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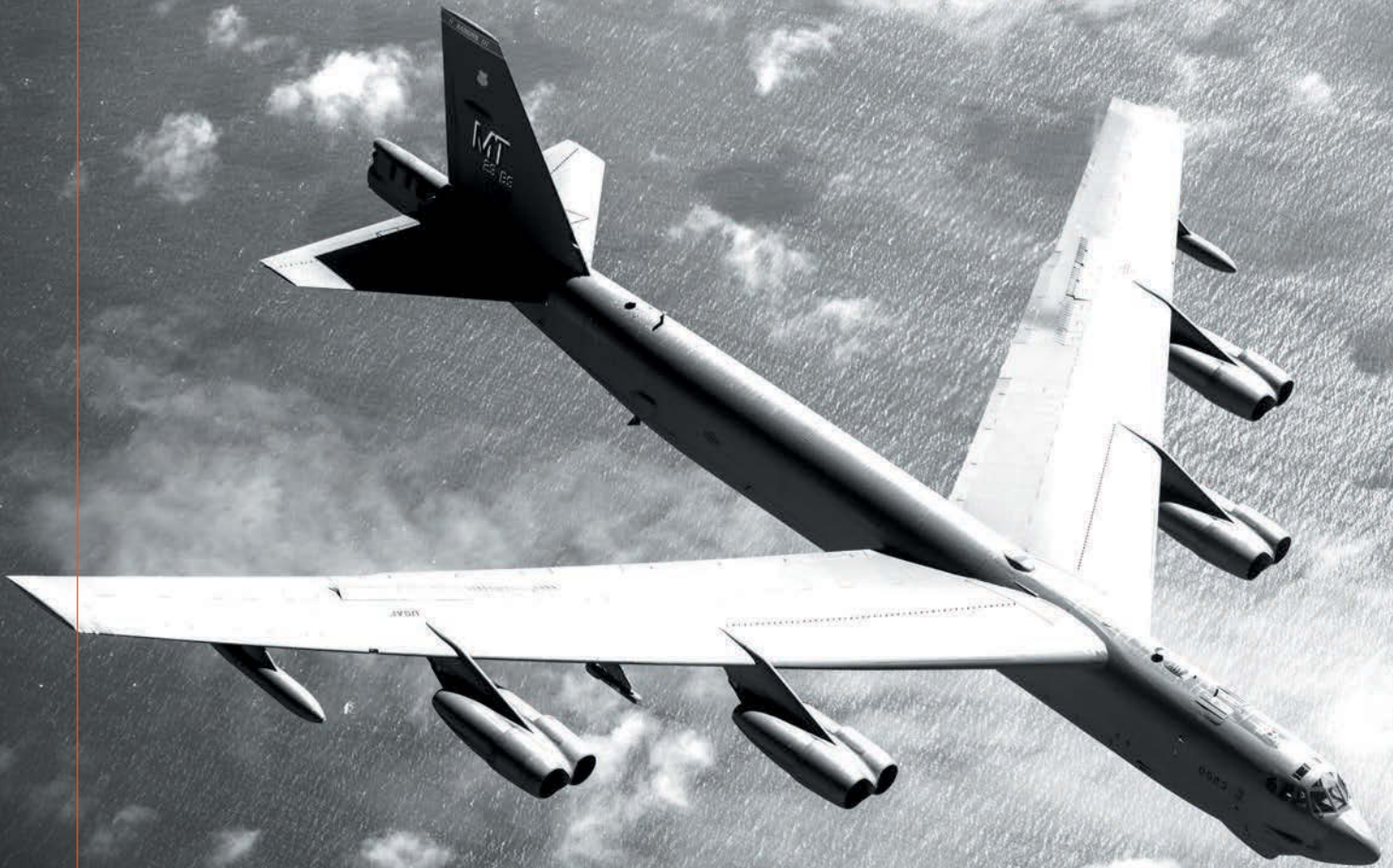


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January/February 2021, Vol. 104, Nos. 1 and 2

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News Editor

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John T. Correll,
Jennifer Hlad,
Jason Sherman,
Lt. Col. Anthony
Tingle, USA (Ret.)



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Russian Tu-95 bombers, shown here with wing-mounted Kh-101 cruise missiles, on Oct. 14, 2020, probed Canadian and U.S. air spaces to goad, provoke, and test the two nations' responses. See "Forging a Shield for the Homeland," p. 40.

ON THE COVER



Mike Tsukamoto/staff

Innovation has been the hallmark of USAF under acquisition chief Will Roper's leadership. See "The Great Experimenter," p. 36.

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What History Tells Us

We have been studying history and relearning old lessons. This is never easy. January's riot at the Capitol and the second impeachment of a single sitting president were unique, yet the discord and division that preceded them is not.

Three decades after Operation Desert Storm, it is easy to forget that Americans were hardly united about committing to that conflict. Some 183 representatives in the House and 47 in the Senate voted against authorizing military force to compel Iraq's withdrawal from Kuwait. The House and Senate both had solid Democratic majorities, yet Republican President George H.W. Bush won bipartisan support for the campaign.

Having recently vanquished the Soviet Union in the Cold War, and still licking wounds from failure in Vietnam, many Americans were loath to become mired in a conflict someplace else. But once the bombs started falling, once the works of stealthy F-117s, laser-guided bombs, and other modern marvels of Cold War weaponry went on display, the tide turned.

It took just 1,000 hours to crush the capacity and will of the Iraqi army. The U.S. Air Force led a 38-day coalition air assault. When that was done, the Army and Marines swept in to complete the destruction, a 100-hour maneuver to chase the already diminished and defeated Iraqi force home to Baghdad.

Here was America's strategy laid out in plain sight: a technologically superior force that didn't have to match up in numbers because its capabilities were so vastly superior, its speed, range, and reach so overwhelmingly greater, its forces so much more professionally trained, that the fight was no contest. The Iraqis outnumbered the Americans 535,000 to 415,000 at the start, and still they never had a chance.

America, however, embraced the wrong lesson. Rather than see this one-sided victory as vindicating the nation's sacrifices over the decades—a decisive victory at the cost of fewer than 150 Americans lost in combat—Congress doubled down on defense cuts and an even bigger peace dividend for winning the Cold War.

In 1992, a seemingly invincible President George H. W. Bush, having built a 35-nation coalition to win the Gulf War and among the best prepared politicians ever to assume the presidency, was defeated by Bill Clinton, the former governor of Arkansas, whose campaign coined the phrase "it's the economy, stupid." Clinton promised to cut defense spending and did—by more, in fact, than even he had imagined.

Air Force Magazine reported in May 1993 that the defense budget would decline (after accounting for inflation) by 42 percent between 1985 and 1997. As The New York Times editorialized, this was acceptable because "U.S. weapon systems are unrivaled, so production of new tanks, planes, and ships can be put off for a decade or more."

Hare, meet tortoise. Putting the brakes on future weapons development bought time for Russia and China and diminished America's ability to wage war, both in military fighting power and industrial might. Our defense and aerospace industries suffered massive consolidation, as rivals chose to combine rather than go out of business; engineers looked to Silicon Valley rather than

aerospace as the best places to work; planned production of our most advanced, lethal, and effective weapons—the systems that delivered the greatest deterrent value to our nation—were cut short.

Deferring national defense investments are like deferring maintenance on your house. You may be able to get another year out of that roof, maybe two. But wait too long and you'll have to replace plywood and trusses, not just shingles. That's why the Air Force is now spending billions to keep its B-1B bombers flying. Purchased in the 1980s, they weren't designed or built to last so long, but their successor, the B-21, won't arrive for another decade. At this writing, it's still more than a year from its first flight.

"The force that won the Gulf War no longer exists," AFA noted in an eerily prescient policy statement in the fall of 1993. "The existing force ... is operating at an arduous tempo to meet operational commitments. Fighter and mobility forces are particularly pressed. The Air Force of the future may draw combat units from a service half the size of the Air Force that waged the Desert Storm air campaign. Unless system modernization proceeds, that force will be left to fight the conflicts of the 21st century with the same equipment—obsolescing and in reduced numbers—employed in the Gulf War."

The threat of global war had receded, but that AFA statement warned the public and Congress

that the impending world order would be neither peaceful nor benign. What followed was a period of nonstop conflict as the United States became enmeshed, one after another, in Somalia, Haiti, Bosnia, Kosovo, Iraq, Afghanistan, Libya, and Syria, usually in more than one place at a time.


Russia has reset its nuclear and strategic forces. China has studied and countered virtually every strategic advance in America's historically technologically superior forces. Iran and North Korea have flouted international law and diplomacy while developing nuclear arms. They, like Russia and China, engage in cyber warfare daily.

And as the world became more dangerous, our nation was weakened by our own fractious infighting. We are the spoiled kids fighting over the remote while the roof caves in above us.

Enough!

Some 75 years ago a few visionary leaders established our Air Force Association to ensure America didn't forget what won World War II, and that we never returned to the impotent interwar period after World War I, when Americans were naïve enough to think we had won the "war to end all wars." We have endured for those 75 years because tens of thousands of us continue to believe that American security is rooted in the strategic development and application of aerospace power, and because history tells us that the failure to advocate for aerospace power will leave us without that power when we need it most.

This is our mission: educating, advocating, and supporting the Airmen and Guardians who stand ready to defend us from all enemies, foreign and domestic. Let us rise above the politics of the hour and hold fast to a common cause, that of a free people committed to the common defense, the rule of law, and common decency.

We live in a dangerous world, where real enemies lurk. We must be ready and waiting, united as one. 

"Those who cannot remember the past are condemned to repeat it!"

—George Santayana, philosopher



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Our mission is to promote dominant U.S. Air and Space Forces as the foundation of a strong national defense; honor and support our Airmen, Space professionals, and their families; and to honor and respect our enduring heritage.

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Field Services field@afa.org
Government Relations grl@afa.org
Insurance afa.service@mercer.com
Membership membership@afa.org
News Media communications@afa.org
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Scud Hunting

I am writing to express my disagreement with [Tobias] Naegele's disparagement of the Army's pursuit of long-range weaponry ["Generating Fires, Not Hype," November 2020, p. 2].

Let us stipulate that the Army bears the responsibility for defense of forward bases, regardless of whether the forces emplaced are Army, Air Force, or ally. Among the deadly threats are cruise and ballistic missiles, against which the Army has invested greatly in perimeter and area defenses: Nike Ajax, Nike Hercules, HAWK, Patriot PAC-1 and PAC-3, THAAD, and Arrow. Let us not kid ourselves that the Air Force can defend against ballistic missiles and give credit for the Army's efforts.

As we say in the strategic defense business, the best active defense is in the "pre-boost" phase, and it is reasonable for the Army to desire a means of shooting back at the enemy launch site. But when we tried to do that with air power in the Great Scud Hunt of Gulf War 1, the results were miserable. I and a colleague were tasked with conducting an analysis of that mission in order to understand why the results were so poor. We modeled the mission segments as functional blocks characterized by time and probability of success. Once we plugged in the architecture fielded in Gulf War 1, we came up with ... miserable results. The main contributor was time delay, both from the mission-planning and strike-planning process and from the target-search process. It became obvious that a responsive defense such as a Scud Hunt must be on a separate track from the theater battle planning and coordination process. There was simply too much valuable time lost in being part of a massive plan. That time lost allowed the target to egress from its launch coordinates and imposed a significant time penalty for reacquisition. Faster reacquisition was important, but not necessarily faster weapon delivery. We were able to show several orders of improvement in mission productivity by implementing an architecture that had a stand-alone planning cycle and weapons that incorporated reacquisition sensors.

Given these results (now 30 years old), it is no surprise to me that the Army wants the ability to engage at theater distances with weapons under its own

battle management and control. It cannot afford delay of response. And it cannot afford slow delivery. Calling in a B-2 strike from Whiteman Air Force Base, Mo., and waiting 12 hours for bomb on target is not operationally useful (assuming the B-2 was even on runway alert). "When minutes count, the Air Force will be there tomorrow." And when you fail to negate the target, all this talk about range, stealth, mobility, cost, and efficiency misses the point, which is: responsiveness and kill probability.

There is no airplane that travels as fast as a ballistic or hypersonic missile. There is no responsiveness better than being fired out of a canister. There is no substitute for being in time to make a difference. The Army does not think in terms of conveyor-belt attrition warfare. They are fighting a ground battle whose circumstances can change within hours or minutes, and they may need to negate targets at 1,000-mile ranges in order to keep threats suppressed, traffic nodes out of commission, communications disrupted, or supplies and reinforcements at bay. The Army would be happy to assign non-urgent targets to the Air Force, but they do not want to miss critical opportunities. A 1,000-mile missile weighs only 8 tons (Pershing II), but an M-1 Abrams tank weighs over 70 tons. Such missiles are "affordable" both in dollar terms and in logistic burden.

All the virtues of frontal aviation require that the aircraft be collocated with the Army, with the same penalties of logistic chains, so it is bait-and-switch to say that the Air Force is less vulnerable—so long as you are willing to await backup from halfway around the world.

Don't misunderstand my criticism as being partisan against the Air Force. I

WRITE TO US

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

have studied, analyzed, and supported Air Force missions for the dominant part of my career. There is much for it to do. But this argument against the Army is misconceived and really amounts to a case of "screw you, buddy." If the Army is wrong in its approach, they are the only ones who know better, as attested by their experience: Corporal, Redstone, Sergeant, Jupiter, Pershing, Lance, Pershing II, GSRS. Give them their due, and let them do their job. They don't accept the Air Force's response time and, frankly, they have grounds for that, even though they are dependent on the Air Force for the success of ground campaigns. So, they are not seeking to do your job. Please give them the professional respect and support to do their job as they best see how to do it.

Michael J. Dunn
Federal Way, Wash.

Unintended Consequences

In the September issue ["World: As DOD Leaves Germany, Spangdahlem Left Hanging," p. 33] (former) Defense Secretary [Mark T.] Esper talks about increasing deployments overseas and reducing permanent stations abroad. It is

supposed to improve mission capability. I would agree it could reduce costs in the long run, but would use the following example of this tactic in the 1970s as a lesson learned. The then-USAF Security Service (USAFSS), which was largely an intelligence-gathering organization, decided to implement a MOB/FOB (Main Operating Base/Forward Operating Base) concept for its airborne reconnaissance component. Its crew members flew on Strategic Air Command RC-135's. The "front end" crews from SAC had used this deployment system for decades with seeming success. So Security Service would do the same with "back-end" crews. Pull people back to one main base in the U.S., scale down the existing field units, and then deploy crew members for various lengths of TDY (temporary duty). The SAC and USAFSS crews would be on the same stateside base.

But much of the USAFSS workforce did not buy into this concept. Highly trained and motivated technical experts in overseas units were centralized into one stateside location. The lure of an overseas tour in some desirable locations (England, Germany, Greece, Okinawa) disappeared. There were more and longer TDYs. The

downsized theater units were now part staff and enough technicians to process high-priority intel. Morale dropped, senior people decided to retire and look for more stability, and the impact on families was evident. Not to mention the challenge of crew scheduling. The USAFSS crews were at least twice the size of the SAC crews.

Within a few years, the Security Service embarked on a "de-MOB/FOB" program to undo some of the negative impact. Overseas units were strengthened, more skilled technicians were sent there PCS (permanent change of station) and morale seemed to improve.

The lesson learned is to do the research before implementing change. Know your workforce. What looks good on paper and works for one command may not work for another.

Capt. Hank Whitney,
USAF (Ret.)
Custer, S.D.

Remember the First

The article "Erasing Artificial Barriers" by Amy McCullough [November, p. 40] quickly caught my eye. Although it was a nice tribute and review of the progress

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of Air Force women pilots in entering the fighter pilot arena, what was conspicuous by its absence was any reference to the historic first group of Air Force women pilots, who started this long journey to its splendid fruition.

I was likely, as the cliché would say, in the right place at the right time. In the summer of 1976, I was assigned to Officer Training School (OTS) Medical Services, Medina Annex, Lackland Air Force Base, Texas, as the Chief of Dental Services. The arrival of that first group of women Flight Screening Program (FSP) students there in July of that year caused quite a stir—locally and of course nationally. I had the privilege of performing their first active Air Force flying training dental examinations—even before they entered UPT (undergraduate pilot training) on Sept. 26, 1976, at Williams Air Force Base, Ariz. (They had to pass FSP before entering UPT.)

These officers all deserve recognition: K. Cosand, V. Crawford, M. Donahue, C. Engel, K. La Sauce, M. Livingston, S. Rogers, C. Sherer, C. Schott, and S. Scott. Although their first operational assignments after graduation from UPT in 1977 did not include fighter assignments, they surely paved the way for their successors. I believe they need to be recognized accordingly.

Col. Fred W. Benenati,
USAFR (Ret.)
Norman, Okla.

I Object

I've been a member of the Air Force Association for 50 years. Air Force Magazine has always been the hallmark of both technical information and reasoned political opinion, until now. Your editorial staff's decision to print Wayne Grane's repetition of false and disparaging slander of President Donald Trump in November's "Letters" violated every standard of taste, judgment, and honesty for which this magazine has always been respected.

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You allowed Mr. Grane to echo the most scurrilous accusations against the President. The fact that your editors granted Mr. Grane an avenue to do exactly that shakes my faith to the core. If they worked for me, they wouldn't work for me anymore.

Lt. Col. Gary Peppers,
USAF (Ret.)
Cape Coral, Fla.

I still hold an image from a "public service message" on AFRTS (American Forces Radio and Television Service) in Iraq in 2010 showing a Navy admiral visiting with moms and children in a military day care center. I wondered who was watching the Med, the South China Sea, the Strait of Hormuz, and other troubled spots. General Brown gives an A-priority to taking care of Airmen and their families ["Strategy and Policy: Brown's A-B-C-Ds for Accelerating Change," November, p. 12] and assuring their quality of life while mission capability of all our aircraft is abysmally low.

I'm reminded of the oft-seen slogan on commercial work vehicles, "Safety Is Our Top Priority." Whatever happened to MISSION—killing bad people and breaking their stuff? In my 16 months as commander of the 479th AGS at Holloman Air Force Base, N.M., in 1980-81, I imposed more Article 15 punishments monthly than the larger maintenance squadrons on the base, and I discharged 50 unsuited and unfit members.

Somehow, my emphasis on mission and on strict discipline cut emergencies in half and brought our MC rate from the low 60s to the high 80s and low 90s. I cared for quality of life, and it was reflected at the end of my tenure in the highest re-enlistment rate of all Tactical Air Command maintenance squadrons. But mission identification and mission pride probably had more to do with the squadron's success than any other factor.

Lt. Col. John F. Piowaty,
USAF (Ret.)
Cape Canaveral, Fla.

The Thanh Hoa Bridge

In their worth-reading article, "A Better Way to Measure Combat Value" [September, p. 60] Lt. Gen. David Deptula and Douglas Birkey, on p. 62, used a photo of an F-4D of the 435th Tactical Fighter Squadron. In my opinion, two things need a correction. (1) The 435th TFS was stationed at Udorn Royal Thai Air Base, Thailand, all right, but only when the squadron was flying the F-104C Starfighter. When it was decided to return

the F-104s to CONUS and to reequip the 435th with brand-new F-4Ds, the squadron PCS-ed WOPE (Without Personnel and Equipment) to Ubon RTAB on July 29, 1967, where the 435th 'inherited' the personnel and equipment of the newly arrived 4th TFS. The 4th designation was then returned to Eglin Air Force Base. Both at Udorn and Ubon, the 435th TFS was assigned to the 8th TFW.

(2) It is stated that laser guided bombs expended by F-4Ds were finally successful in taking down the notorious Thanh Hoa Bridge in Vietnam. It is correct that Ubon F-4Ds struck the bridge in April and May 1972 with M-118 and Mk-84 LGBs and with Mk-84 EOGBs (Electro-Optical Guided Bombs), and damaged it, but certainly did not take it down. On Oct. 6, seven-and-a-half years after the first strike against the bridge, it took two pilots and their A-7C Corsair IIs of USS America's Attack Squadron (VA) 82, Cmdr. Leighton 'Snuffy' Smith and Lt. j.g. Marvin Baldwin, one AGM-62B Walleye glide bomb each, to get the bridge finally into the Song Ma River.

Theo van Geffen,
Utrecht, the Netherlands

Questions ... Answers ... Questions

Your magazine is excellent. It certainly keeps ORFs (Operational Reserve Forces) like me informed and at least mentally involved. It probably keeps the Active duty-types better informed than they otherwise would be. [In the October 2020 issue] the article on the ABMs was exciting, but the article on air bases was troubling. It certainly laid out General Saltzman's "what?" and "so what?" but failed to address his "what's next?" final question.

It seems that whenever the commercial world confronts a showstopper, they tend to rely on the advances in material sciences to move the ball. Can we do the same? It would appear that between DOD and the national labs, there is enough brainpower to concoct a solution.

I look forward to the article written about the day we have to operate out of a base at XYZ and there is no base. So, we chopper in and airdrop the 502nd Bare Base Squadron, and they erect the solar arrays, the tents and portable buildings, string wires, and pour plasticized runways, taxiways, and hardstands—and two weeks later, recover their first fighter squadron.

How do you say, 'They did what?' in Chinese?

Lt. Col. Fred H. Williamson,
USAF (Ret.)
Venice, Fla.

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Combat Controller Staff Sgt. Alaxey Germanovich leads Air Force and Army Special Tactics troops doing memorial pushups after Air Force Secretary Barbara Barrett presented Germanovich with the Air Force Cross Dec. 10, 2020. Germanovich was recognized for actions during a fierce firefight in Nangarhar Province, Afghanistan, April 8, 2017, where the Airman was credited with saving the lives of more than 150 friendly forces by helping to destroy 11 enemy fighting positions.

Staff Sgt. Michael Washburn



The in-flight refueling operator and pilot aboard a KC-135 Stratotanker track progress as a B-52 Stratofortress tanks up during a multiday Bomber Task Force mission over Southwest Asia Dec. 10, 2020. The short-notice, non-stop mission aimed to validate the task force's ability to rapidly deploy combat power anywhere in the world. The frequency and intensity of Bomber Task Force missions increased in 2020.



A Special Tactics Airman guides an MC-130J onto a runway during an exercise Nov. 6, 2020, at Melrose Air Force Range, N.M. The operators, who have the ability to conduct global access, personnel recovery, and airfield seizure missions through the utilization of a wide range of unique skills and infiltration/exfiltration methods—including air and helicopter assault—seized and surveyed the runway.

Weathering the Storm

Lt. Gen. Warren D. Berry is the Deputy Chief of Staff for Logistics, Engineering, and Force Protection. His portfolio includes everything from aircraft readiness to base housing. Editorial Director John A. Tirpak spoke with Berry about new logistics concepts, air base defense, and managing the health of the Air Force's facilities. The conversation has been edited for length and clarity.

Q. The Air Force has been talking a lot about agile combat logistics and logistics under fire. Are they the same thing?

A. Not quite, but they're absolutely related. The National Defense Strategy gave us this operational problem, "Logistics Under Attack." We've enjoyed years of being able to do resupply and replenishment with little resistance from an adversary, in a permissive or semi-permissive environment. That probably won't be the case in the future. We understand that the threat will be both kinetic and non-kinetic.

We've coalesced around a concept of "persistent logistics." It has three major lines of effort: posture, sense, and respond. Posture is how we set the theater, do prepositioned equipment, where we put war readiness materiel, and how we sustain it in advance of a potential fight. It's about ... preparing for that non-kinetic attack, disruptive technologies that can be brought to bear, about hardening some of our critical nodes and training Airmen to be more multi-capable; to do more than just their primary job. And it's about helping our allies and partners, and recognizing the capabilities that they bring.

Then, sensing. We have a lot of data and a lot of information in the logistics space, but we don't have the capability to catalog and clean it of spurious inputs and understand gaps in data integrity. There are unit codes that tell us what went wrong with a system, or a part, and we need to be able to collate that and turn it into information we can use.

The data are so voluminous that a person in the loop can't possibly digest it all. We need to make it actionable, even predictive, so we know when the next failure is going to happen on an airplane and anticipate the parts that will be needed. So I need to sense the environment and use those data to help me know what's going on, logistically.

We need digital modernization to get data that are far more useful to us. You might hear it called Log COP, which is Logistics Common Operating Picture. The goal is to get these data into a secure, resilient system that I can protect and have it available to senior decision-makers so we know the state of play in logistics at virtually any moment. The goal is actionable logistics intelligence that is both proactive and predictive.

Then, I need to respond. But, that response has to be at the speed of relevance to the warfighter, and respond with the broader logistics enterprise; our air logistics complexes, our organic capability, and our defense industrial base. The response may come from artificial intelligence and machine learning or it

might be through a different distribution network, or responding in different ways to protect our assets that are deployed in theater. All of that is the conceptual framework for Persistent Logistics.

We're looking at that now, and asking ourselves, where are the capability gaps, so we can go to the corporate Air Force to say, these are the capabilities we need to develop to logistically support the fight.

Q. And what are some of those?

A. Autonomous distribution, Agility Prime [Ed. Note: Agility Prime is USAF's effort at developing a "flying car" type of system that could be used for medical evacuation or resupply of troops in hard-to-reach places]. We're also looking at artificial intelligence to push parts to the field instead of waiting for the demand signal; particularly in a situation where communication is degraded. How do I mitigate that? Maybe I get into block-chain-like capabilities, that help me protect my data and give me more of a predictive capability.

There may be also be gaps in personnel, training, and doctrine, that we need to fill.

Some we inherently know; others will come to light as we do more study. We may need new forms of distribution, but it has to be in context. In Europe, there's a robust infrastructure; in the Pacific, you have that tyranny of distance. But, we're pretty sure we need to do distribution a bit differently. Our logistics common operating picture isn't where it needs to be.

I'm sure we're going to find more gaps, such as in runway repair. Gaps in how we do supply kits and posture units with readiness spares packages, so they have what they think they'll need for a certain duration of a fight. Those are a few.



