Stephens

Bronze Stars with Valor Device at Davis-Monthan Air Force Base, Ariz., were presented Oct. 1 to Master Sgt. Adam Fagan and Staff Sgt. Benjamin Brudnicki, both 48th Rescue Squadron pararescuemen.

Pararescuemen Earn Bronze Stars for Bravery in Afghanistan

By Brian W. Everstine

Master Sgt. Adam Fagan and Staff Sgt. Benjamin Brudnicki, both assigned to the 48th Rescue Squadron, received the nation's fourth-highest military honor during a ceremony at Davis-Monthan Air Force Base, Ariz. They credited training before their deployment for saving the lives of special operations forces overseas.

"The experience and brotherhood created with my team overseas is the most valuable piece for me," Brudnicki said in a release. "The Air Force best utilizes its special warfare assets when putting them to work in the joint environment, and I am proud to be a part of that."

Fagan, then assigned to the 64th Expeditionary Rescue Squadron at Kandahar Airfield, Afghanistan, was attached to a team of Army Special Operations Detachment Force Alpha and Afghan Special Forces that was raiding Taliban-controlled Sangin on March 24, 2019. As the team approached an enemy compound, they were attacked by small-arms fire from a fortified position as well as an improvised explosive device, according to the award citation.

An Afghan commando was wounded by the gunfire, and Fagan responded despite the onslaught.

"The heavy, small-arms fire, coupled with rocket-propelled grenade blasts and multiple [IED] detonations pinned down the Afghan Special Forces team and hindered access to the critically wounded casualty," the citation stated. "Without hesitation and with complete disregard for his own safety, Sgt. Fagan took immediate control of the dire situation and

engaged the fortified enemy position, repeatedly exposing himself to heavy fire."

Fagan shot back to allow the rest of his team to reach the Afghan commando. He then treated the casualty, called for a medical evacuation, and moved the commando to the helicopter landing zone as gunshots and grenade fire continued. He also provided cover for the helicopters to land, according to the citation.

"The culmination of Sgt. Fagan's exceptionally brave actions and speed of patient delivery led to the destruction of an enemy weapons cache, the elimination of five enemy insurgents, and ultimately saved the life of a coalition partner," the citation states.

Brudnicki, the other honoree, was also assigned to the 64th Expeditionary Rescue Squadron at Kandahar when he was attached to a Special Forces ODA and Afghan commando team on May 3, 2019.

During a counterinsurgency mission in Helmand Province, they approached a village that was a known Taliban stronghold. When they breached the first "compound of interest," the assault team heard an enemy group nearby was preparing for an engagement.

"[Brudnicki] and his team utilized the Taliban's own kill holes against them with decisive small-arms fire," the citation stated. "At distances of less than 5 feet, he engaged relentlessly with personal weapons and hand grenades, despite their cover being damaged with a rocket that failed to detonate."

A civilian was hurt in the fight, and Brudnicki braved "effective enemy fire from an adjacent compound" while running through an open courtyard to rescue and stabilize the wounded person. Another call for aid came when an Afghan commando was severely wounded and pinned down.

"He rushed to join the fight and engaged the enemy's fortified position by again crossing the open courtyard and exposing himself to grave danger," according to the citation. "He successfully suppressed the enemy, allowing partner force commandos to remove the casualty from the courtyard."

Brudnicki then set up a place where they could gather wounded troops and created a plan to transport blood and evacuate people.

"His actions resulted in the seven enemies killed in action, including a Taliban commander, and saved the lives of two coalition partners," the citation states. ✪

F-15Es Can Carry SDB II Bombs

By Amy McCullough

The F-15E Strike Eagle can now carry the Small Diameter Bomb II in combat, after software faults and other problems repeatedly delayed the program for years.

Air Combat Command approved Raytheon Technologies' air-launched, precision-guided munition, also known as StormBreaker, for use on Sept. 23. The F-15E is the first aircraft cleared to fly with SDB II, with the F-35 Joint Strike Fighter and the F/A-18E/F Super Hornet next in line.

"The SDB II StormBreaker is ready for operational use after undergoing extensive development and flight testing," Col. Jason Rusco, SDB II program manager and Miniature Munitions Division senior materiel leader, said in an Oct. 13 release. "This capability is unmatched and is a game-changer for national defense."

Raytheon Technologies

An F-15E carries a StormBreaker smart weapon during a test exercise near White Sands Missile Range in New Mexico.

The Defense Department plans to buy 17,000 StormBreakers, split between 12,000 for the Air Force and 5,000 for the Navy. All current Air Force fighter and bomber aircraft eventually will carry the bombs, as well as the A-10, AC-130J, and MQ-9.

StormBreaker, which can fly more than 40 miles to strike mobile targets, uses an imaging infrared, millimeter wave radar to guide the system along with semi-active laser, GPS, and inertial navigation system guidance, according to Raytheon. Its small size means USAF can deploy fewer aircraft with more weapons and still take out a large number of targets.

"The weapon has proven itself in many complex test scenarios, against a variety of targets in extreme environmental conditions, and is now ready to fly," said Cristy Stagg, StormBreaker program director at Raytheon Missiles & Defense, a Raytheon Technologies business. "With its multimode seeker and data link, StormBreaker will make adverse weather irrelevant."

SDB II has encountered several issues with its software and parts that delayed development for at least three years and grew the price tag.

The Government Accountability Office (GAO) estimated that development costs increased 9.3 percent, from $1.9 billion to $2.1 billion, between 2010 and 2020. However, estimated procurement costs are expected to slightly decrease, from $3.5 billion to $3.2 billion.

Eleven failures were identified in operational testing, which concluded in May 2019. Eight of those issues were related to software, two were hardware-related, and one involved an anomaly with the guidance component, according to the GAO report.

Work halted in 2019 after the military found several safety deficiencies, including concerns that the bomb's fins could inadvertently deploy before launch and damage the aircraft carrying it. That could disproportionately affect the F-35, which will internally carry the weapon.

The decision to greenlight SDB II for combat was delayed for about a year while Raytheon retrofitted the nearly 600 bombs that were already delivered. ACC's decision now opens the door to initial fielding on the Super Hornet later this year and for integration onto the F-35, according to the company. ✪

FACES OF THE FORCE

USAF

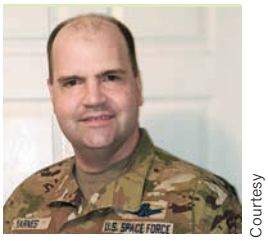
Chief Master Sgt. Maurice L. Williams became the 13th command chief master sergeant of the ANG during an Oct. 9 ceremony at the Pentagon. "He's an Airman's Airman—he's been there on the front lines," ANG Director Lt. Gen. Michael A. Loh said at the event. Williams said the command team's priorities include professional development, promoting innovation, equipping Airmen to be resilient, and assessing "policies and force structure" to meet the mission requirements.

Tech. Sgt. Wes Wright

Airmen and F-16s from Shaw Air Force Base, S.C., deployed in October to Prince Sultan Air Base, Saudi Arabia. The **77th Fighter** and **77th Fighter Generation Squadrons** will provide combat air power to help make the region more stable and secure by patrolling the skies, delivering precision airstrikes, and training with regional partners to maximize capabilities, said 77th Fighter Squadron Commander Lt. Col. David Bennett.

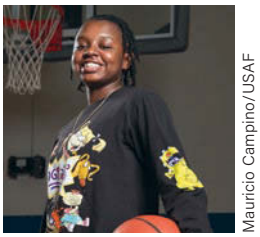
Senior Airman Alexandra Singer

ACC fuels acquisition technician **Tech. Sgt. Justin Chong** is the Virginia Peninsula Chamber of Commerce's 2020 Air Force Military Citizen of the Year. The award recognizes Airmen who excel at their jobs on-duty and perform community outreach during downtime. His track record includes getting his flight committed to regular clean-ups with the Hampton Clean City Commission and taking part in this year's Virginia Waterways Cleanup.



Courtesy

Senior Master Sgt. Robert Yarnes, a division manager at Joint Task Force–Space Defense at Schriever AFB, Colo., was one of the first Space Force troops to graduate from the Air Force Senior NCO Academy. The school's focus on cultivating innovation and agility "will be critical moving forward, ... as operating in such a complex domain such as space demands that the U.S. brings to bear lethal and credible reasons to deter potential adversaries," he said.



Mauricio Campino/USAF

The Boys & Girls Club of America recently recognized **Alexia Jordan** as Delaware Military Youth of the Year and Northeast Military Youth of the Year. The awards recognize military teens who attend on-base youth centers, excel at academics, and are committed to serving their communities. "We are honored to have Alexia and her mother as part of the Dover [AFB] family," said 436th Mission Support Group Commander Col. Phelemon Williams.

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

Joining Up on the F-15EX

The Air Force prepares to welcome the first new F-15s since 2004.

Boeing

The F-15EX, as shown here in this illustration, can carry two more air-to-air weapons than the F-15E.

By John A. Tirpak

Early next year, two Boeing F-15EXs will arrive at Eglin Air Force Base, Fla., for testing. The most tricked-out, advanced Eagles ever built, and the first factory-fresh F-15s acquired by the Air Force since 2004, they're the lead aircraft in a planned fleet of up to 200 F-15EX fighters to be added over the next 15 years.

The F-15EX comes with nearly all the bells and whistles Eagle drivers have ever wished for: fly-by-wire flight controls, two new weapon stations, a new electronic warfare suite, advanced radar, a hyper-fast computer, conformal fuel tanks, and a strengthened structure.

But it's still a fourth-generation fighter, no stealthier than the F-15A that rolled out in 1974. Low observability is considered crucial for operating near modern adversary air defenses, so this new fighter will have to remain, for the most part, outside enemy airspace until those defenses can be beaten down.

The F-15EX was added to the Air Force's budget in 2018 when then-Defense Secretary James Mattis, acting on the advice of Pentagon analysts, decided that a modernized fourth-generation Eagle could provide a needed capacity boost and give the Pentagon competitive leverage with Lockheed Martin, maker of the F-35A, USAF's preferred, fifth-generation fighter.

The F-15EX is "designed to evolve from Day One."
—Will Roper, USAF acquisition chief

Heather Wilson, then-Secretary of the Air Force, would later admit USAF hadn't sought the F-15EX. It had been USAF policy since 2004 not to buy any "new-old" airplanes, and concentrate on fifth-generation machines.

Now that it's in the budget, though, the Air Force is embracing the F-15EX as a means to shore up its fighter force, facing the hard reality that it just doesn't have enough iron to go around. USAF never got the 381 F-22s it planned for to replace its F-15C/Ds and carry the air superiority mission through 2040, receiving only 186 Raptors. To meet global force requirements, it had to retain more than 200 of the youngest or lowest-time F-15Cs well beyond their planned service lives.

Eleven years later, those F-15C/Ds are so worn down that Air Force officials say it's no longer cost-effective to fix them. To remain safe, they require

Eric Shindelbower/Boeing

The first F-15EX taking shape at Boeing's St. Louis final assembly facility. Boeing invested its own money to get USAF the first two jets ahead of schedule, and testing will begin in early 2021. The first contract was awarded in July.

constant and costly inspections to ensure fatigued structural elements are still viable.

The cost of sustaining the Eagle fleet and other old platforms is "eating me alive," said Lt. Gen. David S. Nahom, deputy chief of staff for plans and programs.,

Older aircraft are handicapping the Air Force in multiple ways, Nahom said in an interview. "Not only are they costing us too much money, but they're offering us too much risk," due to obsolete gear and age-related flight restrictions. He said the Air Force must move out swiftly to bring on the F-15EX "as quickly as we can to recapitalize" F-15C/D units.

Boeing quotes a flyaway cost for the F-15EX of $80 million a copy—about the same as the F-35A. But operating costs are a differentiator. Recently retired Chief of Staff Gen. David L. Goldfein said USAF has been leery of the F-35's cost per flight hour, still about $35,000, which is well above the F-15's $27,000 per hour. The Air Force also wants its fleet to be mostly of the Block 4 version of the F-35, which is not yet in production. That jet will have more advanced sensors and can carry a greater variety of weapons. By waiting, USAF can get a greater number of jets in the more advanced configuration and spend less on retrofitting earlier ones.

To Chief of Staff Gen. Charles Q. Brown Jr., it's not a matter of one or the other. "It's capability and capacity," he said during a Defense One online event in October. While Brown insisted, "We still value the F-35," he called the F-15EX an "opportunity." Because foreign customers have invested heavily to modernize the F-15, the Air Force can leverage those investments and acquire an airplane that's as good as a fourth-generation airplane can be, without laying out big dollars for development or tooling, Brown asserted.

Saudi Arabia and Qatar have collectively spent about $5 billion developing their own versions of the F-15, said Boeing Vice President Prat Kumar, who heads its F-15 program, in an October interview. The Air Force can reap the benefit of that investment.

The F-15EX will be almost identical to the F-15QA being built for Qatar. Now in testing, that aircraft builds on the F-15SA developed for Saudi Arabia, the first to trade the old hydraulic actuators and cables for a digital, fly-by-wire system.

Boeing test pilots have reported that the F-15QA flies very much like the F-15C/D and E models, but reaches the edge of the performance envelope faster. Transitioning from USAF's old Eagles to the new should be easy, they say, requiring only that pilots adapt to the EX's new "glass cockpit" displays, which replace the 1980s-era steam gauges in the C/D and E models.

Gen. James M. Holmes, who retired as head of Air Combat Command in August, said he supported the EX purchase because, with congressional funding adds, it's affordable and the first one will be "ready to fight as soon as it comes off the line." Even though it will be limited in how close it can get to enemy air defenses—owing to its large radar cross section—the EX will be effective for homeland defense and in areas where the adversary threat is less severe, he said.

Service officials say they are still figuring out how to "shape" the future force, and for the moment, the F-15EX will simply fall in on the mission of the F-15C/D. In the future, however, one senior official said the EX could shift to more of the E model's ground-attack mission, in the 2030s, as that airplane comes to the end of its service life. The EX will have two cockpit positions, but USAF has officially said it intends to fly the aircraft with a single pilot.

"The EX can carry every weapon that a Strike Eagle can carry, plus a few," a Boeing official said. "I think there's probably going to be a robust conversation … about what the EX can and cannot do … and what is value-added versus not, from a mission standpoint."

Boeing received the first payment of $1.2 billion for the F-15EX on July 13. The cost-plus-fixed-fee, cost-plus incentive contract set a ceiling of $22.89 billion for up to 200 aircraft, although USAF has only spoken of buying 144. Separately, the Air Force awarded GE Aviation a $101.4 million contract for the first 19 GE-F110-129 engines to power the EX test fleet—the same engines that power the F-15SA and the QA. They will be provided as government-furnished equipment. The Air Force will allow Raytheon Technologies' Pratt & Whitney unit to offer a competitive power plant for the production program,

F-15E vs. F-15EX

Not Your Father's F-15

F-15E

Flyaway Unit Price
$64.7 million (2001) $91.7 million (inflation-adjusted to 2018)

Cost Per Flying Hour
$27,000

Inventory
218

Initial Operational Capability
1989

Power plant
2 Pratt & Whitney F100-PW-220

Crew
Pilot + Weapon System Officer

Weapons stations
17 10 on the conformal tanks, 1 on the centerline, and 6 on the wings

Targeting Pod Stations
2 under each intake

Gun
Internal six-barrel 20 mm cannon with up to 500 rounds

Max Air-to-Air Load
10 AIM-9 and/or AIM-120 missiles

Radar/Sensors
- APG-70 original equipment. Since 2010, APG-82(V)1 Active Electronically Scanned Array radar (AESA)
- LANTIRN, Sniper, Litening targeting pods

Processor
Advanced Display Core Processor (2004)

Defensive Systems
Digital Electronic Warfare System (DEWS)

Flight Controls
Analog/hydraulic/cable-type

Service Life
8,000 flight hours

Display

"Steam" gauges, plus both black-and-white and color multifunction displays. Different configuration for Weapon System Officer station.

F-15E front cockpit display.

F-15EX

Flyaway Unit Price
$80 million (2018)

Cost Per Flying Hour
$27,000

Ordered/Planned
8 (ordered) 144-200 (planned)

Initial Operational Capability
2024 (est.)

Power plant
2 GE Aviation F110-GE-129[1]

Crew
Pilot[2]

Weapons stations
23 12 on the conformal tanks, 1 on the centerline, and 10 on the wings

Targeting Pod Stations
2 under each intake

Gun
Internal six-barrel 20 mm cannon with up to 500 rounds

Max Air-to-Air Load
12 AIM-9 and/or AIM-120 missiles

Radar/Sensors
- APG-82(V)1 Active Electronically Scanned Array Radar (AESA)
- Sniper AT, Litening, Legion IRST

Processor
Advanced Display Core Processor II

Defensive Systems
Eagle Passive/Active Warning and Survivability System (EPAWSS)

Flight Controls
Digital, fly-by-wire system with a fiber optic network

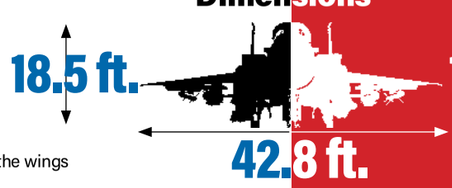
Service Life
20,000 flight hours (+150%)[3]

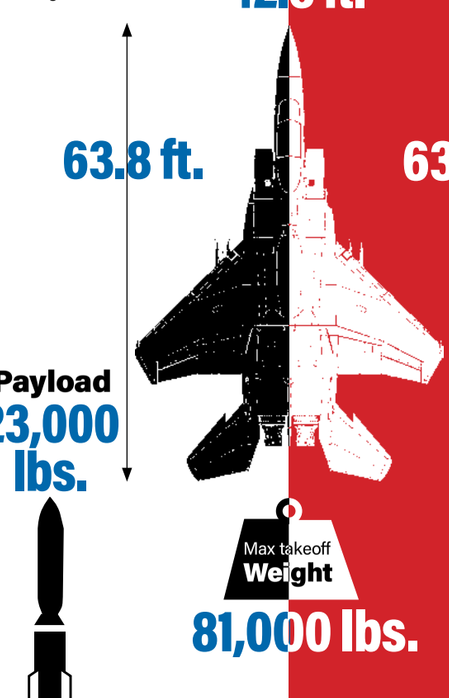
Display

10"X19" color, reconfigurable digital display, front and rear.

Representative of Advanced F-15EX cockpit.

Dimensions





Payload
23,000 lbs.

Payload
29,500 lbs. +28.2%[3]

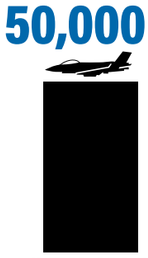
Max takeoff Weight
81,000 lbs.

Ferry Range
2,400 miles

2,992 miles +24.6%[3]

MAX G-LOADING
9Gs

Mach 2.5



AIR FORCE MAGAZINE

Sources: Data from *Air Force Magazine's USAF Almanac, Aviation Week Analysis,* Boeing, globalsecurity.org, Lockheed Martin. USAF Graphic by Dash Parham and Mike Tsukamoto/staff; Photos: SSgt. Jensen Stidham; Boeing

[1]—GE is sole provider of first 19 engines, after which USAF will permit Pratt & Whitney to offer a competitive power plant.
[2]—F-15EX has 2 cockpit positions, but will operate with one pilot.
[3]—Boeing assertion

though, as long as Pratt certifies its engine on the F-15EX, at its own expense.

The Air Force's Future Years' Defense Plan calls for 76 F-15EXs, but Congress will not approve more until USAF submits an acquisition strategy for the fighter.

Because of commonality, an F-15C/D squadron will be able to change over to the F-15EXs within about three months of getting them, Goldfein said, using a lot of the existing ground support gear and requiring little new military construction. By contrast, transitioning a unit from the F-15C/D to the F-35 might take several years, given the unique gear, training and milcon required. This speed of fielding is cited by USAF leaders as the most attractive part of the EX program.

Except for some bridge support by contractor personnel for the test aircraft, the plan is for the EX to be maintained by USAF's organic capability.

The Air Force plans to put the first operational F-15EXs at Kingsley Field, Ore., where it conducts F-15 training.

In addition to state-of-the art missions systems, the F-15EX is being built with modern technologies and with the idea that it will frequently be upgraded, Kumar said.

"We have improved the wing so that it eliminates base-[level] ... and programmed depot maintenance," Kumar said. The digitally re-engineered wings are being built at Boeing's St. Louis plant by a team of a dozen technicians and robots, versus the 86 people needed with the earlier design. The digital construction method minimizes mistakes and rework.

The jet will also have "open mission systems and open architecture," he said, and is a "pathfinder" for the Air Force's agile software development approach. Known as DevSecOps, it accelerates software development and releases by breaking down barriers between developers, security practitioners, and operators.

Will Roper, USAF acquisition chief, said the F-15EX is "designed to evolve from Day One," and will be able to keep up with rapidly changing communications and data-sharing systems the service is creating.

The operating system "can containerize third-party applications" and run new software "without having to go through very extensive flight testing [and] regression testing," Kumar asserted.

The F-15EX can "incorporate future technologies rapidly," enabling it to become "a testbed for technologies more broadly for the Air Force," Kumar said. These will include not just what might go into future versions of the EX but other technologies, given that it has the fastest processor flying, as well as a fiber-optic network and physical room inside.

The F-15EX will be protected by the Eagle Passive Active Warning Survivability System, or EPAWSS, a new electronic warfare suite. While EPAWSS functions remain classified, officials say it will be able to detect, locate, identify, and electronically engage a variety of threat systems. The first two test EX aircraft that reach Eglin will have EPAWSS installed, and Boeing officials said the eight test EXs will give the Air Force more EPAWSS testing capacity. The EPAWSS will also equip the F-15E.

EPAWSS is "included in the price" of the F-15EX, Kumar said, as is the Raytheon APG-82(V) 1 radar, which the Air Force has already installed on many of its C/D and E model Eagles.

Also included in the $80 million flyaway price will be the Suite 9 common operational flight program, and MIDS/JTRS (Multifunctional Information Distribution System/Joint Tactical Radio System) software-programmable radio. Capability for the Joint Helmet-Mounted Cueing System capability will be built in, but the helmets will be government-furnished equipment.

Not included, however, will be any additional sensors, such as Sniper or Litening pods, or Legion Infrared Search-and-Track (IRST) pods, a Boeing official said.

"Everybody wanted it to be crystal clear on what they're getting for what price," the official said. "The Air Force gave us a list of what ... the F-15EX configuration should be, and it had to do with two things: One, the capability they wanted, but the other was commonality with what they were already doing." The Air Force didn't want sensor pods in the package "because [they] said, 'Hey, look, we've already got Sniper pods. We've got IRST pods.'" While the EX doesn't come with the IRST, it can use it.

Boeing says the F-15EX has a 28 percent larger payload than the F-15E, with two more weapons stations. The extra stations add loadout flexibility, company officials said.

Some theater air commanders wanted "different loadouts that might be more applicable" to their regions. "An airplane that can carry seven 2,000-pounders, which an EX can, makes

Master Sgt. Matthew Plew

Squadrons will be able to switch from F-15C/D Eagles to F-15EX aircraft within about three months of getting them since the jets are so similar. Here, Eagles conduct aerial operations in support of Bomber Task Force Europe 20-2 over the North Sea March 16.

Sherif Wagih/Boeing

The F-15EX's central pylon can carry a notional 22-foot, 7,000 pound weapon. This artist's concept shows an F-15EX after firing a hypersonic missile from that station.

a big difference. In other places they have lots of targets ... so carrying 28 (Small Diameter Bombs) in that theater" makes more sense. The EX "can now carry four air-to-air missiles while it's doing all that other ... air-to-ground" work.

The Air Force initially expects to use the EX as an air-to-air platform, directly substituting for the F-15C. In that role it can carry 12 air-to-air missiles, and on the new stations, either the AIM-120 or AIM-9 can be carried.

At the Air Force Association's virtual Air, Space & Cyber Conference in September, Boeing's virtual exhibit included an image of an F-15EX launching a hypersonic weapon. Asked about it, Kumar said only that the aircraft's central pylon "can carry a 22-foot, 7,000-pound weapon." Another Boeing official said there have been "fit checks" with an unspecified missile. "We've done ... work in the simulator on this," the official said.

The first jets will reach Eglin nine months ahead of contract schedule. Boeing has fronted some of its own money to build them, to show the Air Force it can deliver swiftly.

"We're excited to deliver these two airplanes just ... a few months after contract award, and let the Air Force start flying them," Kumar said. "They're going to get ... almost two years of flying on the first two airplanes before the rest of Lot 1 delivers, and [of] the next six, ... four of those will also be test-wired for data collection." The last four will probably be a "top off" to testing, as most developmental tests will be completed by the time they arrive.

The Saudi government paid the U.S. Air Force to flight-test the F-15SA, which was the first to use the fly-by-wire system. That program—for which testers received an award by their peers—"tested every flight-test point the F-15 had ever flown," a Boeing official reported. "And, the thought now is that we simply don't have to go back and do a lot of that because it was great data." The Qatari jets aren't that different from the Saudi aircraft; it has "a smaller test program" focusing on the radar, displays, and computer, "so a lot of that obviously doesn't have to be redone."