USAF Deputy Chief of Staff for Logistics, Engineering, and Force Protection, Lt. Gen. Warren Berry

USAF

Q. When will you have a roadmap for all of this?

A. We will finalize the Logistics Under Attack concept in the spring, and we'll start the capability gap analysis after that. My goal is, by the end of '21, have the capability gap analysis done so we can begin getting at the things we need.

Q. PACAF (Pacific Air Forces) said it's examined every theater airfield for possible operating locations, and they're thinking about a hub-and-spoke distribution concept as USAF moves toward quick deployments to austere fields. Are you involved with that?

A. The regional theater commanders are what I would call the "thought and experiment leaders," but we are clearly part of that team. We've done some exercises, and learned that we need to rethink the footprint that we're sending with the unit, in terms of the Airmen, and supplies, and equipment. We need to be a little lighter and leaner. Part of that is rethinking those spares packages, so that when a core unit goes to a hub, and then goes out to the

spokes after that, they can be self-contained for a short amount of time.

Using all those airfields can really complicate the adversary's targeting calculus; it gives us a lot more agility and unpredictability. But, I have to support that in a way that I'm not necessarily having to resupply, replenish, and support them on a near-continuous basis.

We need to understand what a multiskilled Airman looks like; what are the complementary skill sets we can really capitalize on, and then come up with a training plan so we don't put a burden on each individual wing to develop that.

Q. As the Air Force develops this shell game concept, how will you defend these far-flung sites? The Army won't have enough THAAD (Terminal High-Altitude Area Defense) or Patriots to cover everybody. Is the idea to just get in and get out quickly, or will you be taking some kind of organic defense with you?

A. I think it's going to be both.

There's no silver bullet—no best methodology—to protect the force once it's in the fight. I have to assume there will be some theater protection, but some of our adversaries have pretty deep magazines, and maybe there will be leakage.

I look at it what I can control, and that means looking at it through the lens of point defense. Moving the force under the Agile Combat Employment concept helps with force protection. Beyond that, there's a spectrum of opportunities to protect the base.

At the low end, it's things we've done in the past: camouflage, concealment, and deception; being opaque about allowing our adversary to see what we're doing.

Then, I've got to protect the perimeter. In many cases, we can rely on the host nation to do that. It depends on the capability they have, but they'll be engaged in this conflict, as well. Protecting the perimeter also means I have to have situational awareness of the AOR (Area of Responsibility); sensors and detection capabilities, infrared. I have to give that, in greater volume, to my defenders.

And then I have to look at other capabilities I can put in their hands to counter small, unmanned aerial systems.

Q. What're the key things you need in the next three to five years?

A. I really need to give our defenders that broader battlespace awareness. To see further out, see the threats that are materializing, have command, control, and communications systems, Blue Force tracker, to evolve that capability to make it more robust for them.

Capability against Class 1-3 UAS, working with the Army as executive agent to get that capability in greater volume, that's near-term.

Further out, it might be directed energy, lasers, that we can use to counter rockets and mortars and things of that nature. But that won't be available to me in the next year or two.

Q. Do you feel like the Army is giving enough attention and resources to helping you in this regard?

A. Certainly for small counter-UAS, they are. We've been working very well with them in the Joint Counter Small Unmanned Aircraft Systems Office. It's been pretty collaborative ... to get common systems, open architectures so we can all plug in together and share the operating picture. And that feeds into the broader joint all-domain command and control conversation that we're having. The experience has been pretty positive.

Q. This has been a landmark year for natural disasters: wildfires, hurricanes. What are you doing to harden bases against these calamities?

A. The poster child for air base resiliency efforts would be Tyndall (Air Force Base, Fla.), as a result of Hurricane Michael, and Offutt [Air Force Base, Neb.,] to a smaller degree, with the floods that happened there. We have some MILCON projects there to rebuild resiliency to severe weather.

Congress has been very supportive ... in our attempt to build Tyndall back to what we *need*, and not build it back to what we *had*. We're taking a different approach to how we're constructing the base. We've modified the design criteria to better account for high-category hurricanes. We're taking into consideration more stringent design standards in flood plains ... to handle 100-year floods.

But we're also putting sensors on facilities, so I can do predictive maintenance—using the same idea we're using with airplanes—and putting in smart systems to better control energy consumption.

Across the Air Force, our physical plant value is about \$350 billion. I'm not going to be able to make all of it resilient and hurricane- and flood-proof overnight. But all of those design standards go into all our new ... renovation and modernization projects.


After Hurricane Michael, Chief of Staff General [David] Goldfein commissioned a Severe Weather Readiness Assessment team to look at that, and treat severe weather as an adversary. They came up with 129 recommendations on how to do a better job, from forecasting to sheltering to evacuation timelines. We completed about 25 percent of that quickly; what I would call the "high reward, low difficulty" ones. We're working through the rest, but as you said, this was a heck of a year: we had 30 named storms. Based on some of the actions we took, we came out of it relatively unscathed. It's not all about design standards, it's about actions we can take in advance of severe weather. I think we're on a good path.

Q. Are you comfortable with the resources going to upkeep of facilities, or is USAF digging an even deeper hole?

A. My business in the A4 is sustainment of both weapon systems and infrastructure. Would I like more funding in those areas? Absolutely. We have more mission in the Air Force than we have resources to do it all. So there's some hard choices to be made.

But we do have an investment strategy to get after our infrastructure. It calls for investing in a different way that helps us get out of our maintenance backlog. We used to fix "worst first," but in doing that, we put a lot of money toward failed facilities. We had little left over for more routine maintenance on facilities that were in good shape but needed attention. It was the equivalent of changing a couple of engines instead of doing a whole bunch of oil changes, and we kept getting behind the power curve.

Now we're investing in what we call the "sweet spot" of a facility's life cycle; putting more money into oil changes, if you will. We're prioritizing funding for those facilities that are still good. Don't get me wrong, we're still putting money toward failed facilities, it's just a shift in the priority and volume of dollars that go to each. And looking at whether I even need to recapitalize a particular building and maybe use that space differently, getting after a better footprint on the installation.

This is about understanding the inventory you have, the condition of each building and system within the building, and targeting dollars against systems that need repair but have not yet failed. 

Accelerate Change



Eric Dietrich/USAF

"When I was a captain, I did an interview for Air Force Times, and it talked about the percentage of African Americans that were pilots. It was 2 percent. That was 30 years ago. You know what it is right now? It's still 2 percent."

—Air Force Chief of Staff **Gen. Charles Q. Brown Jr.**, Dec. 22, 2020, speaking at a Facebook town hall.

Winners Never Quit



Petty Officer 1st Class Carlos Vazquez II

"We believe that now after 20 years, two decades of consistent effort there, we've achieved a modicum of success."

—JCS Chairman **Army Gen. Mark A. Milley** on Afghanistan during a virtual Brookings Institution discussion [Dec. 2, 2020].



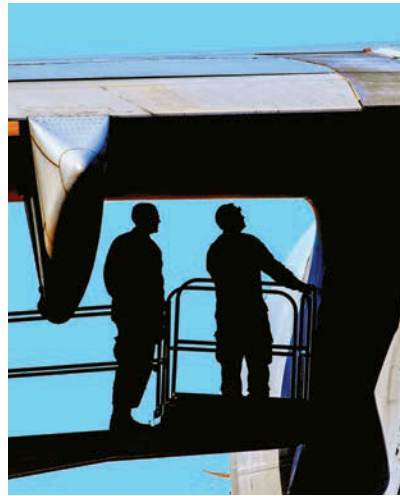
Charles Haymond/USAF

Risky Business

"It's not a good thing when our aircraft break down in a Russian airfield, and you've got to stay there for three to five days waiting for a part. That's unacceptable, and it's what's happening all too often."

—**Rep. Don Bacon (R-Neb.)** discussing the OC-135B fleet during a Dec. 10, 2020, press call.

Alarmed



Mike Tsukamoto/staff; photo: Joshua Seybert/USAF

"They [maintainers] don't have experience and are tired. They are tired and are crying for help. The response is shut up and color."

—A **USAF maintainer** told the National Commission on Aviation Safety, according to a report released Dec. 3, 2020.

Building a Space Force

"I need you to be bold. You will help us build this service from the ground up. You will help us define our warfighting culture. You will build the Space Force as the first digital service. You will lay the foundation of a service that is innovative and can go fast in order to stay ahead of a significant and growing threat, and you, if deterrence fails, will fight and win the battle for space superiority which is so vital to our nation, our allies and our joint and coalition forces. The nation expects you to deliver dominant space power."

—Chief of Space Operations **Gen. John W. "Jay" Raymond** speaking to the first seven [five men, two women] BMT graduates to directly enlist into the U.S. Space Force before administering the Oath of Enlistment [Dec. 10, 2020].



Sarayuth Pinthong/USAF

Moonlighting

"I had a day job in these other companies so that I could support my DOD habit."

—Defense Advanced Research Projects Agency Director **Victoria Coleman**, in a Nov. 18, 2020, Air Force Magazine interview.

I Play a Doctor on TV



Mike Tsukamoto/staff

"Official Washington has long disrespected cybersecurity expertise in a way that would be unthinkable in other complex professions. The Senate would never confirm a malpractice attorney to be a surgeon general!"

—**Alex Stamos**, director of the Stanford Internet Observatory, op-ed, Washington Post, [Dec. 15, 2020].

Getting Back on the Horse



Senior Airman Kedesha Pennant

"Team members need to know that they can recover, right? We're not a one mistake Air Force. We may be a one crime [service], but not one mistake."

—From a September interview on diversity and inclusion efforts within the NAF with 8th Air Force Command Chief, **Chief Master Sgt. Melvina A. Smith**.

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**Supporting the
Greatest Airmen and
Guardians in the World!**

photo by Tech. Sgt. Jonathon Alderman



Architect of the Capitol

For the first time since 2010, Democrats control both houses of Congress, as well as the White House.

Democrats In Charge: What to Expect

Narrow majorities in both houses mean smaller changes in policy ahead.

By Rachel S. Cohen

With Democrats controlling the House, Senate, and White House, and a new Defense Secretary taking up the job, the impact on defense policy, air and space investment, and the direction of national security strategy will be in flux in the year ahead. Yet with only a tie-breaking advantage in the Senate, experts expect incoming President Joe Biden's defense policy to remain centrist, despite the hopes of some in the progressive wing of the Democratic Party.

Biden's choice to lead the Pentagon is retired Army Gen. Lloyd J. Austin III, who led U.S. Central Command during the drawdown of forces in Iraq and during the early air war against the Islamic State group when the self-proclaimed caliphate first established a foothold in western Iraq and Syria. Biden, who was vice president at the time and involved with regional policy, forged a close relationship with Austin during that stretch.

"He understands naval power, he understands space power, he understands air power ... he really strives to get smarter in those areas!"

—Former ACC chief Gen. Herbert "Hawk" Carlisle, USAF (Ret.)

If confirmed by the Senate, Austin would become the first Black Secretary of Defense and only the third former general to hold the position. Because he retired from the military in 2016, Congress must waive a provision barring former military members from holding the post within seven years of serving on Active duty. The House and Senate are expected to approve that waiver and confirm Austin, despite misgivings by some about blurring the lines over civilian control of the military or, among others, over selecting candidates with ties to the defense industry. If confirmed, he will be the third consecutive Secretary to have an infantry background, following retired Marine Gen. James N. Mattis and retired Army Lt. Col. Mark T. Esper.

Former Air Force Chief of Staff Gen. Mark A. Welsh III, now retired, said he was surprised about the choice of another ground commander as Defense Secretary, but recalled Austin as a thoughtful, "very joint-thinking guy, which is a good thing for all services."

Austin's performance in Iraq was "phenomenal,"

Welsh said in a recent interview. “I think he’s a steady hand. ... He’s not afraid to make tough calls.”

Welsh recalled briefing Austin on his budget plans, as he would with all the combatant commanders. “Lloyd always was very understanding of the fact that trades had to be made. ... [There] wasn’t enough money for everything.” And he recalled that Austin was mindful of the value the capabilities provided by the other services.

“I think he was always very appreciative of the fact that air power was a major part of the toolkit in CENTCOM,” he added.

Herbert J. “Hawk” Carlisle, another retired Air Force general and president of the National Defense Industrial Association, ran Air Combat Command during Austin’s tenure at CENTCOM and was a classmate at the Army War College.

“He listens exceedingly well,” Carlisle recalled. “He’s not going to be the first guy to talk. He’s not going to be the one that dominates ... a conversation.”

Carlisle praised Austin’s ability to listen to conflicting arguments and then choose a plan that made sense, even if it didn’t give everyone what they wanted. Austin could compromise when “he needed more of what I had, and I didn’t really have a lot more to give,” Carlisle said. “The key was that he’d listen to what I had to say.”

When sending Austin the additional air power he wanted would have forced Carlisle to “break red lines for deployment schedules,” Carlisle recalled, “I said, ‘Hey, this is where I’m at. I laid it all out for him. He took it all in, and said, ‘OK, so where’s the middle ground?’ And we found it.”

Neither Welsh nor Carlisle expressed concern that Austin’s Army background will bias his views of the joint force.

“I think he already has pivoted,” Carlisle said. “He understands naval power, he understands space power, he understands air power. ... He really strives to get smarter in those areas.”

As Secretary, among Austin’s greatest challenges will be convincing a reluctant Congress that retiring aging systems will be beneficial, when lawmakers’ first concerns are often focused on retaining jobs in their home districts that may be tied to those platforms. Among programs that could see cuts—now that their former protectors are no longer in Congress—is the A-10 attack aircraft, which former Sen. Martha McSally (R-Ariz.) had defended. The MQ-9 strike and intelligence drone, which has remained in production over the Air Force’s objections, may also be on the way out.

Biden’s Pentagon transition team landed at the Defense Department in November, led by Kathleen H. Hicks, Biden’s pick for deputy defense secretary. Hicks is a former principal deputy undersecretary of defense for policy, and deputy undersecretary of defense for strategy, plans, and forces, and most recently ran the international security program at the Center for Strategic and International Studies.

If confirmed as expected, she would be the first woman confirmed for the DOD’s second-highest civilian job.

Todd Harrison, a defense budget analyst and aerospace expert at CSIS, praised his former colleague.

“Kath’s appointment as deputy really balances many of the perceived weaknesses in appointing Austin as SECDEF,” Harrison said. For example, her civil-military relations expertise could reassure lawmakers who might be wary of putting another career military officer in charge of the Pentagon.

Other DOD officials in waiting include Colin Kahl for undersecretary of defense for policy and Kelly Magsamen as Pentagon chief of staff, according to the Biden team and news reports.

Kahl was previously Biden’s national security adviser and deputy assistant defense secretary for the Middle East, and was most recently co-director of the Center for International Security and Cooperation. Magsamen held policy positions in the Pentagon DOD focused on the Indo-Pacific theater and has served as vice president for national security and international policy at the Center for American Progress.

While Biden’s team won praise for its diversity, he has faced criticism for selecting defense establishment mainstays for Pentagon roles.

“They’re an incredibly bright group of folks,” Carlisle said. “They’re very, very in-depth in their knowledge base and how they look at things.”

Department of the Air Force officials including Chief of Space Operations Gen. John W. “Jay” Raymond had started speaking with the transition team as of early January. But questions such as who might be on the short list for Air Force Secretary and related positions remained an open question.

With only a slim majority in the House and a 50-50 split in the Senate—tie votes will be decided by Biden’s Vice President Kamala Harris—defense watchers don’t expect drastic swings in military policy. But shifts in aerospace priorities will be influenced by budget pressures.

House Armed Services Committee Chairman Rep. Adam Smith (D-Wash.) said he expects the defense budget will hover between \$720 billion and \$740 billion in the coming years—which would be flat, at best, and a cut of up to \$20 billion at worst. Any spending overhaul must be justified by a revamped national security policy, he has argued, but he is optimistic that cuts to the nuclear enterprise could pay for new or increased investment in other areas.

For the Air Force, continued sluggish delivery of F-35 fighters could prompt cuts to that program, but investment in emerging technologies, like hypersonic weapons, appear safe.

“The most cost-effective means to project combat power are with the aerospace forces of the Department of the Air Force, so the new administration and Congress would be wise to invest accordingly,” said retired Air Force Lt. Gen. David A. Deptula, dean of AFA’s Mitchell Institute for Aerospace studies.

He’s pushing for the department to overhaul its inventory with new technologies that are more capable at lower cost, and for the government to do away with “pass-through” funding that artificially inflates the Air Force’s coffers with money meant for other agencies.

Two priority issues for the defense industry, according to Carlisle, are how DOD will change its strategy in space, particularly how it buys and uses space launches and satellites, as commercial collaboration increases, and how the coronavirus pandemic is affecting the defense supply chain.

An open question is where the new administration’s priorities will lie in terms of technology development. In addition to the high-profile projects like 5G networking and artificial intelligence, Carlisle encouraged the incoming administration to do more to shore up the U.S. domestic microelectronics industry—something the Pentagon did with major investment programs in the 1970s, ’80s, and ’90s.

Carlisle said he anticipates a fresh look at the National Defense Strategy. “I think it will be tested somewhat under the new administration,” he said. “But ... I think everyone in the new administration still sees the strategic threat of China.”

That should bode well for programs at the top of the Air and Space Forces’ priority lists, such as the B-21 bomber and offensive and defensive space capabilities.

Bipartisan congressional support for the Space Force should ensure the new service isn't just a Trump-era phenomenon. It's important for the Biden administration to give it the resources it needs to grow, advocates said.

"Currently the Space Force is underfunded; undermanned; and does not have the authorities for which it was stood up for to consolidate," Deptula said. "This will be a big challenge for the Biden administration because if they increase resources for the Space Force while decreasing the overall defense topline, some other service is going to get hit."

The National Security Space Association (NSSA), a non-profit founded in 2018 to support the federal space enterprise, published a paper in December urging Biden not to put space on the back burner.

NSSA is pushing the administration to maintain high-level attention to U.S. space policy and strategy, including keeping the National Space Council to discuss those matters. It's unclear whether the National Space Council, which is chaired by the vice president, will continue under Harris.

The group, advised by a panel of former generals, industry players, NASA officials, and other public- and private-sector experts, wants the administration to "promote the peaceful uses of space," incentivize public and private space industrial innovation, and follow through with the ongoing overhaul of the military space enterprise.

"In the coming decade, the U.S. will face as great a challenge to its leadership in space as at any time since the launch of Sputnik," the organization said. "The last 20 years have seen the gap between the U.S. and other nations, especially China, erode dramatically. Unless that trajectory changes, U.S. leadership, and the significant national security and economic benefits that derive from it, may be in jeopardy."

Unified Democratic control will change the discussion around how the U.S. should approach future authorizations of military force overseas and will introduce a new dynamic between Biden and progressives as he looks to reshape the American troop presence in the Middle East, rather than leave it entirely.

Other high-level policy decisions will reverberate through the services as well.

The Biden administration is expected to quickly roll back restrictions imposed by President Donald J. Trump on transgender troops, for example, and is likely to revoke a September 2020 executive order that bars "offensive and anti-American race and sex stereotyping and scapegoating" in diversity training materials, such as "assigning fault, blame, or bias to a race or sex," as might be the case when discussing discriminatory practices or policies.

"Our industry partners are having a really hard time with it," Carlisle said. "The way it's out now, it's unexecutable." ✪

Both Space Force and Air Force Basic Military Training is conducted at Joint Base San Antonio-Lackland, Texas. Seven of these recruits joined the Space Force and were among the first to be called Guardians.



Sarayuth Pinthong/USAF

Guardians of Space

The Space Force prepares for Year 2.

By Rachel S. Cohen

Space Force members will be known as "Guardians" from now on, Vice President Michael R. Pence announced Dec. 18.

"Soldiers, Sailors, Airmen, Marines, and Guardians will be defending our nation for generations to come," he said at a Dec. 18 White House ceremony celebrating the Space Force's Dec. 20 birthday.

As the Space Force turns 1 year old, abandoning the moniker of "Airman" is one of the most prominent moves made so far to distinguish space

"The name Guardians connects our proud heritage and culture to the important mission we execute 24/7!"
—U.S. Space Force

personnel from the Air Force they mostly came from. An effort to crowdsource options brought in more than 500 responses earlier this year, including "sentinel" and "vanguard."

The decision will shape the ranks issued to members as well, ditching terms like "senior Airman" that use the old name. Officials have also stressed the importance of picking a gender-neutral name as they shape the Space Force's unique culture to be more inclusive.

Former Navy SEAL Rep. Dan Crenshaw (R-Texas) earlier this year floated the idea of using naval ranks to identify Space Force personnel. His provi-

sion landed in the House's version of the fiscal 2021 defense policy, but the Senate did not have a similar provision, and ultimately won out in stripping Crenshaw's language from the bipartisan compromise between the two chambers.

The Space Force had been ready to announce its rank plans when Crenshaw's amendment intervened, so the service waited on Congress to decide whether to keep the provision before making any major announcements about its future.

"The opportunity to name a force is a momentous responsibility," the Space Force said on Facebook. "Guardians is a name with a long history in space operations, tracing back to the original command motto of Air Force Space Command in 1983, 'Guardians of the High Frontier.'"

"The name Guardians connects our proud heritage and culture to the important mission we execute 24/7, protecting the people and interest of the U.S. and its allies," the service added.

The Space Force has rolled out multiple other features of its budding identity in the past several months, including a flag, a logo, a seal, and a motto: "Semper Supra," or "Always Above."

The Space Force, which was created on Dec. 20, 2019, to focus on operating military satellites and radars and to defend those assets from attack, spent its first year transforming how the military is organized, trained, and equipped. It will spend its second year proving whether those changes can work.

The new service is preparing to welcome in thousands more recently selected Airmen in fields such as intelligence and acquisition this year, with plans to grow to 6,400 Active-duty members by the end of September, growing to a total of about 16,000 employees including civilians and members assigned from other branches. About 2,400 Active-duty personnel already are part of USSF.

"Now we have to develop those folks to fill those positions and do that organically from the United States Space Force, ... focused on the domain ... and being able to move at speed," Chief of Space Operations Gen. John W. "Jay" Raymond said on a Dec. 15 call with reporters.

"As new missions come about, we will add squadrons as those missions materialize," he added.

Chief Master Sergeant Roger A. Towberman, the Space Force's Senior Enlisted Adviser, said the service is figuring out when it makes sense to bring those new members in "one by one." People in career fields shared by both the Air Force and Space Force—cyber, intel, acquisition, and others—who were tapped for transfer can start joining Feb. 1, 2021.

Space operators who work with satellites and related technologies began transferring in September. In another birthday week event, Raymond welcomed Col. Michael S. Hopkins, a NASA astronaut—while he was aboard the International Space Station—as the service's newest transfer from the Air Force.

The service has also begun picking people for promotion through selection boards, including three chief master sergeants who will pin on the new rank at the beginning of 2021.

The new boss of the Space Force's operations branch on Dec. 14 offered a peek into how the organization is working with other parts of the service as they mature.

Space Operations Command (SpOC) formally stood up at a ceremony in October, making it the first Space Force com-



Staff Sgt. James Richardson

NASA astronaut Mike Hopkins is transferred from the U.S. Air Force to the U.S. Space Force from onboard the International Space Station during a ceremony on Dec. 18, 2020, from the Space Operations Center at NASA Headquarters in Washington, D.C.

mand to do so. Space Systems Command (SSC), which will oversee hardware and software development, sustainment, and retirement, is slated to be up and running this summer. Space Training and Readiness Command (STARCOM), which will manage the pipeline from new recruits through graduate space education, should launch this year as well.

Space Operations Command boss Lt. Gen. Stephen N. Whiting said each organization is trying to stay linked so each piece of the service understands what the others need as they move forward.

"Even though SSC has not yet stood up, we have a number of touchpoints with them," Whiting said during an event hosted by the Space Force Association. "[Space and Missile Systems Center boss Lt. Gen. John D. Thompson] leads a group of program executive officers from his organization and other development organizations who support our mission areas in their meetings."

Over the past several months, SpOC has offered its perspective to SSC through Whiting, as well as through an operations working group with members from the Space Force and U.S. Space Command, the joint combatant command that uses assets such as satellites and radars for daily military missions.

Their relationship will particularly evolve as the space enterprise looks to cut the time it takes to put new satellites on orbit, test cutting-edge technologies, and hand more tools to service members who want to code new software on their own rather than relying on defense companies and contracts for upgrades.

"This morning, I took a brief from a young Airman in our enterprise ... who taught himself to code. He's a space operator who went in and wrote a new piece of software that has completely improved part of our mission area, and has freed up 15 percent of the manpower of that squadron to be repurposed from rote tasks into higher-priority tasks that are more warfighting-focused," Whiting noted. "That's the kind of innovation that we're looking to unlock with the digital Space Force effort."

Space Training and Readiness Delta Provisional, the predecessor to STARCOM, sits under SpOC as it prepares to work on its own, Whiting said. Delta Commander Col. Peter J. Flores participates in SpOC meetings, and the organizational proximity helps officials in the operations and training fields collaborate more smoothly.

Building new training processes and collaboration with the operations realm will be a key aspect of the training organization's growth over the next several months, Whiting said.

“We really are trying to use more modern technology to provide that three-dimensional visualization of the battlespace,” he added. “Our squadron that’s in the Space Training and Readiness Delta, the 533rd Training Squadron ... out at Vandenberg [Air Force Base, Calif.] is doing some really interesting things in that space, to include some virtual reality.”