Moreover, the F-15 test force at Eglin is already shaking out the EPAWSS, MDS/JTRS and Suite 9, so the addition of eight F-15EX jets with all those features will add capacity and speed to the test force, he said. "There's a ton of synergy," he added. Developmental test pilots are already checked out in the QA aircraft, "so they've got a leg up, already. ... The airplane is already very known to the test community."

What will be new on the EX will be the Suite 9 operational flight program and a new armament control suite, which will require shooting some missiles.

A new simulator is being put together, but the changes needed to convert an F-15C/D or E sim to an EX are minimal, a Boeing official said, and won't require new buildings or other large investment. Likewise, there shouldn't be a problem integrating the F-15EX into Defense Department wargaming simulations, because the adjustments will be small.

Because the F-15EX didn't go through the typical process of the Air Force setting a requirement and following a development process, it won't conform to typical programmatic milestones, Kumar said.

"This is different. ... We'll go through the Milestone C decisions" by combining them with a benchmark called Integrated Design Review, rather than Critical Design Review.

"These are really production-ready jets," he said, "so it should be fairly straightforward to get into production right after" Integrated Operational Test and Evaluation.

Boeing is planning to build about four F-15EXs per month, including foreign jets. Can the F-15C/D fleet last long enough for the F-15EX to get onboard?

"The Air Force is looking at that by tail number, and with a lot of attention," a Boeing official said. "They're doing inspections ... and [looking] at the data, and ... looking at what the implications are on the fleet." He said he thinks the Air Force is "cautiously optimistic ... but we're certainly supporting them in every way we can think of."

Kumar said the Air Force's adoption of the F-15EX will potentially expand the number of countries that might buy the jet, including current users Israel, Japan, Qatar, South Korea, and Saudi Arabia.

"The world watches what the U.S. Air Force buys," Kumar said. "So clearly there's interest in our existing customer base across the world." Israel is "taking a look" at the new F-15, he said, while Japan is planning to incorporate many of the EX features except the fly-by-wire system. ✪

Rare Elements of Security

The U.S. moves to ensure a robust supply chain for rare-earth elements—beyond China's control.

Master Sgt. Ben Mota

Each F-35 contains more than 900 pounds of rare earth elements, which are crucial to targeting, communications, and other systems. China has sought to dominate markets for mining and refining these materials. Here, two F-35 Lightning IIs bank over the U.S. Midwest on Sept. 19, 2019.

By Alyk Kenlan

They could be the superheroes of minerals: Neodymium has the world's mightiest magnetic powers, making it essential for missile guidance systems. Lanthanum enhances the clarity of glass, particularly for high-end camera lenses, such as those used for intelligence, surveillance, and reconnaissance, and phosphorescent europium warms the hues in LED lights and plasma displays, while its unique neutron-absorbing properties make it a crucial ingredient in the control rods used in nuclear reactors.

All three are part of a class of 17 elements known as rare-earth metals that are critical for modern technologies, from cellphones to aircraft engines, and from missiles to aircraft carriers. Yet despite their critical nature, the U.S. depends on China for 80 percent of its rare-earth metal consumption.

Now, the U.S. government is moving to change that equation. On Sept. 30, President Donald J. Trump declared U.S. dependence on China for rare-earth elements a national emergency, issuing an executive order directing a multi-agency review and immediate action to provide loan guarantees and grants to help stimulate domestic supply. U.S. mining firms, and possibly some foreign-owned competitors, will be eligible for those funds. In addition, Trump ordered environmental restrictions relaxed to further encourage domestic mining.

"Our nation's undue reliance on critical minerals, in processed or unprocessed form, from foreign adversaries constitutes an unusual and extraordinary threat, which has its source in substantial part outside the United States, to the national security, foreign policy, and economy of the United States," Trump wrote. "I hereby declare a national emergency to deal with that threat."

"Relying on foreign sources for these critical materials poses a risk to the DOD's readiness to deter and defeat adversaries."
—Department of Defense 2021 budget request

In addition to rare-earth metals, China also provides more than half of U.S. annual consumption of 31 of 35 materials deemed critical to national security. The administration said the U.S. has no domestic supply for 14 of those. U.S. dependence on China for gallium, graphite, and barite, among other materials, "constitutes an unusual and extraordinary threat," the order states, to national security and critical U.S. industries.

Competition for access to the Arctic Ocean and the rich resources beneath is one reason China is trying to normalize its presence there, Air Force Secretary Barbara M. Barrett said in July. In rolling out the service's first-ever Arctic strategy, China wants "access to regional resources, which are said to include over 90 billion barrels of oil and an estimated trillion dollars' worth of rare-earth metals."

Trump's September order followed five presidential determinations for the rare-earth elements supply chain issued in July 2019, addressing: Light Rare-Earth Separation and Processing; Heavy Rare-Earth Separation and Processing; Production of Rare-Earth Metals and Alloys; Production of Neodymium Iron Boron Rare-Earth Permanent Magnets; and, production of Samarium Cobalt Rare-Earth Permanent Magnets.

Rare-Earth Elements Crucial to Defense

The U.S. has identified 35 metals or minerals crucial for its industrial base. Among them are:

Name	Properties	Aerospace Uses
Gallium	Superconductivity	Computer chips, light-emitting diodes
Neodymium	Extremely powerful, durable magnets	Missile guidance systems
Samarium	High-temperature magnetism, absorbs neutrons	Nuclear reactor control rods, lasers
Praesodymium	Makes stronger, more heat-tolerant alloys, permanent magnets	Aircraft engines, satellite components
Yttrium	Alloy strengthener, glass clarifier	Microwave emitters, optical coatings, LEDs
Promethium	Low radioactivity	Long-lived batteries for missiles
Lanthanum	Glass clarifier, reacts with hydrogen	Optics and lenses, night-vision goggles, fuel cells
Europium	Phosphorescence	LEDs, plasma displays

These efforts "will establish a domestic industrial capability to support key aspects of the rare-earth supply chain," according to the Pentagon's 2021 budget submission. "Relying on foreign sources for these critical materials poses a risk to the DOD's readiness to deter and defeat adversaries."

It listed rare-earth element permanent magnets required for jet fighter engines, missile guidance systems, missile defense, space-based satellites, and communications systems among the critical needs.

The 2021 National Defense Authorization Act looks to build supply chains domestically and with U.S. allies in an effort to reduce global reliance on China for the elements. The department plans to use some of the additional $120 million in Defense Production Act funds to get this supply chain established. In addition, "multiple projects are anticipated to be awarded in FY20 utilizing prior year funds," the budget documents state.

Rare-earth elements aren't necessarily scarce, according to U.S. Geological Survey (USGS) data. But they can be hard to locate. Instead of appearing as a vein in rock formations, like gold or silver, capturing rare-earth metals requires miners to extract a large volume of rock and then process it to separate out rare-earth elements, said professor Roderick Eggert, deputy director of the Critical Minerals Institute at the Colorado School of Mines.

After the mining phase, the rare-earth elements have to be separated from other material in a technologically tricky and environmentally hazardous process to obtain useful amounts of the elements. Once the elements are separated, they can then be processed into alloys and refined to be used to make useful materials. The final step is to take the refined rare-earth elements and turn them into magnets, chemical catalysts, or other components in aircraft, weapons systems, and other goods.

The Mountain Pass mine in San Bernardino County, Calif., is the only operational rare-earth metals mine in the United States, producing about 10 percent of all rare-earth concentrate, the material from which the metals are extracted, according to USGS data. But the mine does not process its own materials—nor does any other U.S. firm. Instead, Eggert said, all of the material is shipped to China for processing.

Converting rare-earth elements into usable metals is energy-intensive and environmentally fraught, one reason U.S. production disappeared. It's hard to meet U.S. regulatory standards; China's rules are far more forgiving, Eggert noted.

It wasn't always this way. Just 30 years ago, the U.S. controlled most of the global rare-earth market, and the Mountain Pass mine accounted for 50 percent of global rare-earth production, But China pursued a slow and steady strategy to dominate the market, leveraging cheap labor, lax environmental standards, and government policies that promoted the industry, said Dean Cheng, a senior research fellow at the Heritage Institute.

While some raised alarms in the early 2000s, most U.S. policymakers were not concerned about China's growing dominance of the rare-earths market. Cheng said that while China may have sought to manipulate the market to put foreign mines out of business, it generally produced rare-earth elements more efficiently and economically than rivals.

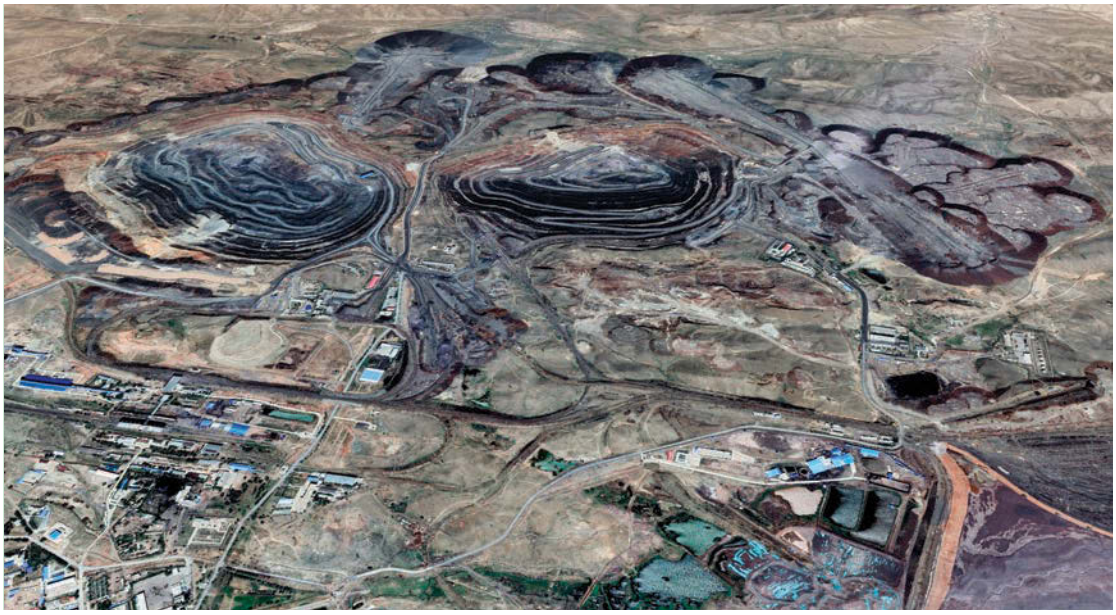
In his executive order, the President asserted that, "since gaining this advantage, China has exploited its position in the rare-earth elements market by coercing industries that rely on these elements to locate their facilities, intellectual property, and technology in China." For example, China suspended exports of processed rare-earth elements to Japan in 2010, threatening that country's industrial and defense sectors and disrupting rare-earth elements prices worldwide. As a result, the order states, "multiple companies were forced to add factory capacity in China."

With a new National Defense Strategy released in 2018, however, the world has changed. "We see China as more threatening today," according to Cheng. "Therefore, we ow think of rare-earths differently than we did 10 or 20 years ago. ... Twenty years ago, why would you want to have horribly polluting, dirty processing of these ores [in the United States] when the Chinese are happy to do it for you?"

Cheng said the Japanese embargo, which struck Japanese cellphone manufacturers and automakers in particular, catalyzed concern among Japan, Australia, and the U.S. to begin investing in their own rare-earth supply chains.

However, Andrew Hunter, director of the Defense-Industrial Initiatives Group at the Center for Strategic and International Studies, said that because the Department of Defense represents such a small share of U.S. rare-earths consumption—less that 5 percent—solving its problem without addressing the wider commercial markets would be inefficient. The solution has to address the entire market, he argued.

"If you throw enough money at it under the Defense Production Act, get Mountain Pass up and operating again and meeting defense needs, you most likely would end up with a supply chain that was divorced from the commercial market," Hunter said. That, he added, would "be incredibly expensive and not very robust."



Google Earth

The Bayan Obo mine located in the Inner Mongolia region of China is the world's biggest rare-earth element mine. The U.S. depends on China for 80 percent of its rare-earth metal consumption.

Making a reliable commercial supply chain likely would involve collaboration with close U.S. allies such as Australia, Japan, and Canada. Australia has large material deposits, and its Lynas Corp. Ltd. is among the largest rare-earth producers outside of China. Japan, meanwhile, has expertise in processing and refinement, Hunter said, so it's possible that raw material harvested in Australia could be processed and refined in Japan, then marketed to Australia, Japan, and the U.S.

Undersecretary of Defense for Acquisition and Sustainment Ellen Lord said the U.S. is considering all options. "One of the highest potential avenues is to work with Australia," she said in 2019. She had visited Australia and held"discussions about rare-earths and whether or not we could work with Australia to stand up a facility that would take care of our DOD needs" and also those of other international partners.

Among U.S. producers, USA Rare Earth is among those that have pressed for government action. "What we're hearing across the globe, both from governments and the private sector, is a concern around a secure supply chain of rare-earth and battery materials—and in particular, what we call the heavy rare earths," said Pini Althaus, CEO at USA Rare Earth.

Each F-35 jet contains some 920 pounds of yttrium, terbium, and other rare-earth elements, particularly for their advanced targeting systems, according to a Congressional Research Service report from 2013.

USA Rare Earth is developing the Round Top Heavy Rare Earth and Critical Minerals Project in West Texas, a site 85 miles from east of El Paso, that has long been scouted by mining firms, but was never before deemed economically viable, Althaus said. It's also developing new refining methods and will spend the next year refining its processes at a temporary facility in Colorado as it prepares to open a production plant in Texas, Althaus said. USA Rare Earth's facility will be among the first new full rare-earth element and critical minerals processing facility outside of China in years, he said.

Round Top contains 16 of the 17 rare-earth elements, and a particularly high concentration of the heavy rare earths essential to the F-35 and other military applications. He argues it will "be able to provide U.S. defense with all the materials it will need for the foreseeable future."

USA Rare Earth is also adapting a magnet plant in North Carolina formerly owned by Hitachi, which will help establish a wholly domestic supply chain for rare-earth element products, Althaus said, making his firm "the only company outside of China with a mine-to-magnet solution."

Founded in Australia, USA Rare Earth established itself as an American company to launch the Texas project with the support of the Navajo Transitional Energy Company—the investment arm of the Navajo nation focused on green energy—as one of its major investors. All its investors are from the Five Eye countries: Australia, Canada, New Zealand, the U.K., and the U.S.

For the industry to survive and thrive in the U.S., however, Althaus argued that government investment and policy leadership will be critical. "As far as what the rare-earth sector is going to look like in five or 10 years, that is really in the hands of the U.S. government," he said. "We can set up a critical mineral supply chain, and that could mean getting 20-, 30-, 40-percent of rare earth elements and critical minerals from U.S.-based companies."

China won't take new competition sitting down, Cheng said. It will continue to stymie rare-earth development abroad by buying rare-earth production companies around the world, exporting refined rare-earth materials, and driving down commercial prices to make competitors unprofitable, Cheng said.

"You can never out-subsidize the Chinese," he said.

But the combined resolve of Australia, Japan, Germany, and the U.S. could be enough to prevent a Chinese monopoly, Hunter said. "The Chinese, in some ways, have done the easy part. Becoming a major market player is one thing, truly establishing a monopoly that everyone else has to do what you want" is a harder nut to crack.

Compared to other nations of its scale, China is relatively resource-poor, Hunter said, and rare earths are among the few naturally occurring commodities China can control. They want to use that control to become a leader in capital goods that need rare-earth elements, including windmills and batteries, both critical elements in alternative energy markets.

"Ultimately," Hunter stated, "the source of U.S. national security is the economic power that made the U.S. what it was in the 20th century, and now the 21st century. That is the No. 1 threat, in my perspective, and the national security threat is derived from that." ✪

John A. Tirpak contributed to this report.

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Erasing Artificial Barriers

The Air Force is making it easier for women to be aviators—and to keep flying should they choose to have children.

Capt. Charlene Sufficool didn't think she could be a fighter pilot until a commander at the Air Force Academy encouraged her to try. Here, then-First Lt. Sufficool poses with an A-10 during B-Course training at Davis-Monthan Air Force Base, Ariz.

355th Wing Public Affairs

By Amy McCullough

When Capt. Charlene Sufficool first got to the U.S. Air Force Academy in 2012, she wanted to be an engineer or maybe work in intel. Although she grew up in a military family and her dad had once been a crew chief for the Thunderbirds Demonstration Team, flying wasn't on her radar, she said. "I never really thought of it as a possibility for me."

But when Sufficool made the Academy's Wings of Blue parachute team her sophomore year, her commander, an A-10 pilot, said she had what it takes to fly fighters. He urged her to give it a try. Sufficool had by then begun thinking of flying, but she'd only met one woman pilot, and she flew C-17s. "I was like, you know, I think I would like to fly C-17s because I've seen a girl, and she flies C-17s, so it seems like that's what girls do," Sufficool recalls.

"But, he was like, 'No, really, I think you could be a female fighter pilot.'" His insistence changed her trajectory. Today, Sufficool flies A-10s with the 354th Fighter Squadron at Davis-Monthan Air Force Base, Ariz. "It took a commander that believed in me as a woman to help me see what I could be," she said, and "for me to believe in myself."

"You can't be what you can't see."
—Gen. Jacqueline Van Ovost, Air Mobility Command boss

Of the 10,964 pilots in the U.S. Air Force today, only 708—just 6.5 percent—are women. The majority fly mobility aircraft and fewer than 3 percent fly fighters.

"You tend to see more women in mobility because that's ... where we started," said Air Mobility Command boss Gen. Jacqueline D. Van Ovost, a command pilot with more than 4,200 flight hours. Now the Defense Department's only female four-star and a former test pilot, Van Ovost oversees 52 percent of the Air Force's women pilots.

"It goes back to that thought ... you can't be what you can't see," she said. "That's why we're so focused on exposure for our aviators."

ARTIFICIAL BARRIERS

The Air Force is also focusing on removing barriers that shouldn't exist. Restrictions on women flying combat missions were dropped in April 1993. Maj. Gen. Jeannie M. Leavitt—then a first lieutenant—

became the Air Force's first-ever female fighter pilot a few months later.

Leavitt made a career of blasting through barriers. She was the service's first woman to graduate from the elite Air Force Weapons School at Nellis Air Force Base, Nev., in 1998, and nearly two decades later, the first woman to command a fighter wing. Today, she serves as Air Education and Training Command's director of operations and communications, where she heads up the service's Rated Diversity Improvement (RDI) team—one of five lines of effort under the Department of the Air Force's overall Diversity and Inclusion Task Force, stood up by former Chief of Staff Gen. David L. Goldfein.

Leavitt said the May decision to remove initial height requirements for pilot applicants was a "key change" to improving rated diversity. Pilots previously had to be between 5 feet, 4 inches and 6 feet, 6 inches tall, with a sitting height of 34 to 40 inches. But that physical requirement disqualifies about 44 percent of the U.S. female population between the ages of 20 to 29, according to AETC. While the former policy allowed Airmen to apply for waivers—and 87 percent of those were approved from 2015 to 2019—the number who never even tried is beyond knowing.

"About a year ago, I met a highly qualified young lady working on her master's in aeronautics and astronautics, and she was thinking about going into the military, but she wasn't sure which service. Of course, I said, 'Well, the Air Force is wonderful,' and she said, 'Yes, but I want to be a pilot.' I said, 'Well, we are the Air Force and we definitely have pilots.' And she said, 'I'm not quite 5 foot 4.' I said, 'No, no, that's not a restriction!'"

Such policies are "artificial barriers," Leavitt stated, defining an apparent absolute minimum, when in reality, it just meant that for those shorter than 5 foot 4 inches, USAF had to take extra measurements to steer them into cockpits suitable for that height and stature. There are very few aircraft that people who did not meet those parameters are prohibited from flying, she added.

"There was a misperception that the Air Force had a minimum height restriction of 5 foot 4, but a lot of that was urban legend," Leavitt said. "Even though we had changed the height restriction, when you Googled, 'What is the minimum height to be a pilot in the Air Force?' 5 foot 4 would come up. Well, it wasn't true, we had made changes, but it took a concerted effort to highlight the changed requirements."

Most USAF aircraft were built around a 1967 anthropomorphic study of males between the ages of 20 to 29 years old, which looked at everything from femur height, sitting height, head size, shoulder width, to how you wear your gear, Van Ovost said. Future cockpits will be more inclusive.

"We are—in the future—designing cockpits that are going to meet 95 percent of the recruitable American population. So, we're changing those 1967 standards and that will provide opportunity," she noted. "As you can imagine, they can't do this overnight, but these are the kinds of things that give hope for women and to our recruits."

FLIGHT SUITS FOR ALL

One key to recruiting and maintaining female aviators is making flight equipment that is specifically suited for their bodies. This includes everything from maternity flight suits to equipment that makes it easier for female fighter pilots to relieve themselves during long sorties.

The Human Systems Division is simultaneously working a three-phase approach to fielding maternity flight suits. The first phase is a temporary fix to the existing 27/P flight suit worn by most aviators. In phase two, USAF is looking to develop a one-piece maternity flight suit with extra, stretchable fabric in the front and adjustable tabs on the sides. The Air Force is conducting burn and extended-wear testing now and fit tests will follow early next year; initial production is slated to start in December 2021, according to a USAF release.

Airman 1st Class Bailee Darbasie

A demonstration of issues and challenges women face with current survival vests at AFWERX's Female Flight Equipment Workshop in Las Vegas in early 2019. Female Airmen attended the workshop to explore areas of opportunity and come up with solutions.

Capt. Sydney Freeman, a C-130J pilot assigned to the 19th Airlift Wing at Little Rock Air Force Base, Ark., made do by wearing her husband's flight suit while pregnant, rolling the sleeves and adjusting the middle to accommodate her frame. Now she's trying to get one of the new flight suits for her current pregnancy.

"Navigating through the purchase and acquisitions for that flight suit, it's taking some time," she said. "It's definitely a bit of a frustration to experience, because I mean, gosh, we've been flying in combat for almost 30 years now. This isn't the first time female pilots have ever had children. … I think we still have a bit of work to do."

HYDRATION AND RELIEF

Flying in combat does bring some unique challenges for women.

During pilot training, Sufficool practiced what she called "tactical dehydration." T-6 sorties were about two hours and T-1 sorties typically only lasted about an hour, so she would drink coffee and try to clear out her system before she flew. Then once she landed, she would chug water to rehydrate.

But that tactic doesn't work in combat where flights are much longer. "When I was getting ready to deploy, and they told me that I might have to sit in the cockpit for seven hours, that's when I started to get kind of concerned," she said. Most of the bladder-relief gear was designed for men, and while the Air Force does have devices for women, most female fighter pilots say they aren't really practical in a cramped fighter cockpit while wearing a G-suit, harness, and combat vest.

That's why AFWERX, the Air Force's innovation arm, is hosting the Sky-High Relief Challenge to find "an improved bladder-relief system [that] will enhance the overall quality of life for female aviators on and off the job by leading to fewer physical and mental health issues," states the challenge site.

Tactical dehydration isn't a safe alternative. Dehydration lowers pilots' G-tolerance by up to 50 percent. It can also re-

93rd Air-Ground Operations Wing

Maj. Danielle Willis and husband Maj. Darren Willis prioritized getting assignments together so they could raise a family, despite warnings that doing so might limit their careers. The couple deployed to Balad Air Base, Iraq, in 2008.

duce physical and cognitive performance, decrease situational awareness, cause intense headaches and altered vision, and can cause G-induced loss of consciousness.

USAF is willing to award up to 10 prizes at a minimum of $100,000 each for firms that can design "comfortable, form-fitting interfaces; urine transfer and storage technology; [and] compact, high-flow rate pump technology," the announcement says. AFWERX is also willing to award as many as two prizes worth $250,000 or more for a "complete pump-less bladder relief system."

"The focus on addressing women's needs at the highest levels of the Air Force demonstrates USAF's commitment to developing superior aircrews while simultaneously fostering inclusion and supporting gender equality," the announcement says. "Addressing female-specific equipment and female aviators' well-being is a top USAF priority. The outcomes of this challenge will help improve retention rates, advance recruitment practices, and eliminate gender gaps."

Still, while the requirement remains, funding has proven a challenge. Efforts to reprogram additional funds for both maternity flight suits and new in-flight bladder relief devices for women were both deferred in recent budget actions.

FAMILY OR CAREER—OR BOTH?

The Air Force is also taking steps to tackle another perceived barrier—the idea that women have to choose between having a family and a flying career in the Air Force. Leavitt calls this a "false choice."

"Personally, my husband and I have two amazing children, and most of the female pilots I know are moms. I think there is the perception that you can choose to be a pilot or choose to be a mom, and I think that is kind of a false choice in terms of choosing one over the other," she said.

Last year, the Air Force updated its policy for pregnant women, allowing those flying remotely piloted aircraft, performing missile operations duty, and "certain fully qualified pilots" to continue their work during pregnancy without a medical waiver.

Lt. Gen. Dorothy A. Hogg, USAF surgeon general, said the policy change was meant to "empower women to work closely with their obstetrician and flight medicine providers to pick a path that is tailored to their individual needs." Women are not required to fly while pregnant and pregnant pilots are free to change their minds about flying at any time, she said.

When the change was made, Lt. Col. Jammie Jamieson, the first operationally qualified female F-22 pilot assigned to a combat-coded unit—and a mom of three—said the policy pays off for both pilots and the Air Force. "Flying is a sport and a perishable skill," she said. "So being able to minimize time out of the air helps preserve their individual skills and readiness and retains the Air Force's significant investment in them."

Col. Danielle Willis, vice commander of the 93rd Air Ground Operations Wing, always wanted to be a fighter pilot. She has a picture of herself at three years old sitting in the cockpit at an air show giving a "thumbs-up with a huge grin on my face," and from that moment on "all I would talk about was flying," she told Air Force Magazine.

Growing up, Willis had no idea women weren't allowed to fly in combat. "Without a strong military background in our family, it honestly never occurred to my mom, my sister, or I that ... wasn't something that was open to us." Willis was a sophomore in college when Leavitt went through pilot training, so when she graduated and joined the Air Force, "I ended up being on the leading edge of women flying fighters in the military, without even realizing how I was on the cusp of essentially the history of women in the Air Force."

She met her husband—a fellow fighter pilot—at Laughlin Air Force Base, Texas. "It was love at first G," she said. The couple prioritized having assignments together, which was one of the reasons they volunteered for instructor duty. "Early on, we got some feedback that it might limit our career," Willis said. But, "we knew that we wanted to have children, and the way that the policies were set up at the time, it was easier for me to requalify in the T-38 as a UPT instructor than it would have been for me to requalify as an F-16 instructor."

Now, things are changing.

Van Ovost, whose prior post was as USAF director of staff and as adviser on the Air Force's Diversity and Inclusion efforts, said the service has made it easier for women to fly while pregnant.

"And, now, we're just in the final throes of authorizing a new policy that specifically talks about women and pregnancy and flying duties," she said. "Currently, when pregnant and flying in a physical airplane, you can only fly if you're cleared in your second trimester. ... That's only in airplanes that have multiple pilots in it, no ejection seats, so we're opening that up so that we can allow our women to continue to fly. We'll have some restrictions, but we'll be able to continue to fly them, and you can maintain currency, and do things that, frankly, are lower risk to them and to the fetus."

When Freeman had her first son in May 2019, she was immediately grounded and had to wait weeks to get a medical waiver. As a C-130 pilot, an aircraft with two pilots and no ejection seat, she was able to keep flying until her 24th week of pregnancy. And, because Little Rock has certified C-130 simulators at the base, she was able to maintain her currency after that, and never worried about requalifying after the baby was born.

"Dyess Air Force Base [Texas], Yokota Air Base [Japan], and Ramstein Air Base [Germany], don't have simulators," she

said. "The ladies that are expecting at those locations don't have that option."

The recent policy change gave Freeman, who is now pregnant with her second child, more time in the air. "It's absolutely wonderful," she said. "I get an extra five weeks [to fly] because the waiver period now goes from my 12th week to 28 weeks [of pregnancy]. And, as soon as I had the meeting with the flight doc, within the next two days I had my waiver approved because it's at the base level now."

In August 2019, USAF also released a new lactation policy, requiring units to provide rooms for nursing mothers. The policy does not only apply to pilots, but it shows the increasing support female Airmen have in the service.

Col. Angela F. Ochoa, vice commander of the 375th Air Mobility Wing at Scott Air Force Base, Ill., is very familiar with the logistical challenge of balancing a busy flight schedule and being a new mom. After giving birth to her daughter, Ochoa would show up for a mission, do all the necessary pre-flight paperwork and briefings, and then send her crew out to the airplane, while she went into a bathroom to pump. But since sorties could last as long as 16 hours, she also had to figure out how to pump in the air.

"I would bring my kit, and go out to the plane, and what I would try to do is find a time where I could pump either while I was flying, while we were up at altitude … or … schedule a period of time [during the] sortie where I [could] sit down on the ground and take care of business," Ochoa said. "This is a common thing that a lot of women that are moms have to deal with and figure out how to work it into the mission."

Now as a leader, she is trying to normalize the process, encouraging female pilots to be upfront about their breastfeeding needs, rather than saying they have a "meeting" or need to take a "phone call" when it's time to pump.

"I am very excited that the rated diversity improvement initiatives have so much attention," Leavitt said. "When I started pilot training quite a while ago, there were no such efforts. There were not a lot of women or minorities in pilot training, and there was no one focused on changing that. So, the fact that our Air Force leadership, from the very top-down, is interested—very interested—in improving the diversity of our rated force is very exciting to me."

PUTTING A FACE TO THE MISSION

In October 2018, the Air Force Recruiting Service (AFRS)—then under Leavitt's command—stood up its Detachment 1 as the "tactical execution arm" of RDI, according to its website. Det. 1's mission is to "inform, influence, and inspire," and it does that largely by having a diverse group of Airmen—from general officers to new lieutenants—tell their story to potential new recruits, said Det. 1 Commander Lt. Col. Annie Driscoll.

The service announced in February that 300 rated officers would join Det. 1's Total Force aviation recruiting team, with the goal of using those officers as "force multipliers" at AFRS recruiting and engagement events. The goal is to increase the number of engagement events with youth and underrepresented groups, such as women and minorities, by 300 percent by fiscal 2025, and then increase the number of minority and female applicants by 20 percent annually to match the demographics of the eligible, qualified American population during the same time period, according to USAF.

The coronavirus pandemic forced AFRS to rethink these engagements, but it hasn't stopped the service from reaching out. In response to the crisis, Det. 1 launched the "Pathway to Wings" virtual program—a live webinar in which pilots from different backgrounds answer questions about what it's like to fly for the U.S. Air Force, while recruiting experts are on hand to answer questions about joining the service. Driscoll said 1,250 people signed up for the first event, and nearly 3,000 participated in the first three events held over the summer. AFRS plans to continue holding the virtual webinars every month.

"We want to show them somebody that they can look up to, that they can identify with their story and say, 'Hey, that could be me,'" Driscoll said.

So far, the efforts appear to be paying off.

"As we've continued to put emphasis on this, we're starting to get momentum," AFRS commander Maj. Gen. Edward W. Thomas Jr. told reporters at the Air Force Association's virtual Air, Space & Cyber Conference in September. "Over the past four years, we've seen a steady increase in female rated selects," going from 9.2 percent four years ago to 19.2 percent today. "So, we are making headway. … We've got to keep our foot on the pedal, clearly, but we are making some headway." ✪

Senior Airman Solomon Cook

Col. Angela Ochoa encourages female Airmen to be upfront about their challenges, such as breastfeeding needs, instead of trying to hide them. The 375th Air Mobility Wing's vice commander is pictured here in front of a C-21 in a hangar at Scott Air Force Base, Ill.

Close Encounters of a Familiar Kind

Competition with Russia intensifies across the Northern Hemisphere.

NORAD

F-22s from the 3rd Fighter Wing at Joint Base Elmendorf-Richardson, Alaska, flew 810 sorties in June—the most in one month since Raptors arrived there in 2007. This F-22 intercepted a Russian Tu-95MS bomber in the Alaskan Air Defense Identification Zone on June 16.

By Brian W. Everstine

In the chilled skies of the Northern Hemisphere, above and over the Chukchi Sea and the Beaufort Sea, west and north of Alaska, and over the Black Sea and the Baltic Sea in Northern Europe, great power competition comes to life. A modern version of the aerial chess match that for decades pitted U.S. Air Force fighters and bombers against those of the Soviet Union.

The U.S.S.R. is no more, but Russia remains, and its fighters, bombers, and maritime surveillance aircraft are engaging U.S. forces on the edges of the Arctic region more frequently now than at any point in recent memory. In the first nine months of 2020, there have been more than a dozen intercepts in the Alaska Air Defense Identification Zone (ADIZ) alone, with North American Aerospace Defense Command (NORAD) scrambling F-22 fighters, KC-135 tankers, E-3 AWACS, and Canadian CF-18 fighters in response. Meanwhile, high-profile intercepts over Eastern Europe—including one recent incident with Russian fighters harassing a B-52 bomber on patrol— demonstrate the increasingly tense nature of great power competition.

"There is an increase in interest in the Arctic, and therefore there is an increase in activity, both on our side and theirs ... resulting in this interaction between our militaries," said Maj. Gen. David J. Meyer, deputy director of operations with NORAD. And we "do have an increase in intercepts that occur as they come around and show their presence in the Arctic. ... This is not unexpected, as we have this increased competition in the Arctic. It's just part of what we do."

"This is not unexpected as we have this increased competition in the Arctic. ... It's part of what we do."
—Maj. Gen. David Meyer, deputy director of NORAD operations

SITTING ALERT

Every day, the Combat Alert Cell at Joint Base Elmendorf-Richardson (JBER), Alaska, fills with crews, who chat lazily, watch TV, read—anything to hold off the monotony while they wait for the klaxon to ring and shake everything loose. "It's hours and days of boredom, followed by a few seconds of terror," said Col. John Krellner, F-22 pilot and commander of the 3rd Operations Group. "It gets exciting pretty quick."

NORAD's long-distance radars and sensors monitor for inbound threats and unusual activity. When it's detected, the alarm sounds, the operations group is notified, and pilots race to their jets. "It's an immediate 'get to the aircraft, get started, and get airborne,'" Krellner said. Pilots are briefed by intelligence officers while en route to let them

know what to expect. The Federal Aviation Administration is notified to clear nearby airspace.

NORAD shares the operating picture with U.S. Northern Command (NORTHCOM), Meyer said. "Depending on what is being detected and where...there is a whole process" for escalating to "the highest level" whether action needs to be taken.

About a dozen disparate systems track incoming threats and the ongoing response for NORAD, and staff assembles that with space-based surveillance, weather, intelligence, and other feeds to provide a clear operating picture. "Then they feed that information up to the decision-makers with all the available information, and it's not perfect information," Meyer stated. "So, we have to rely on our 30-plus years of experience going: 'OK, do I think ... are we really being attacked? Or is this something else?'"

Krellner, the F-22 pilot, said that as the Raptors "get to the merge" with their Russian rivals, pilots' minds race. They must consider their commander's guidance and ongoing command and control communications, while adhering to air- traffic clearances. They also must watch their fuel, closure speed and angle, and remain professional.

"I'll be honest, my mind is pretty full when I'm operating an intercept," he said. "It's really focused on juggling all of those tasks, ... flying the airplane, including getting to that position when I'm on the wing of the Russian long-range aviation, and then have the potential to take a photo of that aircraft and report what I'm seeing back through command and control channels."

Training makes it routine, he said. "But, at the same time, I would say we make the complex look easy."

Recent intercepts have been professional, with no direct communication between the Russian and U.S. side. The Raptor pilots may take "de-escalating measures" if something unprofessional occurs, but that hasn't happened, Krellner said.

"They definitely know we're there," he said. "They can see us. We're on their wing. But other than maybe just seeing a face acknowledging us through the window, there's no other communication."

Staff Sgt. James Cason

Still images from video made by a B-52 crew of an Aug. 28 incident over international waters of the Black Sea. Two Su-27 Flankers made repeated passes by the bomber's nose, within 100 feet, using afterburner.

UNSAFE IN EUROPE

On the other side of the globe, things took on a different complexion on Aug. 28, 2020. A B-52 deployed to Europe flying a long mission through Eastern Europe as part of "Allied Sky," in which six bombers and aircraft from several allied nations showed support for NATO, was overtaken by two Russian Su-27 Flankers over international waters in the Black Sea. Video of the incident showed the Flankers come up alongside the bomber, and then turning sharply and crossing just above and in front of the U.S. bomber. With their afterburners lit, they generated strong turbulence. U.S. Air Forces in Europe (USAFE) said the jets flew within 100 feet of the B-52, the turbulence caused the bomber to shudder, and a photographer in the aircraft's jump seat reflexively ducked down.

USAFE said the incident risked a collision and was inconsistent with good airmanship.

USAFE boss Gen. Jeffrey L. Harrigian said the B-52 crew handled the incident "masterfully," keeping their aircraft safe and remaining professional. "What they did to ensure there was no escalation was exactly what I would expect of them, and it truly demonstrated the professionalism of our force," he said.

Operating from Royal Air Force Fairford, U.K., the B-52 task force flew several long-range flights to Eastern Europe and interacted with Russian aircraft several times throughout the summer and fall, Harrigian said, so crews are prepared for Russian fighters scrambling and for potential interaction.

"The Russians, frankly, are scrambling fighters quite often in our area of responsibility," he said. "My expectation is they are watching and monitoring those locations that we're operating in and when their criteria is met, they're going to launch their fighters to come up there and demonstrate that they're in the international waters that we often operate in. ... This is all about competition and demonstrating that we're going to be here, particularly in international waters."

In early September, a B-1B bomber task force from the 345th

Tech. Sgt. Jerilyn Quintanilla

F-35s are not currently performing homeland defense missions, but they may in the future—including intercepts. Here, four F-35A Lightning IIs fly in formation over Denali National Park, Alaska, as part of RED FLAG-Alaska 20-3.

Bomb Squadron at Dyess Air Force Base, Texas, flew direct from Texas to the East Siberian Sea in a 14-hour, 4,300 nautical mile mission to the far eastern section of the U.S. European Command area of operations. The task force then continued on to Eielson Air Force Base, Alaska. This mission—to the Arctic north of Eastern Russia—demonstrated an ability to operate in the Arctic part of the world just as anywhere else in the world, Harrigian said.

"You've noticed we've gone to the far east, we've been in the high north, we've been down in the Black Sea, then, of course, in the [Mediterranean Sea] and even down in Africa," Harrigian said. "And this has afforded us the opportunity to work through not only the operational-level [tactics, techniques, and procedures] that we would execute in these environments, but also to demonstrate that we've got range and we have the ability to hold any target at risk. And I think these are important concepts that we cannot forget."

THE FUTURE OF THE MISSION

In Alaska, the increased rate of intercepts is setting records. In June, the 3rd Wing at JBER flew 810 sorties—the most since F-22s first began alert missions there in 2007. The wing normally averages 523 sorties per month.

Krellner said Raptors are perfectly suited for these missions because of their speed and advanced avionics, which provide "really good situational awareness."

High demand has added some stress to the F-22 force, which has struggled with maintaining mission capable rates. Indeed, the Government Accountability Office, in a 2018 report, urged the Air Force to rethink alert taskings for the F-22s because intercepting slow-flying, aging Russian aircraft, does not require the advanced capabilities of the F-22. But, while F-22s were the only operational fighters in both Alaska and Hawaii, that is no longer the case. This past spring, Eielson Air Force Base began to bring on Pacific Air Force's first operational squadron of F-35As. Those jets are not now conducting homeland defense missions, but they may in the future.

"We have a requirement to have a particular capability resident to where we want to protect," Meyer said. "We, NORAD are indifferent as to what platform supplies that capability."

The Air Force is also looking at possible ways to modernize its command and control for this mission. NORTHCOM's homeland defense role is central to the service's developing "Internet of Military Things" concept, better known as the Advanced Battle Management System (ABMS).

Originally envisioned as a replacement for the E-8 Joint STARS, ABMS has morphed into an information technology effort intended to link sensors and shooters and provide a single combined operating picture to accelerate decision-making across a battlespace. NORTHCOM led the second "on-ramp" exercise for ABMS in early September, with dozens of sensors and aircraft, both legacy and modern, in a mission scenario based on a threat to the homeland.

NORTHCOM boss Gen. Glen D. VanHerck sees value in trying to quickly bring on new capabilities to streamline NORTHCOM's information feeds and to replace phone calls and PowerPoint slides with a continuously updated operating picture.

In the shorter term, NORAD officials say each sortie they fly needs to translate to lessons learned: "Thou shalt learn from your mission," said Canadian Air Force Brig. Gen. Francis W. Radiff, the deputy commander of the Alaskan NORAD Region.

NORAD is watching as Russia increasingly moves north with their long-range flights.

"This is all about an increase in interest in the Arctic," Meyer said. "It's obviously becoming a greater and greater interest, and therefore the majority of the activity we encounter at NORAD and NORTHCOM is up in the Arctic region. … It's been years since anything has come to our coast, at least in the air domain. … It's all about the increased interest in the Arctic. We're interested in it, they're interested in it, the Chinese are interested in it, all of the Arctic nations are interested in it."

Russia has also been sending different types of aircraft to the region at different times, such as Tu-142 maritime patrol aircraft in pairs to overfly the Aleutian Islands in June or loitering for hours within the Alaska ADI Z and coming within 50 miles of Alaskan shores on Aug. 27. Days before the Aleutian Island intercept, two IL-38 maritime patrol and anti-submarine planes flew within 50 miles of Unimak Island, one of the Aleutians, on June 24. Russia has also repeatedly sent Tu-95 Bear bombers, along with Su-35 fighters and A-50 airborne early warning and control aircraft toward Alaska. On one June 16 flight, two formations came within 32 miles of Alaskan shores.

In turn, NORAD is honing their responses and tactics to more quickly and effectively respond. "Every time we do something, we learn to improve the system because the homeland defense of North America is the No. 1 mission," Radiff said. "We want to ensure we are the best at it that we possibly can." ✪

Maj. Chris Casler, the 29th Weapons Squadron director of operations, observes weapons undergraduate pilots during phase three of the 29th WPS C-130 Weapons Instructor Course.

Airman 1st Class Aaron Irvin

Humble, Approachable Experts

For USAF's Weapons School, teamwork is the recipe for excellence.

By Jennifer-Leigh Oprihory

As far back as World War II, the Air Force learned that to create the best-trained force possible, many of its best performers had to become instructors. The better the instructors, the more skilled the Airmen they turned out.

Today's Air Force Weapons School builds on that tradition, taking some of the service's most promising Airmen out of operational commands and putting them through some of the most intense graduate-level training anywhere to teach them how to apply their specialized skills in combat—and how to teach others to do the same.

Weapons School graduates are like the Ph.D.s of combat training, carrying a patch and prestige that stays with them throughout their careers. Among its notable graduates is Gen. Charles Q. Brown Jr.—a Weapons School graduate-turned-instructor-turned-commandant who went on to become Air Force Chief of Staff.

Brown exudes the school's motto of "humble, approachable, credible," as do many of its graduates, who are forged by intense training to become true experts in their fields.

"There is only one Weapons School standard, and that standard is exceptionally high."
—Col. Jack Arthaud, Weapons School commandant

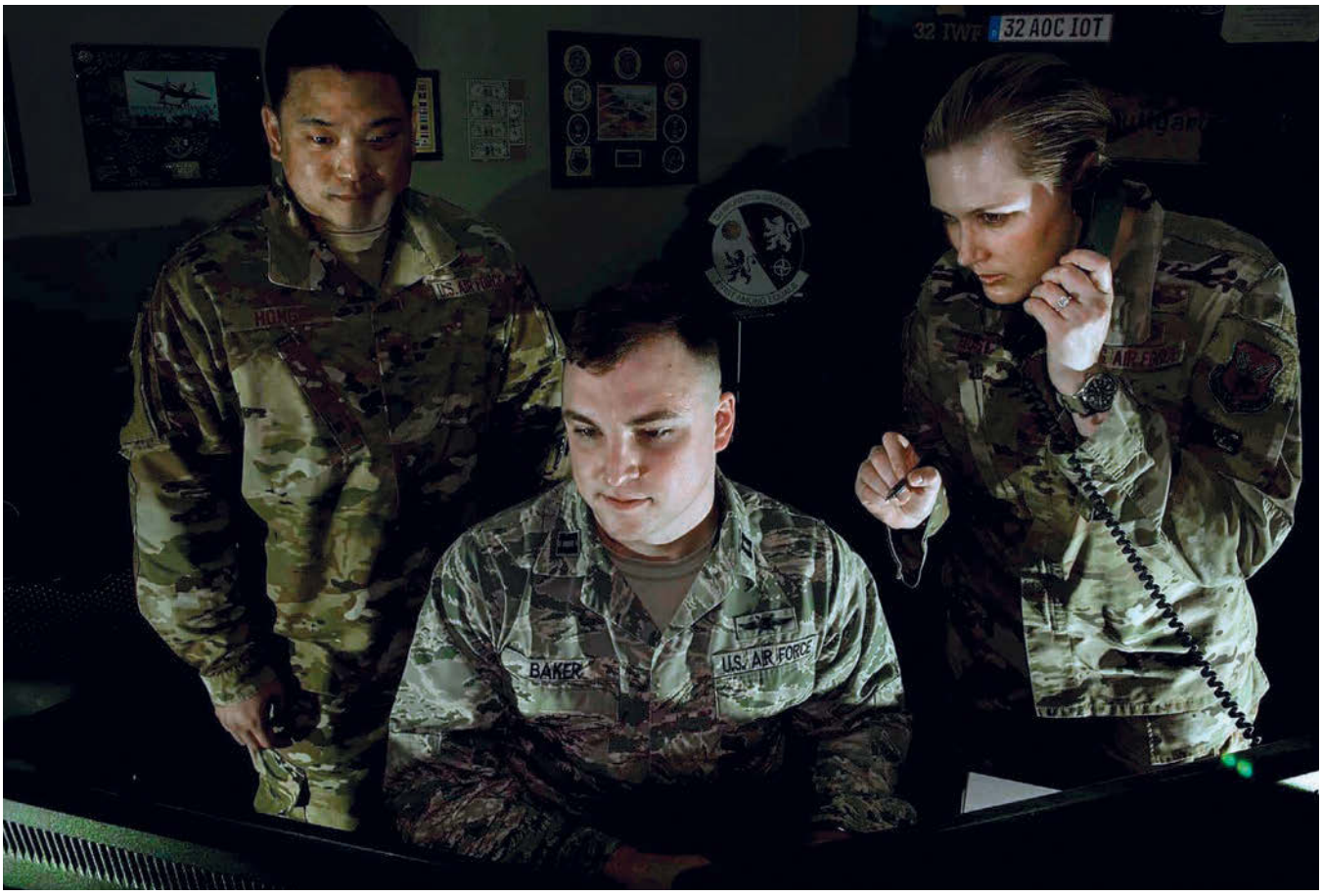
"We take folks who are already leaders and relative experts within their community, we bring them here, and then we make them better," Col. Jack Arthaud, Weapons School commandant, told Air Force Magazine. Students are taught to be "both tactical and technical experts within their specialty" he said. "Once we develop that depth of expertise … we combine it … at the end of the course in that five-week Weapon School Integration phase." Students are asked to combine the capabilities of their platforms with those of others "to solve the toughest tactical problems that we can put together in a training environment, and we do so across the air, space, and cyberspace domains."

THE COURSES

The Weapons School has both officer and enlisted programs, and most run about 22-and-a-half weeks:

■ Weapons Instructor Courses (or WICs) cater to weapon systems, Air Force Specialty Code (AFSC), or their unique roles and missions, Arthaud said. These courses are for officers, as well as enlisted joint terminal attack controllers.

■ Advanced Instructor Courses (AICs) are geared to weapon systems, AFSCs, or taskings, but are engineered specifically for enlisted Airmen. Courses



Airman 1st Class Bryan Guthrie

Maj. Andrew Hong, left, 32nd Weapons Squadron phase manager and instructor, Capt. Stephen Baker, seated, Weapons Instructor Course student, and Maj. Michelle Bostic, WIC student, scan computer monitors at Nellis Air Force Base, Nev., during Weapons School training.

for loadmasters and space operators are slightly shorter. There are eight AICs offered now and two more are in development, Nellis Air Force Base spokesperson 2nd Lt. Richard R. Caesar said.

For officers, the school generally seeks out captains with between four and eight years' of experience, though first lieutenants have also made the cut from time to time, Arthaud said. For enlisted, he said, the school mainly targets staff sergeants who've accrued four to 10 years of service, with senior Airmen and technical sergeants "occasionally" earning acceptance into the school's ranks.

WICs and AICs, which are either partially or completely taught on-site at Nellis Air Force Base, Nev., share a common goal, Arthaud said: creating and developing "expertise for our warfighters."

"There is only one Weapons School standard, and that standard is exceptionally high," Arthaud stated. "We have different cultures ... but there is one common thread across all this and that is a commitment to excellence and to a culture of learning, and debriefing, and a continuous passion to get better and to make those who are around us better."

Students must complete two core requirements of academic work and complete training specific to their skillset before they attend the Weapons Integration Phase, where students from different WICs and AICs come together in realistic combat scenarios.

By the time they're done, "each graduate has completed an average of 380 hours of classroom academics, written a graduate-level paper, and accomplished an average of 21 intense combat-training missions," Caesar said.

The school graduates about 150 students per session. The "Alpha" class runs from January to June and "Bravo" from July until December.

According to Arthaud, about 135 Weapons Instructor Course students start each class, with approximately 120 graduating. Thirty to 35 enlisted AIC students typically begin each class, with 25 to 30 at the end, he said.

THE CULTURE

The Weapons School is extremely selective, but competition ends when the program starts. It's a culture of unequivocal moral support, said Jeanette R. Rivera-Breznai, a graduate and former Weapons School instructor now serving as deputy director of intelligence analysis, partnerships, and engagements at Headquarters Air Force.

"It's one of those places where you compete to get in, but once you get there, everybody locks arms, and it's the most supportive community you've been a part of," she said. "Everybody wants everyone to graduate, which is the rarest thing I've ever seen or been a part of."

The academic core curriculum is rigorous, and the post-mission debriefings are even more so, making some school days last around 20 hours, Arthaud said.

"You're always on the edge of flunking or passing," recalled Air Force Association President, retired Lt. Gen. Bruce "Orville" Wright, a 1982 Weapons School graduate who went on to be vice commander of Air Combat Command and lead Fifth Air Force.