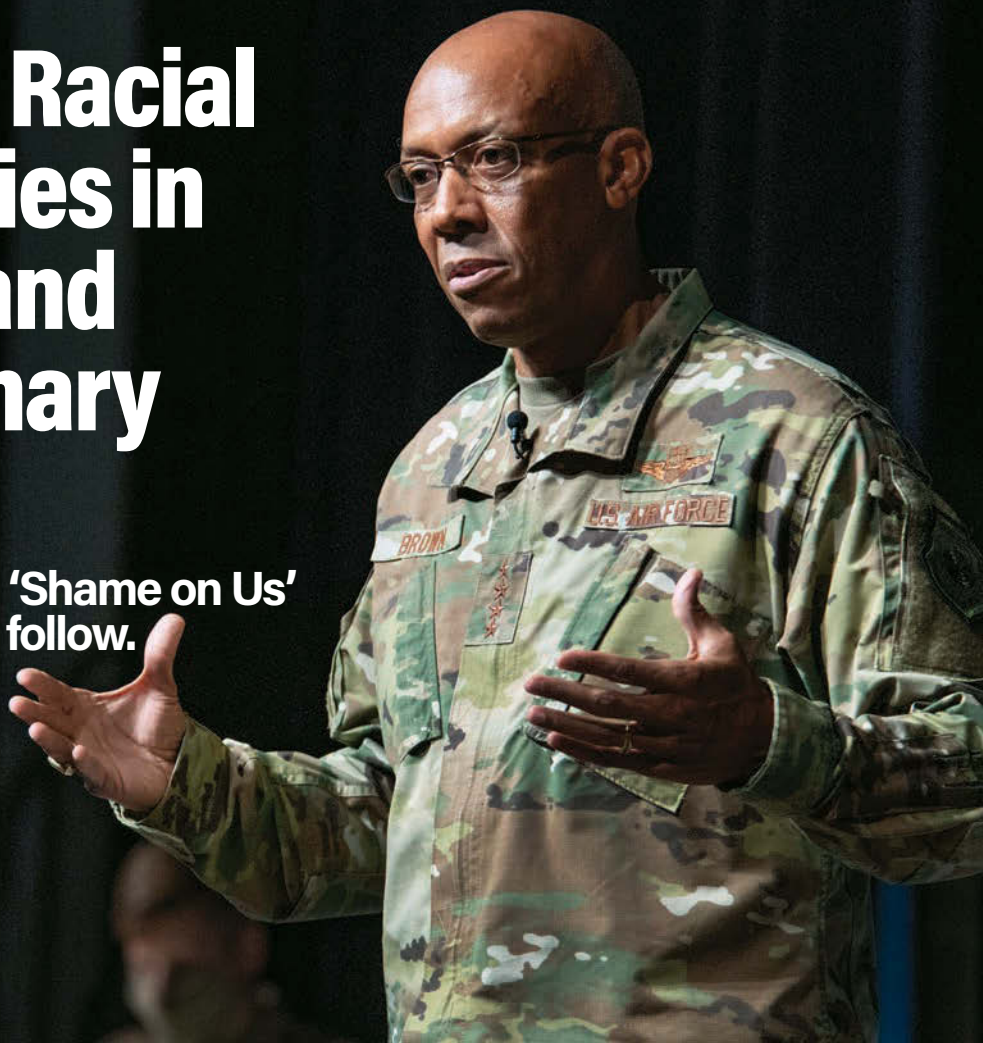
Also in December, Pence presided over a ceremony to rename two historic Air Force installations as part of the Space Force: Cape Canaveral Space Force Station and Patrick Space Force Base, Fla. Those are the first two military facilities to receive the Space Force moniker.

Cape Canaveral has served as America’s premiere space launch facility since the 1950s and is now transforming to meet the needs of a modern space age defined by companies like SpaceX and Blue Origin. The Air Force for years has managed launch operations at the Cape via the 45th Space Wing at Patrick, which itself is taking on more responsibilities as military space begins a new chapter.

“Today, we start a new era at both Cape Canaveral Space Force Station and Patrick Space Force Base, aligning the installations’ names with their critical missions,” Raymond said at a Dec. 9 ceremony. ★

IG Finds Racial Disparities in Career and Disciplinary Review

Brown to USAF: ‘Shame on Us’ if changes don’t follow.



Melanie Rodgers Cox/USAF

Air Force Chief of Staff Gen. Charles Brown Jr. said the Inspector General report on race reflects his own experiences.

By Rachel S. Cohen

The national reckoning with racial tensions that shook up the Air Force last spring and summer brought on a departmentwide self-examination in the fall and the release of an Air Force Inspector General report in December that encompassed more than 123,000 survey responses from Air Force and Space Force members, 138 in-person sessions at bases across the department, and 27,000 pages of written responses.

“Just because I’m here, doesn’t mean that’s the end of the story.”

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

The report’s conclusion: Significant racial disparities persist in both the Air Force’s disciplinary and career development systems.

“Varying degrees of [racial] disparity were identified in apprehensions, criminal investigations, military justice, administrative separations, placement into occupational career fields, certain promotion rates, officer and civilian professional military educational development, and some leadership opportunities,” the Department of the Air Force said Dec. 21. “The data does not address why racial disparities exist in these areas, and that while the

data shows race is a correlating factor, it does not necessarily indicate causality.”

Air Force Chief of Staff Gen. Charles Q. Brown Jr. said the service must seize the moment to respond to an urgent and long-time need for reforms. “Shame on us if we miss this opportunity to make a change that’s required across our Air Force to make it better, whether it’s the Air Force or the Space Force,” he said Dec. 22.

The survey responses reported that:

■ A third of Black service members believe the military discipline system is biased against them.

■ Three-fifths of Black service members do not believe they will receive the same benefit of the doubt given their White peers should they get in trouble.

■ One-third of Black officers do not believe the Air Force and Space Force provide them the same opportunities to advance as their White peers.

■ Two of five Blacks—whether enlisted members, civilians, or officers—do not trust their chains of command to address racism, bias, and unequal opportunities.

■ Half of all respondents said they had experienced or witnessed racial discrimination from another Airman.

The IG report examined records from Article 15 evidentiary hearings, courts-martial, and nonjudicial punishments and found Black Airmen are 72 percent more likely to face Article 15 hearings and 57 percent more likely to face courts-martial. Young Black Airmen are twice as likely to be involuntarily discharged based on misconduct; twice as likely to be stopped by Security Forces; and 1.64 times more likely to be suspects investigated by the Office of Special Investigations.

Brown, the first Black officer to serve as a U.S. military service Chief, said he read the 150-page report cover-to-cover “five or six” times, and noted that it reflects his own experience as a Black man who rose through the ranks. These are “things I’ve actually felt,” he said.

The IG team reviewed 23 prior studies and reports on race and demographics, finding that the issues have persisted for years, despite efforts to raise consciousness through training and policy. So what might be different now? “George Floyd,” Brown said. “Think about what happened. ... Look at all the protests over the course of the summer,” following Floyd’s death at the hands of a White police officer last May.

“When those other studies were done, there probably weren’t as many protests,” Brown said. “Think about it: It was 1973 and beyond. So you didn’t have a major national event that focused us on this particular topic—until this summer.”

In the wake of the incident and the protests that followed, former Chief Master Sergeant of the Air Force Kaleth O. Wright sparked a servicewide discussion on race and discrimination, and Brown, who was nominated but not yet confirmed as Chief, issued a video that went viral for its blunt acknowledgment of his experience growing up in an Army family and later as an officer and combat pilot in the Air Force.

“When I was a captain, I did an interview for Air Force Times, and it talked about the percentage of African Americans that were pilots,” Brown said. “It was 2 percent. That was 30 years ago. You know what it is right now? It’s still 2 percent.”

In a service that values pilots above all else, Brown’s ascendance is all the more remarkable because there are so few minorities who fly. The solution, Brown said, should be holistic, including empowering Airmen in other fields to have the same kinds of command opportunities usually reserved for pilots.

“Will the shape of the Air Force change in the future as we look at cyber, information operations, and other areas? I think

LGBTQ Airmen Say Their Fight Is Not Yet Over

By Rachel S. Cohen

The repeal in 2010 of “Don’t Ask, Don’t Tell” (DADT) erased a law that had allowed gay military members to serve in uniform, as long as they didn’t tell their colleagues about their sexuality. Enacted as a compromise in the 1990s, the policy formally ended in September 2011 after months of preparation at the Pentagon.

For Jennifer Dane, an Air Force veteran who is now interim executive director of the LGBTQ advocacy organization Modern Military Association of America, it erased a barrier to her interactions with others.

“I became a better supervisor because I was able to live up to the core values of the Air Force at that time,” she said. “It made me a better Airman because I was able to be open and transparent about my life.”

“When you’re doing a mission together, you share a lot of yourself with your troops,” she said. “I wanted to show them I was a person just like they were.”

But while gay Airmen and Guardians are optimistic about a military where the LGBTQ community is better represented and accepted, some still see room for improvement, especially in terms of health care.

For example, the Air Force offers an annual multiday seminar for HIV-infected Airmen to get specialized advice for living with HIV, including information on topics from diet to safe sex. But one HIV-positive Airman said that, while helpful, other requirements and restrictions for people with the virus need review.

“Every time I change a unit, I am required by [Air Force instructions] to sit down with my commander, and we have to sign a letter together about my sexual activity,” the Airman said. “Very invasive. ... No one wants to have that conversation.”

Airmen have fought HIV-related issues in the courts. In early 2020, a federal appeals court sided with two Airmen who faced military discharge after testing positive for the virus in 2017. The Pentagon bars personnel with HIV from deploying to the Middle East, making them a target for discharge under the Defense Department’s “deploy or get out” policy. The Airmen argued they could deploy with medication or a policy exception, or take different jobs in the service.

Another federal judge recently ruled that DOD has “no rational basis” for blocking HIV-positive service members from accepting an officer’s commission, another hurdle. And while the Air Force does cover the cost of Truvada, the pre-exposure prophylaxis (PrEP) treatment that protects individuals from contracting the virus that causes HIV, one Airman complained that health workers aren’t necessarily familiar with the tests that must be performed each time a prescription is refilled.

“When I had to go do the bloodwork, it was hard for the lady to understand what I was asking for,” said Tech. Sgt. Donald G. Goins Jr., assigned to the 30th Space Communications Squadron’s cyber mission defense team at Vandenberg Air Force Base, Calif.

Others worry about uncertainty given that laws and policies remain in flux in today’s contentious political climate. Master Sgt. Kate Huguenin, the additional duty first sergeant for U.S. Cyber Command at Fort Meade, Md., wonders if the Air Force would continue to recognize same-sex marriage if the law enabling that policy was overturned.

“The reason I can [permanently relocate] with my spouse

Continued on next page

it will," he said. "But it won't make a dramatic shift."

To spur lasting change, Brown and Chief of Space Operations Gen. John W. "Jay" Raymond are eyeing the Officer Qualifying Test and Weighted Airman Promotion System tests for change. The Space Force has indicated it may be small enough to forgo testing as a measure for selecting Guardians for promotion.

For the civilian workforce, Air Force Materiel Command's Gen. Arnold W. Bunch Jr. has started a "status of discipline" review, like that used by service members, to track and discuss performance issues. The aim is to raise red flags over barriers to progress or biases in specific units or career fields.

Brown and Raymond encouraged troops to continue productive dialogue when they can, and to call in backup when needed. There should be a balance between mission readiness and ensuring people's voices are heard on the issues that affect their quality of life, they said. Brown added that the department is establishing a diversity and inclusion office with the goal of reducing the number of incidents that warrant attention from the Inspector General or equal-opportunity program.

INCLUSION FROM THE START

For the Space Force, the investigation is a chance to rectify racist practices and attitudes from its inception. The newest military service's human capital plan aims for a diverse workforce with an ingrained culture of acceptance.

"Our forces are more ready when everybody that comes to work—regardless of race, color, sex, creed, or religion—feels welcome and has an environment [in] which they can flourish across all of our ranks," Raymond said. "This is not affirmative action; this is equal opportunity and inclusion."

Brown said his own ascendance to Chief marks progress, but not necessarily a victory over discrimination. "Just because I'm here, doesn't mean that's the end of the story," he said. "Is it a woman that comes behind me? Is it someone of a different sexual orientation? Is it another diverse group? It can't be a one-and-done. We can't slap the table and pat ourselves on the back now that I'm sitting here as the Chief of Staff."

The two service Chiefs, along with Secretary of the Air Force Barbara M. Barrett, will assign stakeholders to review the IG report, conduct a root-cause analysis, and develop recommendations to address the disparities. The IG will conduct a "vector check" every six months to evaluate progress.

Next steps include direction to commanders to review every visual symbol, turn of phrase, and other form "of unit recognition and identity" to ensure alignment with service values.

"Commanders, at the squadron level and above, will remove any visual representation, symbols, or language [that is] derogatory to any race, gender, sexual orientation, ethnicity, religion, age, or disability status to ensure an inclusive and professional environment," the Air Force said in a Jan. 5 release.

Everything from unit nicknames and mottos to sanctioned and unofficial challenge coins and morale patches must be reviewed by Feb. 21. The use of derogatory symbols and language "ostracizes our teammates, undermining unit cohesion and impeding our mission readiness and success," the memo said. "Our diversity of experience, culture, demographics, and perspectives is a force multiplier and essential to our success in this dynamic global environment. ... We must ensure all our Airmen and Guardians are valued and respected." 🌟

Air Force Magazine Pentagon Editor Brian W. Everstine and Digital Editor Jennifer-Leigh Oprihory contributed to this report.

is because legally, the federal government says you cannot separate legally married couples," said Huguenin, whose wife is in the Coast Guard.

Under DADT, Airmen shied away from connecting with their colleagues for fear that any action considered "telling" could lead to discharge. Now they can comfortably display a photo or invite a spouse to a command event without risk.

"It's exciting that I'm going to retire from the Air Force and I am going to have a husband that gets to be there—literally there, in person," said Master Sgt. Michael Burd, who works with the Rapid Capabilities Office at Kirtland Air Force Base, N.M. "When I was an Airman [under DADT] and I was winning awards, my partner couldn't go to the award ceremonies."

Amid those shifts, advocates say it will take time to rebuild the number of LGBTQ employees in the leadership pipeline. "You couldn't get a clearance if you were gay until 1998," said Luke Schleusener, president of the advocacy group, Out In National Security, and a former speechwriter in the Office of the Secretary of Defense. "There are people who could come over one way or the other, Hill staff, that sort of thing. But it's hard, in part because the culture has to change."

Diversity-minded changes underway across the Defense Department could also bolster the LGBTQ community. Hiding the names and photos of candidates up for promotion, for example, might not only reduce racial discrimination, but could also protect against sex or gender-identity discrimination.

TRANSGENDER SERVICE

The Pentagon cleared the way in 2016 for service by transgender members, only to block members from newly coming out as transgender in 2019. Troops diagnosed with gender dysphoria after April 2019 must continue serving according to their birth sex and cannot receive transition-related health care available to those who came out under the old policy. Americans with gender dysphoria or who are transitioning cannot join the military under present rules.

In 2016 a RAND Corp. study estimated that more than 6,600 transgender troops were part of the Active-duty force, noting that not all of them would seek gender transition-related treatment. RAND predicted that allowing transgender personnel to access transition-related health care would increase Active-duty health costs by up to \$8.4 million a year, an increase less than 1 percent, based on private health insurance claims data.

"Even upper-bound estimates indicate that less than 0.1 percent of the Total Force would seek transition-related care that could disrupt their ability to deploy," RAND said.

Dane said there should be no limit on those capable and qualified to serve. "I think the biggest fear from 'Don't Ask, Don't Tell' was that we were going to be able to come out, and then have to go back in the closet because of a different policy," she said. "The trans folks were able to come out one day, and the next day, they had to either go back in, or come really out and say, 'Yes, I suffer from gender dysphoria.'"

The incoming Biden administration is expected to repeal restrictions on transgender service soon after taking office. Dane would like to see Congress go a step further and enshrine protections for transgender personnel in law. Generation Z—anyone born after 1997—has grown up in a different world and will need policies that recognize differences in how individuals self-identify.

"What do you do whenever you have recruits that don't really fit into the standards that you have?" Dane asked. "We've got to be ready for that." 🌟

Mishaps Rise Due to Lack of Training, Shortage of Maintainers, Report Says



Members of the National Commission on Military Aviation Safety (NCMAS) observe a C-17 Globemaster III in a hangar on Joint Base Lewis-McChord, Wash., Jan. 7, 2020.

Airman 1st Class Mikayla Heineck

By Brian W. Everstine

A lack of flying hours and overworked maintainers are contributing to high rates of crashes and other aviation mishaps, according to a Congressionally mandated report, which called on the services to quickly overhaul how they manage maintainers and pilot training.

The National Commission on Military Aviation Safety looked at more than 6,000 aviation mishaps, including 198 deaths, 157 aircraft destroyed, and about \$9.41 billion in losses, from 2013 to 2018—none of the losses were due to combat operations. The information was compiled in a report released Dec. 3, and the Defense Department has 120 days to formally respond to the report.

Although the Air Force saw a decrease in “Class A” mishaps, there was an increase in “Class C” mishaps, largely because of maintenance or other on-the-ground issues. Class A mishaps are any mishaps that results in the destruction of an aircraft, or permanent total disability of a person, or causes damage in excess of \$2.5 million (from 2010-2019 it was \$2 million.) A Class C mishap is one that results in an injury causing loss of more than a day of time off from work or damage between \$60,000 to \$600,000. (From 2019-2020, it was \$50,000 to \$500,000).

The commission visited 80 different bases and other sites, talking to about 200 different units who outlined myriad issues impacting the military’s aircraft fleets. The recurring themes were: not enough flying hours for pilots, maintainers that were distracted by excessive duties, inadequate prioritization of safety, insufficient data collection, a lack

of consistent funding, and a “relentless” operations tempo, according to the report.

“These are great, patriotic, young American people. Many of them have stayed with us, and reenlisted, and stayed on after 16 to 17 years of war. They know what right looks like. They know what the difference is between being a current pilot and a proficient pilot for the mission tasks that they’re being asked,” said retired Army Gen. Richard A. Cody, the chairman of the commission. “But they’re frustrated with the ops tempo. They’re frustrated with the unpredictable funding. And they’re also frustrated a bit, being away from home as much as they are.”

PILOTS’ PERSPECTIVE

Pilots complained of a lack of real flying hours and an overreliance on simulators. While simulators are effective at practicing emergency routines and other tasks, they do not effectively replicate intense, real-world flying and can contribute to a lack of proficiency, they said.

“We think simulator time is great for emergency procedure training and for other things,” Cody said. “But when we went to the units, they were complaining that they had pilots coming out of the training base during this time period, with less flying hours and not really up to speed on all the types of flying that was required. And then the units were having to expand their flying hour dollars in the units to bring them up to speed at a time when their ops tempo was high.”

This starts in original flight training, where pilots graduate without enough seat time and move on to squadrons without enough experience in required aspects of flying,

forcing operational squadrons to spend their own flying hours getting new pilots up to speed. Additionally, pilots are spending an extended period of time not flying after graduation because of other requirements, such as survival, evasion, resistance, and escape training. One pilot told the commission, “When I get to my unit, it will be six months since I’ve flown.”

In the training units, flying hours and the number of instructors has been cut, with one training unit for example only having 82 instructor pilots despite being authorized 114. This issue is highlighted as the Air Force is increasing its use of simulators in initial pilot training, through its Pilot Training Next initiative, which seeks to further cut the amount of time a student needs to fly before completing undergraduate pilot training.

Commanders in operational squadrons are issuing more waivers to keep pilots operational even though they haven’t met all the requirements, indicating “problems” that should be reported and tracked. While getting enough funding to increase flight hours is a systemic issue that will require a national approach and take a long time to address, the services should take smaller steps, such as tracking waivers to address trends in the short-term so they can identify and fix some of the issues, Cody said.

MAINTAINERS’ MORALE

Morale on the ground with maintainers is a large problem across all services. Specifically, for the Air Force, a lack of experienced 5- to 7-level supervisors, in addition to a shortfall of maintainers overall, has proven to be problematic. While the Air Force’s usual trainer to trainee ratio should be 1:5 or 1:6, it is closer to 1:8 or 1:9, according to the report. These maintainers are finishing training without enough understanding of their duties—one maintainer told the commission that new Airmen could not tell the difference between a ratchet and a socket—and are going into squadrons that are understaffed, the report states.

“Knowing that with task saturation and sleep deprivation, work performance suffers. We see human factors and an increase in mishaps,” a USAF maintainer told the commission. “They don’t have experience and are tired. They are tired and are crying for help. The response is shut up and color.”

To address some of these issues, the commission recommends the military “fence” maintainers from additional duties so they can focus on their main role. The report, for example, suggested maintainers should not be tasked with doing other jobs, such as providing security. The recommendation comes at time, however, when the Air Force is pushing forward with the idea of creating “multi-capable Airmen” under the Agile Combat Employment model.

The military needs to keep recruiting maintainers and treat the ones they have better through incentive packages and a career track that incentivizes promotions, instead of having personnel change jobs to get promoted. Additionally, the services should incentivize maintainers who graduate from advanced schools, for example, providing an airframe and power plant license “so they feel they are aviation professionals,” Cody said.

OTHER SYSTEMIC ISSUES

The commission also outlined other systemic maintenance issues, specifically with a lack of parts and depot maintenance, that does not support the needs of operational flying units. An Air Force major command representative

told the commission that depots have been so deficient that “jets are coming out of the depot in worse shape than when they started.” This in turn leads to “greater workloads, increasing risk, lowering morale, and exacerbating already acute readiness problems,” the commission said in a briefing.

“For example, as the commission heard during a visit at one Air Force base, when an actuator failed on a deployed aircraft in the Pacific, the only replacement parts were in two locations on the other side of the world. The maintenance group commander was forced to have an actuator taken off of a working plane at his home base in the United States and flown to the aircraft so it could be fixed,” the report states in an example of the problem.

The military has regularly operated under continuing resolutions from Congress since sequestration, which has led to unpredictable funding and impacted how squadrons plan to fly. One Air Force squadron commander told the commission, “We don’t plan exercises and [mission-related travel] because you don’t know if you will have funding. ... I can’t plan my budget and make the purchases [needed] and can’t get them the [equipment] they need to do safe flight operations.” An Air Force Reserve unit commander added, “I redo the annual budget twice a quarter,” with Reservists preparing for months for a deployment that suddenly gets canceled.

The commission, which briefed lawmakers in a closed hearing on Dec. 3, called on lawmakers and the Pentagon to:

- Adopt an “aggressive and coordinated” approach to understand the physiological needs of aviators.
- Better reward and incentivize professional achievements of maintainers.
- “Firmly establish” safety responsibility in the Defense Department by creating a Joint Safety Council.
- Update and modify Force Protection Key Performance Parameters to incorporate Aviation Human Systems Safety.
- Link simulator sustainment to aircraft production, upgrades, and modifications.
- Stop using continuing resolutions to fund national security, military readiness, and aviation safety.

A LOOK AT HISTORIC USAF RATES

The same day the commission released its report, the government-funded RAND Corp. released its own study, “Trends in U.S. Air Force Aircraft Mishap Rates (1950-2018).” In the report, researchers analyzed mishap data for 55 different aircraft types, specifically looking at Class A mishaps, destroyed aircraft, and pilot fatalities. The report found that, broadly, flight safety has improved, with the greatest improvement early on through the 1960s. Researchers found there are more mishaps early in an aircraft’s service life, with fewer crashes and other incidents as an airplane ages. Newer aircraft have also experienced fewer mishaps.

According to the RAND data, multi-engine aircraft experience fewer serious Class A mishaps compared to single-engine airplanes. Mobility and trainer aircraft experienced the lowest mishap rates, when compared to fighter and bomber aircraft.

RAND recommends that future research should consider trends in the causes of mishaps, such as operator error, equipment failure, and environmental factors, to better understand the importance of different drivers. There is not readily available data to support that sort of research, however, so detailed case studies are required, according to researchers.

Chuck Yeager, 1923-2020

Legendary Test Pilot and WWII Ace

By John A. Tirpak

Charles E. “Chuck” Yeager, iconic test pilot, World War II ace, head of the Air Force’s test pilot school, and the first man to fly faster than the speed of sound in level flight, died Dec. 7, 2020, at the age of 97.

Air Force Chief of Staff Gen. Charles Q. Brown Jr. called Yeager “a leader whose innovative spirit had global impact in aviation and air power. His legend will continue to inspire generations to push and break barriers.”

Born and raised in West Virginia, Yeager enlisted in the Army in 1941, serving first as an aircraft mechanic. After the Japanese attack on Pearl Harbor, he applied to become a “flying sergeant,” and he flew the P-39 Airacobra after winning his wings. Deployed to Europe in 1943, he was assigned to P-51 Mustangs, and shot down one German fighter before being shot down himself over France on his eighth mission.

Yeager evaded capture with the help of the French resistance, and during his time with them, helped assemble bombs. With the help of the Maquis, he made his way to Spain, making a harrowing passage over the Pyrenees and saving the life of a fellow evader, a B-17 bombardier, for which he later received the Bronze Star. From Spain he returned to England.

Pilots helped by the resistance were barred from flying combat again, out of fear that they would, if shot down and captured, reveal information about the underground network. Yeager appealed personally to Supreme Allied Commander Gen. Dwight D. Eisenhower, only a week after the Normandy landings, to let him return to flying combat, arguing that the Maquis was openly fighting the Germans and the no-fly policy was obsolete. Eisenhower relented, and Yeager went back to combat flying in August 1944.

It proved a good decision. Over the next five months, Yeager racked up an additional 10.5 aerial victories, including five ME-109s in one day and four FW-190s on another. He was also one of the first to shoot down a German Me-262; the first operational jet fighter. He received a commission and was promoted to captain by the end of his tour in Europe. When he left the theater in January 1945, he had racked up 64 combat missions. He attributed much of his success to exceptional vision—better than 20/20, which he said gave him an edge in spotting the enemy first.

His combination of flying skills, maintenance experience, and evader status gave Yeager a choice of assignments, and he picked being a test pilot of repaired aircraft at Wright Field, Ohio. He impressed Col. Albert Boyd, head of the Aeronautical Systems Flight Test Division, who urged Yeager to study mathematics so he could advance as a test pilot. Yeager got tutoring help from other pilots. After graduating from test pilot school, Yeager was assigned to Muroc Army Air Field—now Edwards Air Force Base, Calif.—and over the next two years flew a wide variety of aircraft and tested modifications.

Partly at Boyd’s urging, Yeager was chosen for the Bell X-1 research aircraft program, meant to explore transonic flight. Supersonic flight was an unknown, and an attempt at it had killed British pilot Geoffrey de Havilland in 1946, creating the mystique of a “sound barrier.”