Those exhausting debriefs serve a purpose, said Maj. Alex Wallis, an air battle manager who graduated in 2015.

"They're long because they really want you to get to that depth," he said. Instructors sit side-by-side with students throughout, rather than sending them to decipher challenges on their own, he said. After each mission, WIC instructors listen to "every word that went over the radio" and dissect what was said, why and how they said it, the accuracy of each statement, and how they prioritized things and why, he added.

All that attention to detail helps students become not just their own worst critics, but also their best evaluators, said Maj. Cara Treadwell, an intelligence WIC graduate now serving as director of operations for a squadron that supports the National Security Agency.

"If you've ... debriefed yourself really hard and been brutal, that debrief from the instructor may not be that long, because you've kind of self-reflected enough that they don't need to double down on that," she said.

Another intelligence graduate, Capt. Levinia St. Jean, said she'd like to see that approach spread across the larger USAF Intelligence Community.

"Aside from the Weapons School, we don't teach folks how to self-reflect or debrief after they teach something," she said. "So they say, 'yep, I did a good job, move on.' You've got to take that time to sit down and figure out where you can get better."

All that introspection comes at a cost. A Weapons School tour can be on par with a deployment, Rivera-Breznai noted. Treadwell recalled that her husband was only able to visit twice during her class, and screenshots of conversations he saved from that period were like a pingpong match of "I love you's exchanged at "odd hours of the day."

"I think that that's also part of the extra mile that people ask weapons officers to go," she said.

Capt. Francesca Chun, an intel WIC alum from Class 18A, now teaches with the 19th Weapons Squadron. She got married while she was a student and her husband was about to deploy. Two years later, they have a baby and her husband is a student at the Weapons School.

"He gets to see the baby once a week, I see him in the hallways at work, and I tell him good luck on his flight," she said. "But, I also realize ... if he can't come home on a weekend, that's just how it is."

Instructors demand excellence, and most students deliver.

"If they're still swinging, and they haven't hit the ground, and they're trying," students will be given every opportunity to graduate, Rivera-Breznai said.

SECRET SAUCE

The way in which Weapons School alumni approach problem-solving also distinguishes them from the rest of the Total Force.

Rivera-Breznai said the institution excels at creating leaders who can make split-second decisions with limited information without being intimidated.

"You are given ... very complicated missions with other people that you've never work[ed] with before, on very little sleep, with huge gaps of information," she said. "So they want to see, when you're in those tough times, what falls off the table? What decisions are you going to make? And more importantly, are you going to stay in the fight and figure it out to make sure the mission gets done?"

Further, she said, students learn to own the consequences of those decisions, and to "be willing and ready to remedy the risk you took" when making them.

Airman 1st Class Bryan Guthrie

In addition to an average of 380 hours of graduate-level academics, Airmen participate in demanding combat exercises, ending with a capstone called Weapons School Integration. Here, Weapons School student Airmen prepare to launch an F-15E Strike Eagle at Nellis Air Force Base, Nev., June 2.

Senior Airman Kevin Tanenbaum

There are eight Advanced Instructor Courses offered by the Weapons School; two more are in development. Here, Master Sgt. William Freshley, a 29th Weapons Squadron loadmaster, on a C-130J Super Hercules cargo aircraft prior to a Weapons School Advanced Integration mission at Nellis Air Force Base, Nev.

However, Wallis underscored that the proof is in the pudding—not the patch.

"I don't look at my attendance at the Weapons School as me having an inherent right to something that other Airmen won't," Wallis said. "What I hope is that I can apply the tools that were given to me in that course and be effective in the job the Air Force asks me to do, and that the Air Force will value that product over a patch on my shoulder."

Nearly all the graduates we spoke to agreed: The school is there to make Airmen more effective warriors, not to supercharge graduates' assignment prospects. Even though attending the school may help the trajectory of your career, it's not meant to be a resume booster.

"It's not designed to rehab careers [or] boost careers," Wallis said. "You know, it has a very specific function. And if you can apply the tools you get to be successful in it, then you'll probably be successful in many other environments as well, that the Air Force will value independently of a patch on your arm."

EMBRACING JADC2

At a time when the Air Force is developing new concepts and tools to enable joint all-domain command and control, the Weapons School's long-term approach to showing students how they fit into the larger picture seems particularly appropriate.

"The school really tries to strike a balance between creating depth of expertise in your specific career field ... or weapon system or airplane, while also having a broader understanding of how to apply that expertise to larger tactical problems, which requires an understanding of what other domains are doing and how you can support those activities, or how you can benefit from those activities," Arthaud said.

All Weapons Instructor Course and Advanced Instructor Course students complete crash courses in the "attributes, challenges, threats, and capabilities" of each warfighting domain, providing a common baseline knowledge to help inform them how to tackle tactical challenges. These include:

- Air operations (to include air superiority, suppression of enemy air defenses, and attack and strike operations)
- Cyber operations (offensive and defensive)
- Space operations (offensive and defensive)
- Counterspace operations
- Intelligence, surveillance, and reconnaissance

Even though U.S. Space Force is less than a year old, the Weapons School has emphasized space as a warfighting domain for years, Arthaud noted.

Students learn about orbital warfare—"in space, in-domain combat where you are using space capabilities to gain an advantage in whatever your particular mission objective might be"—as well as using air power in support of space-related aims, and vice versa.

"We feel that the relationship is mutually beneficial and goes both ways, and that air and space have a unique operational relationship that we want to sustain here at the Weapons School," Arthaud said.

The school's 328th Weapons Squadron was slated to transition to the Space Force at the time of his interview, but Arthaud did not anticipate any impact on academics or "integrated training opportunities" as a result.

Cyber operations are also inherent to the school's instruction.

Today, though, no matter which domains students are focusing on, Arthaud said it all comes back to great power competition.

"We'll train our graduates to be capable and proficient across the entire conflict spectrum, but given the experience of our force over the last 20 years, there is a greater need for us to focus on the high end of combat to ensure that we ... rebuild those muscles for the high-intensity fights," Arthaud said. "So, the Weapons School's primary focus is on training to skills, tactics, and scenarios that improve the Air Force's capability ... to use the NDS [National Defense Strategy] 2018 line, to compete, deter, and win." ✪

For Active or Retired Military, Federal Long-Term Care Insurance Offers Peace of Mind

The prospect of needing long term care may be far from your mind today, but circumstances can change. A long term care event can happen at any age, and the potential financial and emotional strain that comes with it can have an impact on you and your loved ones. Unfortunately, traditional health insurance plans—including TRICARE For Life—do not pay for the chronic, ongoing assistance with daily living that is most often associated with long term care.

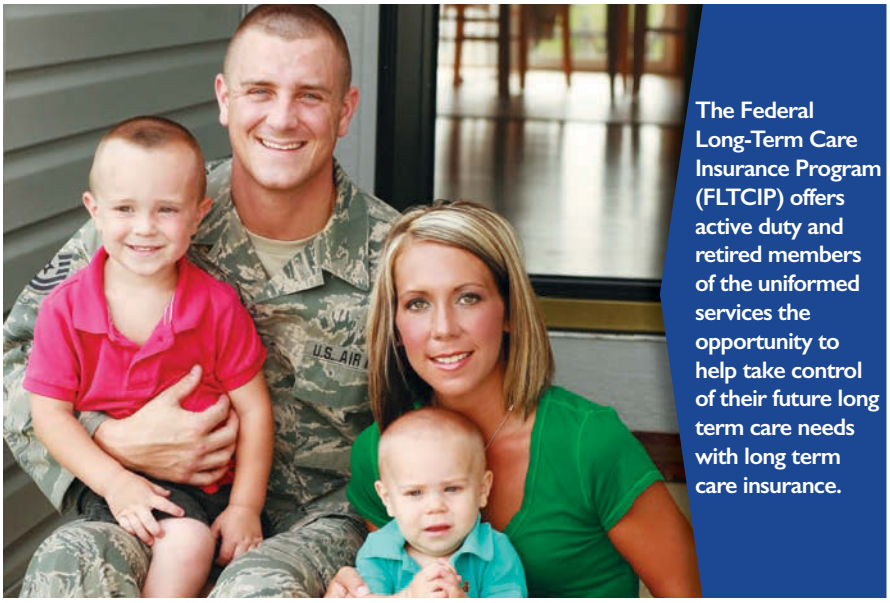
In fact, even the long term care benefits offered through the Department of Veterans Affairs (VA) are tied to specific triggers, including service-connected disability, available funding, and even your ability to contribute to the cost of care. Long term care can be expensive, and service members often rely on the VA to cover the associated costs. Depending on your eligibility status in the VA program, the level of coverage available to you may not be enough. For this reason, you may want to research standalone long term care insurance like a plan offered through the **Federal Long Term Care Insurance Program (FLTCIP).**

The FLTCIP—created specifically for the federal family—offers active duty and retired members of the uniformed services the opportunity to help take control of their future long term care needs with long term care insurance. Designed to be both comprehensive and flexible, the FLTCIP provides insurance coverage for qualified long term care services, including the type of care you may receive and where you receive it.

Coverage under the FLTCIP

FLTCIP 3.0, the current plan available to new applicants, offers comprehensive coverage, including a stay-at-home benefit and home care provided by friends and family*, with added premium stability.

One thing that makes FLTCIP 3.0 unique is the premium stabilization feature. This built-in, innovative feature is designed to reduce the potential need for large future premium increases—a concern many consumers wanted the long term care insurance industry to address. Under certain conditions, this amount may be used to offset an enrollee's future premium payments or provide a refund of premium death benefit.



The Federal Long-Term Care Insurance Program (FLTCIP) offers active duty and retired members of the uniformed services the opportunity to help take control of their future long term care needs with long term care insurance.

The FLTCIP is designed to reimburse for qualified long term care services and can lessen or eliminate an individual's reliance on a loved one to provide hands-on care. FLTCIP 3.0 benefits also include:

International coverage up to 100% of the maximum lifetime benefit

Choice of a 3% automatic compound inflation option or future purchase option

Choice of a two-year, three-year, or five-year benefit period

Build a FLTCIP plan

There's no one-size-fits-all when it comes to long term care insurance, and it's no secret that planning for your future care can be overwhelming. Our new Guided Planner was designed to simplify the process of building a FLTCIP plan that's right for you, and it will guide you through these key considerations:

- **Cost of care:** Compare the national average cost of long term care with other locations in the United States. You can choose where you live, or plan to retire.
- **Care options:** Learn more about different care options, such as home care, assisted living facilities, and nursing homes, as well as the associated costs.
- **Inflation protection:** Understand the impact of inflation on the cost of care over time and see examples of how our inflation protection options can help.

Talk candidly with your family members and tell them about the FLTCIP. Starting the conversation prior to needing care can help you prepare for the unexpected. And, if you're currently serving, your parents and parents-in-law are eligible to apply too, even if you don't.

Visit LTCFEDS.com/militaryfamily to learn more about the benefits of applying for the FLTCIP.

For personalized assistance, call **1-800-LTC-FEDS** (1-800-582-3337) **TTY** 1-800-843-3557 to speak with a program consultant. They are available to answer any questions you may have and can walk you step-by-step through the plan design and application process.

Note: Certain medical conditions, or combinations of conditions, will prevent some people from being approved for coverage. You need to apply to find out if you qualify for coverage under the FLTCIP.

The Federal Long Term Care Insurance Program is sponsored by the U.S. Office of Personnel Management, insured by John Hancock Life & Health Insurance Company, under a group long term care insurance policy, and administered by Long Term Care Partners, LLC.

*Informal care provided by friends and family members is covered, as long as the caregiver isn't your spouse or domestic partner and doesn't live in your home at the time you become eligible for benefits. Benefits for covered care provided by family members is limited to 500 days

The Promise of Skyborg

Low-cost attritable UAVs raise the ante for adversaries seeking to challenge USAF.

AFRL

An artist illustration of a Skyborg conceptual design for a low-cost attritable Unmanned Combat Aerial Vehicle (UCAV).

Over the next decade, the U.S. Air Force must find a way to maintain readiness, modernize its aging aircraft inventory, and grow to 386 operational squadrons. The reasons are clear: Threats are on the rise, and U.S. leaders need new options empowered by next-generation combat air forces with increased capacity. A flat or declining defense budget could deprive the Air Force of the resources it needs to pull off this balancing act and force harmful compromises that increase the risk of mission failures.

Historically, USAF used two approaches to modernize and grow its capacity: First, it bought new, more advanced aircraft with life cycles spanning decades; second, it procured larger quantities of single-use capabilities such as precision-guided munitions, which it expends to achieve operational effects.

There will soon be a third choice. The Air Force is now developing a family of unmanned aerial vehicles (UAVs) designed to fly a limited number of sorties and cheap enough to use in threat environments where the risk of attrition is too high for manned aircraft. These "attritable/reusable" (A/R) UAVs will employ artificial intelligence-enabled autonomy to team with other aircraft to conduct multiple missions. Procuring low-cost A/R UAVs to complement required high-end capabilities such as F-35As and B-21s is an affordable way to grow USAF's combat capacity while balancing other requirements. A/R UAVs that do not require airfields for launch and recovery would also help the Air Force remain an "inside force" capable of generating combat power from dispersed expeditionary locations within range of Chinese or Russian anti-access/area-denial (A2/AD) threats. This will help change adversary defense calculations and impose costs on opponents—to the advantage of U.S. interests.

*By **Col. Mark Gunzinger, USAF (Ret.)** who is the director for future aerospace concepts and capabilities assessments at the Mitchell Institute for Aerospace Studies and **Lukas Autenried,** senior analyst at the Mitchell Institute. The full report can be found at www.mitchellaerospacepower.org.*

WHAT ARE ATTRITABLE/REUSABLE UAVS?

A/R UAVs are low-cost, modular, artificial intelligence (AI)-enabled unmanned systems designed to conduct 10 to 100 sorties in contested operational environments. These aircraft will integrate the full spectrum of autonomous capabilities, as the Air Force develops and tests them. They are:

■ **Attritable.** Unlike manned fighters and bombers, whose structures, engines, and mission systems must last for decades, attritable UAVs are designed for shorter life spans, as little as months and at most several years. This reduces costs to make them affordable options in high-threat situations where using manned or extremely expensive UAVs would be too risky.

■ **Reusable.** Unlike cruise missiles, which are destroyed as they create their desired effects, these

F-16s vs. A/R UAVs: Payload, Range, and Affordabillity

A/R UAVs will have lower unit and flying hour costs compared to a typical manned fighter.

	Range (takeoff to recovery)	Payload in Pounds	Launch and Recovery	Average Unit Cost	Cost per Flying Hour Compared to F-16
F-16C fighter	Air refuelable	16,000 external carriage	Long, improved runways	About $70 million	Estimated $21,000
LCAAT medium-large UAV (Valkyrie) with limited missions systems	3,000 nm	600–1,200+ internal could include: Sensors Non-kinetic mission systems Decoy Comm node	Rocket-assisted takeoff (RATO), parachute recovery; may use runways of 5,000' or less	$2 million to $3 million	Less than 10%
LCAAT medium-large UAV (Valkyrie) with limited missions systems and variants	3,000 nm	600–1,200+ internal could include: Sensors Non-kinetic mission systems Air-to-air missiles Air-to-ground weapons	RATO, parachute recovery; may use runways of 5,000' or less	$10 million to $20 million depending on missions systems	Less than 10%

Mitchell Institute

multi-use systems can be recovered and then flown again. The XQ-58A Valkyrie A/R UAV can be launched from a relocatable containerized rocket-assisted takeoff assembly and recovered on its return by means of a parachute. A second example: The Defense Advanced Research Projects Agency's Gremlin A/R UAVs, which aim to be launched and recovered in-flight by appropriately equipped C-130s.

■ **Low-cost.** By leveraging novel and agile manufacturing, modular components, and small and advanced turbine engines, the Air Force aims to greatly reduce the cost and time to manufacture A/R UAVs—as little as a few weeks compared to the 18 months it can take to build a manned fighter. With unit costs of a few million dollars to $20 million, depending on size, range, payload, and mission systems, A/R UAVs will cost a fraction of what it costs to operate a manned fighter, and they will never require depot-level maintenance.

■ **Modularity.** The Air Force's intent is to field a family of A/R UAVs that share an adaptable open architecture and a "plug and play" design philosophy to execute multiple missions. This modularity will drive down costs, support rapid technology insertion, and allow for in-theater mission changes, such that a system configured with sensors for ISR missions could be quickly reconfigured to conduct electronic attacks or strikes should operational needs change.

■ **AI-enabled.** AI technologies will make A/R UAVs more capable than existing systems, said Gen. James "Mike" Holmes, then the head of Air Combat Command. "The low-cost, attritable aircraft we've been looking at will be more autonomous than the RPAs we fly now," he told Air Force Magazine last spring. "We'll give it goals, and we'll tell it about its operating environment, we'll prioritize targets and actions for it, and, through machine learning, we'll teach it to make more decisions on its own."

The Air Force's Skyborg program is one of three Air Force "Vanguard" science and technology (S&T) programs that are prototyping and experimenting with new weapon systems and operating concepts to "deliver remarkable new capabilities that provide warfighters with superior advantages in the battlefield." Vanguard status prioritizes Skyborg's institutional and warfighter support with an eye toward ensuring the autonomous A/R UAV program survives the so-called acquisition valley of death.

The program aims to develop a digital AI architecture and software to support a family of A/R UAVs capable of manned-unmanned teaming operations. Skyborg will also demonstrate technologies and concepts for generating large numbers of sorties without requiring the runways and airbase infrastructure that can be vulnerable to adversary attacks.

AFFORDABLE COMBAT POWER

After decades of budget cuts, the Air Force's combat air forces now lack the capacity to fight a major conflict with a peer adversary such as China, deter threats in other regions, defend the U.S. homeland, and meet other demands articulated in the National Defense Strategy. This includes the ability to attain the air superiority needed to enable joint operations, launch large-scale precision strikes into contested areas, and perform electromagnetic warfare (EW). Recognizing these limitations, a comprehensive Air Force study mandated by Congress concluded the service must grow by about 24 percent—from 312 to 386 operational squadrons—to execute its requirement at a moderate level of risk.

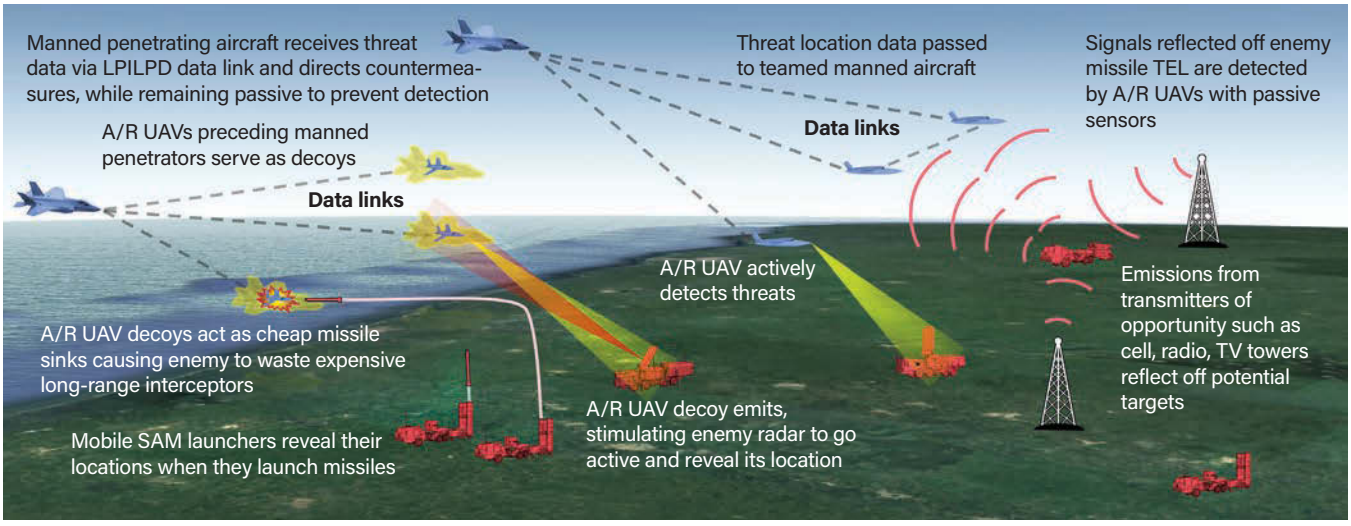
Achieving "The Air Force We Need" will require the Department of Defense (DOD) and Congress to break from traditional resource allocation practices and prioritize Air Force investment to acquire 5th generation F-35s, B-21 bombers, and other advanced aircraft along with this family of low-cost A/R UAVs, which will be most effective when teamed with manned systems. This combination would help create a future force that is more lethal and survivable, and also has combat mass needed to defeat great power aggression. If fielded in large enough quantities, U.S. commanders could simultaneously use A/R UAVs in multiple areas of the battlespace to degrade an enemy's combat tempo, overwhelm air defenses, and prevent it from concentrating forces.

RESPONDING TO A2/AD THREATS

Attacking an enemy's military airbases is one of the most efficient ways to suppress an opposing air force. China and Russia both have thousands of long-range guided missiles that can crater runways, destroy fuel storage and maintenance facilities, and otherwise wreak havoc on U.S. airbase facilities. Large-scale missile attacks such as these on U.S. and allied airbases in the Indo-Pacific and Europe could severely degrade

Skyborg: How it Works

Acting as reusable jammers, A/R UAVs disrupt/disable/destroy scores of threats per sortie with high-power microwaves, attack targets with small anti-radiation missiles, and cue strikes by other aircraft.



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the Air Force's ability to generate the hundreds of sorties needed to rapidly halt a Chinese or Russian attack.

While there is debate inside the Air Force on how best to adapt warfighting concepts and capabilities to counter this growing missile threat, the ultimate solution will require generating and projecting power from both inside and outside an enemy's A2/AD threat envelope. Each has inherent advantages, and the benefits of harnessing both approaches are considerable. The Air Force must develop new operating concepts and capabilities to ensure it can continue to fight alongside allies and partners that live inside A2/AD umbrellas.

A/R UAVs that can launch and recover from dispersed expeditionary locations without the need to use an airfield would be an invaluable component of this solution set. The ability to disperse and relocate these aircraft would complicate adversaries' ability to find, fix, track, and launch effective missile attacks against USAF combat forces. It would also impose new costs on rivals: Instead of concentrating their attacks on a few main operating bases, China and Russia would have to fly more ISR sorties and expend more weapons to find and attack USAF operating locations dispersed across a theater. This would also create uncertainty about their missiles' effectiveness, and could cause China or Russia to doubt if their campaigns would succeed.

Air-transportable containerized A/R UAVs and their launch systems also would improve USAF resiliency under attack, reducing the logistics footprint required to sustain operations. A recent RAND Corporation study determined that A/R UAVs like the XQ-58A Valkyrie could require "one-fifth the personnel and one-half the equipment" to operate and maintain compared to an F-16 fighter. That translates into only 25-35 percent the number of C-17 airlift missions to deploy the assets, depending on what XQ-58A materiel is prepositioned in a theater. A/R UAVs with ranges of 3,000 nm or more that can launch and recover closer to the joint operating area could also help reduce USAF's aerial refueling requirements, freeing tanker capacity for other high-priority combat operations.

OPERATIONAL RISK, SURVIVABILITY, AND RESILIENCY

In conflicts with a peer adversary, there may be areas of the battlespace where there is significant uncertainty about threats or the risk of attrition is simply too high to use manned aircraft. A/R UAVs would expand theater commanders' options for highly contested environments. On night one of a conflict with China or Russia, U.S. commanders could use hundreds of A/R UAV variants to locate enemy air defenses, jam air defense command and control nodes, and conduct other missions to improve the survivability of U.S. forces. According to Air Force Assistant Secretary for Acquisition and Logistics Will Roper, Skyborg UAVs will "allow the Air Force to take measured risk with attritable platforms to keep our high-value aircraft in the fight." Later, as threats are reduced, commanders could shift to using more higher-end A/R UAVs and manned aircraft for operations in contested areas.

To maximize the combat value of A/R UAVs, it may be more cost effective to use them to multiply the kinetic effects that can be created by other combat aircraft that have greater payload capacity, as estimated payloads range from 600 to 1,200 pounds—equivalent to two to four GBU-39 Small Diameter Bombs.

Appropriately equipped A/R UAVs, however, could help backfill USAF's shortfall in electronic warfare capacity, enhancing the survivability of all U.S. forces within A2/AD envelopes. Using A/R UAVs as remote sensors in contested areas would reduce the need for manned penetrating aircraft to emit radar energy, which can give them away to enemy defenses. Decoy A/R UAVs could be used to stimulate enemy surface-to-air-missile (SAM) systems, causing them to reveal their locations and exposing them to USAF strikes. A/R UAVs equipped with jammers or high-power microwave payloads could conduct electromagnetic attacks on enemy acquisition radars, C2 links, and other air defense components, increasing the survivability of U.S. stealth aircraft and weapons penetrating contested areas.

A/R UAVs should also be explored as part of the Air Force's Next-Generation Air Dominance family of systems to enable air superiority for U.S. forces. A/R UAVs teamed with manned and unmanned aircraft could increase formations' overall situational awareness and air-to-air weapon capacity. Leveraging these capabilities, A/R UAVs could help protect aerial refueling tankers and other non-stealth high-value airborne assets, conduct sweeps to defeat enemy fighters

that could threaten USAF penetrating strikes, and escort penetrating bombers and fighters.