Master Sgt. Jason Edwards

Sixty-five years after breaking the sound barrier for the first time, Brig. Gen. Charles “Chuck” Yeager suited up to fly in an F-15D Eagle on Oct. 14, 2012.

On Oct. 14, 1947—despite having broken two ribs two nights before, in a riding accident—Yeager flew the X-1 to Mach 1.05 at 45,000 feet. He later described the sensation as “poking through Jell-O.” He told National Public Radio in 2011 that the X-1 experience was more a matter of “being in the right place at the right time” than of being an especially gifted pilot.

The feat was kept secret until Aviation Week revealed the event in late 1947, and it was acknowledged by the Air Force in 1948. In that year, Yeager was awarded the Collier and Mackay Trophies for the X-1 flight, and he became famous enough to be featured on magazine covers.

Yeager became the Air Force’s “go-to” test pilot. In 1953, he was picked to secretly fly and evaluate a captured North Korean MiG-15 and compare it with the Air Force’s F-86, revealing its strengths and weaknesses in the air battles then taking place. Later that year, Yeager became the first man to exceed Mach 2, flying the Bell X-1A to Mach 2.44 on Dec. 12, besting the record of Scott Crossfield in the Douglas D-558 Skyrocket. Due to inertial roll coupling—a problem never encountered before—the X-1A went out of control at about 80,000 feet, spinning violently in all three axes and causing Yeager’s helmeted head to crack the canopy. After losing 50,000 feet in altitude in under one minute, he regained control at 29,000 feet. The following year, he received the Distinguished Service Medal for the record and the airmanship demonstrated in recovering the aircraft.

Yeager returned to the operational Air Force from 1955 to 1960, commanding at the squadron and wing levels, flying F-86Gs in Germany and France and the new F-100 Super

Sabre at March Air Force Base, Calif. He lost command of a squadron at Aviano Air Base, Italy, after members of his unit trashed a local bar.

After attending the Air War College, he was assigned in 1962 as commander of the USAF Aerospace Research Pilot School. Although only 39, and having flown nearly every high-performance research aircraft the Air Force produced over the previous 15 years, Yeager was deemed ineligible to be an astronaut because he lacked a college degree. During his time commanding the school, he trained astronaut-bound flyers and he, himself, flew the M2-F1 lifting body, a research forerunner of the Space Shuttle, for NASA.

In December 1963, Yeager attempted to take the NF-104—an F-104 fitted with a rocket booster engine—to 100,000 feet. But the reaction control system, which steered the aircraft in the absence of enough air for control surfaces to be effective, failed around 80,000 feet. The aircraft entered an unrecoverable spin, and he had to eject. Struck in the head by the falling ejection seat's smoldering rocket booster, Yeager's face and hands were burned. He avoided permanent damage to his eyes, but lost portions of two fingers. It was his final record-setting attempt.

In 1966, Yeager commanded the 405th Tactical Fighter Wing at Clark Air Base, in the Philippines, frequently doing temporary duty in Vietnam. Flying mostly the B-57 Canberra as a bomber, he accumulated 127 combat missions in that conflict. By 1968, he was the 4th Fighter Wing commander at Seymour Johnson Air Force Base, N.C., flying the F-4. While there, he took his unit to South Korea during the USS Pueblo seizure.

Yeager was promoted to brigadier general in 1969. He served in a diplomatic assignment in Pakistan, was vice commander of 17th Air Force in Germany, and headed the Air Force Inspection and Safety Center from 1973, until his retirement in 1975.

Yeager returned to prominence with the publication of Tom Wolfe's book, "The Right Stuff," about the heyday of test flying at Edwards and the Mercury astronaut program, which featured Yeager's exploits. Wolfe wrote that every pilot imitated Yeager's West Virginia drawl and unflustered response to a crisis in the cockpit.

The 1983 movie version of "The Right Stuff"—in which he had a cameo role, as a bartender—made Yeager a household name, which he capitalized on with a two-part autobiography, titled "Yeager" and "Press On," respectively, as well as TV commercial appearances promoting AC Delco car batteries.

He did not rest on his aviation laurels, however. He worked as an aviation consultant and did test flight work for Northrop and Piper into the 1990s. Across his career, he flew more than 350 types of aircraft, amassing more than 18,000 flying hours. In 1986, he served as a member of the Rogers Commission, exploring the factors that led to the Challenger Space Shuttle accident.

To recognize the 50th Anniversary of the Mach 1 flight in 1997, the Air Force flew Yeager in an F-15, going supersonic at Nellis Air Force Base, Nev. There were several more similar anniversary flights, the last in 2012.

Yeager's military decorations include the Distinguished Service Medal, the Silver Star, the Legion of Merit, two awards of the Distinguished Flying Cross, the Bronze Star, Purple Heart, 10 Air Medals, and the Air Force Commendation medal.

Among his many other awards and honors, he received a special noncombat Congressional Medal of Honor in 1976 for his contributions to aerospace science and was presented the Medal of Freedom by President Ronald Reagan in 1985. In 1966, he was inducted into the International Air and Space Hall of Fame, and in 1973, he was inducted into the National

Aviation Hall of Fame. He also is honored by both the California and West Virginia Halls of Fame. Yeager Airport in Charleston, W.Va., is named for him, as well as a bridge in the area on Interstate 64. Senior members of the Civil Air Patrol receive the Charles E. "Chuck" Yeager Award as part of the Aerospace Education Program.

Yeager's second wife, of 17 years, Victoria Yeager, announced his death over Twitter, citing "an incredible life well-lived" and calling him "America's greatest pilot, and a legacy of strength, adventure, and patriotism."

"Chuck Yeager was a true American hero whose bravery as a test pilot inspired generations who followed in his footsteps," Air Force Association President retired Lt. Gen. Bruce "Orville" Wright said. ★



115th Fighter Wing/courtesy

Capt. Durwood Jones died in a Dec. 8, 2020, plane crash in Michigan's Upper Peninsula.

Fatal Crash of Wisconsin ANG F-16 Pilot

By Brian W. Everstine

Capt. Durwood "Hawk" Jones, 37, an F-16 pilot assigned to the Wisconsin Air National Guard's 115th Wing, was killed when his jet crashed in Michigan on Dec. 8.

Jones, from Albuquerque, N.M., was flying a routine training mission when the F-16 crashed in the Hiawatha National Forest in Michigan's Upper Peninsula.

He joined the Air National Guard in 2011, graduating from F-16 basic qualification training in 2015, the wing said in a release. He deployed as part of a theater support package to Japan in 2015, to South Korea in 2017, and to Afghanistan in 2019, where he received two Air Medals with "C" devices for operating while exposed to hostile action or under significant risk of hostile action.

Before joining the military, he graduated from Northwestern University in 2005. He is survived by his wife and two children.

The crash remains under investigation, and wing leadership did not provide details on the circumstances surrounding the mishap.

"We are deeply saddened by this tragic loss. Our thoughts and prayers are with the family during this difficult time," 115th Fighter Wing Commander Col. Bart Van Roo said in a Dec. 10 release. "Today is a day for mourning. The 115th Fighter Wing and the entire Wisconsin National Guard stands with the pilot's family as we grieve the loss of a great Airman and patriot." ★

USAF Awards Air Force Cross to Combat Controller

By Brian W. Everstine

Staff Sgt. Alaxey Germanovich, from the 26th Special Tactics Squadron, was awarded the Air Force Cross during a Dec. 10 ceremony at Cannon Air Force Base, N.M., for his actions in a 2017 battle in Afghanistan, where he is credited with protecting more than 150 friendly forces and destroying 11 fighting positions over the course of an eight-hour fight.

On April 8, 2017, Germanovich was attached to a team of U.S. Army Special Forces Soldiers and Afghan National Army commandos on a mission to clear a valley in Nangarhar Province. When the team was ambushed, he repeatedly exposed himself to sniper and machine gun fire, directing multiple



Staff Sgt. Alaxey Germanovich, a Special Tactics combat controller, was awarded the nation's second highest medal for gallantry against an armed enemy of the U.S. in combat.

danger-close airstrikes from a nearby AC-130 gunship.

The team used all their rifle ammunition and grenades, then drew pistols to try to suppress the approaching enemy force, according to an Air Force Special Operations Command release. Germanovich directed the team to withdraw and carried a casualty 700 meters to a helicopter landing zone while directing close air support.

Since 2001, 11 Airmen have received the Air Force Cross for valor in combat, second only to the Medal of Honor, including 10 awards for actions in Afghanistan and one for actions as part of Operation Inherent Resolve in Iraq and Syria, according to a Pentagon tally. The Air Force Special Tactics community has received more than 50 Silver Stars, the third-highest award for valor, since 2001.

The Air Force in recent years has been reviewing its valor awards for possible upgrade, with Master Sgt. John Chapman in 2018 receiving the Medal of Honor posthumously. Air Force Special Operations Command boss Lt. Gen. James C. Slife said in September that review is winding down. ❄

Air Force Retention Soars Amid COVID-19 Uncertainty

By Rachel S. Cohen

More people are opting to stay in the Air Force than at nearly any other time in the past 20 years, choosing to stay put amid pandemic-era economic uncertainty.

The Air Force wanted to grow by 900 Active-duty members to 333,700 Airmen in fiscal 2021. But by October 2020, the

service had already hit the workforce goal it set for September 2021. The Active-duty force now sits at around 334,600 people, according to Lt. Gen. Brian T. Kelly, the Air Force's deputy chief of staff for manpower, personnel, and services.

Retention levels in nearly all career fields are "extraordinary" right now, he said. In the past two decades, the only time retention outpaced the current rate was after the 9/11 terror attacks, according to the Air Force.

Conversely, the Air National Guard has seen retention sag this year as members saw their activation orders continually extended throughout the summer. ANG expected to miss its manpower goal of 107,500 at the end of September.

Active-duty operations jobs continue to lag behind in staffing, though each career field will need a different number of people at various ranks. Some professions will need more master sergeants to come in as the service balances the force, while others might require more staff sergeants.

Kelly said those opportunities will be voluntary, not mandatory. ❄

USAF Postpones PT Tests, Says It Will Cease Waist Measurements

By Jennifer-Leigh Oprihory

Airmen and Guardians don't have to take their fitness assessments until April 2021 as a result of COVID-19, and the Department of the Air Force has empowered commanders to push those tests even further if necessary, according to a Dec. 7 release.

When testing finally resumes, however, it will look a little different. After years of debate, the Department of the Air Force is cutting waist measurements from the annual fitness assessments.

Previously, the Air Force considered three components when assessing the overall health of an Airman: body composition, which is primarily evaluated through waist measurements, and aerobic and muscular fitness. Troops will still do the 1.5 mile run, one minute of pushups, and one minute of situps, but participants will get full points for the waist measurement section until the department can make "system changes," the release added.

Beginning in October, the Department will still take troops' heights and weights as part of the assessment, the release noted.

"Along with removing the waist measurement, we are also exploring alternative strength and cardio components to our current Air Force fitness assessment," Air Force Chief of Staff Gen. Charles Q. Brown Jr. said in the release. "We believe these potential test structure changes will impact Airmen in a positive way and help with a holistic approach to health and fitness standards." ❄

Scrappy Johnson, 1920-2020

Howard C. "Scrappy" Johnson, who received the Collier Trophy for setting an altitude record in the F-104 Starfighter and helped found the Red River Valley Fighter Pilots Association, died Dec. 9, 2020, at 100 years of age.

A veteran of World War II, Korea, and Vietnam, Johnson was the first to pilot a jet aircraft over the North Pole (in an F-94 Starfire) and in May 1958, after only 30 hours in the F-104A Starfighter, took it to 91,243 feet, besting previous altitude records

by more than 10,000 feet. His record-setting “Operation Sky High” earned him a Distinguished Flying Cross and the Robert J. Collier Trophy.

Johnson was deputy commander of operations for the 388th Tactical Fighter Wing at Korat Royal Thai Air Base, Thailand, from September 1966 to the following August, racking up 117 combat missions over North Vietnam and Laos in the F-105 Thunderchief. It was there that he organized the May 1967 “Red River Valley Fighter Pilot’s Tactics Conference,” which drew fighter, bomber, escort, electronic warfare, and tanker pilots to focus on operations near and beyond the North Vietnamese border. The legendary party that followed prompted 8th Tactical Fighter Wing Commander Col. Robin Olds to suggest they form a permanent, unofficial Red River Valley Fighter Pilots Association. Johnson was elected its first president.

Known affectionately as the “River Rats,” the group held reunions and raised money for the survivors of lost, captured, and missing Airmen. Johnson retired as a colonel in 1972 and published his story, “Scrappy: Memoir of a U.S. Fighter Pilot in Korea and Vietnam,” co-written with Ian A. O’Connor. ✪

AGM-183 Hypersonic Weapon Still Awaiting First Flight

By John A. Tirpak

The Air Force’s AGM-183 hypersonic missile didn’t fly by the end of December, as predicted by service acquisition executive Will Roper last month. Instead, an instrumented round was again captive-carried on a B-52 and the procedures for launching it were “practiced,” USAF said, without disclosing why the missile wasn’t launched.

In a Dec. 19 test, an “Instrumented Measurement Vehicle” (IMV) version of the Air-launched Rapid Response Weapon, or ARRW, “was successfully captive-carried” on a B-52 over the Edwards Air Force Base, Calif., test complex, the Air Force reported in response to a query. Instead of flying as expected, the test merely confirmed integration with the B-52 and “transmission of telemetry and GPS data” from the missile, designated “IMV-2,” to ground stations.

The program will “now move ahead toward its first “Boost-er Test Flight ... later this year,” the Air Force said. The service could not immediately be more specific as to whether that means the first flight is expected to happen closer to next month or the end of 2021.

At the inaugural event of AFA’s Doolittle Leadership Center on Dec. 14, Roper forecast that ARRW would fly before the end of 2020.

“We’re hoping that our flight demonstrator for a hypersonic weapon will be successful this month, and that we’ll get into production next year,” Roper said.

The Air Force plans to test ARRW on both the B-52 and the B-1, and long-standing plans call for an initial operational capability before the end of 2022. Both bombers will carry the missile externally; the B-1 will carry ARRW on six external hardpoints that have not been used for munitions since the START Treaty was signed and the B-1 was withdrawn from the nuclear role. Roper has previously said the ARRW could be employed by the F-15, as well.

Lockheed is developing the ARRW under contracts valued at more than \$1.3 billion, which will cover the program through

critical design review, test, and production readiness circa December 2022.

A complementary program, the air-breathing Hypersonic Air-breathing Weapon Concept, being developed by USAF and DARPA, also failed to fly in December, as planned. ✪



Airman 1st Class Luis Ruiz-Vazquez

Maj. “Vudu,” U-2 Dragon Lady pilot, prepares to taxi at Beale Air Force Base, Calif., after returning from a training sortie using AI assistance, Dec. 15, 2020.

U-2 Flies with Artificial Intelligence as Its Copilot

By Brian W. Everstine

One of the Air Force’s oldest planes became the first military aircraft to fly with artificial intelligence as its copilot on Dec. 15.

A U-2 from Beale Air Force Base, Calif., flew with an AI algorithm that controlled the Dragon Lady’s sensors and tactical navigation during a local training sortie. The algorithm, developed by Air Combat Command’s U-2 Federal Laboratory and named ARTUμ in a reference to the droid that serves as a copilot in the “Star Wars” film franchise, took over tasks normally handled by the pilot, in turn letting the flier focus on the flying.

“ARTUμ’s groundbreaking flight culminates our three-year journey to becoming a digital force,” said Will Roper, the Air Force’s assistant secretary of acquisition, in a release. “Putting AI safely in command of a U.S. military system for the first time ushers in a new age of human-machine teaming and algorithmic competition. Failing to realize AI’s full potential will mean ceding decision advantage to our adversaries.”

The laboratory used more than a half-million simulated training missions to build the algorithm, which took over sensors after takeoff. The training scenario focused on a simulated missile strike, with ARTU finding enemy missile launchers and the pilot looking for adversary aircraft—both using the U-2’s radar, according to the release.

“We know that in order to fight and win in a future conflict with a peer adversary, we must have a decisive digital advantage,” Air Force Chief of Staff Gen. Charles Q. Brown Jr said in the release. “AI will play a critical role in achieving that edge, so I’m incredibly proud of what the team accomplished. We must accelerate change and that only happens when our Airmen push the limits of what we thought was possible.” ✪

FACES OF THE FORCE

Two 700th Airlift Squadron Reservists got married in the back of a C-130 Hercules on the Dobbins Air Reserve Base, Ga., flight line on Nov. 10. Pilot **Capt. Will Jones** married



Andrew Park/USAF

navigator **1st Lt. Lyndsy Harrison** in the AvGeek-worthy nuptials. "I think when he brought up the idea of us getting married in the back of the plane, he threw it out there as a joke," Harrison said in a 94th Airlift Wing release. "But when I approved and was just as stoked about it as he was, we didn't want to do it anywhere else." The unconventional setting came with some unique logistical challenges, but the ceremony was a success. "After a crew chief marshaled in the plane, the aircrew lowered the ramp, revealing a U.S. flag hanging as a backdrop," the wing recalled of the event. "The pilot and navigator—or in this case, the bride and groom—rushed off the back of the plane like a couple late to the chapel and got into position." At the end of the ceremony, Jones lowered the topside of the Hercules' ramp, upon which the words "Just Married" had been scrawled in chalk, the wing wrote.

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



Tech. Sgt. Rose Gudex

23rd Special Tactics Squadron Airmen from Hurlburt Field, Fla., recently deployed to Soto Cano Air Base, Honduras, to backup USSOUTHCOM and Joint Task Force-Bravo humanitarian assistance efforts in the wake of Hurricanes Eta and Iota. Efforts included providing air traffic control and assessing remote airfields to help Joint Task Force-Bravo commanders figure where to deliver aid to Honduran citizens. The Airmen were also equipped with gear to assist in personnel recovery.



Senior Airman Taylor Cru

For **2nd Lt. Brenna Larson**, flying the T-1A Jayhawk is a family affair. Her dad, **Bruce Mason**, works as a Jayhawk simulator instructor at Vance Air Force Base, Okla., and her husband, Pilot Capt. Matthew Larson, is a former T-1A instructor pilot. "How many other student pilots going through training have their father just a few buildings over who can help if I don't understand something, a husband on speed dial who was a prior T-1 instructor pilot, and a mom I can go home to and vent about my day," she said.



USAF

On Nov. 24, **944th Fighter Wing Vice Commander Col. Sean "Double" Rassas** became only the 296th F-16 pilot to exceed 3,000 flying hours in the F-16 Fighting Falcon. He accomplished the feat during a flight at Luke Air Force Base, Ariz., which marked his 2,024th sortie. "Even though we are making that gradual shift [to the F-35A Lightning II], we believe it is still extremely important for us to retain that high level of experience in the F-16," said Wing Commander Col. Jim Greenwald.



Courtesy

2nd Lt. Jeff Martin, Defense News' former associate editor for multimedia who hosted and produced the "Defense News Weekly" television show, recently traded in his camera for camouflage and graduated from Officer Training School at Maxwell AFB, Ala. He commissioned into USSF. "Became an officer in the Space Force today," he tweeted on Dec. 10. "It's been two years in the making, and I can't believe it's finally here." Martin will now train as an intelligence officer at Goodfellow AFB, Texas.



Senior Airman Neil Mabini/ANG

Airmen from the **California ANG's 163rd Attack Wing Grizzly Resiliency Team** collaborated with a church and VFW post near March Air Reserve Base, Calif., to distribute food boxes to Active-duty and Reserve-component troops, veterans, and civilians in December. "With the pandemic ... going on, we're trying to be something positive," said Chaplain's Assistant Tech. Sgt. Juan Marquez. "There was a time in my own life when I was really in need. ... I feel this is a way of giving back."



Airman 1st Class Mariam Springs

189th Airlift Wing Airman **Sandy Smock** was recently appointed as Little Rock Air Force Base, Ark.'s, inaugural privatized housing resident advocate. She serves as a bridge between residents and the base's privatized housing partner to make sure Airmen are treated fairly, their residences are up to par, and their conflicts and concerns are addressed. "Empowering a voice if something seems not quite right to speak up is vital," Smock said.



Staff Sgt. Orlando Corpuz/ANG

Airmen from the Hawaii ANG's **154th Medical Group** helped safeguard the Joint Base Pearl Harbor-Hickam community by operating a flu-shot drive-through during their October and November drill weekends. The Airmen—including Medical Service Specialist **Tech. Sgt. Alvin Turla**—conducted pre-vaccine health assessments on visitors before administering the shots to medically cleared individuals through their car windows, which maximized the number of Airmen it could safely vaccinate.



Master Sgt. Ben Mota

434th Air Refueling Wing Paralegal Tech. Sgt. Lucille Reyna, wrote the children's book "A Soldier's Story" to help kids make sense of deployments. "My intent for this book is to provide children with something which would help them understand, in a kid-friendly way, why their parent may be gone," Reyna said. "My kids did live it, and I can still remember how I felt to leave for the first time—I hope other parents who are service members can use this book as a resource."



Repairing Broken Bones

A smaller fleet, fatigue tests and continuous depot repairs should keep B-1s flying until the B-21 joins the force.

Master Sgt. William Greer

Heavy use for close air support in Afghanistan meant extended loiter times and flying at high altitudes with wings swept forward, prematurely aging critical wing components.

By John A. Tirpak

The Air Force expects to have enough money, spare parts, and maintainers to keep its B-1B bombers flying safely until they are replaced by the B-21—due largely to Congress allowing USAF to retire 17 of the most problem-prone Bones. But the service is well behind on structural fatigue tests meant to better understand life-limiting cracks and stress on B-1 airframes, so there could be surprises ahead.

The 2021 National Defense Authorization Act clears the way for the Air Force to reduce the B-1 fleet from 62 aircraft to 45. If the B-21 delivers on schedule, enough should be on hand by 2030 to 2036 to retire the rest of the B-1s.

The Air Force has pushed since September 2019 to shed its most-worn B-1s, saying it would use the savings to keep the remainder of the fleet ready for action. Parts shortages and structural and systematic problems have driven the B-1's mission capable numbers to single digits in recent years.

Engineering assessments found “17 of the B-1Bs were in a state that would require tens of millions of

“It is a cost avoidance. It does help ... our healthiest aircraft to [retire] ... these 17”

—Bomber Program Executive Officer Brig. Gen. John Newberry

dollars per aircraft” to get them to a baseline capability, said a spokesman for Air Force Global Strike Command (AFGSC). By retiring these airplanes in 2021 “maintenance dollars and manpower can be focused on the healthiest aircraft in the fleet,” he said. While other fleet sizes were considered, keeping 45 aircraft ensures enough planes to meet “global commitments.”

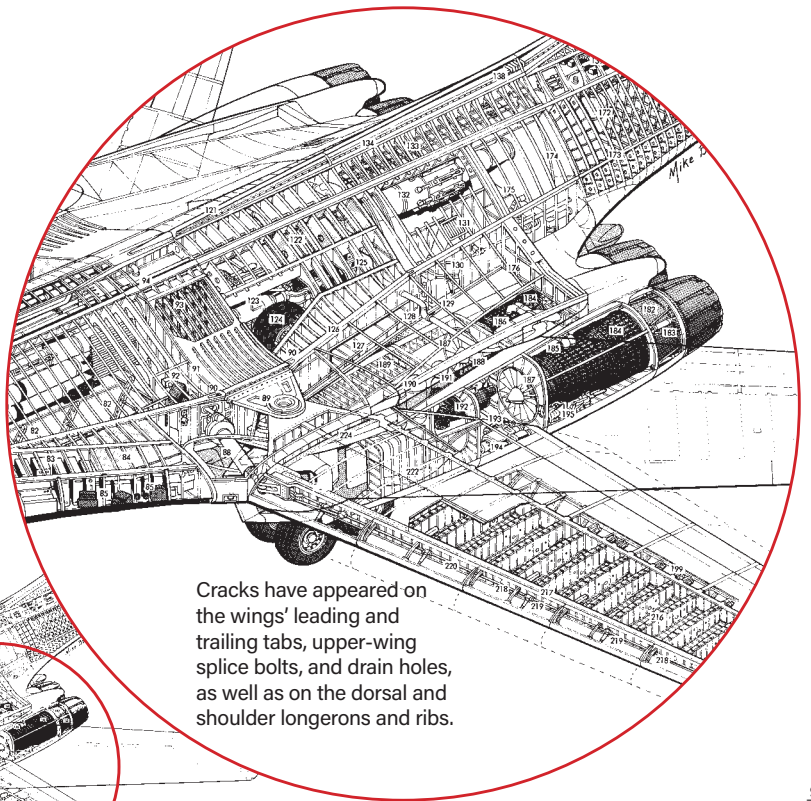
The B-1s average more than 32 years old. “This is the first step in gradually drawing down the fleet,” he said, to make way for the B-21.

The Air Force retired 33 of its B-1s in 2003, leaving 60 aircraft, on the argument that a severe maintenance backlog of the fleet would cost \$2 billion to fix. The Air Force said then it made no financial sense to keep all those aircraft in service and, once the fleet was cut, mission capable rates soared. Ironically, that persuaded field commanders to call on them more—which soon wore down their newfound reliability. Congress later ordered seven of the bombers brought back to service.

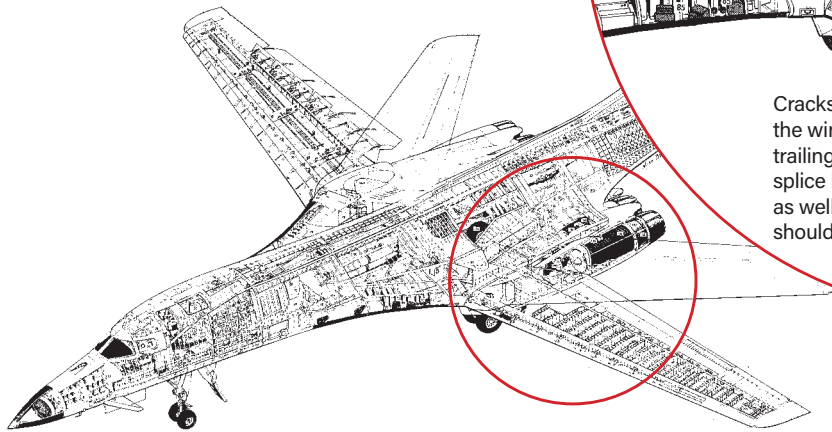
Retiring 17 more planes now will leave enough resources for B-1 repairs and structural modifications to “get us as long as we need for the B-1 to fly,” bomber

BONE Fatigue

The B-1 was designed to be a penetrating bomber, flying fast and low with swept wings. In Afghanistan, however, close air support duties meant loitering at high altitudes, heavily loaded, with wings swept forward, before dashing at high-speed to respond when needed. The unanticipated stress caused cracks in highly stressed structural components joining the wings to the fuselage.



Cracks have appeared on the wings' leading and trailing tabs, upper-wing splice bolts, and drain holes, as well as on the dorsal and shoulder longerons and ribs.



© Mike Badrocke

Program Executive Officer Brig. Gen. John P. Newberry told Air Force Magazine in a December interview.

"It obviously helps the Air Force to get 17 aircraft off the books," he explained. "They will be the most expensive to sustain, right? ... So, it is a cost avoidance. It does help ... the 45 of our healthiest aircraft to not [fix] these 17 aircraft."

AFGSC hasn't said yet when the 17 bombers will go to the boneyard, but Congress stipulated that the aircraft must be kept in Type 2000 "or better" storage, meaning they'll be available for harvesting of parts, but not recallable to active service. The 17 airplanes will come about evenly from the two B-1 bases: Dyess Air Force Base, Texas, and Ellsworth Air Force Base, S.D.

A number of think tanks, including the Air Force Association's Mitchell Institute for Aerospace Studies, have urged the Air Force not to retire the B-1s and to retain as many bombers as possible until the B-21 is operating in significant numbers. Indeed, the Air Force's new goal is to have a fleet of 220 bombers—far more than the 135 it will have once the 17 B-1s are gone.

The B-1 was designed to fly 8,000 to 10,000 hours, or about 30 years in normal service, depending on the rate of usage, but the fleet has actually flown about 12,000 hours, on average. To help predict where physical failures are likely to occur, the Air Force has, since 2012, run a structural fatigue test on a B-1 carcass and wing taken out of the boneyard at Davis-Monthan Air Force Base, Ariz. In a test apparatus at Boeing's facilities near Seattle, a series of bars and pulleys apply forces on the wing and fuselage, simulating the effects of multiple flights. This ages the test article faster than the operational fleet and helps engineers discover structural vulnerabilities before they appear in operational aircraft.

The goal, Newberry said, is to achieve 28,000 simulated flight hours on the representative wing, and 27,000 hours on

the fuselage; what's called the "durable life" of the airplane. So far, tests have simulated 15,875 hours on the wing, but just 7,154 hours on the fuselage.

Those hours are actually half of the real numbers, though, because fatigue tests are meant to establish a "Certified Structural Life." The service is only comfortable flying the fleet to half the number of simulated hours applied to the fatigue test article, to leave a generous margin for the unexpected. Consequently, while the wing taken from the boneyard had 3,085 hours already on it, the structural fatigue test could only be credited 1,547 hours at the outset.

"Unfortunately, we're behind," Newberry allowed. "The [actual] fleet average is a little over 12,000 [hours]." The wing test article is ahead of the fleet average, but the fuselage lags it.

The reason the test is behind has to do with the way structural fatigue tests are run. If a structural failure occurs on the test article, the test must be stopped while engineers figure out what broke, and why. A repair is then designed, prototyped, and installed. The fatigue test then continues. When the operational fleet encounters the same problem, a fix is ready to go. Or, it may be installed preventively during depot maintenance.

Major problems that required stopping the test included "on the wing ... leading and trailing tabs, upper wing splice bolts, and drain holes," Newberry said. On the fuselage, it was "cracks ... on the dorsal and shoulder longerons." A repair is now being prototyped on the forward intermediate fuselage. There are also rib cracks, he said, as well as "shearing bolts and tension clips. So there are various items."

"We want to get ahead of the fleet," Newberry said, he can't predict when that will happen, because it's impossible to know when the next failure will occur. Even now, the test is on hold while a fix to a longeron—a main structural piece that carries heavy loads in the structure—is being prototyped.

Sheet metal and aircraft technicians check wing components on the B-1 Structures Repair Line at Tinker Air Force Base, Okla. The Air Force anticipates cycling five to eight B-1s through Tinker annually, with each aircraft returning for further work every five years or so, until the B-1s are retired in the 2030s.



Kelly White/USAF

UNINTENDED CONSEQUENCES

The B-1 was used hard in Afghanistan and Iraq as a high-speed close air support (CAS) platform. Its wings swept forward at high altitude, it would loiter, waiting for a call to help troops in trouble, then swoop down at high speed. But it was designed instead for the strategic mission: low-altitude penetration missions with wings swept back. The CAS mission put undue stress on the swing-wing mechanism and attach points.

“Now we’re having to pay the piper,” then-Air Force Chief of Staff Gen. David L. Goldfein said in 2019.

The Air Force no longer intends to use the B-1s for close air support. Throughout 2020, the Bone has been limited to bomber task force missions, conducting short-notice, short-duration deployments to Europe, the Pacific, and the Middle East.

Air Force Materiel Command (AFMC) has moved quickly to restore the B-1’s mission capable rates to percentages above 60 percent, far better than the single-digit performance of just a few years ago.

At the B-1 depot maintenance center at Tinker Air Force Base, Okla., a separate “speed line” was set up to repair specific problems crushing the B-1s readiness, such as the ejection system, cracks in the forward intermediate fuselage, and wing problems. Spare parts, chronically in short supply, also got a boost in funding.

Availability still suffered, though, as compounding structural problems overwhelmed maintainers, according to USAF B-1 program manager William Barnes.

“When we were at very low mission capability rates ... we were behind in analyzing some of the data we were seeing in the full-scale fatigue test,” Barnes said. As the data were analyzed, it became clear that the airframe was aging fast, requiring more invasive and time-consuming inspections.

“A lot of that work fell on the backs of the maintainers out in the field,” he said. There wasn’t enough capacity at the depot, “nor did we have all the supplies we needed to

perform that repair work.”

In May 2018, a B-1’s ejection system failed during an in-flight emergency. The crew landed safely, but the incident prompted a new wave of frequent fleetwide B-1 inspections, Barnes said.

“Since that time, we got the ejection system all fixed and got that work off the field maintainers,” Barnes said. “We brought a lot of the repair work into the depot ... and then in 2019 ... stood up the dedicated repair line at Tinker ... where we bring in aircraft for nothing but structural repairs.” It’s, “to my knowledge, ... the only dedicated structural repair line in the Air Force.” Doing it that way allowed USAF to hire extra workers for the surge repairs “and let the maintainers get back to their day-to-day job of launching aircraft and meeting mission needs.”

All that “significantly improved the availability of the fleet,” Barnes said.

“The B-1 has never been grounded due to structural problems,” said Maj. Gen Mark E. Weatherington, commander of 8th Air Force and the Joint Global Strike Operations Center, in a statement provided to Air Force Magazine.

While Gen. Timothy M. Ray, commander of Global Strike Command, “directed a B-1 safety stand-down in March 2019 to address a Time Compliance Technical Order inspection of the B-1 drogue chute system,” he noted, the fleet was flying again the following month.

“In the past six months we have seen an impressive 71 percent increase in bomber training readiness,” Weatherington noted. In 2020, he pointed out, B-1 detachments conducted six bomber task force (BTF) deployments and “eight BTF long-range strike missions from home station; a significant achievement.” The B-1 “improved in both readiness and maintenance rates while executing BTF missions in support of U.S. Strategic Command and various geographic commands.” The B-1 is “combat-ready and can employ weapons anywhere in the world” in support of the U.S., its allies, and partners, he said.

But big repairs remain to be done. A longeron replacement in the forward intermediate fuselage that will require substantial disassembly of the airplane will be an intensive process.

“We are going to bring an aircraft into Boeing’s Palmdale [Calif.,] facility in April to perform a prototype of that repair,” Barnes said, “where we will replace the forward intermediate fuselage, and we will repair the ‘shoulder’ longeron,” and this will be the prototype for a fleetwide fix. The repair apparatus will be brought to the depot for the fleet install, “but that’s not going to happen until the ’23-’24 time frame,” he said. “So, we’re still a few years away from where we have to be.”

Lt. Col. Joseph Lay, material leader for B-1 engineering, said the longeron is “a huge section of the backbone of the aircraft.” Doing the forward fuselage and the longeron at the same time “facilitate each other” because they require access to the same areas.

The prototype will be done on a B-1 already headed into depot, and it will have “an extended stay” in that status, Newberry noted.

“It’ll go to Tinker for a little bit,” then to Boeing’s Palmdale, facility, “and then go back ... and finish out its normal depot. It was picked because it was ready for the depot, and it was ... needing a forward intermediate fuselage replace as well.”

DIGITAL TWINNING

In October 2020, Air Force Materiel Command announced a partnership with Wichita State University to create a “digital twin” of the B-1. In a press release, Lay said the digital twin will help USAF anticipate cracks and develop repairs so that when needed, they are “on the shelf” and ready to go. Another B-1 carcass from the boneyard was trucked to Wichita, Kans., where every part is being disassembled, inspected, and digitally scanned. This will allow USAF to “discover all the places that saw structural failure or damage,” creating a maintenance overlay that will be a “living medical record” for the airplane, Lay said. The process of scanning the aircraft down to every bolt will take about six years.

With a fleet of 45 B-1s, the aircraft will flow through the

depot at about nine per year—down from 11 or 12 with the larger fleet—so it will take five years to cycle the whole fleet through, Newberry said. Before the B-1’s putative wholesale retirement, each airplane will likely go through at least two more depot visits. In addition, Barnes said, there will typically be “two to four” B-1s in the structural repair line, meaning “five to eight” B-1s at Tinker “at any given time.”

Ray has also said that eight B-1s will be dedicated to testing a range of new weapons. So, assuming an average of seven Bones in depot on average, the operational fleet will number about 30 deployable aircraft.

Among other munitions, the B-1s will be testing hypersonic missiles, expected to be carried on external hardpoints not used since before the START treaty dictated that they be closed up. AFMC officials said this shouldn’t create any new structural stresses on the airplane.

“The hypersonics testing right now has no impact to our full-scale fatigue testing,” Newberry said, nor do the new weapons require any changes—wing fences, vortex generators, etc.—to the outer shape of the airplane. When new weapons are introduced, “typically, we adjust the weapon, not the platform.”

Continuing the full-scale fatigue test right up until the B-1’s retirement is a good investment, he said. It allows the Air Force “insight to the structural health” of the bomber, and a preview of big repairs needed, so Tinker can be “prepared for it, with parts and such.”

Given the stress test, digital twin and a surveillance program that tracks the stresses encountered by each B-1 on each flight, the fleet is “safer today than it was yesterday, and we [plan to] make it even safer,” Newberry said.

“As we continue with the full-scale fatigue test article, we learn more,” he added. “We find other, very small or very significant structural repairs that need to happen.” Structure repairs will continue “probably for the remaining life of the aircraft, Newberry said.

“There’s a lot of work ahead of us, but we’re on a great trajectory from where we were in the past.” ✪



Lance. Cpl. Tyler Harmony/USMC

Since dropping their close air support mission, B-1B bombers have seen increased mission capable rates, enabling them to participate in bomber task force missions and, here, in Valiant Shield 2020, a joint force exercise in the Indo-Pacific.



Airman 1st Class Dakota LeGrand

Roper, shown here after a U-2 flight in October 2019, challenged the U-2 Federal Laboratory to apply artificial intelligence to ease the burden on the high-flying jets' pilots. They delivered, and the system successfully flew Dec. 16, 2020.

The Great Experimenter

Will Roper spawned a revolution in acquisition as USAF's procurement chief. Will his innovations survive?

By Brian W. Everstine

The fighter jet, in all its complex, high-performance glory, has long defined the public image and brand of the U.S. Air Force. Yet for all its power, it is not the brand definition the Air Force of tomorrow will need, argues Will Roper, who completed four years as the Air Force's assistant secretary of acquisition in January.

Roper, a self-styled disruptor, technology advocate, and innovation enthusiast, has a different vision in mind.

"The thing I would wish is that the Air Force's brand is innovation—and I think we're getting there," Roper said in December. "When I came in, I felt like it was the fighter. And there's nothing wrong with fighters. I am for the Air Force having amazing airplanes. But what I feel from reading history ... is that in the early Air Force, air power was so in flux that it wasn't clear what would be coming down the pipelines. Planes changed so frequently, ... records were being broken ... the next thing was always more important than the current thing."

"The thing I would wish is that the Air Force's brand would be innovation—and I think we're getting there."

—Will Roper, outgoing USAF assistant secretary for acquisition, technology, and logistics

The result was a steady and remarkable flow of innovation, as new wing forms and engine technologies helped produce aircraft with unique speed, altitude, or maneuver advantages.

But with the end of the Cold War, the international competitive threats that drove investment and innovation slowed, Roper said, calling that shift a "tragedy" and "one of the real casualties of the Cold War, specifically for the Air Force, because it took away that adaptive, agile vibrancy of the future only being a year away."

As acquisition chief, Roper sought to reinvigorate innovation by hitting the accelerator on modernization, innovative acquisition, and investment strategies, and preaching the gospel that transformation can come about through digital engineering, artificial intelligence and cloud technology, and agile software development based on proven commercial practice.

Roper pressed to replace the E-8C Joint STARS aircraft, not with another airplane but with a system-of-systems concept intended to link up everything in the battlespace. He calls the evolving network the Advanced Battle Management System (ABMS) the

“Internet of Military Things.” Similarly, he has pressed for accelerating aircraft development by laying aside recent history and programs that develop slowly and last decades longer in the field and instead pursuing a “Digital Century Series,” an incremental approach to rapidly developing future fighter jets without the intent to keep them flying for decades on end. He invested in Air Force-owned and -operated “software factories” built to practice agile, iterative development, much as commercial internet behemoths do. Finally, he stood up AFWERX to collaborate and contract with innovative startups and AFVentures to invest in promising, nascent firms.

“We can’t stand back and hope that the world’s best technology is going to be available,” Roper said. “We can’t stand back and hope we’re gonna have the world’s best industrial base to make the 10th generation aircraft—whatever it looks like. We’ve got to actively engage innovation itself as a battlefield, so that technology and markets emerge in this nation first, leading to an industrial base that is capable of building a war-winning Air Force that’s backward from the way we’re trained. We are given a world-leading industrial base and we go build a war-winning Air Force with it. That will lose in this competition with globalized technology. We actually have to find a way to make an Air Force, a Space Force, or any part of the military, a catalyst to make sure that our industrial base remains at the top. And if it does, then our military will” remain on top, as well.

Yet while Roper preached a gospel of optimistic change, his drive to upend the acquisition system ran into skepticism on Capitol Hill, with legislators cutting requested funding for ABMS and Next-Generation Air Dominance (NGAD) substantially.

Todd Harrison, director of defense budget analysis at the Center for Strategic and International Studies sees threats to both programs in the future. “I think the fact that Congress just cut ABMS funding by 47 percent and NGAD funding by 13 percent indicates that these programs are in trouble,” he said in January. “Much of the intent behind what Dr. Roper has been pushing is sound—using more digital engineering in programs, giving the government more insight and ability to test designs, and breaking the lock companies traditionally hold on future upgrades and sustainment.

“But I think where these new approaches have fallen short,” he added, “is in the implementation details and how the analysis behind decisions have been communicated.”

With a new administration taking over, some lawmakers are pressing to cut funding for major programs and to call in outside oversight to review costly investments. Added to growing budget deficits in the wake of COVID-19 pandemic relief, many are wondering whether Roper’s innovative strategies will survive.

FROM JSTARS TO THE CLOUD

ABMS represents Roper’s most ambitious bet. A project that began as a concept for replacing the E-8C JSTARS ballooned into a series of technology demonstrators intended to connect every sensor to every shooter in a single, grand “Internet of Military Things.” Instead of operators working in the back of an old Boeing 707 aircraft, ABMS aims to enable almost anyone in the chain of command to access, in real time, a complete battlefield operational picture, including threats, assets, and recommended courses of action generated through artificial intelligence.

ABMS advanced from theoretical PowerPoint briefings to real-time “on-ramp” experiments, testing new technologies and solutions to prove real-world applicability. In September 2020, the second on-ramp experiment connected dozens of aircraft across the country, plus ground- and sea-based sensors, and culminated with a remote command to down a cruise missile threat with non-typical shooters, including a “smart bullet” fired from a howitzer and a ground-based AIM-9X. The goal of these experiments was to prove that the “Internet of Military Things” is possible, and now in 2021 the next step is to make it more of a reality.

“This is a huge endeavor to take on—building the military’s internet of things—and there has been broad support for doing it,” Roper said in an interview. “But there’s also been concern about how do I understand this unconventional program in a way I can oversee?”

To do that, Roper assigned the Air Force’s Rapid Capabilities Office (RCO) in November to be the “program executive office” for ABMS. This means the RCO, already tasked with overseeing the B-21 Raider and X-37B space plane, has authority to define requirements

“It’s just acquisition work,” Roper said. “It’s time for ABMS to start having procurement and operations and sustainment funding associated with it.”

The first fruit of that effort will be a data pod that can be



Lt. Col. Matthew Strohmeier, U.S. NORTHCOM scenario coordinator, briefs senior leadership during the first Advanced Battle Management System live demonstration, at Eglin Air Force Base, Fla., Dec. 18, 2019. ABMS may prove to be Roper’s most enduring legacy.

Tech. Sgt. Joshua Garcia

Chief Master Sgt. of the Air Force JoAnne Bass, left, joins Air Force Secretary Barbara Barrett and Chief of Staff Gen. Charles Q. Brown Jr. during a visit to AFWERX's hub in Austin, Texas, in August 2020.



Staff Sgt. Jordyn Fetter/ANG

mounted on a tanker's wing and can offload data while fighters refuel. This ABMS "Release No. 1" will debut in calendar 2021.

Here's how that pod could work: F-22s and F-35s operating without data links in an anti-access, area-denial environment, depart the threat ring to refuel; while tanking up, they download new intelligence and orders that the tanker has downloaded from the ABMS cloud to the pod. Then they return to the fight.

"We have an opportunity with our tankers who will be airborne," Air Mobility Command boss Gen. Jacqueline D. Van Ovost said in an interview. "Why not have the capability to relay ... line-of-sight and beyond-line-of-sight links to ensure that our tactical forces have the intelligence and support that they need while they're airborne?"

The RCO will try to take sensors and data links that perform well in on-ramp exercises and build them into pods that can be distributed to operating bases and quickly mounted on tankers as needed. Roper said the RCO is studying pod form factors, acquisition strategies, and data-linking technologies.

The objective is for ABMS to "get some dirt on it, meaning when we demonstrate it, it stays in the field—in 2021. That takes the program out of the realm of fantasy and places it squarely in the operational world.

"There's a real program with a real baseline with real warfighters ready to use it day to day, not an exceptional event that we stood up to prove the technology works," Roper noted. "We already know the technology works. We use it every day. This is about showing we can use it on our military systems without having to wait for traditional acquisition timelines."

Skeptics on Capitol Hill placed limits on funding ABMS and called the Air Force out for insufficient direction and limited oversight. Roper said, "Release No. 1" and similar steps will demonstrate progress and, hopefully, win over the skeptics to avoid future budget cuts.

"Cutting the funding for the on-ramps means we may be in danger of making them more technology demonstrations rather than what they currently are, which is a good balance of technology and warfighter tradecraft," according to Roper. "I hope we'll be able to convince Congress that we need to do both."

ENGINEERING GONE DIGITAL

Roper also pushed for modern engineering and manufac-

turing by using digital modeling to simulate performance tests and accelerate design. At the Air Force Association's virtual Air, Space & Cyber Conference in September, he dropped a bombshell: A prototype of the NGAD platform had secretly completed its first flight, setting a development speed record in the process.

Digital engineering made that possible. This approach also helped Boeing deliver a clean-sheet airplane design—the T-7A trainer—in record time and at considerably lower cost than anticipated. And it is the foundational cornerstone of Roper's Digital Century Series initiative, the enabling technology for squeezing the timeline to develop new tactical aircraft.

"What we're proposing is pretty radical—and that's exactly what tactical aviation needs," Roper stated. "We've been stuck in a rut since the end of the Cold War, and we've watched a commercial industry radically change in a way the defense industry hasn't. So, with this breakthrough technology, that's already changed the automotive industry, peeking into defense, a really valid question would be, 'Why aren't you doing something radical with it?'"

NGAD is still in the design phase, and it is still under evaluation "in the digital world." As with ABMS, legislators have challenged Roper's concepts, cutting NGAD funding and calling for the Pentagon's Cost Assessment and Program Evaluation (CAPE) office to review both NGAD and the Digital Century Series approach. Roper said in December that classification makes it difficult to talk about these programs openly and that COVID-19 and social distancing made communicating harder over the past year.

"The thing that's the big delineator on NGAD is whether we're able to talk with folks on the Hill in a classified level or not," Roper said. "It's a difficult program to say anything on without being able to get in the SCIF," or sensitive, compartmented information facility. Roper made waves when he announced the first NGAD flight, but he defended that decision. "It's helped us to say that a full-scale flight demonstrator has flown—that we're not just talking theory, but we've taken this to practice," he said. "But to really talk about anything that makes us excited about the program, we have to get in the SCIF. And that's been difficult during COVID-19. I hope NGAD does not become an unintended casualty of COVID-19."

Roper argues it's in everyone's best interests to give the concepts a chance. His new approach promises shorter timelines and fewer expenses.

"You don't really have to believe in the approach to approve of the program," he said. "Because if we fail, we're going to fail in practice, and you're going to be able to tell long before we get to that Digital Century Series. You'll be able to tell because we're behind on all of our deliverables and we're not integrating as quickly as you can. You'll know far in advance of us trying to do that alternating vendor business. So, if you want to see that aircraft procurement curve bent—hopefully broken—then give us a shot."

THE AIR FORCE AS A STARTUP

Another of Roper's gambles has been to apply a Silicon Valley-style approach to defense technology. The Air Force created AFWERX—a tech "startup" within the Air Force aimed at spurring development and connecting companies with military customers, and AFVentures, which operates similarly to venture capitalists (VC), securing seed funding for new businesses developing military-relevant tools.

"We are kind of like an investor, we see a lot of technology, but we don't really think of it like a VC would, like we're seeding a lot of technology to have one of them come through and then end up paying for the rest," he said. Rather, the investments are more like an individual investor's, who is spreading money around to ensure a strong future in retirement.

"We're bringing that methodology into the Air Force, and it's sticking really well," Roper said. "In fact, sticking so well with us that the analysis we're doing of companies to put them on contract for these investments is so well received by private venture capitalists that ... every dollar that the Air Force is putting into commercial tech companies is being matched, on average, by four private investment dollars. We are literally multiplying our money."

The Air Force has embraced "pitch days" where small businesses pitch their concepts and many walk away with contracts, paid on the spot with a government credit card. These events showed that the Air Force—and Space Force—can cut through bureaucracy and quickly produce results, Roper said.

"We have small businesses working with us now that are building quiet, supersonic airplanes and attempting to build a hypersonic drone," Roper said. "These are small businesses, but we should just change the word small to agile, they're not small, they're agile. And you know, Yoda in "Star Wars" told us not to judge him by his size, and we shouldn't judge these companies by theirs either. So, pitch days are about providing them a level playing field to get their ideas to us."

Among the innovations fueled by Roper's "Agility Prime:" small, lightweight "flying cars." With the U.S. having failed to capitalize on its early lead in drone technology, with China instead becoming the global commercial leader for small, off-the-shelf drones. The Air Force launched Agility Prime in April expressly to encourage the development of comparatively low-cost "flying cars" to carry up to eight people at 100 mph or faster, at least 100 miles. Roper's aim is to have a small fleet of these micro aircraft by 2023. The Air Force's instigation could spur a whole new industry, he said, "There is a path for the military market to accelerate domestic use."

WHAT'S NEXT

Might Roper's changes last? Time will tell, but he is hopeful.

"Most of what we need are long-term changes that have to be started in the near-term, and my hope is that for efforts



Senior Airman Christian Conrad

David Strobel of Space Micro Inc., left, looks on as Capt. Ashley Feldman, a contracting officer, and Will Roper process payment on a small business grant using a government credit card during a Space Pitch Day event in November 2019.

that I think are important are that ... they'll be checked by the incoming administration," he said. "Do they think they're the right efforts? Do they think these are the things the military will need to be competitive long-term? And then look at the fruits that have been borne, given the time that they've had to mature," said Roper.

NGAD's success in flying a demonstrator within a few short years proves he's on the right track, Roper argues. "And when can you stay that of another program in recent department history?" he asked. Likewise, in just three years, AFWERX has helped attract \$4 billion in private venture capital investment to firms it's contracted. That demonstrates the programs have value.

ABMS could face the steepest hurdles, though Roper argues that having only been going "in earnest" for a year and a half, "we finally created cloud-enabled, AI kill chains that are able to make decisions that would take us tens of minutes today operationally," he said. That should convince skeptics.

"When I came into this job, we couldn't even code in the Air Force," he said. Today, air operations centers have their own software to improve operations, and there are native Air Force coding efforts, such as Kessel Run, to create apps, and Kobayashi Maru, focused on space operations.

Roper isn't sure what's next for him. He spent the past four years coming into the office every day to "help the military compete against China," he said. He learned a lot in the process.

"The Air Force really can change," Roper said. "I've taken back a lot of the things I thought about doing with innovation in a big bureaucracy. You can do it; it just is harder because there are more layers. And it's hard to message through those layers. And it's harder to build excitement and energy through them, because there are dampeners in the system. But, if you're willing to put in the calories to create the energy, the same processes that work at the small organizations work in big ones."