A/R UAVs would also help create a more heterogeneous future force that is less predictable and more capable of distributed operations. Using many A/R UAVs to conduct highly distributed active and passive sensing operations in contested areas would make USAF's ISR force more resilient and challenge enemy defenses; instead of targeting a relative few high-value manned ISR aircraft, such as the E-3 Airborne Warning and Control System (AWACS) and E-8 Joint Surveillance and Target Attack Radar System (JSTARS), adversaries would need to defeat hundreds of individual A/R UAVs to degrade U.S. commanders' battlespace awareness.

Likewise, A/R UAVs could help disaggregate today's monolithic kill chains, creating "kill meshes" consisting of hundreds of sensors, shooters, and C2 nodes. Each A/R UAV could observe and share sensor data throughout the mesh, enabling penetrating and standoff shooters and other weapon systems as needed. These kill meshes would enable 5th-generation F-35s, B-21s, and other manned penetrators to search for mobile, relocatable targets over larger areas in contested environments.

Finally, this more heterogeneous force with AI-enabled autonomous UAVs would be less predictable, complicating adversaries' ability to quickly assess and understand the intentions of U.S. commanders, and enabling those commanders to conduct highly distributed, simultaneous offensive operations to overwhelm their adversaries' capacity to react and defend. Enemies' defensive challenges would be further complicated by their inability to discern A/R UAVs from manned fighters and bombers, causing them to use high-end defenses to engage lower-end targets.

CONCLUSION

America's Air Force is now too small and too old to generate enough combat mass to simultaneously defeat great power aggression and meet other National Defense Strategy requirements. It needs affordable solutions to overcome the damage done by decades of insufficient modernization funding. Low-cost attritable and reusable UAVs present a new class of force multipliers that could help the Air Force balance its requirements and modestly grow its force capacity. Enabled by artificial intelligence and operating without risk to life and limb could change how the Air Force operates.

To build on this concept, the Air Force should:

- Procure low-cost A/R UAVs in significant numbers to increase combat capacity, lethality, and survivability in contested environments.
- View A/R UAVs as complementary, force-multiplying capabilities, rather than replacements for 5th-generation stealth aircraft, which are needed to maintain USAF's combat advantage over peer adversaries.
- Use A/R UAVs, given their relatively small payloads, for electromagnetic warfare, persistent C2ISR, and other non-kinetic missions that take advantage of their force-multiplying potential.
- Leverage the low cost and modularity of A/R UAVs to rapidly innovate, operationalize advanced technologies, and speed new capabilities to warfighters.
- Experiment with A/R UAVs to allow warfighters to develop concepts for integrating them into operations with other manned and unmanned aircraft.
- Develop operational concepts and the logistical support and other requirements to launch and recover large numbers of A/R UAVs from distributed theater locations without airfields.

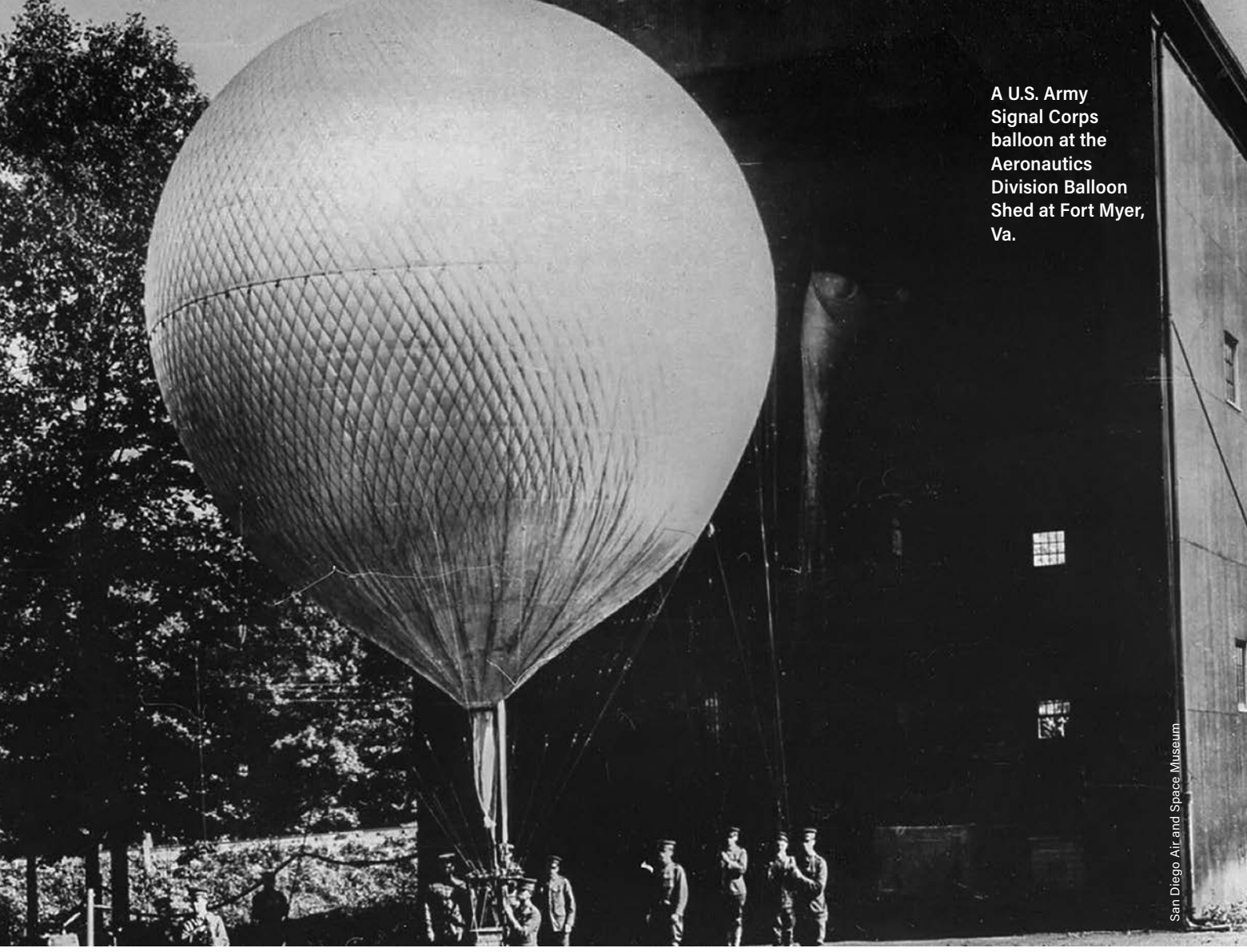
Maintaining the Air Force's current readiness, modernizing for the future, and building The Air Force We Need demands the Air Force seek new, cost-effective alternatives and low-cost A/R UAVs answer that need by improving USAF's ability to generate and project combat mass inside A2/AD environments. While A/R UAVs should not be seen as a cheaper alternative to F-35A, B-21, and other advanced capabilities, they should be included as part of the next step in the evolution of AI-enabled unmanned systems that can team with advanced manned platforms to achieve decisive effects in the battlespace. Unlike force design approaches that would simply buy more legacy systems with capabilities that are well-known to America's competitors, A/R UAVs will create new options for U.S. commanders to defeat great power aggression.

General Atomics Aeronautical Systems

General Atomics Aeronautical Systems, Inc. (GA-ASI) conducted captive carry Sparrowhawk Small Unmanned Aircraft Systems (sUAS) flight demonstrations in September. The Sparrowhawk aircraft is designed as an airborne launch and recovery demonstrator aircraft tailored to fit GA-ASI platforms, and is focused on Advanced Battle Management System's attritableONE technologies.

USAF

The Air Force Research Laboratory and Kratos Defense & Security Solutions, Inc., completed the successful fourth flight of the XQ-58A Valkyrie demonstrator, a long-range, high subsonic unmanned air vehicle, at Yuma Proving Ground, Ariz., in January. AR/UAV can be launched from a relocatable containerized rocket-assisted takeoff assembly and recovered on its return by means of a parachute.



A U.S. Army Signal Corps balloon at the Aeronautics Division Balloon Shed at Fort Myer, Va.

San Diego Air and Space Museum

Balloonists in the Family Tree

The first chief of the air arm was a pilot—but not an airplane pilot.

By John T. Correll

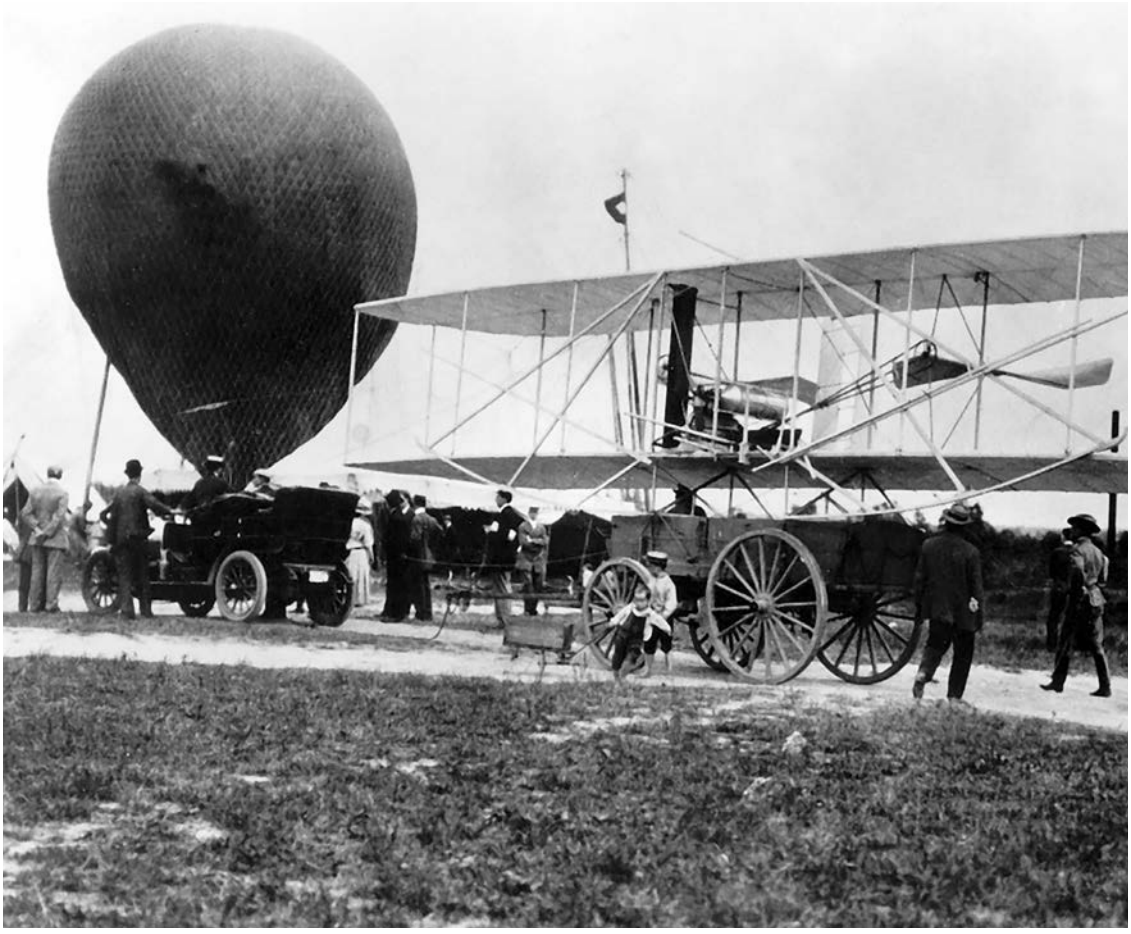
The U.S. Air Force celebrates its birth date as Aug. 1, 1907, when the Aeronautical Division of the Army Signal Corps was established.

The first chief was Capt. Charles DeForest Chandler, a balloon pilot. There were no airplane pilots in the Army at that point. In fact, the Army did not even have any airplanes yet—and would not get its first one for another two years Its small air fleet consisted entirely of lighter-than-air balloons.

The Wrights' "flying machine is not suitable for military purposes."
—Brig. Gen. James Allen, the Army's chief signal officer in 1907

The Wright brothers had achieved the world's first manned, powered, sustained, and controlled flight in a heavier-than-air machine at Kitty Hawk, N.C., in 1903, but airplanes were new and little understood. Balloons were familiar. They had been around for more than 100 years and had seen military service in the Civil War. The Signal Corps had operated a balloon section since 1892.

The Wright brothers' "flying machine is not suitable for military purposes," said Brig. Gen. James Allen, the Army's chief signal officer in 1907. "An appropriation from Congress with a



The Wright brothers' Flyer arrives at Fort Myer, Va., aboard a wagon, attracting the attention of children and adults.

Department of Defense via National Archives

view of purchasing one or more of these flying machines is not recommended."

Even those usually thought of as forefathers of the Air Force initially had balloon connections. Capt. Billy Mitchell in 1903 was an assistant instructor at the Signal Corps school at Fort Leavenworth, Kan., where he "lectured on the uses of the balloons and dirigible in reconnaissance and bombardment."

Lt. Benny Foulois is famously and fondly remembered as "the Air Force's first pilot." He qualified in the Wright Flyer in 1910, but before that he was a balloon pilot in 1909. He was also extensively involved in the testing of balloons for the Army.

Nudged along by President Theodore Roosevelt, the Army in 1907 decided to obtain both a dirigible—a steerable, maneuverable airship—and an airplane. The dirigible, "Signal Corps No. 1," was delivered in August 1908. It was the Army's first powered aircraft of any type. It moved along on a 30-horsepower engine. Direction was controlled by a rudder in back. The first military airplane, a Wright Flyer, was accepted for service a year later, in August 1909.

Side-by-side comparison with the airplane was devastating for the balloon, and the influence of airship advocates declined. By1913, the Army's focus had shifted almost completely to airplanes.

On his second tour as chief of the Aeronautical Division (June 1911-Sept. 1913), Chandler qualified as an airplane pilot at the aviation school at College Park, Md., where he was taught by 2nd Lt. Henry H. "Hap" Arnold, one of the Army's first flight instructors.

World War I brought a resurgence, of sorts, for balloons. In 1917-1918, Chandler commanded the American Expeditionary Forces balloon section at the front in France. He retired as a colonel in 1920.

Despite their greatly reduced role, airships remained around for a while. Vestiges of the Army balloon corps persisted until 1937.

FLOAT THROUGH THE AIR

It all began in France, where multiple balloon ascensions took place in the course of a single year, 1783. The first of them got off the ground by inflating the spherical bag with heated air. However, hydrogen—which weighed just one-fourteenth as much as air—was a much superior lifting element, and the French knew how to produce it from the reaction between iron filings and sulfuric acid.

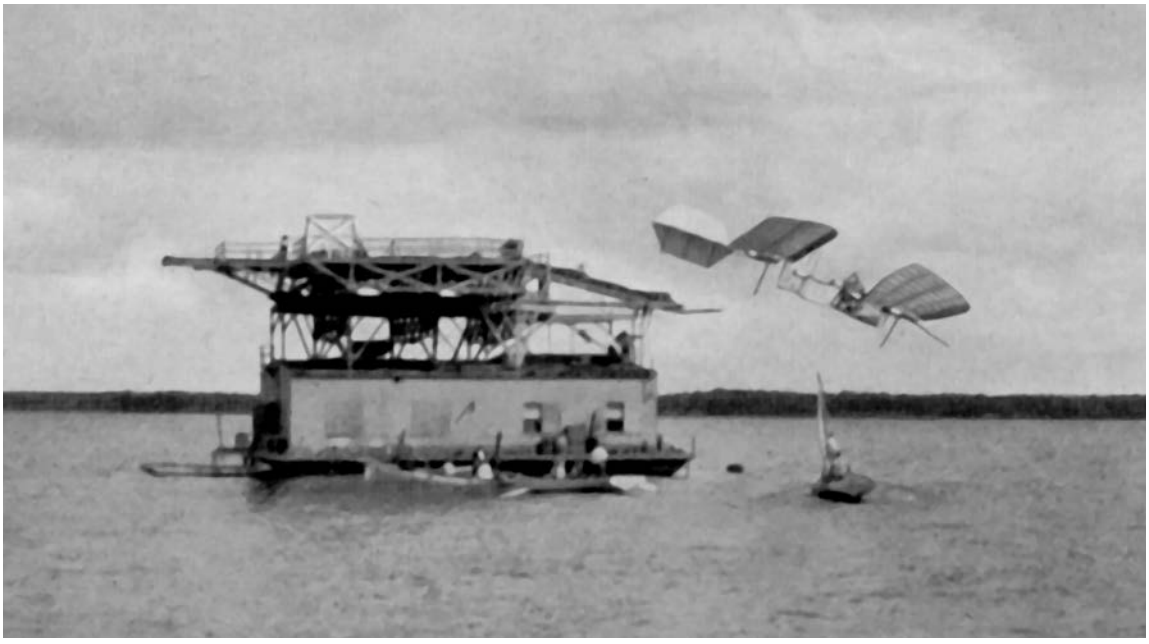
In August 1783, a hydrogen-filled balloon arose from Paris and sailed above the city to descend about 15 miles to the northeast. Among those watching with rapt interest was the American diplomat and scholar Benjamin Franklin.

Balloons gained in popularity and attracted a large following in Europe and the United States. Enthusiasts included engineers interested in aeronautics, well-to-do persons who could afford an expensive adventure, and ordinary citizens who enjoyed the spectacle.

Balloon raisings were standard events for fairs and festivals, often with gymnastic stunts and trapeze acts by performers hanging from the basket of the balloon. Even the most serious scientists provided such entertainments as a means of funding their studies.

"Races" could not be decided by speed from point to point. The wind, not the aeronauts, chose the course to be taken, and it was seldom the same for all competitors. The winner was the one that went the greater distance or remained in the air longest.

In the 19th century, gas manufactured from coal emerged



NASA

The Langley Aerodrome, piloted by Charles Manly, plunges into the Potomac River immediately after its launch from a catapult mounted on a houseboat on Oct. 7, 1903. A second attempt on Dec. 8 was also unsuccessful.

as a cheaper, less explosive alternative to hydrogen as a lifting medium. Coal gas—sometimes known as "town gas" because it was commonly available at city mains—was not as buoyant as hydrogen, but it could fill a balloon in two or three hours. Inflation with hydrogen was an all-day job. Coal gas was also slower to leak out.

In 1860, nearly 400 plants in the United States distributed gas as a public utility for the lighting of cities. By 1905, the number had risen to almost a thousand. The gas supply for balloons was abundant.

BALLOONS FOR THE UNION

The Civil War brought forward a number of balloon operators who offered their services to the Union Army. The first use was for surveillance of the enemy lines at the Battle of Bull Run in July 1861. The balloon was filled with coal gas in Washington and towed, fully inflated, behind a wagon to the battlefield 30 miles west of the city.

Balloons were of some value in observation and direction of artillery fire, but military commanders regarded them as marginal if not irrelevant. Thaddeus C. Lowe, the leading Civil War aeronaut, wanted official status as an Army organization for ballooning, but he did not get it.

Airship activities came, successively, under the jurisdiction of three different branches: the Army Topographic Engineers in 1861, then the Quartermaster in 1862, and finally the Corps of Engineers in 1863. Lowe was paid $10 a day, slightly more than the rate for a colonel.

Portable generators were available to generate hydrogen in the field with a system of tanks and copper plumbing to make the conversion from iron filings and sulfuric acid. This procedure was sometimes used, but primary reliance was on the regular gas pipelines.

The Confederates had only three balloons, which they deployed for the Peninsular campaign in Virginia in 1862. They had no gas except at Richmond, where the aeronauts inflated the balloon, then hitched it to a railroad engine which ran it down the York River Railroad to the battlefront.

Between 1863 and 1890, there were no military balloon operations in the United States. During the interval, however the British in 1884 developed portable cylinders for the storage and transport of compressed hydrogen. This was a significant improvement in capability over the traveling generators Lowe had used.

SIGNAL CORPS

In 1890, Congress gave the Signal Corps the mission of collecting and transmitting information from the Army. Brig. Gen. Adolphus Greely, the chief signal officer, thought that observation balloons would be useful in carrying out that assignment. He requested approval of a balloon "section," which was established within the Signal Corps in 1892.

"His goal was to convert the balloon into a dependable vehicle for gathering and transmitting battlefield intelligence by combining it with the telegraph to ensure the rapid transmission of information," said historians Alfred Hurley and William Heimdahl.

One of Greely's balloons was used with some success at the Battle of San Juan Hill in Cuba during the Spanish-American War, until enemy riflemen riddled it with holes and brought it down.

"As balloons became more popular with the military, the graceful spherical shape that had characterized them through their first century was recognized as a liability," said Donald Dale Jackson in "The Aeronauts." "The traditional globular balloon was ideal for free flight, but it could rotate wildly when anchored to the ground; a violent gust could easily flip its lightweight basket parallel to the earth. To solve these problems, the military aeronauts of the late 19th century developed an egg-shaped craft designed to nose diagonally into the wind—in effect, a tethered dirigible without an engine."

Public opinion toward the airplane was poisoned by the disaster of Samuel Pierpoint Langley's "Great Aerodrome" on Dec. 8, 1903, nine days before the Wright brothers' flight at Kitty Hawk.

The Aerodrome was an oversized, ill-designed flying machine 52 feet long with a wingspan of 48 feet. It had two huge pusher propellers between the two sets of tandem wings and was said to look like a giant dragonfly. Langley figured to launch it from a houseboat in the Potomac River with help from a catapult, but it promptly crashed and sank.

Unlike the host of promoters and publicity seekers marketing their aeronautical inventions, the Wright brothers avoided public exhibition of the Kitty Hawk Flyer. Their achievement

on the remote Outer Banks of North Carolina went almost unnoticed, as ridicule of the Langley Aerodrome spread to tarnish—by association—all airplane developments.

Brig. Gen. James Allen, no admirer of the Wright brothers, succeeded Greely as chief signal officer in 1906. The Army had accumulated nine balloons, most of them small and operated from a line tethered to the ground. None of them were powered, and could be steered only in a rudimentary fashion. The lifting agent for all was hydrogen.

In 1907, the Army decided to buy three big "war balloons," twice the size of any airship then in service and large enough to carry bombs. The new balloons would be able to use either hydrogen or coal gas to lift.

FOREFATHERS

The theory and practice of aeronautics was a marginal effort for the Army. Individuals who were interested explored research and opinion in non-military publications and looked for inspiration to Europe, where the ballooning tradition was stronger.

Two young Signal Corps officers, Lt. Frank P. Lahm and Capt. Charles DeForest Chandler, were becoming well-known in the balloonist community. Their activities led to renewed attention to the Army balloon program.

Lahm made his first balloon flight in France in 1904 while visiting his father, the Paris representative for an American corporation. The elder Lahm had qualified as a balloon pilot in 1902 and was an active promoter of aeronautics.

Lieutenant Lahm gained public notice when he won an international air race in Europe in 1906. The participants took off in free balloons from Paris. A favorable breeze to the north swept Lahm and his copilot across the English Channel. They might have continued on to Scotland, but an east wind sprang up to carry them back seaward, so they made their descent at Fylingdales, England. They had covered 475 miles to win the race. An Italian crew, which traveled 370 miles, finished second.

Chandler studied the British balloon facilities at Farnborough while on leave in London in 1905 and made his first balloon flight in 1906. In the spring of 1907, he was the lead pilot in testing the Army's big new war balloons. In April—taking along carrier pigeons to send back messages—his crew set out from St. Louis, hoping to land in Washington. Instead, the wind pushed them backward. They crossed the Mississippi River three times, drifted for 19 hours, and finally came down in Goloncona, Ill., only 130 miles from St. Louis.

A subsequent flight in June, with Chandler as observer, took off from Washington. The balloon was inflated from the local gas works. The prevailing winds took them north. "Harrisburg [Pa.], was the first place that was recognized after leaving Washington," Chandler said. "We passed over a city which we later knew to be York, but we could not get our bearings until we were near Harrisburg." They set down in a farmer's field.

The three-man Aeronautical Division was created Aug. 1 with Chandler in command, assisted by Cpl. Edward Ward and Pvt. Joseph E. Barrett. Ward was commissioned during WWI and earned his certificate as a balloon pilot in 1921.

Barrett, failing to appreciate the special spot in history that had fallen into his hands, soon deserted. He later joined the Navy, from which he retired honorably after 20 years of service.

Lahm and Chandler wrote a joint memoir of the early years, "How Our Army Grew Wings," published in 1941.

USAF

Capt. Charles Chandler in civilian clothes holding balloon instruments prior to free-balloon flight in 1907.

Aero. Division, U.S. Signal Corps

Charles deForest Chandler made his first balloon flight in 1906.

USAF

Maj. Gen. Benjamin Foulois learned to fly the first military planes purchased from the Wright brothers.

THE BALDWIN DIRIGIBLE

Urged on by Chief Signal Officer Allen, the Army in January 1908 advertised for bids for a dirigible that could sustain an average speed of 20 mph. The contract was awarded on competitive bid in February to balloon exhibitionist Thomas S. Baldwin.

On the basis of a thesis written at the Signal Corps School analyzing the value of dirigibles, Lt. Benjamin D. Foulois was brought to Washington as member of the board to evaluate the Baldwin Dirigible. Lahm was on the board as well.

On its test flight from Fort Myer in August 1908, the Baldwin Dirigible failed to meet the speed specification, achieving an average of 19.61 percent instead. The Army accepted the dirigible as "Signal Corps No. 1" but deducted 15 percent from the bid price because of the speed.

The sausage-shaped dirigible was 93 feet long and lifted by hydrogen. The car for the two-man crew was slung underneath and ran for approximately the length of the balloon. The engine drove a propeller extending from the front of the car. The forward pilot was positioned behind the engine. The rear pilot rode in back to operate the rudder.

In 1909, Baldwin trained three Army pilots, including Foulois and Lahm, to fly the dirigible. It was the biggest and best balloon the Signal Corps ever had, but its day was almost done before it started. The superiority of the airplane over the balloon was increasingly obvious.

Subsequently, Foulois was an observer in tests of the Wright Flyer, and recommended that the Army concentrate its interest in heavier-than-air vehicles. That put him at odds with Allen and the Signal Corps staff.

Signal Corps No. 1 was scrapped in 1912. The Army did not buy another dirigible until after WWI.

THE WRIGHT STUFF

Upon their return from Kitty Hawk, Wilbur and Orville Wright made modifications to their airplane and flew it at Huffman Prairie near their home in Dayton. An offer on their behalf to the Army Board of Ordnance and Fortification in 1905 was rejected with the insulting comment that the aircraft had "not yet been brought to the stage of practical operation."

Reviews from abroad were little better. In 1907, with interest finally developing in the Wright Flyer, Major von Gross, head of the dirigible section of the German army, told the New York Times that "it was not doubted that the Wrights had flown, but what they effected was not an aeronautic achievement but mere acrobatics."

"The military uses of a flying machine of any type will be only for purposes of observation or reconnaissance, or as an offensive weapon, to drop explosives on the enemy," said Chief Signal Officer Allen. "For the purpose of dropping explosives on the enemy, a high-speed airplane is hardly suitable."

The Wright Flyer made its spectacular public debut in 1908 in Europe and the United States. Wilbur took one of the aircraft to France, where it was under consideration by a syndicate, and Orville prepared another one for U.S. Army evaluation at Fort Myer. Wilbur flew first, on April 8 at Le Mans, France.

As recounted by military analyst Rebecca Grant, "The Flyer leapt into the air and headed straight for a grove of trees. Then with perfect ease, Wilbur executed the first tight, controlled banking turns the world had ever seen. Over the next several days, he continued to amaze France and the world with figure eights and flights at 75 feet and above, far higher than anything ever seen. The ease, control, and consistence of the Wright Flyer put it head and shoulders above any other aircraft."

Orville's demonstration flights for the Army at Fort Myer had similar success. On the final test in July 1909—with Benny Foulois as navigator—the Wright Flyer set world records for distance, altitude, and speed. In fact, the speed was calculated at 42.5 mph. That exceeded the specification of 40 mph, earning the Wrights a bonus over the base price.

The Wright Flyer was accepted for service in August 1909, becoming the first U.S. military airplane. Foulois completed his qualification as an aircraft pilot by his own ingenuity and what he could learn through mail correspondence with Orville Wright.

ON THE WESTERN FRONT

World War I brought a brief reprise of attention for balloons. Thirty-five U.S. Army balloon companies deployed to France with the American Expeditionary Force. Seventeen of them served at the front, making 1,642 tethered combat ascensions for observation. The air arm remained under Signal Corps control until May 1918, when it became the Army Air Service.

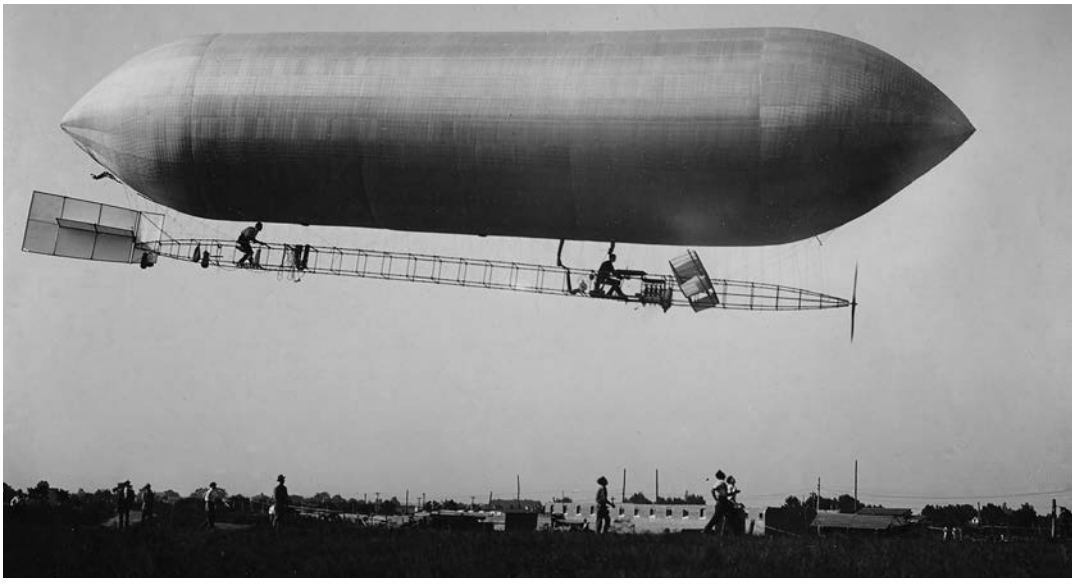
The Germans made greater use of balloons, including the barn-sized Zeppelin. The Zeppelins made 51 long-range bombing raids on Britain, 26 of them targeted against London, but their cost was figured to be about five times that of the damage they inflicted.

In the U.S. scheme of things, balloons were regarded mostly as targets. During two-and-a-half weeks in September 1918, American ace Lt. Frank Luke shot down 14 German balloons and four German airplanes. The balloonists managed to hang on for some time after the war ended, but no mission of any significance could be found for them.

However, there was a final technological advancement to come. In the 1920s, the preference of lifting medium shifted to helium, the second lightest of known elements. Helium had less lifting power than hydrogen, but it was cheaper, had less danger of explosion, and was easy to obtain.

It fell to the old balloon pilot and Chief of the Army Air Corps Maj. Gen. Benny Foulois, to pull the plug. With Congress seeking to reduce funding for military air power in 1935, Foulois recommended that balloon activities be terminated. In 1937, the Army airship program was officially ended. ✪

John T. Correll *was editor in chief of* Air Force Magazine *for 18 years and is a frequent contributor. His most recent article,* "The Air Force Enters the Vietnam War," *appeared in the October issue.*



National Archives

The Baldwin Dirigible was the first powered aircraft ordered by the Aeronautical Division. The Signal Corps had long urged the U.S. Army to buy a dirigible, and many European armies had them by the turn of the century. Lts. Frank Lahm, Thomas Selfridge, and Benjamin Foulois were taught to fly it.

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AFA ALMANAC

By Chequita Wood

The Air Force Association's 12 Founders

John S. Allard
Bronxville, N.Y.

Everett R. Cook,
Memphis, Tenn.

Edward P. Curtis
Rochester, N.Y.

Jimmy Doolittle
Los Angeles

W. Deering Howe
New York

Rufus Rand
Sarasota, Fla.

Sol A. Rosenblatt
New York

Julian B. Rosenthal
New York

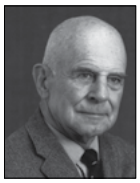
James M. Stewart
Beverly Hills, Calif.

Lowell P. Weicker
New York

Cornelius Vanderbilt Whitney
New York

John Hay Whitney
New York

AFA Chairmen of the Board and National Presidents



Jimmy Doolittle
President, 1946-47
Chairman, 1947-49

Edward P. Curtis
Chairman, 1946-47

Thomas G. Lanphier Jr.
President, 1947-48
Chairman, 1951-52

C. R. Smith
President, 1948-49
Chairman, 1949-50

Robert S. Johnson
President, 1949-51

Carl A. Spaatz
Chairman, 1950-51

Harold C. Stuart
President, 1951-52
Chairman, 1952-53

Arthur F. Kelly
President, 1952-53
Chairman, 1953-54

George C. Kenney
President, 1953-54
Chairman, 1954-55

John R. Alison
President, 1954-55
Chairman, 1955-56

Gill Robb Wilson
President, 1955-56
Chairman, 1956-57

John P. Henebry
President, 1956-57
Chairman, 1957-58

Peter J. Schenk
President, 1957-59

James M. Trail
Chairman, 1958-59

Howard T. Markey
President, 1959-60
Chairman, 1960-61

Julian B. Rosenthal
Chairman, 1959-60

Thos. F. Stack
President, 1960-61
Chairman, 1961-62

Joe Foss
President, 1961-62
Chairman, 1962-63

John B. Montgomery
President, 1962-63

W. Randolph Lovelace II
President, 1963-64
Chairman, 1964-65

Jack B. Gross
Chairman, 1963-64

Jess Larson
President, 1964-67
Chairman, 1967-71

Robert W. Smart
President, 1967-69

George D. Hardy
President, 1969-71
Chairman, 1966-67
Chairman, 1971-72

Martin M. Ostrow
President, 1971-73
Chairman, 1973-75

Joe L. Shosid
President, 1973-75
Chairman, 1972-73
Chairman, 1975-76

George M. Douglas
President, 1975-77
Chairman, 1977-79

Gerald V. Hasler
President, 1977-79
Chairman, 1976-77

Victor R. Kregel
President, 1979-81
Chairman, 1981-82

Daniel F. Callahan
Chairman, 1979-81

John G. Brosky
President, 1981-82
Chairman, 1982-84

David L. Blankenship
President, 1982-84
Chairman, 1984-85

Edward A. Stearn
Chairman, 1985-86

Martin H. Harris
President, 1984-86
Chairman, 1986-88

Sam E. Keith Jr.
President, 1986-88
Chairman, 1988-90

Jack C. Price
President, 1988-90
Chairman, 1990-92

Oliver R. Crawford
President, 1990-92
Chairman, 1992-94

James M. McCoy
President, 1992-94
Chairman, 1994-96

Gene Smith
President, 1994-96
Chairman, 1996-98

Doyle E. Larson
President, 1996-98
Chairman, 1998-2000

Thomas J. McKee
President, 1998-2000
Chairman, 2000-02

John J. Politi
President, 2000-02
Chairman, 2002-04

Stephen P. Condon
President, 2002-04
Chairman, 2004-06

Robert E. Largent
President, 2004-06[a]
Chairman, 2006-08

Joseph E. Sutter
Chairman, 2008-10

S. Sanford Schlitt
Chairman, 2010-12

George K. Muellner
Chairman, 2012-14

Scott P. Van Cleef
Chairman, 2014-16

F. Whitten Peters
Chairman, 2016-19

Gerald R. Murray
Chairman, 2019-

[a] The office of National President, an elected position, was disestablished in 2006.

AFA Executive Directors/Presidents

Wilis S. Fitch
Executive Director
1946-47

James H. Straubel
Executive Director
1948-80

Russell E. Dougherty
Executive Director
1980-86

David L. Gray
Executive Director
1986-87

John O. Gray
Acting Executive Director
1987-88, 1989-90

Charles L. Donnelly Jr.
Executive Director
1988-89

Monroe W. Hatch Jr.
Executive Director
1990-95

John A. Shaud
Executive Director
1995-2002

Donald L. Peterson
Executive Director
2002-06[c]
President-CEO
2006-07

Michael M. Dunn
President-CEO
2007-12

Craig R. McKinley
President
2012-15

Mark A. Barrett
Acting President
2015

Larry O. Spencer
President
2015-19

Bruce A. Wright
President
2019-

Jim Simmons
Vice Chairman
for Field Operations
2020-

VICE CHAIRMEN FOR FIELD OPERATIONS

Joseph E. Sutter	2006-08
James R. Lauducci	2008-10
Justin M. Faiferlick	2010-12
Scott P. Van Cleef	2012-14
David A. Dietsch	2014-16
F. Gavin MacAloon	2016-20
Jim Simmons	2020-

James T. Hannam
Vice Chairman for
Aerospace Education
2018-

VICE CHAIRMEN FOR AEROSPACE EDUCATION

L. Boyd Anderson	2006-07
S. Sanford Schlitt	2007-10
George K. Muellner	2010-12
Jerry E. White	2012-15
Richard B. Bundy	2015-18
James T. Hannam	2018-

Richard W. Hartle
National Secretary
2017-

NATIONAL SECRETARIES

Sol A. Rosenblatt	1946-47
Julian B. Rosenthal	1947-59
George D. Hardy	1959-66
Joseph L. Hodges	1966-68
Glenn D. Mishler	1968-70
Nathan H. Mazer	1970-72
Martin H. Harris	1972-76
Jack C. Price	1976-79
Earl D. Clark Jr.	1979-82
Sherman W. Wilkins	1982-85
A. A. "Bud" West	1985-87
Thomas J. McKee	1987-90
Thomas W. Henderson	1990-91
Mary Ann Seibel	1991-94
Mary Anne Thompson	1994-97
William D. Croom Jr.	1997-2000
Daniel C. Hendrickson	2000-03
Thomas J. Kemp	2003-06
Judy K. Church	2006-09
Joan Sell	2009-11
Edward W. Garland	2011-14
Marvin L. Tooman	2014-15
John T. Brock	2015-17
Richard W. Hartle	2017-

Charles L. Martin Jr.
National Treasurer
2020-

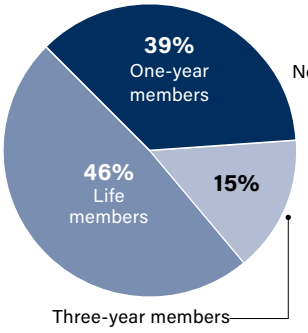
NATIONAL TREASURERS

W. Deering Howe	1946-47
G. Warfield Hobbs	1947-49
Benjamin Brinton	1949-52
George H. Haddock	1952-53
Samuel M. Hecht	1953-57
Jack B. Gross	1957-62
Paul S. Zuckerman	1962-66
Jack B. Gross	1966-81
George H. Chabbott	1981-87
William N. Webb	1987-95
Charles H. Church Jr.	1995-2000
Charles A. Nelson	2000-05
Steven R. Lundgren	2005-10
Leonard R. Vernamonti	2010-14
Nora Ruebrook	2014-16
Charles L. Martin Jr.	2016
Steven R. Lundgren	2016-2020
Charles L. Martin Jr.	2020-

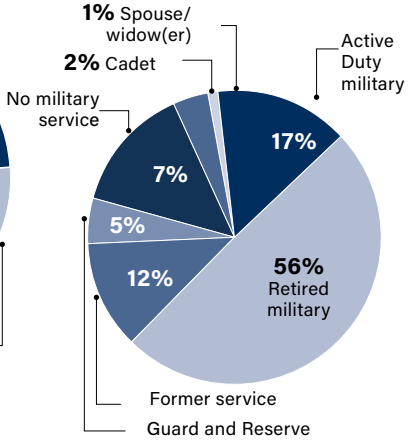
AFA Membership

As of June 2020. Total **91,979.** Numbers are rounded.

MEMBERSHIP CATEGORY



MILITARY STATUS



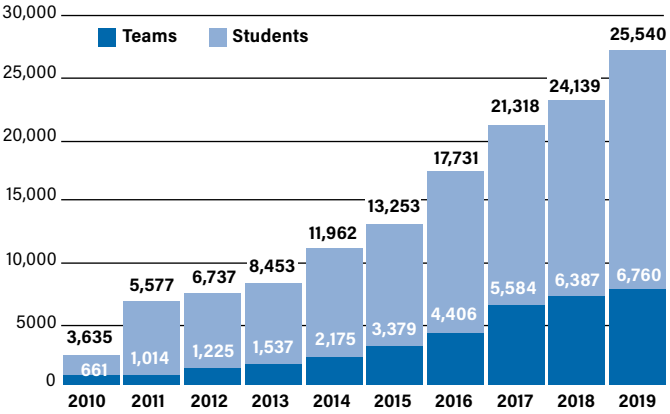
Year	Life Members	Total
1946	32	**51,243**
1947	55	**104,750**
1948	68	**56,464**
1949	70	**43,801**
1950	79	**38,948**
1951	81	**34,393**
1952	356	**30,716**
1953	431	**30,392**
1954	435	**34,486**
1955	442	**40,812**
1956	446	**46,250**
1957	453	**51,328**
1958	456	**48,026**
1959	458	**50,538**
1960	464	**54,923**
1961	466	**60,506**
1962	485	**64,336**
1963	488	**78,034**
1964	504	**80,295**
1965	514	**82,464**
1966	523	**85,013**
1967	548	**88,995**
1968	583	**97,959**
1969	604	**104,886**
1970	636	**104,878**
1971	674	**97,639**
1972	765	**109,776**
1973	804	**114,894**
1974	837	**128,995**
1975	898	**139,168**
1976	975	**148,202**
1977	1,281	**155,850**
1978	1,541	**148,711**
1979	1,869	**147,136**
1980	2,477	**156,394**
1981	3,515	**170,240**
1982	7,381	**179,149**

Year	Life Members	Total
1984	18,012	**218,512**
1985	23,234	**228,621**
1986	27,985	**232,722**
1987	30,099	**237,279**
1988	32,234	**219,195**
1989	34,182	**204,309**
1990	35,952	**199,851**
1991	37,561	**194,312**
1992	37,869	**191,588**
1993	38,604	**181,624**
1994	39,593	**175,122**
1995	39,286	**170,881**
1996	39,896	**161,384**
1997	41,179	**157,862**
1998	41,673	**152,330**
1999	42,237	**148,534**
2000	42,434	**147,336**
2001	42,865	**143,407**
2002	43,389	**141,117**
2003	42,730	**137,035**
2004	42,767	**133,812**
2005	43,094	**131,481**
2006	43,266	**127,749**
2007	43,256	**125,076**
2008	43,557	**123,304**
2009	43,782	**120,507**
2010	43,954	**117,480**
2011	44,182	**111,479**
2012	43,686	**106,780**
2013	43,851	**102,540**
2014	43,720	**96,017**
2015	43,936	**92,829**
2016	44,074	**93,379**
2017	44,083	**90,970**
2018	44,068	**96,429**
2019	44,035	**97,181**
2020	44,031	**91,979**

STEM Programs

AFA'S CYBERPATRIOT PROGRAM

CyberPatriot is the National Youth Cyber Education Program created by AFA to inspire K-12 students toward careers in cybersecurity or other science, technology, engineering, and mathematics (STEM) disciplines.



CyberPatriot Mentor of the Year

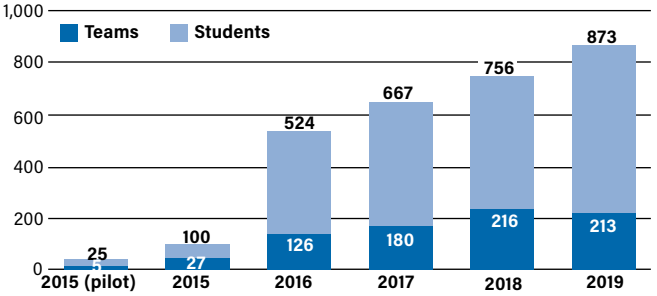
James Monroe
Robertsdale High School
Alabama

CyberPatriot Coach of the Year

Brian Kowal
Dayton Youth Cyber Club

AFA'S STELLARXPLORERS PROGRAM

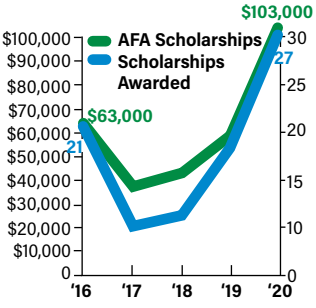
StellarXplorers is a challenging, space system design competition involving all aspects of system development and operation with a spacecraft and payload focus.



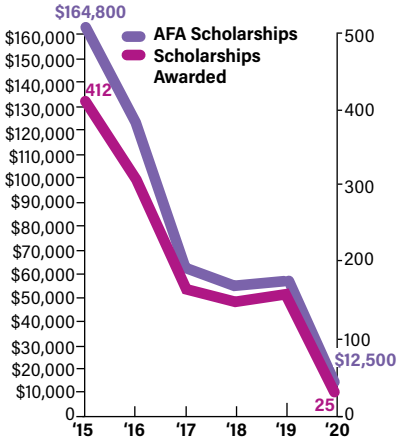
Scholarships

AFA awards **scholarships,** to aspiring college students backed by funds from generous organizations and individuals. AFA also funds **Pitsenbarger** awards for Airmen who complete their associate degree through the Community College of the Air Force and intend to pursue a bachelor's degree.

AFA SCHOLARSHIPS



PITSENBARGER SCHOLARSHIPS



National Aerospace Awards

H.H. ARNOLD AWARD

Named for the World War II leader of the Army Air Forces, the H.H. Arnold Award has been presented annually in recognition of the most outstanding contributions in the field of aerospace activity. Since 1986, it has been AFA's highest honor to a member of the armed forces in the field of national defense.

Year	Award Recipient(s)
1948	W. Stuart Symington, Secretary of the Air Force
1949	Maj. Gen. William H. Tunner and the men of the Berlin Airlift
1950	Airmen of the United Nations in the Far East
1951	Gen. Curtis E. LeMay and the personnel of Strategic Air Command
1952	Sen. Lyndon B. Johnson and Sen. Joseph C. O'Mahoney
1953	Gen. Hoyt S. Vandenberg, USAF (Ret.), former Air Force Chief of Staff
1954	John Foster Dulles, Secretary of State
1955	Gen. Nathan F. Twining, Chief of Staff, USAF
1956	Sen. W. Stuart Symington
1957	Edward P. Curtis, special assistant to the President
1958	Maj. Gen. Bernard A. Schriever, Cmdr., Ballistic Missile Div., ARDC
1959	Gen. Thomas S. Power, CINC, SAC
1960	Gen. Thomas D. White, Chief of Staff, USAF
1961	Lyle S. Garlock, Assistant SECAF
1962	A. C. Dickieson and John R. Pierce, Bell Telephone Laboratories
1963	The 363rd Tactical Recon. Wing and the 4080th Strategic Wing
1964	Gen. Curtis E. LeMay, Chief of Staff, USAF
1965	The 2nd Air Division, PACAF
1966	The 8th, 12th, 355th, 366th, and 388th Tactical Fighter Wings and the 432nd and 460th TRWs
1967	Gen. William W. Momyer, Cmdr., 7th Air Force, PACAF
1968	Col. Frank Borman, USAF; Capt. James Lovell, USN; and Lt. Col. William Anders, USAF, Apollo 8 crew
1969	(No presentation)
1970	Apollo 11 team (J. L. Atwood; Lt. Gen. S. C. Phillips, USAF; and astronauts Neil Armstrong and USAF Cols. Buzz Aldrin and Michael Collins)
1971	John S. Foster Jr., Dir. of Defense Research and Engineering
1972	Air units of the allied forces in Southeast Asia (Air Force, Navy, Army, Marine Corps, and the Vietnamese Air Force)
1973	Gen. John D. Ryan, USAF (Ret.), former Chief of Staff
1974	Gen. George S. Brown, USAF, Chm., Joint Chiefs of Staff
1975	James R. Schlesinger, Secretary of Defense
1976	Sen. Barry M. Goldwater
1977	Sen. Howard W. Cannon
1978	Gen. Alexander M. Haig Jr., USA, Supreme Allied Commander, Europe
1979	Sen. John C. Stennis
1980	Gen. Richard H. Ellis, USAF, CINC, SAC
1981	Gen. David C. Jones, USAF, Chm., Joint Chiefs of Staff
1982	Gen. Lew Allen Jr., USAF (Ret.), former Chief of Staff
1982	Gen. Lew Allen Jr., USAF (Ret.), former Chief of Staff
	United States
1984	The President's Commission on Strategic Forces (Scowcroft Commission)
1985	Gen. Bernard W. Rogers, USA, SACEUR
1986	Gen. Charles A. Gabriel, USAF (Ret.), former Air Force Chief of Staff
1987	Adm. William J. Crowe Jr., USN, Chm., Joint Chiefs of Staff
1988	Men and women of the Ground-Launched Cruise Missile team
1989	Gen. Larry D. Welch, Chief of Staff, USAF
1990	Gen. John T. Chain, CINC, SAC
1991	Lt. Gen. Charles A. Horner, Cmdr., CENTCOM Air Forces and 9th Air Force
1992	Gen. Colin L. Powell, USA, Chm., Joint Chiefs of Staff
1993	Gen. Merrill A. McPeak, Chief of Staff, USAF
1994	Gen. John Michael Loh, Cmdr., Air Combat Command
1995	World War II Army Air Forces veterans
1996	Gen. Ronald R. Fogleman, Chief of Staff, USAF
1997	Men and women of the United States Air Force
1998	Gen. Richard E. Hawley, Cmdr., ACC
1999	Lt. Gen. Michael C. Short, Cmdr., Allied Air Forces Southern Europe
2000	Gen. Michael E. Ryan, Chief of Staff, USAF
2001	Gen. Joseph W. Ralston, CINC, EUCOM
2002	Gen. Richard B. Myers, USAF, Chm., Joint Chiefs of Staff
2003	Lt. Gen. T. Michael Moseley, Cmdr., air component, CENTCOM, and 9th Air Force
2004	Gen. John P. Jumper, Chief of Staff, USAF
2005	Gen. Gregory S. Martin, USAF (Ret.), former Cmdr., AFMC
2006	Gen. Lance W. Lord, USAF (Ret.), former Cmdr., AFSPC
2007	Gen. Ronald E. Keys, Cmdr., ACC
2008	Gen. Bruce Carlson, Cmdr., AFMC
2009	Gen. John D. W. Corley, Cmdr., ACC
2010	Lt. Gen. David A. Deptula, USAF Deputy Chief of Staff, ISR
2011	Gen. Duncan J. McNabb, Cmdr., TRANSCOM
2012	Gen. Norton A. Schwartz, USAF (Ret.), former Chief of Staff
2013	Gen. Douglas M. Fraser, USAF (Ret.), former Cmdr., SOUTHCOM
2014	Gen. C. Robert Kehler, USAF (Ret.), former Cmdr., STRATCOM
2015	Gen. Janet C. Wolfenbarger, USAF (Ret.), former Cmdr., AFMC
2016	Gen. Mark A. Welsh III, USAF (Ret.), former Chief of Staff
2017	Lt. Gen. Christopher C. Bogdan, USAF (Ret.), former PEO, F-35 Prgm
2018	Gen. Herbert J. Carlisle, USAF (Ret.), former Cmdr., AFMC
2019	Gen. Ellen M. Pawlikowski, USAF (Ret.), former Cmdr., AFMC
2020	Gen. David L. Goldfein, USAF (Ret.), former Chief of Staff, USAF

W. STUART SYMINGTON AWARD

AFA's highest honor to a civilian in the field of national security, the award is named for the first Secretary of the Air Force.