Indeed, the Air Force has already turned a major corner, Roper asserted. "I've seen it, in just the time I've been here, transcend its identity [from] being fighters ... to innovation," he said. "And there couldn't be a better pivot, given the competition that we face." ❖

Forging a SHIELD for the Homeland

A 'new era' of domestic air defense dawns.



Russian Federation Ministry of Defense

Russian incursions into U.S. air identification zones have increased in the past year. Here, two U.S. Air Force F-22 fighters appear visible in this video screen grab shot from a Russian Tu-95MS bomber as it approached Alaska, Oct. 19, 2020.

By Jason Sherman

A pair of F-22s scrambled into the arctic sky Oct. 19, in hot pursuit of two Russian bombers that had just penetrated the Alaskan Air Defense Identification Zone. It was, the 14th such incursion of 2020—a potentially record-setting, post-Cold War pace. It also highlighted growing concern among U.S. and Canadian commanders over domestic air defense.

The Tu-95 bombers, escorted by two Su-35 fighters and supported by an A-50 airborne early warning aircraft, were merely testing U.S. and Canadian responses, executing a dry run for a notional conventional strike on critical infrastructure in order to impair U.S. power-projection capabilities.

“The strategic threat to the homeland has entered a new era,” Air Force Gen. Terrence J. O’Shaughnessy warned Congress before he retired last summer, in the sharpest terms of his tenure as the dual-hatted head of U.S. Northern Command and the bi-national North American Aerospace Defense Command (NORAD).

“The strategic threat to the homeland has entered a new era.”

—Gen. Terrence O’Shaughnessy, then-dual hatted head of USNORTHCOM and NORAD

Russia and China, he said, have a range of new capabilities to hold the U.S. and Canada at risk with more than just nuclear strike options, including advanced long-range cruise missiles, maneuvering hypersonic strike weapons and cyber attacks to offset U.S. military power-projection advantages, and limiting U.S. diplomatic options in a crisis.

Such a prospect has prompted a rethink over the last year at the highest levels of the Pentagon about the need for a robust domestic air defense capability to protect the entire nation—which has long relied on two vast oceans and airborne defense against adversaries attacking the continental United States.

In the future, more will be needed, warned Mike Griffin, then Pentagon chief technology officer in an October 2019 memo. “Increasing adversarial capability and capacity challenge the United States to provide homeland air defense for our nation,” Griffin wrote. “Proliferation of enemy weapon

systems with global reach dictate that the United States can no longer presume domestic sanctuary.”

Griffin, who departed the Pentagon in July, directed the influential Defense Science Board to dig into the matter. The panel’s classified work is not yet complete, according to a spokesman, but a senior Air Force official said its early findings are already shaping plans, budgets, and modernization strategies at NORAD, specifically its new construct for domestic air defense.

SHIELD

Growing Russian and Chinese threats—specifically new long-range, conventional strike weapons designed to hobble critical domestic infrastructure—have NORAD seeking unprecedented air and maritime sensing capabilities, linked to joint all-domain command and control tools to guide a new array of anti-missile systems.

NORAD’s Strategic Homeland Integrated Ecosystems for Layered Defense (SHIELD) aims to harden maritime and air approaches to the United States to create a more capable, credible deterrent and complicate attempts to thwart U.S. force projection by attacking American airfields, ports, utilities, and economic significance.

“Our approach in the past has been to fight over there so that they don’t attack us here,” Air Force Brig. Gen. Pete M. Fesler, NORAD’s deputy director of operations, said in an interview. “Our adversaries recognize that, and they specifically developed methods to avoid our fielded forces and attack us in the homeland. So, this is no longer a choice of what type of fight we’re going to fight; our adversaries have made that decision for us. So we have to defend along

the whole continuum from all the way forward in the other theaters to all the way back here where forces originate.”

SHIELD builds on nearly two decades of work on Homeland Defense Design, a NORAD project launched in the wake of the Sept. 11, 2001, terrorist attacks that aimed to improve the U.S. military’s ability to find, fix, track, target, and engage growing air threats, such as those posed by cruise missiles, low-slow aircraft, and long-range aviation.

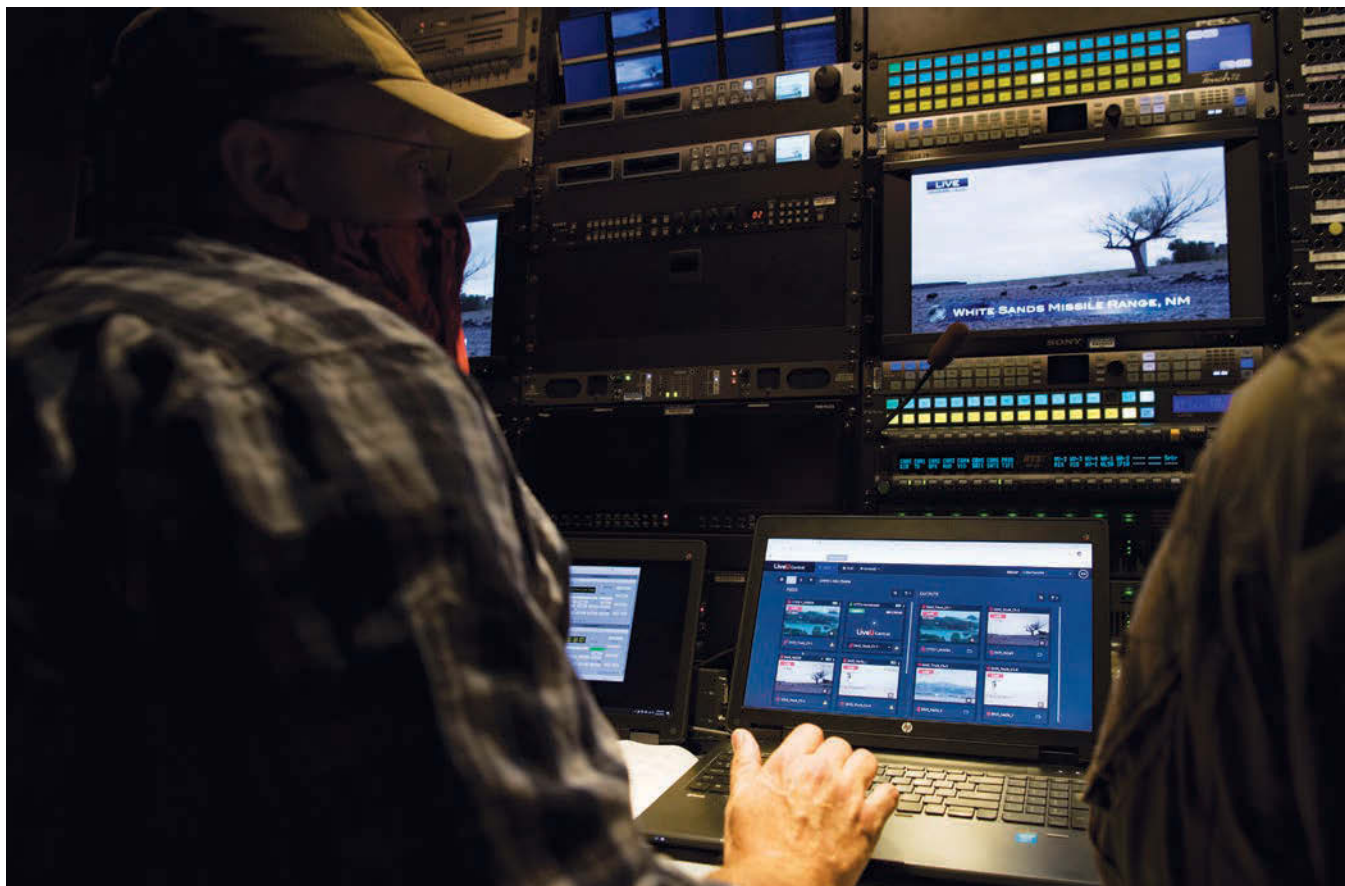
Homeland Defense Design was used to forge new air defense packages for the National Capital Region, with an original goal to scale that capability and replicate it across the nation to defend locations deemed critical.

However, plans to proliferate around the nation Homeland Defense Design Block 3 air defense capabilities were canceled because the cost of the sensors and guided missile systems needed to protect the national capital was too great to expand that to defend the rest of the country. Instead, NORAD is now proposing that SHIELD can provide a new conceptual backbone for future domestic air defense modernization.

Fesler said the need is urgent. Russia and China are exploiting seams in U.S. and Canadian domestic defenses, including sensor networks that detect approaching threats as well as the allies’ ability to coordinate command and control across their many disparate systems.

The new SHIELD strategy calls for improving air defenses through a combination of existing and new equipment in combination with new technologies across three areas: domain awareness, joint all-domain command and control, and defeat mechanisms.

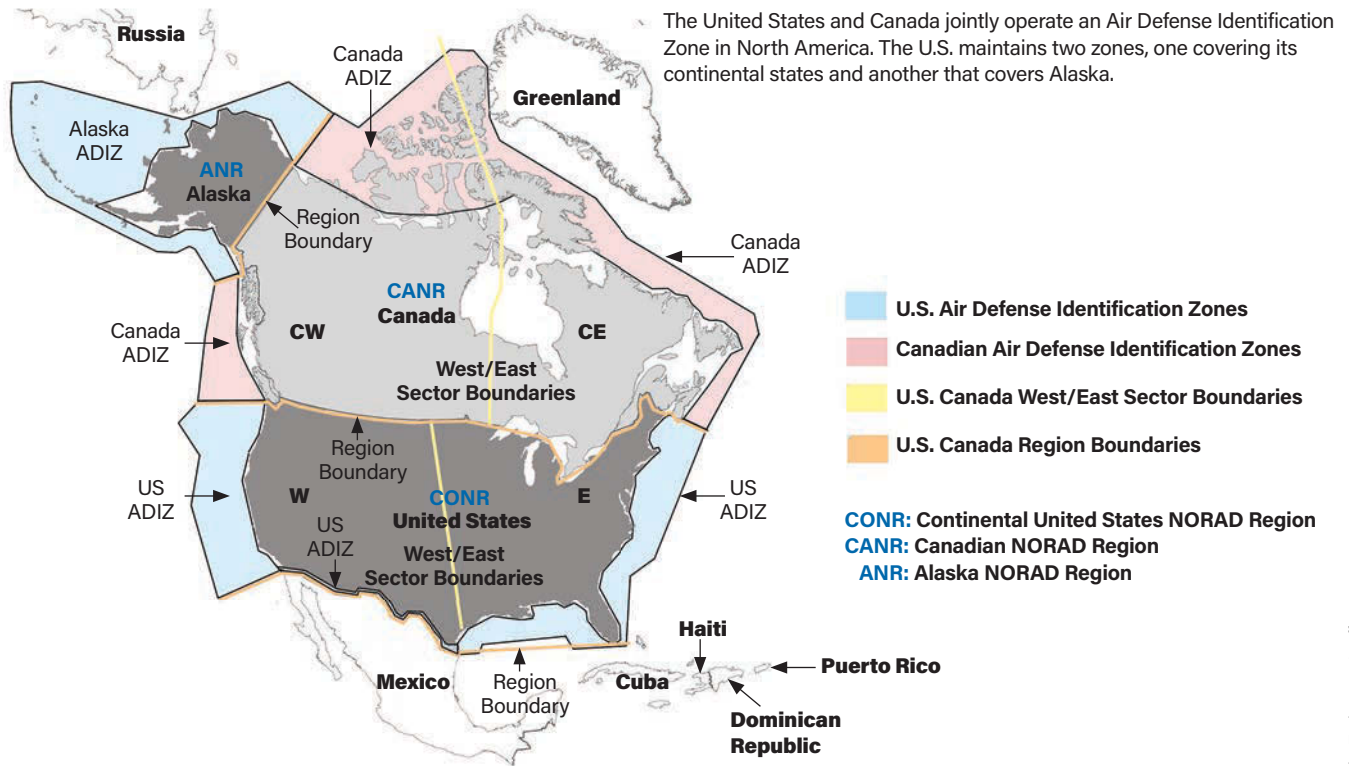
NORAD is keeping many details of the specific technol-



The Advanced Battle Management System On-ramp 2 exercise in August 2020 tested the agility of an interconnected battle network. Here, Jason Davis, a cyber technician, monitors a live feed from inside a production truck as part of the exercise.

Senior Airman Daniel Hernandez

North American Air Defense Identification Zones



Sources: NORAD/Eastern Air Defense Sector; USAF; FAA; Canada National Defense/Canadian Forces College

Mike Tsukamoto/staff

ogies that would constitute SHIELD under wraps. “As you can imagine, a lot of the stuff that we have, we talk about—specific capabilities and specific programs—immediately gets into the classified realm,” Fesler noted.

Still, he outlined the contours of the new concept and other senior leaders in various forums over the last year have pointed to new capabilities that are slated to be part of SHIELD.

DOMAIN AWARENESS

The SHIELD vision for homeland domain awareness calls for sensors—originally designed to provide information in a unique format to a designated platform—to instead feed data to a central repository where it is then available for access by all users across the enterprise.

“What SHIELD does differently than our previous approaches is really focused on not a single threat, but a range of threats,” said Fesler. “When I say multiple threats for a single sensor, that’s not to suggest we want to buy one gold-plated system that can do all things for all people. Rather, it’s the layering part of that, that really makes this unique. It’s a combination of using things like old systems that are being repurposed from their original design spec to give us data. It’s taking old technology and then using it not only in creative ways, but putting [new] computers on the back end of it, they help us pull more [data] out of those old systems. And in some cases, it’s the purchase of new systems and fill gaps that aren’t covered by any of those other things. That’s not the approach we’ve taken in the past. And I think that’s what’s maybe a little bit revolutionary rather than evolutionary when we look at SHIELD.”

A pilot project paired new computer processors with legacy Federal Aviation Administration (FAA) radars and proved able to detect and track very small unmanned aircraft without any modifications to the sensors

“One of the things that we’re finding particularly interesting is its ability to breathe new life into existing sensors by putting better processing power behind the sensors that already are out there,” Fesler said. “You can imagine what the computers looked like if they’re attached to a radar that was built in 1985. Now take modern computer processing and put it against that same radar. You get a pretty significant increase in capability.”

JADC2

DOD’s recent adoption of joint all-domain command and control as a collective, joint-service goal is critical to NORAD’s strategy. JADC2 technologies will be needed to tie together independent systems and then direct the best possible response, be it from the Air Force or Space Force, or the Army, Navy, Marines, Coast Guard, or Canadian forces.

The first two in a series of Air Force Advanced Battle Management System on-ramp events were conducted with NORTHCOM. The events focused on defending against cruise-missile attacks on U.S. territory. Fesler said both events aimed to showcase an ability to detect, track, and identify incoming weapons and then hand those tracks to a fire unit to destroy the incoming cruise missile.

“One of the things that we learned is, in order to enable that, you really need that robust command and control system that we talk about in SHIELD,” according to Fesler.

DEFEAT MECHANISMS

The third element of the SHIELD strategy deals with “defeat mechanisms” to blunt an attack. NORAD relies on weapon systems optimized for deployment overseas and capable of working in rugged environments, features that add cost. The SHIELD strategy seeks ways to reduce costs by optimizing for defense of domestic locations.

Patriot surface-to-air missile defense systems, for exam-

ple, were originally designed to protect Army units while on the move. They're built to travel over rough terrain and hardened to operate through chemical or biological attacks. NORAD believes it can cut costs by stripping out some of those features while retaining its advanced fire-control system.

In addition, SHIELD calls for adopting new, nonkinetic technologies, such as high-powered lasers and microwave weapons.

NORAD's current Integrated Air Defense System (IADS) deployed in the National Capital Region—featuring the National Advanced Surface-to-Air Missile System that utilizes an AIM-120 interceptor and its expeditionary system, the Deployable-IADS (D-IADS)—is an Avenger short-range air defense system.

CANADIAN BUY-IN?

In the past, the U.S. and Canada have not seen eye-to-eye on missile defense policy, which is one reason ballistic missile defense of the U.S. homeland is the domain of U.S. Northern Command, not NORAD. As SHIELD works to integrate guided missile interceptors or directed-energy weapons into the air-defense equation, the kinetic dimension could raise thorny issues for the two nations.

"If this works, it will be a great step forward," said Christopher Sands, director of the Wilson Center's Canada Institute. "If it generates the kind of pushback that it might from Canada, we will have to retool it to see if we can figure out a way to make something like this work."

NORAD has adopted a plan to implement SHIELD over time, using "spiral" improvements. The first step calls for repurposing and integrating existing sensors. The second calls for using data analytics with existing sensors, applying the Pathfinder pilot program to FAA and NAV CANADA (Canada's civil air navigation service) radar feeds.

NEW SENSORS

The third SHIELD spiral calls for fielding new sensors.

In January, the Air Force completed installation of new Northrop Grumman AN/APG-83 SABR radars on F-16s operated by the Air National Guard at Joint Base Andrews, Md. That project directly supports a NORAD Joint Emergent Operational Need to improve National Capital Region defenses against cruise missile threats. In February, the Air Force urged Congress to support fiscal 2021 funding for an additional 150 new radars for the F-16 fleet: "This program directly maps to the [National Defense Strategy] as it provides the most critical upgrade to the F-16's ability to successfully defend the homeland against attack," the Air Force said.

NORAD recently added a new wide-area surveillance system to provide overwatch of the National Capital Region consisting of the Stateside Affordable Radar System and Scorpion to detect and track low, slow, and related asymmetrical threats in and around Washington, D.C., airspace.

To provide point defense of other "critical" sites—whether domestic military posts, urban areas, or other "nodes" such as computer server farms, power stations, or transportation hubs—NORAD is now looking for new over-the-horizon radars to improve detecting cruise-missile and hypersonic threats.

The Missile Defense Agency (MDA), in direct support of NORAD and NORTHCOM, earlier this year established a new Cruise Missile Defense-Homeland architecture organization to explore folding in a new layer to the Ballistic Missile Defense System dedicated to these air-breathing



Raytheon

The National Advanced Surface-to-Air Missile System is a highly adaptable mid-range, air defense system integrated into the U.S. Capital Region's air defense toolbox in 2005.

threats. This organization is working with the Office of the Secretary of Defense and the Naval Surface Warfare Center, Crane Division in Indiana to assess an elevated electronically scanned array radar called Sentry that NORAD sees as having potential for mid-range detection. This sensor, one of a few elevated sensor options being assessed, would be used to detect and track targets with low-radar cross sections, such as cruise missiles and unmanned aircraft.

Other technologies being assessed include wide-area persistent surveillance systems, 360-degree-coverage fire-control sensors, command and control and battle management alternatives, and different defeat mechanisms, according to a Pentagon official.

Separately, Air Combat Command this fall was finalizing the Northern Approaches Surveillance Analysis of Alternatives (NAS AoA), a bi-national study with Canada's Department of National Defence—a project that aims to identify ways to improve NORAD's ability to counter airborne threats across vast geographic areas.

"The final NAS AoA report is being drafted and is expected to be reviewed by Air Force leaders this fall," said ACC spokeswoman Leah Garton. This study aims to present alternatives that reduce the life-cycle cost of legacy sensors for the U.S.-Canada North Warning System, while also enhancing air surveillance capabilities in the Arctic region, she added.

NORAD expects the AoA to inform U.S. and Canadian leaders on costs, capabilities, and potential material solutions "for the modernization of persistent, long-range, wide-area air surveillance in the northern approaches to North America," she said. The Air Force is eyeing fiscal 2023 to proceed with potential material solutions, and is forecasting a 10-year window beginning in FY25 to adopt new technologies and capabilities, while considering requirements beyond 2035.

Meantime, House lawmakers—in their version of the fis-

cal 2021 defense policy bill—recommended that MDA and NORTHCOM prepare a report on cruise-missile defense to identify “any vulnerability of the contiguous United States to known cruise-missile threats” and develop “a plan to mitigate any such vulnerability.”

WHAT COST?

NORAD has no authority to independently procure new weapons technology, so the command is reliant on persuading U.S. and Canadian defense officials to fund the SHIELD strategy.

NORAD officials declined to share cost estimates.

Instead, NORAD spokesman Bill Lewis, said “through the development of a purpose-built homeland defense capability, we actually reduce the demand for the forces provided by the services. ... SHIELD capitalizes extensively on existing capabilities, eliminating the need for an entirely new architecture.”

Fesler said he expects the Pentagon and Congress to support the effort.

“A lot of it is going to depend on what we actually buy and when the phasing is,” he said. “What I can tell you, though, is that the defense of the homeland is affordable. And it’s necessary. I don’t think there are very many people that would say, ‘Yeah, we just can’t afford to defend ourselves.’”

OPERATION NOBLE EAGLE

All these new technologies are designed to improve operations in U.S. and Canadian airspace that are rolled up in the 24/7/365 mission called Operation Noble Eagle, executing NORAD’s primary task: surveillance and control of North American airspace.

This operational mission, supported by about 200 exercises annually, aims to respond “rapidly and appropriately” to potential threats, using a graduated response culminating in the use of lethal force, if necessary.

Since resuming long-range bomber flights within North American striking range in 2007, Russia had triggered an

average of six or seven NORAD scrambles a year—through 2019. But in 2020, Russia increased its sorties dramatically.

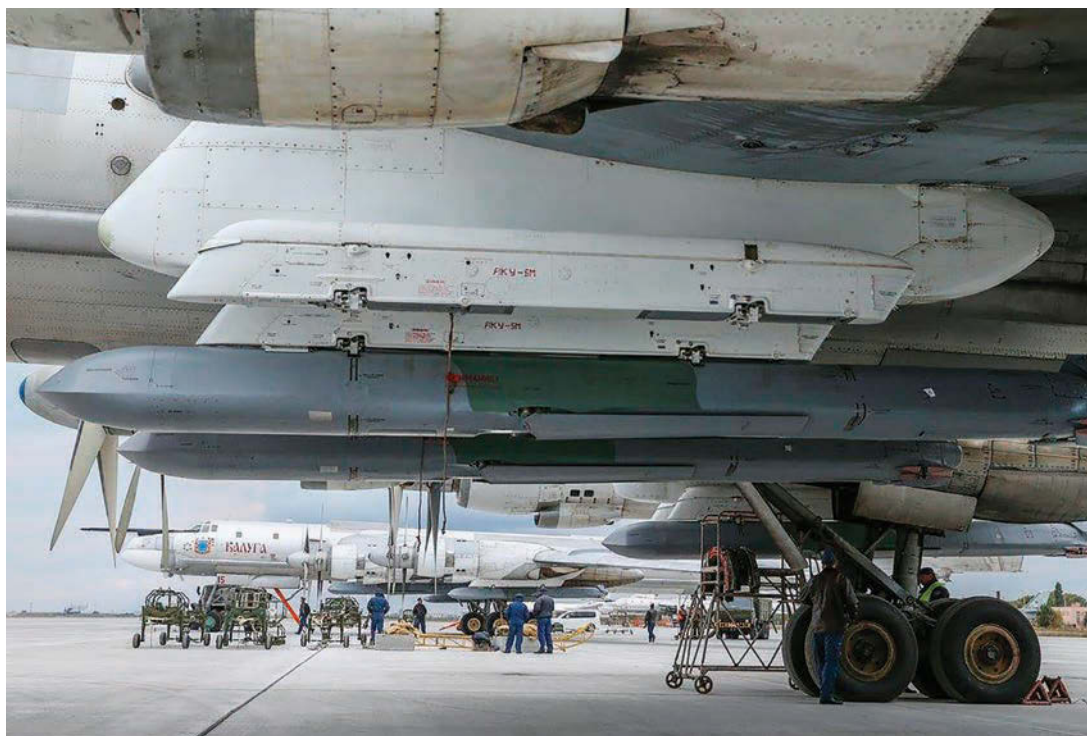
In September, NORAD declassified reports for the first time indicating that Russian approaches to North America peaked in 2014 at 15 missions. So, in October, when the two F-22s—supported by a KC-135 tanker and AWACS—intercepted the Russian bombers in international air space near the Alaskan shore, it marked a 14th, and a pace that left time for a new high to be set.

“During the Cold War, the Russians were very predictable,” said Steven Armstrong, NORAD vice director of operations. “If they wanted to launch some kind of attack against us in the air domain, specifically with their bomber aircraft, they had to fly to specific locations or points to be able to launch cruise missiles. And as we’ve seen over the last several years, in the last decade, specifically—like us, they have been able to update their weapon systems—so they don’t have to be as predictable. ... So now, they can take off and with their equivalent of a global positioning satellite system, they can go to a point in space and they can now actually launch weapons from their airspace and hit our assets in either Canada or Alaska and in some cases down in the lower 48.”

Russia’s new AS-23 cruise missile and the modular KA-LIBR-NK cruise missile system and its precise land-attack capabilities are of particular concern.

“The homeland is no longer a sanctuary,” said Armstrong. The Atlantic, Pacific, and Arctic oceans no longer provide the same buffer they used to. “All of that space between us and potential enemy combatants: it [once] took them time, it took them significant capability to get to our shores. That is no longer the case with some of the weapons systems that are being developed and capabilities that are out there. Now, we have to change our paradigm: We have got to be able to protect from a distance, not just as they come to us.”

Jason Sherman is a senior correspondent for Inside Defense. His last article for Air Force Magazine, “The Arctic Heats Up,” appeared in the January 2018.



Russian Federation Ministry of Defense

Russian Tu-95 bombers, shown here with wing-mounted Kh-101 cruise missiles at Engels Air Base, Saratov, Russia, probed U.S. and Canadian air spaces to see how they’d respond in October, the 14th such provocation of 2020.

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75 Years of Action: Highlights of AFA's Storied History

The Air Force Association has played a crucial role in support of the U.S. Air Force for 75 years—longer, in fact, than the Air Force has existed as an independent military branch. Today, AFA remains dedicated to its mission to Educate, Advocate, and Support the Air Force, its Airmen, and their families—and to do the same for the new U.S. Space Force, which celebrated its first anniversary in December.

Here are highlights of AFA's most notable achievements in its first 75 years.

Feb. 4, 1946



AFA is incorporated in Washington, D.C. Gen. Jimmy Doolittle is elected AFA's first president.

Sept. 18, 1947

The United States Air Force is made an independent military service, as a part of the National Security Act of 1947.

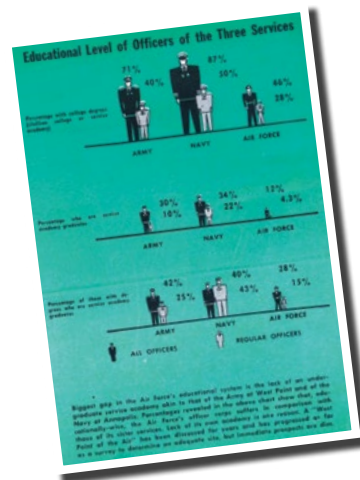
July 1946



Air Force Magazine, "The Official Service Journal of the U.S. Army Air Forces," becomes the official journal of the Air Force Association.

1948

AFA creates its award program and institutes the H.H. Arnold Award, the Flight Trophy (renamed in 1957 as the David C. Schilling Award), the Science Trophy (later renamed in honor of the late Theodore von Karman), the Arts and Letters Trophy (renamed in 1966 in honor of the late Gill Robb Wilson), and the Hoyt S. Vandenberg Award.

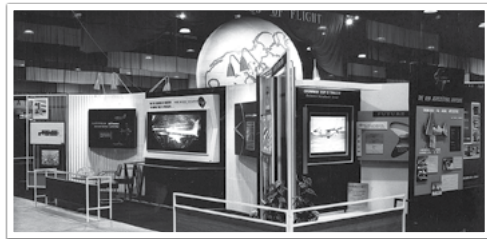


September 1951

The first "USAF Almanac" appears as the "Anniversary Issue" of Air Force Magazine.

May 1956

The Air Force Association Foundation (later renamed the Aerospace Education Foundation) is formally established.



April 1959

AFA's hosts the World Congress of Flight in Las Vegas. It is the first international air show in U.S. history. Some 51 foreign nations participated.



March 1964

AFA's Airmen's Council asks USAF to appoint a "Sergeant Major of the Air Force." Three years later, in 1967, the first Chief Master Sergeant of the Air Force is appointed.

August 1956



The Outstanding Airmen of the Year program is born at the Air Force Association's 10th Annual National Convention, held in New Orleans.

March 1967

The Aerospace Education Foundation undertakes "Project Utah" in cooperation with the U.S. Office of Education, demonstrating the feasibility of using Air Force technical training courses in the Utah public school system. This later leads to the creation of the Community College of the Air Force.



October 1969

Air Force Magazine cover story, "The Forgotten Americans of the Vietnam War," helps ignite national concern for American prisoners of war and those missing in action, after Readers Digest publishes a version of the story.

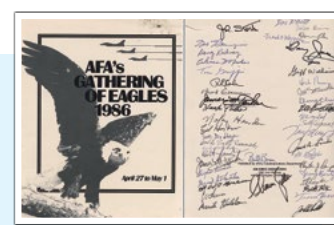
August 1984



AFA moves into its own building in Arlington, Va., after 38 years in the District of Columbia.

January 1985

AFA's 1st Tactical Air Warfare Symposium is held in Orlando, Fla. The event later grows into one of the Air Force's two annual departmentwide professional development events.



April 1986

AFA hosts the "Gathering of Eagles" in Las Vegas to honor WWI, Korea, and Vietnam War veterans.



September 1987

President Ronald Reagan invites the 12 Outstanding Airmen of the Year to the White House and pins the OAY Badge on each.



October 1990

AFA, in conjunction with the Air Force Chief of Staff, sponsors "Stealth Days" at Andrews Air Force Base, Md., to educate members of Congress about stealth technology. Members also view stealth aircraft, including the F-117, the B-2, and early development models of the F-22 and F-35.

January 1992

AFA leads the way in establishing the Air Force Memorial Foundation to build a national monument to the Air Force and Airmen in or near Washington, D.C.

March 1994

An AFA Special Report, "The Smithsonian and the Enola Gay," exposes the National Air and Space Museum's plan to display the B-29 that dropped the atomic bomb on Hiroshima as a prop in a politically charged exhibition critical of the mission. In response, Congress, the news media, and the public force the museum to change the exhibit and its approach to future exhibition planning.



September 1995

The Aerospace Education Foundation awards spouse scholarships to 10 select spouses from among more than 500 applicants—its first-ever spouse scholarships.

December 1995

AFA and the Military Coalition helps convince Congress pass legislation ensuring that "no state may impose an income tax on any retirement income of an individual who is not a resident or domiciliary of such state." As a result, military retirees are spared having to pay taxes to each state they lived in throughout their careers.

April 1997



AFA hosts the 50th Anniversary of the Air Force in Las Vegas, including a Global Air Chiefs Conference and an air show at Nellis Air Force Base.

September 1998

Some 587 AFA delegates personally deliver messages to Congress about the difficulty families have getting military honors at funerals for veterans and retirees. The Defense Authorization Act of 1999 orders that an honor guard detail of not less than three persons must be made available on request for any veteran's funeral.

March 2001

AFA successfully advocates for eliminating capital gains taxes on the sales of members' private residences as a result of a permanent change-of-station move.

March 2001

AFA successfully advocates for eliminating dual-compensation penalties for military members who immediately take civilian jobs in the federal government after retirement.

December 2002

AFA helps secure a Silver Star for Lt. Col. David B. Van Pelt for heroic actions during the Korean War—50 years prior.

August 2005

DAILY REPORT

Air Force Magazine launches the Daily Report, an email news product covering the Air Force, air power, and defense.

October 2006



The Air Force Memorial is dedicated, and the United States Air Force Memorial is presented to the nation. President George W. Bush attends.



May 2007

The Eaker Institute is renamed the Mitchell Institute for Airpower Studies in tribute to air power pioneer Billy Mitchell.

February 2009

AFA establishes its CyberPatriot Program and hosts its first competition. CyberPatriot was conceived by AFA to inspire high school students to pursue careers in cybersecurity or other science, technology, engineering, and mathematics (STEM) disciplines critical to our nation's future. The program evolves into a comprehensive National Youth Cyber Education Program, reaching thousands of elementary, middle, and high school students annually.



April 2010

AFA's CyberPatriot program expands beyond cadets, thanks to Northrop Grumman, which becomes its Presenting Sponsor.

November 2011

AFA establishes the Wounded Airman Program (WAP) to provide funds that go directly to helping seriously ill and injured Airmen.



September 2013

The Mitchell Institute becomes the Mitchell Institute for Aerospace Studies under the direction of retired Lt. Gen. David Deptula as its Dean.

April 2013

CyberPatriot expands to middle schools. Two years later, it further expands into elementary schools, and less than three years after that, to senior citizens through CyberGenerations, a program designed to help protect seniors from cyber pitfalls and exploitation.



November 2013



AFA's CyberPatriot becomes an international program, expanding to the United Kingdom (CyberCenturion). In the following years it puts down roots in Australia (CyberTaipan), Saudi Arabia (CyberArabia), and Japan (CyberSakura).

April 2014

AFA renames its headquarters building the "James H. Doolittle Building" in honor of its first president.

June 2014

CyberPatriot launches AFA Cyber Camps.

August 2014

Inspired by the success of CyberPatriot, the Secretary of the Air Force asks AFA to develop a Space-oriented STEM program like it. Two years later, StellarXplorers launches as a STEM education program with a curriculum and annual competition built on orbit determination, satellite design and launch vehicle planning.

April 2015



AFA's StellarXplorers program hosts its first competition. StellarXplorers is a rigorous, hands-on space system design challenge that involves all aspects of system development and operation, focusing on spacecraft and payload.

September 2016



AFA's Air & Space Conference is renamed to Air, Space & Cyber Conference to highlight the importance of the cyber domain in the Air Force.

December 2017

In collaboration with the Air Force and General Atomics, the Mitchell Institute establishes the Remotely Piloted Aircraft (RPA) Squadron of the Year Award.



December 2018

The Defense Advanced Research Projects Agency contracts with the Mitchell Institute to study the concept of Mosaic Warfare. It is the institute's first major contract. About a year later the Mitchell Institute is an approved vendor on the General Service's Administration's Professional Services Schedule.

April 2019

The Mitchell Institute establishes the General T. Michael Moseley Airpower Chair to develop and advance solutions for national security challenges through the domains of air, space, and cyberspace, and appoints Maj. Gen. Lawrence "Stutz" Stutzriem, USAF, (Ret.) to the position.



December 2019



After successfully seeing the Air Force Memorial designed, constructed, and operated for 13 years, AFA stood down its Air Force Memorial Foundation and granted ownership of (and trademark rights to) the Air Force Memorial to the Air Force District of Washington.

December 2019

The U.S. Space Force is created as an independent military branch inside the Department of the Air Force.

April 2020

In the face of the COVID-19 pandemic and a national lockdown, the Mitchell Institute launches Aerospace Nation, a new virtual medium to help top Air Force and Space Force leaders converse with the public and the media.



May 2020

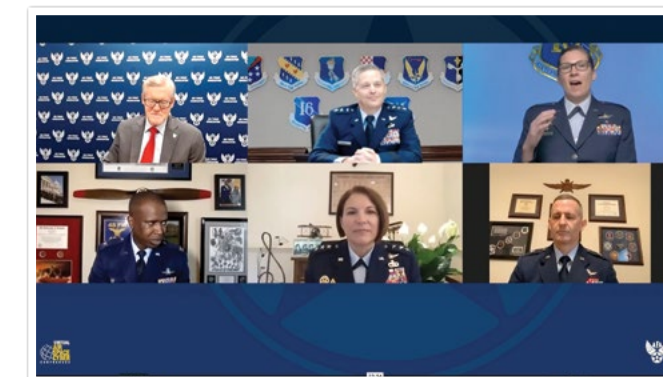
AFA updates its mission statement, establishes a formal commitment to support the new U.S. Space Force.

September 2020

AFA dedicates the General James Doolittle Leadership Center to improve warfighter and industry leadership interaction.



September 2020



AFA hosts its first-ever virtual conference, necessitated by the global pandemic. The virtual Air, Space & Cyber Conference uses a TV news format to facilitate its national conference, with 10,000+ registrants.

October 2020

AFA renames its Air Warfare Symposium the Aerospace Warfare Symposium, in recognition of the growing importance of space and the ascendance of the U.S. Space Force.

November 2020



Lockheed Martin becomes Presenting Sponsor for StellarXplorers enabling further expansion. One month later, former Lockheed Martin Chairman Norman Augustine is named Chairman of StellarXplorers Board of Advisors.

December 2020

The Mitchell Institute establishes the Neal Blue Chair for Space Studies.

This timeline, compiled by AFA staff, highlights only a few of the Air Force Association's achievements over the past 75 years. Got a favorite AFA milestone not included here? Tell us at letters@afa.org.

5G Netcentricity

The coming revolution in networking will redefine the concept of sensor fusion.

Mike Tsukamoto/staff, USAF; Google Earth



An R9X Hellfire missile can strike one individual in a car without hurting the other passengers. Digital technology enables such precision—and will only become more advanced with 5G networks powering artificial intelligence.

By Lt. Col. Anthony Tingle, USA (Ret.)

The U.S. government now has the ability to deliver munitions so precisely that it is using explosive-free Hellfire missiles fitted with blades to kill passengers inside a vehicle without collateral damage. As the physical means to kill enemies becomes evermore automatic, the identification, tracking, and targeting of those individuals become the critical components of the kill chain.

Prompted by the digital revolution and corresponding advances in data transfer, manipulation, and storage, information has taken on increased value in warfare. With the advent of Network Centric Warfare (NCW) in the 1990s, the U.S. military sought to apply commercial digital information sharing to warfare. NCW became the cornerstone of military information infrastructure development.

Today, information warfare dominates discussions on military operations and technology acquisition. Just as they did in the 1990s, civilian technological developments signal new uses in information



Anthony Tingle was the concepts evaluation branch chief at U.S. Army Space and Missile Defense Command and writes on research, development, and the application of technology at the Department of Defense. Download the entire paper at www.mitchellaerospace-power.org.

warfare. Fifth-generation (5G) cellular network technology stands to revolutionize battlespace sensing and the way militaries approach data. Rapid growth of networking technologies is driven by powerful and small microelectronics, automated data manipulation and artificial intelligence, and advanced wireless connectivity. 5G networking technologies such as these will converge to enable future capabilities and present a new theory of information dominance based on these projections.

NETWORK-CENTRIC WARFARE

Today's networking technologies are quickly evolving, enabling them to move more data, more rapidly, than ever before. The emergence of 5G networks presents the ability to add more sensors to our networks and will change the very nature of civilian communications. Likewise, 5G will present new opportunities to change how we conduct military intelligence and targeting.

5G does not represent a single technology, but a confluence of them. Its cellular antennae are

smaller and consume less energy than older generations, and their ability to exploit the advantages of beamforming allow them to send signals only where necessary. 5G's massive multiple-input, multiple-output (massive MIMO) architecture will support far more traffic than existing technologies. Just as these capabilities support an "Internet of Everything" in the civilian world, it can likewise support an "Internet of Military Things" to enable the "combat cloud." The network will have lower power requirements, lower latency (that is, minimal signal delay), and greater data capacity.

5G technology will enable the network-centric future envisioned years ago, where each person, vehicle, drone, or other system is interconnected, sharing sensor data among systems. Additionally, the reduced size and cost of 5G sensors could increase the number of simple sensors across the battlespace. Aerial assets could drop these small, low-power sensors into a conflict zone.

With thousands of sensors working in concert, combat sensor networks could collect data on scale with the likes of Google, Facebook, and Amazon, providing an ever clearer picture of the battlespace.

From the earliest days of the internet, it has been clear that the rapid connectivity and information flow digital communications provides would revolutionize military operations. Early advocates cited Metcalfe's Law to illustrate their point: The value of a network increases exponentially with the increase in the number of interconnected nodes. The theorem's shortcomings are immediately obvious. First, the value of some nodes is inherently greater than others, especially those that provide greater information. For example, in a missile early warning network composed of land- and ship-based radars, the ship-based radar is often weaker and may be of less value in terms of total detection capability. Additionally, the smaller the network, the more valuable the addition of another node is to the overall power of the network. In very large networks, like the type represented by the interconnected users on Facebook, the addition of one more user will not represent an exponential increase in the value of the website. Yet Metcalfe's Law remains germane to network discussions precisely because of its simplicity. It is still used today to discuss large interconnected environments, such as those involving Bitcoin.

ANALYZING BATTLESPACE DATA

Between 1965 and 1972, the U.S. flew 871 sorties against the Thanh Hoa Bridge in Vietnam. Only after the introduction later that year of laser-guided bombs was the bridge destroyed. Other conflicts, such as the first Gulf War and Bosnia in the 1990s, showed that destroying the target is no longer the imperative to military success—finding the *right* target is what is paramount. Battlespace data is now the most important component in defeating an enemy, and the first step in developing a theory for the next evolution of military sensing is observing the way the military uses data in the battlespace. In its simplest form, data is used to locate, identify, and track the enemy.

Currently, making battlespace inferences is complicated by the volume of data. As data increased from satellite, aerial, and other sensors, analysts have been overwhelmed. The result is that signals begin to become noise. Analysts are forced to determine which sensors provide the most valuable data and most useful information, and which supporting data is necessary to make predictions. In effect, they predict which supporting data they need, turning battlespace intelligence into a system

of probabilities in series. This makes for an ever-destabilized intelligence cycle.

Here is where the future of battlespace networking gets interesting. The solution to this deluge of data may not be better, more powerful sensors, nor the ability to select the most appropriate and accurate sensors at a given time and place. The solution for too many sensors may be more sensors.

DATA SATURATION

The underlying assumption necessary for a new theory of battlespace data collection is that emerging technologies will revolutionize battlespace sensing. Moore's Law states that computer speeds will double roughly every 18 to 24 months. When you apply that to 5G networking, it's clear we can anticipate continued decline of cost and size of advanced electronic sensors and communication equipment, along with corresponding advances in data processing and storage, and the realization of automated data analytics, including artificial intelligence and machine learning. The confluence of these technologies should allow for a massive network of small, inexpensive, low-power electro-optical, sonic, and thermal sensors to be placed or air-dropped by the thousands into an operational theater. They would supplement the ever-expanding list of networked sensor sources, both manned and unmanned, in every domain.

By effectively saturating the operational environment with sensors, we can produce a more complete picture of the conflict zone. Analysts and operators will no longer search for the enemy so much as remove benign data. In other words, instead of searching for the glint of the needle in the haystack, they will rapidly remove the hay. Battlespace data collection will shift from seeking anomalies to applying analysis and correlating to a "baseline" of the battlespace.

Instead of searching for the glint of a needle in the haystack, analysts will soon more rapidly remove the hay.

IMPACT ON PREDICTION

The application of this theory has two major ramifications. First, sensor saturation will reduce the necessity for and increase the accuracy of battlespace prediction. Greater knowledge of the battlespace will make it easier to discern the location and description of nefarious actors. Additionally, knowledge gaps will be more readily filled; the new network will increase certainty about known enemies and help predict enemy actions.

Here we can look to the stock market for insight. In financial markets, data and analysts drive the models investors use to anticipate price movements for stocks, bonds, and indices. Knowledge is power and more information is usually better. Even so, few can beat index-investing with any regularity. Stock picking remains a "random walk." Why?

First, the data inputs (or sensors) used for stock picking do not directly predict price movements. The specific inputs also do not account for additional inputs that come with market fluctuation. Let's take the price of corn futures, for example. Sensor inputs to the price of corn futures could include satellite imagery showing the relative condition of local and global corn fields, as well as applicable weather predictions. Given the basic principle of supply and demand, total knowledge of the future global corn-crop yield and the total future demand for corn, analysts could still not accurately determine the future price. Perhaps the most influential reason for this predictive shortcoming is what John Maynard Keynes called "animal spirits"—that is, the human emotional factor in the trading of stock prices. Additionally, other factors may influence stock

price movements, including unpredictable industry expansions, regulatory decisions, and natural disasters. It is generally accepted, however, that the greater amount of specific information influencing a market sector (e.g., corn-crop yield), the greater the probability of predictive success.

Now, let us consider the central objective function of military data collection, which is to identify and locate specific entities across the battlespace—a very specific objective with a well-defined end state. Yet, unlike the large number of stock information inputs, the sensor inputs in the battlespace more directly contribute to the objective. These sensors discover the identity and location of the target at a discrete time. Detection and identification of a target are the primary objectives of the data collection.

If financial analysts have been unable to predict stock prices given the amount of information, analysis, and raw resources available, then how will militaries be able to predict enemy actions, movements, or intents? Given enough sensors and the proper “infostructure,” battlespace intelligence will transform from a system that detects sensor inputs to one that detects environmental abnormalities, develops useful correlations in the data, and provides a holistic analysis of the operating environment.

MORE SENSORS, MORE DATA

Today, the U.S. military seemingly has a surplus of battlespace data, so much that the inclusion of more data raises fears of distraction, a detriment rather than an improvement. The value of the additional data is effectively offset by a corresponding increase in noise caused by the excess. So if the system itself begins to become the noise, then the information in the system is reduced, as is the value of the network.

There is an addendum to Metcalfe’s Law called Zelf’s Law, also known as the “long tail” theory of the value of the lower-tiered contributors to the network. Zelf’s Law posits that each additional node on a network decreases in relative value. In terms of the battlespace sensor mosaic, an analogy for Zelf’s Law is the television pixel. In the extreme case of a one-pixel network, that one pixel would be extremely valuable, perhaps indicating on or off, day or night. As we add pixels to this imaginary battlespace TV, each additional pixel helps describe and form the picture. The value of the system increases exponentially, as predicted by Metcalfe. Yet, as we reach the fidelity of modern televisions with thousands of pixels, the value of each individual pixel is reduced. In terms of discerning the actual picture, the value of one of these pixels effectively goes to zero—one pixel barely contributes to the overall picture.

Likewise, in extremely large battlespace data-collection networks, the value of the average individual sensor approaches zero. In these types of networks, the “message internals,” or the actual data that the average sensor is transmitting, is of ever-decreasing value. Conversely, the “message externals,” or those parts of the message that describe the message itself,

such as date, time, and location, become more important. The network becomes Boolean, with each sensor simply on or off (detecting or idle).

What this sensor-saturation theory describes for future battlespace sensing is a television picture with thousands of pixels (sensors). Each of these sensors is simply on or off—transmitting message externals—at a given time. It is the activation pattern of these sensors that allow for detection—by removing the hay to find the needle—or predictive analysis. The predictive analysis on these thousands of data points is similar to the big data analysis performed by Amazon.com to predict which products shoppers may want to see at a given time.

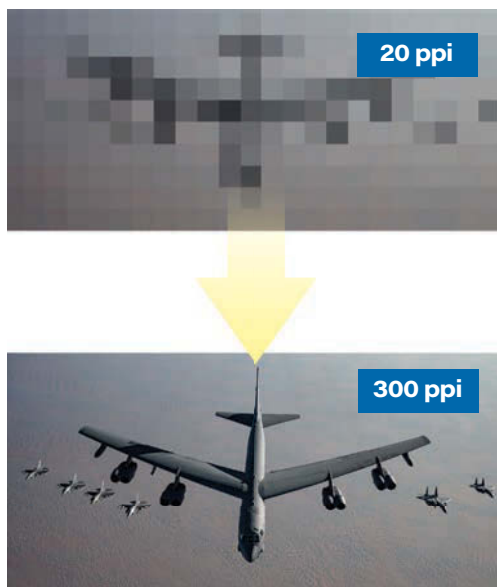
HIGH-FIDELITY TARGETING

One of the fundamental data fusion problems—configuring the data to be compatible across a network—becomes less formidable as the speed and power of 5G networking becomes available. Additionally, the data that comprise the message externals are minute compared to the internals. Thus, this future network may have the added bonus of less overall actual bits transmitted per sensor. The military may then become less reliant on individual complex sensors, and instead enable large sensor networks to complete a higher-resolution picture of the battlespace, much like adding pixels to a television improves the definition of the picture.

Thousands of miniature interconnected sensors could provide new fidelity on the targeting cycle; faster data processing enabled by modern networks would likewise counteract the growing problem of wasted intelligence data by enabling faster and more thorough data analysis. By flooding the battlespace with sensors, the network is strengthened, even as each individual sensor is devalued; the message externals become more valuable than the internals. With these emerging technologies, analysts will approach data holistically, reducing the need for analysts to rely on intelligence spikes in the operating environment. Moving ahead, however, they face a two-fold problem.

First, the military will very likely lag behind the commercial sector in developing sufficient “infostructure” to take advantage of massive sensor data, including shortfalls in data storage and AI computational power. Second, military organizations lack necessary and sufficient abilities to successfully manipulate large data, AI learning, and prediction models. The military and Intelligence Communities can begin remedying the latter problem today by accelerating the application, testing, and acceptance of universal data models.

The sooner the U.S. military acts on this networking eventuality, the better it will be positioned relative to our rivals in the future. Success will require a holistic approach focused not only on acquisitions and research and development, but also systemic changes, including those in doctrine, organization, and tactics. An underlying theory of data collection and analysis that accounts for future technologies will guide the development of the next evolution in NCW. ✪



Just as adding pixels improves the resolution of an image (as illustrated here), adding sensors will yield a clearer picture of the battlespace in the future. Metcalfe’s Law posits that the value of such a system increases exponentially as pixels are added.

Mike Tsukamoto/staff; photo: Staff Sgt. Sean Carnes

Honoring the 75th Anniversary of the B-17 Flying Fortress

Legal Tender, Limited-Edition Coin

Genuine legal tender silver-plated coin

38.6 mm diameter

2016 and the profile of Her Majesty Queen Elizabeth on the obverse



One Crown denomination

Special 75th Anniversary logo marking the historic introduction of the B-17 Bomber

Dynamic portrait of the legendary B-17 Flying Fortress Bomber by Joel Iskowitz

Without the B-17, we might have lost the war.

— General Carl Spaatz, Commander, US Strategic Air Forces in Europe, 1944

KEY DETAILS

EVENT: The 75th Anniversary of the introduction of the B-17 Flying Fortress, that helped “the Greatest Generation” achieve Victory in World War II.

LIMITED RELEASE: This historic coin collection is strictly limited to only 1,941 total collections. Due to the extremely low quantity available, only the earliest applicants will be able to successfully secure this genuine legal tender coin.

GENUINE LEGAL TENDER: Intended as a collectors’ item, this legal tender silver-plated crown is offered in coveted Proof Condition. Fully plated with genuine silver, it bears a portrait of the B-17 Flying Fortress and a winged 75th Anniversary logo.

SECURED AND PROTECTED: Your coin arrives secured in a crystal-clear capsule to enjoy for years

Artist Joel Iskowitz This renowned coin and aviation artist has had over 27 designs for U.S. coins and medals minted. His aviation work is on permanent display at the NASA Kennedy Space Center and USAF Museums. The Bradford Exchange Mint is pleased to present his artwork in *The All-New 75th Anniversary of WWII Bombers Silver Crown Collection*.

A Salute to Democracy’s Flying Fortress

During World War II, victory wasn’t a given. It took blood, sweat, tears, and the mighty muscle and innovative design of a legendary aircraft to keep freedom soaring. Now you can salute the 75th anniversary of the iconic aircraft that flew “The Greatest Generation” to victory, with *The 75th Anniversary of the B-17 Flying Fortress Bomber Silver Crown* from The Bradford Exchange Mint.

The reverse of this magnificent legal tender coin showcases a winged 75th anniversary logo. It’s joined by powerful B-17 imagery by American coin and aviation artist Joel Iskowitz. America’s storied four-engine heavy bomber began its wartime service in 1941. First deployed by the Royal Air Force, it served the Allies with distinction in most every combat zone. The B-17 was revered for its ability to keep flying, even with damage, and bringing its crew home. The obverse features Her Majesty Queen Elizabeth II, marking it as official legal tender of Tristan da Cunha. Lavishly plated in genuine silver, your coin arrives in coveted Proof condition, preserved for posterity in a crystal-clear holder. Don’t miss this chance to acquire this striking tribute as well as additional issues to come in *The All-New 75th Anniversary of WWII Bombers Silver Crown Collection*.