Year	Award Recipient(s)
1986	Caspar W. Weinberger, Secretary of Defense
1987	Edward C. Aldridge Jr., Secretary of the Air Force
1988	George P. Schultz, Secretary of State
1989	Ronald W. Reagan, former President of the United States
1990	John J. Welch, Asst. SECAF (Acquisition)
1991	George Bush, President of the United States
1992	Donald B. Rice, SECAF
1993	Sen. John McCain (R-Ariz.)
1994	Rep. Ike Skelton (D-Mo.)
1995	Sheila E. Widnall, SECAF
1996	Sen. Ted Stevens (R-Alaska)
1997	William Perry, former SECDEF
1998	Rep. Saxby Chambliss (R-Ga.) and Rep. Norman D. Dicks (D-Wash.)
1999	F. Whitten Peters, SECAF
2000	Rep. Floyd Spence (R-S.C.)
2001	Sen. Michael Enzi (R-Wyo.) and Rep. Cliff Stearns (R-Fla.)
2002	Rep. James V. Hansen (R-Utah)
2003	James G. Roche, SECAF
2004	Peter B. Teets, Undersecretary of the Air Force
2005	Rep. Duncan Hunter (R-Calif.)
2007	Michael W. Wynne, SECAF
2008	Gen. Barry R. McCaffrey, USA (Ret.)
2009	Sen. Orrin G. Hatch (R-Utah)
2010	John J. Hamre, Center for Strategic & International Studies
2011	Rep. C. W. "Bill" Young (R-Fla.)
2012	Gen. James L. Jones, USMC (Ret.)
2013	Michael B. Donley, SECAF
2014	Ashton B. Carter, former Deputy SECDEF
2015	William A. LaPlante, Asst. SECAF (Acquisition)
2016	Jamie M. Morin, Director, Cost Assessment & Prgm Evaluation
2017	Lisa S. Disbrow, Undersecretary of the Air Force
2018	Deborah Lee James, former SECAF
2019	Heather Wilson, former SECAF
2020	Will Roper, Asst. SECAF (AT&L)

JOHN R. ALISON AWARD

AFA's highest honor for industrial leadership.

Year	Award Recipient(s)
1992	Norman R. Augustine, Chairman, Martin Marietta
1993	Daniel M. Tellep, Chm. and CEO, Lockheed
1994	Kent Kresa, CEO, Northrop Grumman
1995	C. Michael Armstrong, Chm. and CEO, Hughes Aircraft
1996	Harry Stonecipher, Pres. and CEO, McDonnell Douglas
1997	Dennis J. Picard, Chm. and CEO, Raytheon
1998	Philip M. Condit, Chm. and CEO, Boeing
1999	Sam B. Williams, Chm. and CEO, Williams International
2000	Simon Ramo and Dean E. Wooldridge, missile pioneers
2001	George David, Chm. and CEO, United Technologies
2002	Sydney Gillibrand, Chm., AMEC; and Jerry Morgensen, Pres. and CEO, Hensel Phelps Construction
2003	Joint Direct Attack Munition Industry Team, Boeing
2004	Thomas J. Cassidy Jr., Pres. and CEO, General Atomics Aeronautical Systems
2005	Richard Branson, Chm., Virgin Atlantic Airways and Virgin Galactic
2006	Ronald D. Sugar, Chm. and CEO, Northrop Grumman
2007	Boeing and Lockheed Martin
2008	Bell Boeing CV-22 Team, Bell Helicopter Textron, and Boeing
2009	General Atomics Aeronautical Systems Inc.
2010	Raytheon
2011	United Launch Alliance
2012	Boeing
2013	X-51A WaveRider Program, Boeing, Aerojet Rocketdyne, and Air Force Research Laboratory
2014	C-17 Globemaster III, Boeing
2015	F-22 Raptor, Lockheed Martin
2016	SpaceX
2017	Northrop Grumman
2018	Skunk Works, Lockheed Martin
2019	Draken International
2020	Marillyn Hewson

AFA LIFETIME ACHIEVEMENT AWARD

The award recognizes a lifetime of work in the advancement of aerospace.

Year	Award Recipient(s)
2003	Maj. Gen. John R. Alison, USAF (Ret.); Sen. John H. Glenn Jr.; Maj. Gen. Jeanne M. Holm, USAF (Ret.); Col. Charles E. McGee, USAF (Ret.); Gen. Bernard A. Schriever, USAF (Ret.)
2004	Gen. Russell E. Dougherty, USAF (Ret.); Florene Miller Watson
2005	Sen. Daniel K. Inouye; William J. Perry; Patty Wagstaff
2007	CMSAF Paul W. Airey, USAF (Ret.)
2008	Col. George E. Day, USAF (Ret.); Gen. David C. Jones, USAF (Ret.); Harold Brown
2009	Doolittle Raiders; Tuskegee Airmen; James R. Schlesinger
2010	Col. Walter J. Boyne, USAF (Ret.); Andrew W. Marshall; Gen. Lawrence A. Skantze, USAF (Ret.); Women Airforce Service Pilots
2011	Natalie W. Crawford; Lt. Gen. Thomas P. Stafford, USAF (Ret.); Gen. Larry D. Welch, USAF (Ret.); Heavy Bombardment Crews of WWII; Commando Sabre Operation-Call Sign Misty
2012	Gen. James P. McCarthy, USAF (Ret.); Vietnam War POWs; Berlin Airlift Aircrews; Korean War Airmen; Fighter Pilots of World War II

Year	Award Recipient(s)
2013	Maj. Gen. Joe H. Engle, USAF (Ret.); US Rep. Sam Johnson; The Arlington Committee of the Air Force Officers' Wives' Club—"The Arlington Ladies"
2014	Brig. Gen. James A. McDivitt, USAF (Ret.); Civil Air Patrol—World War II veterans; American Fighter Aces
2015	R. A. "Bob" Hoover; Eugene F. "Gene" Kranz; Gen. Michael V. Hayden, USAF (Ret.)
2016	Maj. Gen. Claude M. Bolton Jr., USAF (Ret.); Lt. Col. John T. Correll, USAF (Ret.); Gen. Charles A. Horner, USAF (Ret.); Lt. Gen. James M. Keck, USAF (Ret.); Gen. Richard B. Myers, USAF (Ret.)
2017	Gen. Ronald R. Fogleman, USAF (Ret.); Col. Clarence E. "Bud" Anderson, USAF (Ret.); Elinor Otto; Lafayette Escadrille Memorial Foundation
2018	Maj. Gen. Alfred K. Flowers, USAF (Ret.); Dan Friedkin; Air Force Scientific Advisory Board; Air Force Enlisted Village; Air Force Aid Society
2019	Gen. John A. Shaud, USAF (Ret.); Gen. T. Michael Moseley, USAF (Ret.); Dr. Benjamin Lambeth
2020	Gen. Lloyd "Fig" Newton, USAF (Ret.); Gen. John M. Loh, USAF (Ret.); Maj. Gen. Michael Collins, USAF (Ret.)

AFA CHAIRMAN'S AEROSPACE EDUCATION ACHIEVEMENT AWARD

For long-term commitment to aerospace education, making a significant impact nationwide.

Year	Award Recipient(s)
2009	ExxonMobil Foundation
2010	*USA Today*
2011	The National Science Foundation
2012	The Military Channel
2013	The Civil Air Patrol Aerospace Education Program
2014	Department of Defense STARBASE Program
2015	Northrop Grumman Foundation
2016	Harry Talbot
2017	Analytical Graphics, Inc.
2018	Project Lead the Way
2019	Air Force Junior Reserve Officer Training Corps.
2020	Bernard K. "Bernie" Skoch

AFA Aerospace Awards

David C. Schilling Award
Most outstanding contribution in the field of flight
Capt. Sean Foote, Spangdahlem Air Base, Germany

Theodore von Karman Award
Most outstanding contribution in the field of science and engineering
SpaceX

Gill Robb Wilson Award
Most outstanding contribution in the field of arts and letters
"The Last Full Measure"

Hoyt S. Vandenberg Award
Most outstanding contribution in the field of aerospace education
The Mitchell Institute

Thomas P. Gerrity Award
Most outstanding contribution in the field of systems and logistics
Lt. Col. Jose Crespo, Ellsworth Air Force Base, S.D.

Lieutenant General Claire Lee Chennault Award
For outstanding aerial warfare tactician(s) from ACC, PACAF, USAFE, ANG, and AFRC
Maj. Brady Augustine, Aviano AB, Italy

General Larry D. Welch Award
- **Officer**

Most significant impact by an individual on the overall operations, safety, security, and effectiveness of the Air Force nuclear mission
Maj. Spencer Shibler, Minot AFB, N.D.

- **Enlisted**

Most significant impact by an individual on the overall operations, safety, security, and effectiveness of the Air Force nuclear mission
MSgt. Brandon Tanaka, Eglin AFB, Fla.

- **Civilian**

Most significant impact by an individual on the overall operations, safety, security, and effectiveness of the Air Force nuclear mission
Matthew Bianco, Minot AFB, N.D.

General George C. Kenney Award
Most significant contribution by an individual or team in the area of lessons learned
706th Surveillance and Analysis Team, Patrick AFB, Fla.

General Larry O. Spencer Innovation Award
Most outstanding contribution to creative innovation and efficiency
- **Individual**

SSgt. Patrick Leach, RAF Mildenhall, U.K.

- **Team**

The Robotics Process Automation Team, JBSA-Randolph, Texas

Joan Orr Spouse of the Year Award
For civilian spouses of military members for their significant contributions to the United States Air Force
Whitney Armstrong, Wright-Patterson AFB, Ohio

Chief Master Sergeant of the Air Force Thomas N. Barnes Award
Most outstanding aircraft crew chief in the United States Air Force
SSgt. Garrett Kester, Ramstein AB, Germany

Crew and Team Awards

Lt. Gen. Howard W. Leaf Award
Best test team
AFOTEC Joint Strike Fighter Operations Test Team, Edwards AFB, Calif.

Lt. Gen. William H. Tunner Award
Best airlift crew
Crew of 437th Airlift Wing, Davis-Monthan AFB, Ariz.

Brig. Gen. Ross G. Hoyt Award
Best air refueling crew
Crew of 22nd Air Refueling Wing, Davis-Monthan AFB, Ariz.

Gen. John P. Jumper Award
Best remotely piloted aircraft crew in USAF
Pilot: Capt. Anthony Marco; Sensor Operator: SMSgt. Eric Vazquez; Mission Intelligence Coordinator: TSgt. Mallory Rushing

Gen. Curtis E. LeMay Award
Best bomber aircrew
Crew of MYTEE 21, Whiteman AFB, Mo.

Gen. Thomas S. Power Award
Best missile combat crew
1st Lt. Stacee Glass and Capt. Stephanie Sanchez, F.E. Warren AFB, Wyo.

Best Space Operations Crew
4th Expeditionary Space Control Flight Crew, Africa

BAVA Humanitarian Mission of the Year Award
Most outstanding humanitarian mission
36th Airlift Squadron, Dyess AFB, Texas

Citations of Honor

Recipients and achievements

AT&T
Since 2013, AT&T and the AT&T foundations have invested more than $144 million to support STEM initiatives and given nearly $12 million to support women in STEM. The Company and the Foundation support education programs that promote innovation and interest in STEM skills-building with a goal of encouraging young people to pursue meaningful careers in these industries. AT&T has supported AFA's CyperPatriot programs as a Cyber Diamond Sponsor and has been represented on the CyberPatriot Board of Advisors since 2013. AT&T's Air Force Team members have led AFA CyberPatriot camps since 2016, and more than 70 AT&T volunteers have donated over 2,000 hours for the camps, welcoming 270 cyber campers. In 2019, AT&T hosted five CyperPatriot camps in California, Colorado, Texas, and Ohio, including Beginner and Advanced camps.

33rd Special Operations Squadron
The members of the 33rd Special Operations Squadron, 27th Special Operations Wing, Cannon AFB, N.M., flew 802 combat sorties, accruing 15,000 combat hours as the premier remotely piloted aircraft squadron. The 33rd was routinely the special operations joint task force's "go-to" unit for eliminating the most dangerous targets and the nation's first choice problem-solver in the unmanned special operations realm. The Airmen of the 33rd conducted 162 strikes with a 98 percent success rate, removing 361 enemies from battle.

325th Maintenance Group
The 325th Maintenance Group, 325th Fighter Wing, Tyndall Air Force Base, Fla., provided critical support to two Task Force Raptor Teams executing recovery efforts following Hurricane Michael. Notably, the unit reconstituted the $35 million Low-Observable Hangar, driving immediate, significant improvements to the F-22's fleet stealth capability. The group relocated 432 Airmen and $4.9 billion in assets to Eglin Air Force Base, Fla., ensuring the return to operations of the Air Force's sole F-22 training unit.

349th Air Refueling Squadron
The 349th Air Refueling Squadron, 22nd Operations Group, 22nd Air Refueling Wing, McConnell Air Force Base, Kan., recognized as the first-ever squadron to receive both the Gen. Carl A. Spaatz Trophy and SMSgt. Albert Evans Award in the same year, was instrumental in providing aircrew and staff for Nuclear and Conventional Operational Readiness Inspections; Expeditionary Air Refueling Squadrons; and the Combined Air Operations Center. Executing air refueling, airlift, and aeromedical evacuation missions around the globe, the squadron delivered unparalleled combat support.

Professional, Civilian, Education, Management, and Environmental Awards

AFMC Management Award

Executive Division
- **Gregory Sutton, Robins AFB, Ga.**

Middle Division*
- **Lt. Col. Mark Allard, Wright-Patterson AFB, Ohio**

Junior Division*
- **Capt. Christopher Beto, Edwards AFB, Calif.**

AFROTC Cadet of the Year
Cadet Laityn Tippy, AR-91, Westside High School, Ark.

CAP Aerospace Education Cadet of the Year
Cadet Grayson Logan, Grafton, Mass.

Paul W. Myers Award for Physicians
Maj. Sarah Avila, Beale AFB, Calif.

Juanita Redmond Award for Nursing
Capt. Annalynn Pilcarca, Yokota AB, Japan

Stuart R. Reichart Award for Lawyers
Col. Ira Perkins, JB Pearl-Harbor Hickam, Hawaii

Verne Orr Award for Effective Utilization of Human Resources
Directorate of Technology and Information, JBSA-Randolph, Texas

Civilian Senior Manager of the Year
Sarah Bernal, Kirtland AFB, N.M.

Civilian Program Manager of the Year*
Valerie Borgman, Wright-Patterson AFB, Ohio

Civilian Program Specialist of the Year*
Andrew Sutton, Wright-Patterson AFB, Ohio

Civilian Wage Employee of the Year*
Gregory Chapman, Malmstrom AFB, Mont.

Lisa Disbrow Outstanding Civilian Award
Alaina Garrett, Los Angeles AFB, Calif.

Gen. Edwin W. Rawlings Award
- **Management***

Francisco Castaneda III, JBSA-Lackland, Texas
- **Technician***

MSgt. Anthony Kun, Kadena AB, Japan

* Presented at recipient's location.

Air Reserve Component Awards

AIR NATIONAL GUARD AWARDS AND RECIPIENTS

Earl T. Ricks Award
Outstanding ANG airmanship
Capt. Benjamin Otterbein, Pennsylvania ANG

CMSgt. Dick Red Award
Best ANG maintainer
SMSgt. Janis Grace, California ANG

Outstanding ANG Unit
Best ANG unit airmanship
176th Fighter Squadron, Wisconsin ANG

AIR FORCE RESERVE COMMAND AWARDS AND RECIPIENTS

President's Award for AFRC
Best AFRC flying unit or individual of the year
514th Air Mobility Wing, JB McGuire-Dix-Lakehurst, N.J.

AFRC Unit Award
Best AFRC wing of the year
932nd Medical Group, Scott AFB, Ill.

Citizen Airman and Employer of the Year Award for AFRC (Officer)
Maj. Avram Bra-Mostyn, Luke AFB, Ariz., and Maimonides Physiatry, Pasadena, Calif.

Citizen Airman and Employer of the Year Award for AFRC (Enlisted)
CMSgt. Brian Marquardt, Youngstown ARS, Ohio, and Nick Sage, Eastpointe Fire & Rescue Department, Eastpointe, Mich.

AFA Field Awards

AFA MEMBER OF THE YEAR AWARD

State names refer to recipient's home state at the time of the award.

Year	Award Recipient(s)
1953	Julian B. Rosenthal (N.Y.)
1954	George A. Anderl (Ill.)
1955	Arthur C. Storz (Neb.)
1956	Thos. F. Stack (Calif.)
1957	George D. Hardy (Md.)
1958	Jack B. Gross (Pa.)
1959	Carl J. Long (Pa.)
1960	O. Donald Olson (Colo.)
1961	Robert P. Stewart (Utah)
1962	(No presentation)
1963	N. W. DeBerardinis (La.) and Joe L. Shosid (Texas)
1964	Maxwell A. Kriendler (N.Y.)
1965	Milton Caniff (N.Y.)
1966	William W. Spruance (Del.)
1967	Sam E. Keith Jr. (Texas)
1968	Marjorie O. Hunt (Mich.)
1969	(No presentation)
1970	Lester C. Curl (Fla.)
1971	Paul W. Gaillard (Neb.)
1972	J. Raymond Bell (N.Y.) and Martin H. Harris (Fla.)
1973	Joe Higgins (Calif.)
1974	Howard T. Markey (D.C.)
1975	Martin M. Ostrow (Calif.)
1976	Victor R. Kregel (Texas)
1977	Edward A. Stearn (Calif.)
1978	William J. Demas (N.J.)
1979	Alexander C. Field Jr. (Ill.)
1980	David C. Noerr (Calif.)
1981	Daniel F. Callahan (Fla.)
1982	Thomas W. Anthony (Md.)
1983	Richard H. Becker (Ill.)
1984	Earl D. Clark Jr. (Kan.)
1985	George H. Chabbott (Del.) and Hugh L. Enyart (Ill.)
1985	George H. Chabbott (Del.) and Hugh L. Enyart (Ill.)
1986	John P. E. Kruse (N.J.)
1987	Jack K. Westbrook (Tenn.)
1988	Charles G. Durazo (Va.)
1989	Oliver R. Crawford (Texas)
1990	Cecil H. Hopper (Ohio)
1991	George M. Douglas (Colo.)
1992	Jack C. Price (Utah)
1993	Lt. Col. James G. Clark (D.C.)
1994	William A. Lafferty (Ariz.)
1995	William N. Webb (Okla.)
1996	Tommy G. Harrison (Fla.)
1997	James M. McCoy (Neb.)
1998	Ivan L. McKinney (La.)
1999	Jack H. Steed (Ga.)
2000	Mary Anne Thompson (Va.)
2001	Charles H. Church Jr. (Kan.)
2002	Thomas J. Kemp (Texas)
2003	W. Ron Goerges (Ohio)
2004	Doyle E. Larson (Minn.)
2005	Charles A. Nelson (S.D.)
2006	Craig E. Allen (Utah)
2007	William D. Croom Jr. (Texas)
2008	John J. Politi (Texas)
2009	David R. Cummock (Fla.)
2010	L. Boyd Anderson (Utah)
2011	Steven R. Lundgren (Alaska)
2012	S. Sanford Schlitt (Fla.)
2013	Tim Brock (Fla.)
2014	James W. Simons (N.D.)
2015	James R. Lauducci (Va.)
2016	David T. Buckwalter (Texas)
2017	James T. Hannam (Va.)
2018	Russell V. Lewey (Ala.)
2019	Susan Broderick Mallett (Ala.)
2020	Mark Tarpley (Okla.)

GOLD LIFE MEMBER CARD

Awarded to members whose AFA record, production, and accomplishments on a national level have been outstanding over a period of years.

Name	Year	Card No.
Gill Robb Wilson	1957	1
Jimmy Doolittle	1959	2
Arthur C. Storz Sr.	1961	3
Julian B. Rosenthal	1962	4
Jack B. Gross	1964	5
George D. Hardy	1965	6
Jess Larson	1967	7
Robert W. Smart	1968	8
Martin M. Ostrow	1973	9
James H. Straubel	1980	10
Martin H. Harris	1988	11
Sam E. Keith Jr.	1990	12
Edward A. Stearn	1992	13
Dorothy L. Flanagan	1994	14
John O. Gray	1996	15
Jack C. Price	1997	16
Nathan H. Mazer	2002	17
John R. Alison	2004	18
Donald J. Harlin	2009	19
James M. McCoy	2013	20
George M. Douglas	2014	21
John A. Shaud	2016	22
Mary Anne Thompson	2018	23

DONALD W. STEELE SR. MEMORIAL AWARD

Air Force Association Chapter of the year.

Year	Award Recipient(s)
1953	San Francisco Chapter
1954	Santa Monica Area Chapter (Calif.)
1955	San Fernando Valley Chapter (Calif.)
1956	Utah State AFA
1957	H. H. Arnold Chapter (N.Y.)
1958	San Diego Chapter
1959	Cleveland Chapter
1960	San Diego Chapter
1961	Chico Chapter (Calif.)
1962	Fort Worth Chapter (Texas)
1963	Colin P. Kelly Chapter (N.Y.)
1964	Utah State AFA
1965	Idaho State AFA
1966	New York State AFA
1967	Utah State AFA
1968	Utah State AFA
1969	(No presentation)
1970	Georgia State AFA
1971	Middle Georgia Chapter
1972	Utah State AFA
1973	Langley Chapter (Va.)
1974	Texas State AFA
1975	Alamo Chapter (Texas) and San Bernardino Area Chapter (Calif.)
1976	Scott Memorial Chapter (Ill.)
1977	Thomas B. McGuire Jr. Chapter (N.J.)
1978	Thomas B. McGuire Jr. Chapter (N.J.)
1979	Brig. Gen. Robert F. Travis Chapter (Calif.)
1980	Central Oklahoma (Gerrity) Chapter
1981	Alamo Chapter (Texas)
1982	Chicagoland-O'Hare Chapter (Ill.)
1983	Charles A. Lindbergh Chapter (Conn.)
1984	Scott Memorial Chapter (Ill.) and Colorado Springs/Lance Sijan P. Chapter (Colo.)
1985	Cape Canaveral Chapter (Fla.)
1986	Charles A. Lindbergh Chapter (Conn.)
1987	Carl Vinson Memorial Chapter (Ga.)
1988	Gen. David C. Jones Chapter (N.D.)
1989	Thomas B. McGuire Jr. Chapter (N.J.)
1990	Gen. E. W. Rawlings Chapter (Minn.)
1991	Paul Revere Chapter (Mass.)
1992	Central Florida Chapter and Langley Chapter (Va.)
1993	Green Valley Chapter (Ariz.)
1994	Langley Chapter (Va.)
1995	Baton Rouge Chapter (La.)
1996	Montgomery Chapter (Ala.)
1997	Central Florida Chapter
1998	Ark-La-Tex Chapter (La.)
1999	Hurlburt Chapter (Fla.)
2000	Wright Memorial Chapter (Ohio)
2001	Lance P. Sijan Chapter (Colo.)
2002	Eglin Chapter (Fla.)
2003	Hurlburt Chapter (Fla.)
2004	Carl Vinson Memorial Chapter (Ga.)
2005	Central Florida Chapter
2006	Enid Chapter (Okla.)
2007	Central Oklahoma (Gerrity) Chapter
2008	Lance P. Sijan Chapter (Colo.)
2009	Paul Revere Chapter (Mass.)
2010	C. Farinha Gold Rush Chapter (Calif.)
2011	Lance P. Sijan Chapter (Colo.)
2012	Hurlburt Chapter (Fla.)
2013	Paul Revere Chapter (Mass.)
2014	D.W. Steele Sr. Memorial Chapter (Va.)
2015	Lance P. Sijan Chapter (Colo.)
2016	Paul Revere Chapter (Mass.)
2017	Enid Chapter (Okla.)
2018	Langley Chapter (Va.)
2019	Wright Memorial Chapter (Ohio)
2020	Mile High Chapter (Colo.)

Daniel Chambers, bottom frame, right, is awarded a $1,000 scholarship from the Air Force Association's D.W. Steele, Sr. Memorial Chapter as his parents, Gail and Lee, watch. Officers and members of the chapter attended this virtual presentation in September.

Distinguished Sustained Aerospace Education Award

Presented to an individual AFA member whose record overwhelmingly demonstrates distinguished sustained service in any support of the educational mission of the Air Force Association over a period of years.

Regina "Gina" Giles

Aerospace Education Excellence Award

Presented for excellence in aerospace education programming. To qualify, a chapter must have received the Aerospace Education Achievement Award this year.

Small Chapter

Mel Harmon Chapter, Colo.
President Michael Sumida

Large Chapter

Paul Revere Chapter, Mass.
President Donald "Bud" Vazquez

Extra Large Chapter

Lance P. Sijan Chapter, Colo.
President Angelo Bryant

Aerospace Education Achievement Award

Presented to chapters for outstanding achievement in aerospace education programming.

Ak-Sar-Ben Chapter, Neb.
President Chris Canada

Albuquerque Chapter, N.M.
President Frederick J. Harsany

Central Oklahoma Gerrity Chapter, Okla.
President Scott Wilson

Cheyenne Cowboy Chapter, Wyo.
President Irene Johnigan

Eglin Chapter, Fla.
President Candace Curtis

Gen. Charles A. Gabriel Chapter, Va.
President Mike Winters

Gen. David C. Jones Chapter, N.D.
President Erin Vergara

Lance P. Sijan Chapter, Colo.
President Angelo Bryant

Langley Chapter, Va.
President Richard Shook

Lincoln Chapter, Neb.
President Richard T. Holdcroft

Martin H. Harris Chapter, Fla.
President Sharon Branch

Mel Harmon Chapter, Colo.
President Michael Sumida

Mile High Chapter, Colo.
President Cliff Klein

Montgomery Chapter, Ala.
President Dale B. Barton

Mount Clemens Chapter, Mich.
President Randy Whitmire

Paul Revere Chapter, Mass.
President Donald "Bud" Vazquez

Richmond Chapter, Va.
President Harper S. Alford

Roanoke Chapter, Va.
President Dwight Holland

Savannah Chapter, Ga.
President Edward Hood

Seidel Chapter, Texas
President Paul Hendricks

Space Coast Chapter, Fla.
President Dwyer Dennis

Thunderbird Chapter, Nev.
President Roberta "Bobi" Oates

Tucson Chapter, Ariz.
President Walter Saeger

Outstanding State Organization

ARIZONA

President Stu Carter

Outstanding Chapters by Size

Small Chapter
Green Mountain Chapter, Vt.
President Ray Tanguay

Large Chapter
Paul Revere Chapter, Mass.
President Donald "Bud" Vasquez

Medium Chapter
Ramstein Chapter, Germany
President Aaron Williams

Extra Large Chapter
Central Oklahoma Gerrity Chapter, Okla.
President Scott Wilson

Unit Exceptional Service Awards

Airmen and Family Programs
Mile High Chapter, Colo.
President Cliff Klein

Community Relations
Martin H. Harris Chapter, Fla.
President Sharon Branch

Best Single Program
Seidel Chapter, Texas
President Paul Hendricks

Overall Programming
Paul Revere Chapter, Mass.
President Donald "Bud" Vazquez

Communications
Mile High Chapter, Colo.
President Cliff Klein

Veterans Affairs
Paul Revere Chapter, Mass.
President Donald "Bud" Vazquez

Community Partners
Northeast Chapter, Texas
President Sandra Gage

AAS/SW Integration
South Central Region
President Teresa Anderson

Jack Gross Award

Presented to the chapter in each size category with the highest number of new members as a percentage of chapter size at the beginning of the membership year. A minimum of 10 is required.

Small Chapter
MiG Alley Chapter, South Korea
President Jeremy Nickel

Extra Large Chapter
Montgomery Chapter, Ala.
President Dale Barton

Medium Chapter
Ramstein Chapter, Germany
President Aaron Williams

Chapter Size Larger Than 1,100
Thunderbird Chapter, Nev.
President Roberta "Bobi" Oates

Large Chapter
John C. Stennis Chapter, Miss.
President Christopher Gage

Special Recognition Awards

STATE GROWTH

This state has realized a growth in total membership from June 2019 to June 2020: **Wyoming**

REGION GROWTH

This region has realized a growth in total membership from June 2019 to June 2020: **European Region**

CHAPTER GROWTH

These chapters have realized a growth in total membership from June 2019 to June 2020:

Altus Chapter, Okla.
Charlemagne Chapter, Europe
Cheyenne Cowboy Chapter, Wyo.
John C. Stennis Chapter, Miss.
Lt. Col. "B.D." Buzz Wagner Chapter, Pa.
Ramstein Chapter, Europe
Seidel Chapter, Texas
Southern Indiana Chapter, Ind.
Spangdahlem Chapter, Europe
Tokyo Chapter, Japan
United Kingdom Chapter, Europe

Community Partner Membership Awards

GOLD AWARD

Presented to chapters whose Community Partners represent at least six percent of overall chapter membership, with a minimum number of Community Partners. The minimum number is determined by chapter size.

Cheyenne Cowboy Chapter, Wyo.
Fairbanks Midnight Sun Chapter, Alaska
Lincoln Chapter, Neb.
Mel Harmon Chapter, Colo.
Meridian Chapter, Miss.
Northeast Texas Chapter, Texas
Ute-Rocky Mountain Chapter, Utah

ACHIEVEMENT AWARD

Presented in the field to chapters whose Community Partners represent at least three percent of overall chapter membership, with a minimum number of Community Partners. The minimum number is determined by chapter size.

Altus Chapter, Okla.
Col. H.M. Bud West Chapter, Fla.
Enid Chapter, Okla.
Fort Wayne Chapter, Ind.
Golden Triangle Chapter, Miss.
Hurlburt Chapter, Fla.
Swamp Fox Chapter, S.C.
Tennessee Valley Chapter, Ala.

Chairman's Citation

Awarded to those individual AFA members whose distinguished contribution to AFA in a specific field has improved and elevated the effectiveness of the Association in a national sense.

Kevin Grady
Irene Johnigan
Ken Spencer
Bill Striegel
Kevin Sullivan
Paul Weseloh

AFA's Mile High Chapter in Colorado supports Airmen and Family Programs in the community, shown here at Buckley Air Force Base, Colo., Retiree Appreciation Day.

Individual Awards by Region

Presented for outstanding service.

Medal of Merit

Awarded for exceptional services in local, regional, or national fields and shall denote great initiative on the part of the recipient for specific achievements.

Exceptional Service

Presented to those individual AFA members who have performed exceptional services for AFA in local, regional, or national fields.

Central East

Medal of Merit

Dawne Nickerson-Banez
Miles Sawyer
Richard "Rich" Shook
Justin Thomas
John Thompson
Robin Thompson
Sonora Vasquez

Exceptional Service Award

Nikki Barry
David Baylor
Brad Wilkins
Mike Winters

Far West

Medal of Merit

Cristina Agnew
Randy Odle
Jack Porath
Marty Wojtysiak

Florida

Medal of Merit

Chris Bailey
Brett Roundtree
Steven Searcy

Exceptional Service Award

Marian McBride
David Price

Great Lakes

Medal of Merit

Colin Ballein
Michael McDonald
Charles Russell

Exceptional Service Award

Kent Shin

Midwest

Medal of Merit

Charles McDonald
Steven Miller
Fred Niblock
Thomas O'Shea
Paul Theriot

Exceptional Service Award

Todd Hunter

New England

Medal of Merit

Jim Bergen
Mark Eastman
Brandon McCarty
Todd Myers
Marcia Price
Jack Russell

Exceptional Service Award

ShellEy Lipman
Ray Tanguay
Bud Vazquez

North Central

Medal of Merit

Deborah Johnson
Erin Vergara

Exceptional Service Award

Daniel Murphy
Nathan Wages

Northeast

Medal of Merit

Stuart Shippey
Tobia Terranova

Exceptional Service Award

Michael Szymczak

Northwest

Medal of Merit

Jeff Putnam
William J. Tidd

Exceptional Service Award

Gabrielle "Gabbe" Kearney

Overseas

Medal of Merit

Sergio A. Carpio
Austin Hood
Christopher J. Parente
Odemaris A. Rivera
Samuel L. Wilhite
Aaron Williams
Sunn Yi

Exceptional Service Award

Robert Montalvo
Jeremy Nickel

Rocky Mountain

Medal of Merit

Mary Ann Blair
Jeanie Bosen
Ray Brown
Carolyn Ritschard
Catharine Rozema

Exceptional Service Award

Margaret Eichman
Kirk Schmierer
Lorrell Walter

South Central

Medal of Merit

Dale B. Barton
Daria Coulhurst
Troy Eastman
Chris Gage
John Phillip

Exceptional Service Award

Patrick McCoy
Ken Philippart

Southeast

Medal of Merit

Edward Hood
Laurie Orth

Exceptional Service Award

Cheryl Moye
Jackie Trotter
Mike Wilkins

Southwest

Medal of Merit

Floyd Cisco
Robert Curry
Jo Ellen Doyle
Kathy Jagiello
Angelo Rossetti
Fred Shirley
Gene Trosterud

Exceptional Service Award

Marie Lankford
Dick Roberts

Texoma

Medal of Merit

Matthew Crawford
Lori Earl
Robert Eldridge
Christopher Pineda
Fletcher Sharp

Exceptional Service Award

John Campbell
Jeffrey W. James
Scott Northcutt
Janelle Stafford
Scott F. Wilson

AFA's Regions, States, and Chapters

The population of each is listed below:

CENTRAL EAST REGION — 10,279

Ken Spencer

Delaware — 345
Brig. Gen. Bill Spruance . . . 97
Delaware Galaxy . . . 248

District of Columbia — 1,479
Nation's Capital . . . 1,479

Maryland — 1,832
Baltimore* . . . 691
Central Maryland . . . 402
Thomas W. Anthony . . . 739

Virginia — 6,447
Donald W. Steele Sr. Memorial . . . 3,055
Gen. Charles A. Gabriel . . . 1,375
Langley . . . 1,238
Richmond . . . 508
Roanoke . . . 271

West Virginia — 176
Chuck Yeager . . . 176

FAR WEST REGION — 6,826

Wayne R. Kauffman

California — 6,197
Bob Hope . . . 409
Brig. Gen. Robert F. Travis . . . 405
C. Farinha Gold Rush . . . 760
David J. Price/Beale . . . 213
Fresno* . . . 373
Gen. B. A. Schriever Los Angeles . . . 562
General Doolittle Los Angeles Area* . . . 666
Golden Gate* . . . 384
High Desert . . . 101
Orange County/Gen. Curtis E. LeMay . . . 401
Palm Springs . . . 258
Robert H. Goddard . . . 287
San Diego . . . 665
Stan Hryn Monterey Bay . . . 118
Tennessee Ernie Ford . . . 349
William J. "Pete" Knight . . . 246

Hawaii — 629
Hawaii* . . . 629

FLORIDA REGION — 7,036

Mark Chapman

Florida — 7,036
Brig. Gen. James R. McCarthy . . . 238
Space Coast . . . 773
Col. H. M. "Bud" West . . . 171
Eglin . . . 901
Falcon . . . 422
Florida Highlands . . . 227
Florida West Coast . . . 260
Gold Coast . . . 476
Hurlburt . . . 669
Martin H. Harris . . . 942
Miami-Homestead . . . 291
Red Tail Memorial . . . 394
Tyndall . . . 266
Waterman-Twining . . . 1,066

GREAT LAKES REGION — 5,783

Tom Koogler

Indiana — 1,016
Central Indiana . . . 333
Fort Wayne . . . 148
Grissom Memorial . . . 167
Lawrence D. Bell Museum . . . 143
P-47 Memorial Chapter . . . 111
Southern Indiana . . . 114

Kentucky — 575
Gen. Russell E. Dougherty . . . 357
Lexington . . . 218

Michigan — 1,198
Battle Creek . . . 8
Lake Superior Northland . . . 103
Lloyd R. Leavitt Jr. . . . 252
Mount Clemens . . . 835

Ohio — 2,994
Capt. Eddie Rickenbacker Memorial* . . . 404
Frank P. Lahm . . . 310
Gen. Joseph W. Ralston . . . 419
North Coast* . . . 157
Steel Valley . . . 84
Wright Memorial* . . . 1,620

MIDWEST REGION — 4,948

Chris Canada

Illinois — 1,797
Chicagoland-O'Hare . . . 810
Scott Memorial . . . 987

Iowa — 390
Fort Dodge . . . 23
Gen. Charles A. Horner . . . 148
Northeast Iowa . . . 179
Richard D. Kisling . . . 40

Kansas — 463
Lt. Erwin R. Bleckley . . . 315
Maj. Gen. Edward R. Fry . . . 148

Missouri — 1,268
Harry S. Truman . . . 448
Spirit of St. Louis . . . 472
Whiteman . . . 348

Nebraska — 1,030
Ak-Sar-Ben . . . 834
Lincoln . . . 196

NEW ENGLAND REGION — 2,516

Kevin M. Grady

Connecticut — 493
Flying Yankees/Gen. George C. Kenney . . . 296
Lindbergh/Sikorsky . . . 197

Massachusetts — 1,164
Minuteman . . . 211
Otis . . . 168
Paul Revere . . . 574
Pioneer Valley . . . 211

New Hampshire — 549
Brig. Gen. Harrison R. Thyng . . . 549

Rhode Island — 160
Metro Rhode Island . . . 127
Newport Blue & Gold . . . 33

Vermont — 150
Green Mountain . . . 150

NORTH CENTRAL REGION — 2,235

Dan Murphy

Minnesota — 733
Gen. E. W. Rawlings . . . 604
Richard I. Bong . . . 129

Montana — 243
Big Sky . . . 176
Bozeman . . . 67

North Dakota — 265
Gen. David C. Jones . . . 128
Happy Hooligan . . . 69
Red River Valley . . . 68

South Dakota — 327
Dacotah . . . 153
Rushmore . . . 174

Wisconsin — 667
Billy Mitchell . . . 667

NORTHEAST REGION — 4,554

David Ribbe

New Jersey — 1,045
Brig. Gen. Frederick W. Castle . . . 175
Hangar One . . . 128
Highpoint . . . 55
Mercer County . . . 78
Sal Capriglione . . . 200
Shooting Star . . . 154
Thomas B. McGuire Jr. . . . 255

New York — 1,696
Albany-Hudson Valley* . . . 279
Finger Lakes . . . 226
Gen. Carl A. Spaatz . . . 107
Genesee Valley . . . 148
Iron Gate . . . 194
L. D. Bell-Niagara Frontier . . . 236
Long Island . . . 410
Pride of the Adirondacks . . . 96

Pennsylvania — 1,813
Altoona . . . 97
Joe Walker-Mon Valley . . . 172
Lehigh Valley . . . 132
Liberty Bell . . . 448
Lt. Col. B. D. "Buzz" Wagner . . . 91
Mifflin County* . . . 73
Olmsted . . . 207
Pocono Northeast . . . 155
Total Force . . . 232
York-Lancaster . . . 206

NORTHWEST REGION — 3,579

Jeff Putnam

Alaska — 455
Edward J. Monaghan . . . 331
Fairbanks Midnight Sun . . . 124

Idaho — 375
Snake River Valley . . . 375

Oregon — 696
Bill Harris . . . 182
Columbia Gorge* . . . 514

Washington — 2,053
Greater Seattle . . . 660
Inland Empire . . . 542
McChord Field . . . 851

ROCKY MOUNTAIN REGION — 4,384

Linda Aldrich

Colorado — 3,190
Gen. Robert E. Huyser . . . 104
Lance P. Sijan . . . 1,772
Mel Harmon . . . 129
Mile High . . . 1,185

Utah — 900
Northern Utah . . . 311
Salt Lake City . . . 334
Ute-Rocky Mountain . . . 255

Wyoming — 294
Cheyenne Cowboy . . . 294

SOUTH CENTRAL REGION — 5,212

Teresa Anderson

Alabama — 1,726
Birmingham . . . 267
Montgomery . . . 778
South Alabama . . . 165
Tennessee Valley . . . 516

Arkansas — 686
David D. Terry Jr. . . . 411
Lewis E. Lyle . . . 275

Louisiana — 746
Ark-La-Tex . . . 398
Maj. Gen. Oris B. Johnson . . . 348

Mississippi — 730
Golden Triangle . . . 226
John C. Stennis . . . 357
Meridian . . . 147

Tennessee — 1,324
Everett R. Cook . . . 285
Gen. Bruce K. Holloway . . . 572
H. H. Arnold Memorial . . . 107
Maj. Gen. Dan F. Callahan . . . 360

SOUTHEAST REGION — 5,827

Jackie Trotter

Georgia — 2,450
Carl Vinson Memorial . . . 748
Dobbins . . . 1,220
Savannah . . . 293
South Georgia . . . 189

North Carolina — 1,934
Blue Ridge . . . 368
Cape Fear . . . 202
Kitty Hawk . . . 51
Pope . . . 493
Scott Berkeley . . . 253
Tarheel . . . 567

South Carolina — 1,443
Charleston . . . 453
Columbia Palmetto . . . 320
Strom Thurmond . . . 332
Swamp Fox . . . 338

SOUTHWEST REGION — 5,099

Roberta Oates

Arizona — 2,726
Cochise . . . 110
Frank Luke . . . 1,403
Prescott/Goldwater . . . 326
Tucson . . . 887

Nevada — 1,326
Thunderbird . . . 1,326

New Mexico — 1,047
Albuquerque . . . 736
Llano Estacado . . . 95
White Sands . . . 216

TEXOMA REGION — 9,578

Paul Weseloh

Oklahoma — 1,467
Altus . . . 119
Central Oklahoma (Gerrity) . . . 954
Enid . . . 115
Tulsa . . . 279

Texas — 8,111
Abilene . . . 293
Aggieland . . . 134
Alamo . . . 2,999
Austin . . . 888
Concho . . . 166
Del Rio . . . 108
Denton . . . 276
Fort Worth . . . 1,140
Gen. Charles L. Donnelly Jr. . . . 165
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San Jacinto . . . 735
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*These chapters were chartered before Dec. 31, 1948, and are considered original charter chapters. Ohio's North Coast Chapter was formerly the Cleveland Chapter; Oregon's Columbia Gorge Chapter was formerly the Portland Chapter.

These figures indicate the number of affiliated members as of June 2020. Listed below the name of each region is the Region President.

AIRMAN FOR LIFE

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

AFA's Mississippi Chapters Honor CMSAF Bass

MISSISSIPPI STATE SENATE

Lieutenant Governor Delbert Hosemann,
as President of the Senate,
and Senate Pro Tempore Dean Kirby
EXTEND THE RECOGNITION OF THE MISSISSIPPI SENATE TO
CHIEF MASTER SERGEANT JOANNE BASS

ON THE OCCASION OF BEING SELECTED AS THE NEXT
CHIEF MASTER SERGEANT OF THE UNITED STATES AIR FORCE.

Outgoing AFA Mississippi State President Len Vernamonti gathered state and national leaders for a virtual ceremony saluting the new Chief Master Sergeant of the Air Force JoAnne S. Bass for her recent appointment in October. Mississippi Lt. Gov. Delbert Hosemann and the state senate's President Pro Tempore Sen. Dean Kirby honored Bass for her past service as command chief of 2nd Air Force at Keesler Air Force Base, Miss.

"Chief Master Sgt. Bass' service represents a strong and free America, and for her career of selfless service, a grateful State of Mississippi thanks her," Hosemann said, reading from the proclamation.

Separately, he added, "You are extended a personal request to come back and join us after you get finished running all of the Air Force personnel throughout the world. ... We'd love to have you as a Mississippian."

Bass reflected on her time in uniform as she thanked Hosemann for honoring her. "Our military careers go by very fast," she said. "I look back at all the places I've been stationed, and I tell you, my two years in Mississippi ... was a wonderful opportunity, one because of just the Southern hospitality of the great folks from the state of Mississippi, but two, how much they ... love our service members and their families."

Among those attending the virtual session were AFA Chairman and former CMSAF Gerald Murray; AFA President Lt. Gen. Bruce "Orville" Wright, USAF (Ret.); Maj. Gen. Andrea D. Tullos, Chief Bass' former boss at Keesler; Mississippi Air National Guard State Command Chief, Chief Master Sgt. Lynn Cole; and new Mississippi State president, Master Sgt. Chris Gage. ✪

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d. Percent paid (both print & electronic copies) (16b / 16c x 100)	99.84%	99.84%

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I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).

USAF (1,3); Staff Sgt. Hailey Staker

1 Brig. Gen. Richard E. Ellsworth 2 A B-1B Lancer at Ellsworth AFB. 3 An RB-36 at Ellsworth/Rapid City circa 1950s.

ELLSWORTH

From the Front

Richard Ellsworth—a big South Dakota air base carries his name—was not your typical wing commander. Enlisted mechanics often were startled to find him at their sides, working late into the night to help prepare aircraft for action.

Not bad for a general. It was his way—hands on, leading from the front—but it was a trait that, in the end, exacted a price.

Richard Elmer Ellsworth, born in 1911 in Pennsylvania, graduated from high school in 1929 but deferred college, hoping for a West Point appointment. He spent two years in the National Guard, after which he did in fact get the appointment.

Ellsworth entered West Point and graduated with the Class of 1935. The newly minted second lieutenant relocated to Texas for his flight training and in late 1936 received his wings.

For the next six years, Ellsworth's career was steady but unspectacular. He rose to lieutenant colonel and earned an advanced degree (in meteorology) from California Institute of Technology. Then came World War II.

Through 1942, Ellsworth served in Alaska and the Southwest Pacific, working as both a transport pilot and as an expert, pulling together vital data on Pacific weather patterns.

The year 1943 was pivotal. Ellsworth was promoted to colonel and transferred to the China-Burma-India Theater, where he started flying combat missions with 10th and 14th Air Forces.

Ellsworth pulled 400 combat missions, amassing nearly 800 combat hours. He was awarded battle stars for eight campaigns. His many decorations included two Distinguished Flying Crosses.

Now a war hero, Ellsworth returned to the U.S. and quickly advanced in USAF. In quick order, he served as chief of operations at Air Weather Service, commander of 380th Reconnaissance Group, and chief of plans for 2nd Air Force. For good measure, he graduated in 1950 from the Air War College.

In the early 1950s, Ellsworth became commander of 28th Strategic Reconnaissance Wing, a SAC B-36 outfit at Rapid City Air Force Base, S.D., near the Black Hills. He received his first star.

That's where the Ellsworth success story comes to an end.

On March 18, 1953, Ellsworth was co-piloting a RB-36H bomber on a 25-hour simulated combat mission from the Azores to South Dakota. The crew, observing radio silence, switched off radar and used celestial navigation. Late at night, the bomber hit bad weather, went off course, and struck a low peak on Newfoundland. The crash killed Ellsworth and the other 22 crew members.

President Dwight D. Eisenhower renamed the Rapid City base in his honor. Years later, Col. John Edwards, 28th Bomb Wing commander, noted, "Brig. Gen. Ellsworth led from the front—a very good example for enlisted, officers, and civilians."

Today, Ellsworth Air Force Base is a major hub of USAF's global strike capabilities, its 28th Bomb Wing being one of two locations of the B-1B long-long bomber. It has been selected as a preferred site for the first operational B-21 Raider bomber unit. ✪

RICHARD ELMER ELLSWORTH

Born: July 18, 1911, Erie, Pa.
Died: March 18, 1953, Newfoundland, Canada
Colleges: U.S. Military Academy, West Point N.Y.; California Institute of Technology
Occupation: U.S. military officer
Services: Pennsylvania National Guard; U.S. Army (Air Corps, Air Forces); U.S. Air Force
Main Eras: World War II, Postwar
Years Active: 1929-53
Combat: China-Burma-India Theater 1943-45
Final Grade: Brigadier General
Honors: Legion of Merit, Distinguished Flying Cross (3) Air Medal (3), Campaign Battle Star (8) China Air Force Wings.
Resting Place: Black Hills National Cemetery, Sturgis, S.D.

ELLSWORTH AIR FORCE BASE

State: South Dakota
Nearest City: Rapid City
Area: 7.59 sq mi / 4,858 acres
Status: Open, operational
Opened as: Rapid City Army Air Base: Jan. 2, 1942
Renamed: Rapid City Army Air Field: Sept. 1, 1946
Renamed: Rapid City Air Force Base: Nov. 28, 1947
Renamed Weaver Air Force Base: Jan. 13, 1948
Renamed Rapid City Air Force Base: June 24, 1948
Renamed Ellsworth Air Force Base: June 1, 1953
Current owner: Air Force Global Strike Command
Former owners: Second Air Force, Continental Air Forces, Strategic Air Command, Air Combat Command.
Home of: 28th Bomb Wing

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