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Romance of the Air

Barnstormers, wing walkers, and air racers lit the spark to enchantment with aviation.



Al Wilson clings upside down to the wing of a Curtiss Jenny JN-4, putting his head on the upper wing of another, in a daredevil stunt at Chaplin Field, Calif. in the 1920s.



Frank S. Luqueer Photo Collection/San Diego Air and Space Museum

A wing walker “trains” a fox on the upper wing of a Curtiss JN-4 Jenny during a barnstorming event.

prices dropped as the Air Service sold its excess inventory directly to the public.

Maximum speed was 75 mph but the Jenny could be throttled down for a slow pass a few feet above the ground where the spectators got a good look. With modification, it could be landed at 35 mph.

“The slow-flying Jenny was perfect for wing walkers who clung to the Jenny’s maze of struts, the straight wheel axle, or the king posts above the wings while performing death-defying stunts for the crowds below,” says a posting by the National Air and Space Museum.

Old photos show wing walkers working in smooth-soled boots, no safety harness in sight. In an especially spectacular feat, a Jenny at low level would overtake an open-top automobile speeding along the airstrip. As the airplane approached, a stunt man in the car reached upward to grab a rope ladder dangling from the lower wing and was yanked into the air.

With plenty of airplanes and pilots on hand, between 500 and 600 young fliers flocked to the barnstorming circuit.

AERIAL CIRCUS

“Air shows changed significantly,” said David H. Onkst, writing for the U.S. Centennial of Flight Commission. “In the past, spectators had usually gone to airfields to see an exhibition, but after the war, stunt pilots and wing walkers brought their shows to the people, even in the most remote areas.

“As a result, barnstorming became one of the era’s most popular forms of entertainment. Essentially, when a barnstorming show toured a region, most towns in the area would shut down on the spur of the moment so that everyone could see the exhibition.

“The pilot or teams of aviators would then land at a local farm (hence the name ‘barnstorming’) and negotiate with the farmer for the use of one of his fields as a temporary runway from which to stage an air show and offer rides to the customers,” Onkst said.

It was dangerous, of course, but danger was part of the attraction. In 1923 alone, there were 179 barnstorming accidents, in which 85 were killed and 126 injured. There were no federal regulations governing aviation.

By the late 1920s, though, “new safety regulations forced the demise of the popular entertainment,” Onkst said. “Such laws made it nearly impossible for barnstormers to keep their already fragile Jennys up to specification (let alone in the air)

By John T. Correll

In the 1920s, a great wave of excitement about airplanes and flying swept the nation. It is remembered as the Golden Age of Aviation, part of the “Roaring Twenties,” a period of flamboyant change that overlapped with the Jazz age, the prohibition era, and the Depression.

Flying was still relatively new with lots of rough edges. The state of the art was open-cockpit biplanes with lightweight wood frames covered by doped fabric. However, aviation was developing rapidly along with other technologies that included the emergence of motion pictures, radio, and everyday use of automobiles.

First came the barnstormers, rough-and-ready pilots in war surplus airplanes bought on the civilian

“After the war, stunt pilots and wing walkers brought their shows to the people, even in the most remote areas.”

—David Onkst, aviation historian

market for as little as \$50. They fanned out in large numbers to airstrips and farmers’ fields for shows that featured aerobic maneuvers, inverted flight, wing walkers, and stunt performers clambering from one airplane to another in flight.

Higher up the status ladder were the air racers, who competed for trophy honors and cash prizes in airplanes of advanced design. Race results were front-page news in *The New York Times* and the most successful pilots—such as Jimmy Doolittle and Roscoe Turner—were famous.

The popularity of aviation peaked in May 1927 with Charles A. Lindbergh’s solo nonstop flight in his monoplane, *The Spirit of St Louis*, from New York to Paris. It was the occasion for worldwide celebration.

The romance of the air continued into the 1930s,

spurred along by the movies and other factors. The barnstormers were no longer part of it, though, pushed aside by the rising cost of aviation as the old biplanes were supplanted by closed-cockpit monoplanes of all metal construction. New laws and safety regulations put an end to the more dangerous aspects of the exhibitions.

THE JENNY

Almost all of the barnstormers flew the same kind of airplane: the Curtiss Jenny. It was America’s first mass-produced aircraft, a two-seater with a conventional wood and fabric structure, 27 feet 4 inches long and a wingspan of 43 feet.

Ninety percent of U.S. pilots in World War I trained on the Jenny. The definitive design of the series, the JN-4D, was introduced in June 1917. Total production was 6,070, of which some 3,300 were available as surplus in 1919. Jenny

Jimmy Doolittle poses beside a Granville (Gee Bee) R-1 Racer. Doolittle in 1932 set two speed records in the stubby, dangerous little airplane. Doolittle shrugged off the instability of the Bee Gee because it was "the fastest thing going."



National Air and Space Museum

and outlawed several forms of aerial stunts, at least at a low enough altitude where crowds could easily view them."

Some of the larger air shows, particularly those staged from regular airports, advertised themselves as "air circuses."

AIR RACERS

A step up from the dusty air shows were the big air races, sponsored by manufacturing companies and wealthy aviation enthusiasts and offering large cash prizes to the aviators who flew their airplanes, often custom built, to victory.

There were four major trophy races—the Schneider, the Pulitzer, the Thompson, and the Bendix—and national newspapers gave them detailed coverage in front-page articles. In 1929, the Thompson competition was merged into the National Air Races, a 10-day series of events that became the most important of the racing venues. In 1929, more than half a million people attended the National Air Races, which were held in Cleveland. The *New York Times* called it "the greatest annual air pageant in the United States."

The leading air racers also set important records on their own. Among the best known of the contenders was James H. Doolittle, who gained fame early. His self-deprecating wit concealed a driving ambition.

Doolittle set his first record in 1922 as the first pilot to make a transcontinental flight of the United States in less than 24 hours. He won the Schneider Trophy in 1925 and the Bendix in 1931. He went on to lead the air raid on Tokyo in 1942 and command 8th Air Force in Europe. In 1946, he was elected as the first president of the new Air Force Association.

The 1932 National Air Races were a showcase for Doolittle. He won the 100-mile Thompson Trophy with an average speed of 252 mph and in a separate event, set a world speed record at 296 mph.

In both instances, he flew a Granville Brothers "Gee-Bee" R-1 Super Sportster, which stood out—even among experimental aircraft—as strange-looking. Just 17 feet long, it has been described as "the smallest possible airframe constructed around the most powerful available engine."

The stubby Gee Bee was notoriously unstable, but very fast. Doolittle knew it was dangerous but flew it anyway because, he said, "it was the fastest thing going."

LINDBERGH

Lindbergh bought his first airplane—a war surplus Jenny, of course—in 1923, when he was 20 years old. Even before that, "I began to do a little wing walking," he said, "flying low over town while I was standing on one of the wing tips." He became an air mail pilot in 1926.

His eye, however, was on bigger things. A purse of \$25,000 was offered by hotel owner Raymond Orteig to the first aviator or aviators to fly nonstop from Paris to New York or New York to Paris.

Two British airmen, John Alcock and Arthur Brown, had already made the first nonstop transatlantic flight, but it was from Newfoundland to Ireland. Lindbergh's flight from Roosevelt Field in New York to Paris would be nearly twice that distance.

Ryan Airlines Corporation built a single-engine airplane, *The Spirit of St. Louis*, to Lindbergh's specifications. To save weight it had no radio, gas gauge, night flying lights, navigation equipment, or parachute.

Lindbergh landed at Le Bourget Field in Paris May 21, 1927, after a grueling flight of 33.5 hours. Tens of thousands had gathered to await his arrival. He won the Orteig prize and returned to further acclaim in the United States. Four million people lined the route of a parade in New York, and he received the Medal of Honor by special act of Congress.

His flight added considerably to the public's enthusiasm for aviation. This showed up in the form of popular songs and movies and supposedly was the inspiration for a popular dance, the Lindy Hop.

MOVIES

The lore of flight and airplanes flashing across the screen were an ideal fit as motion pictures expanded from silent

films to higher-budget sound epics. The studios recruited former barnstormers to do the flying.

First of the major features was “Wings,” released in 1927. It was set during the battle of Saint-Mihiel in World War I and won the Academy Award for Best Picture, the only silent film ever to do so. Gary Cooper, just starting out, had a small role as a cadet.

“Wings” was a box office success and the yardstick against which future aviation films would be measured. “Hell’s Angels,” produced in 1930 by Howard Hughes, sought to rival the success of “Wings” and was well received.

Best remembered of the big aviation movies was “Dawn Patrol.” It was done twice, starring Douglas Fairbanks Jr. in the 1930s version and Errol Flynn in the 1938 remake.

Almost forgotten, however, is “Plane Crazy,” from 1928, one of Walt Disney’s last silent animated films. A rubber-legged Mickey Mouse takes his girl friend Minnie up on a flight. The silent cartoon did not go into distribution and was remade as a sound cartoon, which appeared in 1929.

Newspaper comic strips followed suit. “Scorchy Smith,” featuring pilot-for-hire Scorchy, was introduced by the Associated Press in 1930. It became the syndicate’s leading strip, published in 250 newspapers. “Smilin’ Jack,” built around another flying soldier of fortune, ran from 1933 to 1973.

The definitive artist for “Scorchy Smith” was Noel Sickles. He drew in a bold, cinematic style that was adapted and made his own by Milton Caniff, who shared a studio with Sickles. Caniff began “Terry and the Pirates” in 1934, but in the beginning, Terry’s adversaries were river pirates and renegades along the China Coast. The strip did not take on its classic aviation theme until 1941.

NEW OPTIONS

New possibilities were demonstrated regularly in speed, distance, altitude, and duration. The Army Air Service—the Air Corps after 1926—was in the thick of it, hoping to gain in roles and missions and the federal budget by calling public and congressional attention to remarkable improvements.

■ In 1924, the Army Air Service completed the first circumnavigation of the globe in Douglas World Cruisers,



U.S. Information Agency via National Archives

Charles Lindbergh and *The Spirit of St. Louis* after Landing in Paris, 1927. His nonstop flight from New York to Paris sparked the imagination of would-be aviators everywhere.

single-engine, two-place, open-cockpit biplanes built to Army specifications.

■ Four crews started on the voyage in Seattle, but only two of the airplanes made it all of the way. The route went via Japan, India, the Middle East, Europe, across the Atlantic, and back to Seattle, a distance of 27,553 miles. The trip took 175 days and overflew 28 different nations, with the aircraft making 72 stops en route.

■ The *Question Mark*, a Fokker C-2 commanded by Air Corps Maj. Carl A. Spaatz, remained aloft Jan 1-7, 1929, setting an endurance record for refueled aircraft of 150 hours, 40 minutes, 14 seconds. The crew included three future generals: Spaatz, Capt. Ira C. Eaker, and Lt. Elwood R. Quesada. It was a high point in the demonstration of aerial refueling, the first instance of which had been in 1921 when Wesley May, with a five-gallon can of gasoline strapped to his back, climbed from the wing of one aircraft to the wing of another.

■ The formidable Jimmy Doolittle contributed to the expansion of capabilities as well. In September 1929, Air Corps Lt.



San Diego Air and Space Museum

Stunt woman Gladys Ingle gets ready to jump from Bob McDougall's airplane to Art Goebel's Curtiss JN-4 airplane. Ingle was a member of the 13 Black Cats, an aerial daredevil team that did stunt work for Hollywood in the 1920s.

Howard Hughes and his H-1 racer, built by Hughes Aircraft, in 1935, The Hughes H-1, piloted by the eccentric businessman, set a world air speed record, a transcontinental speed record, (across the United States), and, in 1935, the world's land plane speed record at 352 mph.



AFA Library

Doolittle made the first blind, all-instrument flight at Mitchel Field, N.Y., in a completely covered cockpit. He took off, flew a short distance, and landed. To cut off all visual cues other than those provided by the instruments, a hood was fitted over Doolittle in the rear cockpit. Another pilot occupied the front cockpit as a safety measure.

CELEBRITY AVIATORS

News reports followed the aviation exploits of a number of private individuals. Amelia Earhart, who learned to fly in 1921, was in the spotlight frequently. In 1922, she set a woman's altitude record in an open-cockpit biplane. She set several more records in 1930 and 1931, and in 1932 became the first woman to complete a nonstop transcontinental flight from Los Angeles to New York.

In 1937, Earhart decided to make a trip around the world at its widest point, near the equator. She and her navigator, Fred Noonan, departed Miami June 1 in a Lockheed Model 10E Electra, the most advanced, long-range non-military aircraft available.

The airplane disappeared over the South Pacific off New Guinea July 2, and is the continuing source of questions about what happened. The mystery and speculation have kept the Amelia Earhart legend alive.

Wiley Post was also well-known to the public. In 1931, he and navigator Harold Gatty set a record for their round-the-world flight in eight days, 15 hours, and 51 minutes. In July 1933, Post, flying solo in his Lockheed Vega *Winnie Mae*, repeated the trip and beat the earlier record by 21 hours.

"On August 15, 1935, in a plane crash near Point Barrow, Alaska, famed aviator Wiley Post perished alongside his close friend, the renowned humorist and pop culture icon Will Rogers," said Roger Connor of the National Air and Space Museum. "With the exception of Charles Lindbergh, no American aviator of the time was as celebrated as Post, while Rogers was widely considered the nation's most gifted commentator on American society."

"The nation entered a state of mourning that it has rarely done outside the death of presidents. Flags were ordered lowered to half-staff by federal and state authorities. Twelve thousand motion picture theater screens went dark for two minutes at 2:00 p.m. on Aug. 22 in tribute."

The ultimate private air adventurer was Howard Hughes, who inherited the Hughes Tool Company in 1925, then moved to Hollywood to produce movies. He continued to fly his own airplane and in the 1930s set speed records in the custom-built Hughes H-1 Racer. In 1938, flying a Lockheed Lodestar, he broke Wiley Post's around-the-world record from 1933.

AVIATION GROWS UP

By the end of the 1930s, aviation had moved on from the barnstormers. There were still air shows, but they were increasingly oriented to business rather than to entertainment. The war surplus Jennys were gone, replaced by more advanced airplanes that sold for high prices.

Aviation was becoming corporate, official, and established, dominated by industry and government. The new records were mostly incremental gains on previous ones, with the armed forces and government contractors central to the effort.

The number of people traveling by air increased, too, but they were not from the social levels that turned out for the barnstorming shows in the 1920s.

"America's airline industry expanded rapidly, from carrying only 6,000 passengers in 1930 to more than 450,000 by 1934, to 1.2 million by 1938," the National Air and Space Museum recalls. "A coast-to-coast round trip cost around \$260, about half the price of a new automobile. Only business executives and the wealthy could afford to fly." ❖

John T. Correll was editor in chief of *Air Force Magazine* for 18 years and is a frequent contributor. His most recent article, "The Allied Rift on Strategic Bombing," appeared in the December 2020 issue.



1

- 1 Second Lt. Samuel R. Keesler Jr.
- 2 BMT graduates at Keesler.
- 3 P-39 maintenance, 1942.



2



3

KEESLER

Iron Man

Keesler Air Force Base, in Biloxi, bears the name of a native Mississippian shot down and killed in World War I air combat.

That's the short version of the final mission of Sam Keesler. The full version is considerably more technicolor in nature.

That story begins with the birth in 1896 of Samuel Reeves Keesler Jr. into a prominent family in Greenwood, Miss. His father was a wealthy cotton broker. His mansion was named "Cottonlandia."

For all that, young Sam was down-to-earth and a natural leader; he was class president and salutatorian. Though small, he enjoyed a superb athletic career—not only in high school but also at Davidson College, where he was student body president.

Keesler planned to teach school, but, after the U.S. entered World War I in April 1917, he passed up college commencement and on May 13, 1917, entered the U.S. Army's Aviation Section.

He received his commission in August and went to Fort Sill, Okla., for training as an aerial observer. In March 1918 he shipped out for France and, after undergoing training in aerial gunnery, joined the 24th Aero Squadron on the Western Front.

The Allies soon launched the big Meuse-Argonne Offensive and, on Sept. 14, Keesler flew his first mission. It was a dangerous job. Usually a pilot-observer team flew unescorted behind German lines to photograph or sketch enemy dispositions. On that first mission, Keesler's aircraft took serious damage.


Keesler's last flight commenced on Oct. 8, 1918, in the late afternoon. He and his pilot, 1st Lt. H.W. Riley, flew behind German lines and were returning home when they were jumped by four Fokker pursuit aircraft. The German leader dove and began firing.

What came next was a remarkable display of skill, bravery, and fortitude. First, Keesler returned fire and shot the leader out of the sky. In seconds, however, the Americans were raked by German gunfire, which disabled the airplane's rudder and elevator and caused Riley to lose control of his aircraft.

Keesler suffered six bullet wounds in the chest and abdomen. Despite that, and even though his airplane was spiraling downward, he kept up a high rate of accurate fire, fending off the Fokkers all the way to the ground. After the Americans crashed, Keesler kept firing his mounted gun at the Germans, which were strafing the U.S. aircraft. Here, Keesler sustained a seventh bullet wound.

German soldiers captured Keesler and Riley, but no medical care came. Riley, who survived, later wrote a commendation letter, stating, "Keesler received no medical attention and, although he must have suffered terribly, he showed wonderful self-control and won the admiration of all the German soldiers."

The Mississippian died the next day. He was 22 years old.

Some 23 years later, the Army Air Forces bestowed Keesler's name on a new base in Biloxi. It has specialized in ground-trade training and features high-quality technical schools. Today, more than 400 instructors teach more than 30,000 students each year. 



SAMUEL REEVES KEESLER JR.

Born: April 11, 1896, Greenwood, Miss.
Died: Oct. 9, 1918, near Verdun, France
College: Davidson College
Occupation: US military officer
Services: US Army—Signal Corps, Air Service
Main Era: World War I
Years Active: 1917-18
Combat: Western Front, Meuse-Argonne Offensive
Final Grade: Second Lieutenant
Honors: Silver Star, Distinguished Service Cross, World War I Victory Medal, all awarded posthumously
Resting Place: Thiaucourt, France

KEESLER AIR FORCE BASE

State: Mississippi
Nearest City: Biloxi
Area: 2.8 sq mi / 1,784 acres
Status: Open, operational
Opened as Army Air Corps Station No. 8: June 13, 1941
Renamed Keesler Army Air Field: Aug. 25, 1941
Renamed Keesler Air Force Base: Jan. 13, 1948
Current owner: Air Education and Training Command
Former owners: Air Corps Technical Training Command; Army Air Forces Technical Training Command; Army Air Forces Flying Training Command; Army Air Forces Training Command; Air Training Command.
Home of: 2nd Air Force

Keesler AFB; U.S. Army Air Forces; Kimberly Groue/USAF

The Most Important Air Force and Space Force Issues for 2021

The annual release of the Air Force Association's Top Issues establishes the policy positions the Association and its members will advocate for in the year ahead. AFA advocates for policies that support our mission: to ensure America retains dominant U.S. Air and Space Forces as the foundation of a strong National Defense, and that the nation honors and supports our Airmen, Guardians, Veterans, and their Families.

"The United States faces unprecedented threats in an increasingly complex world," said AFA Chairman Gerald R. Murray, the 14th Chief Master Sergeant of the Air Force. "Everyone who supports our Association and our mission—everyone who believes in a strong national defense and the fighting and deterrent power of effective Air and Space Forces—should familiarize themselves with the points outlined here and the specific issues on this list. This is how each of us can do our part to educate the public and our elected leaders on the importance of this critical agenda."

America's dominance in air, space, and cyber domains is critical to defending U.S. national interests. The realities of a new strategic environment defined by threats from peer competitors like China and Russia require us to focus on a Joint Warfighting Concept in defending our homeland, while protecting American interests abroad as outlined in the National Defense Strategy.

The U.S. Air Force and the U.S. Space Force face daunting demands. In coming decades, the two services, within the budget of a single military department, must recapitalize forces that are the oldest and fewest in its history; invest in smarter capabilities; invest in people and families; connect, command, and control their forces in a robust and reliable way as the indispensable member of the joint community—all while growing and fortifying the Space Force.

The Department of the Air Force (DAF) provides strategic and tactical airlift, precision strike, air superiority, precision navigation, global communications, and air- and space-based intelligence and surveillance as an integral element of joint and coalition force operations. The Air Force operates two legs of the nuclear triad—intercontinental ballistic missiles and nuclear-capable bomber aircraft. The Space Force provides space dominance through space launch, missile warning, protected satellite communications, weather, and remote sensing, surveillance, reconnaissance, precision global positioning, and timing (via GPS).

The Space Force was created to ensure that U.S. national interests are protected and defended in the warfighting domain of space. In addition to dominating this warfighting domain, Space Force assets provide key civilian support functions such as

Without an understanding of the dire condition of the Department of the Air Force in the Pentagon and Congress, leading to modernization and growth, the U.S. will be hard-pressed to deter or defeat a peer enemy in the next decade.

accurate timing and location data, secure financial networks, safe worldwide navigation, and assured command, control, and communications. Yet the new Space Force is underfunded, undermanned, and not in control of dozens of organizations that affect U.S. operations in space that should be under the purview of the Space Force.

In its current state, the Air Force is experiencing immense pressure. The average age of Air Force aircraft is 28 years, and most cannot penetrate modern enemy air defenses. B-52 bombers average 58 years old, and most air refueling tankers were purchased nearly 60 years ago. Nevertheless, the Air Force absorbed the largest budget cuts of all the branches following the Cold War. The Air Force's procurement funding was cut by over half, losing 52 percent of its acquisition budget. In comparison, the Army and Navy procurement budgets were cut by roughly 30 percent.

Over the past 30 years, the Air Force fighter inventory dropped roughly 55 percent (4,400 to around 2,000). Bomber aircraft fell 57 percent from 327 in 1990 to 140 in 2020. Our geriatric Air Force must be modernized and grown in order to leverage game-changing technologies and capabilities—as well as capacity—to compete, deter, and, if necessary, win against peer and near-peer competitors.

Without an understanding of the dire condition of the Air Force by the Department of Defense and Congress leading to modernization and growth of the Air Force, the U.S. will be hard-pressed to deter or defeat a peer enemy in the next decade.

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

AFA Supports the Following:

BUILD THE U.S. SPACE FORCE

The United States must retain its long-held strategic position as the global leader in outer space.



- Organize, train, and equip the United States Space Force to deter, compete, and win in the space domain while assuring our Nation's military advantage in space.
- The following three critical issues are required to build the world's greatest Space Force:
 - The Space Force will require resource allocation growth to design, develop, and build the capabilities to defend, and if necessary, defeat any aggression against U.S. space-based systems.
 - To develop the Space Force, as well as adequately support USSPACECOM, the U.S. must grow the number of personnel assigned to the Space Force to ensure a larger, deeper, and more flexible stable of space talent.
 - The U.S. must consolidate the nation's fragmented multitude of over 60 separate space organizations into the Space Force.

MODERNIZE AND PROMOTE DOMINANT AIR AND SPACE FORCES

America must not allow its air and space capabilities to age and atrophy any longer.



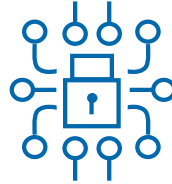
- Accelerate change or lose. Promote a competitive mindset, underscored by the urgency to innovate across industry, academia, and government to modernize and grow Active, Guard and Reserve force capacity necessary to meet the needs of the National Defense Strategy.
- Educate the public, Congress, and the Pentagon that the most cost-effective means to project combat power are with aerospace forces, and additionally, that the DAF is the most lethal arm of the Department of Defense.
- Promote the need for a thorough, honest, and comprehensive review of service roles and missions as a prerequisite for optimizing Department of Defense resource allocation in an era of growing pressures to reduce defense budgets.
- Because Airmen and Guardians give U.S. taxpayers the most bang for the buck across America's military, the Department of Defense must begin evaluating programs in a "cost-per-effect" assessment manner. This means judging programs based on how they achieve mission objectives, not simply unit and sustainment costs.
- Money over which the Air Force has no control must be separated from its budget to ensure accurate understanding of its actual budget. This money is called "pass-through," and amounts to about 20 percent of the total Air Force budget (\$39.2 billion in 2020), and takes 45 percent of Air Force procurement accounts. The negative effect of pass-through funding is real and must be stopped.
- Prioritize readiness and modernization to ensure winning during joint force operations, including new capabilities and capacity in joint all-domain command and control (JADC2); space dominance; a new generation of combat power; and effective logistics under attack.

■ Pursue and transition to game-changing technologies that ensure our Air and Space Forces remain strong and recognized as indispensable in the conduct of joint force operations.

■ Enact timely appropriations and authorizations to enable responsible funding to the DAF.

PROMOTE STRONG AIR-SPACE-CYBER LEADERS AND RESILIENT FAMILIES

Our armed forces are only as good as the people that fill their ranks, so our Air and Space Forces must attract the best talent our nation has to offer.



- Recruit and retain skilled military and civilian personnel. Tie military and civilian pay raises to Employment Cost Index. Implement selective bonuses for depleted career fields.
- Ensure pay, entitlements, and skills have parity with the marketplace or industry sectors to attract and retain the right people with in-demand skills.
- Treat health care as a readiness issue:
 - Fully fund TRICARE to provide proper care for military members, retirees, and families.
 - Prohibit realigning or reducing military medical positions until analyses are conducted.
 - Develop tomorrow's leaders through STEM education at all grade levels. Actively support and promote participation in high school and university ROTC programs and Civil Air Patrol.
 - Enhance Airmen's ability to transition between services and in and out of civilian life and expand the use of telework and remote hiring—all aimed toward better recruitment, quality of life, talent management, and retention.
 - Advocate for revolutionary training methods to revamp technical training via new technologies.
 - Bring awareness to, and mitigate factors that negatively affect, readiness and retention for military members and their families as they transition from one duty location to the next, including licensing reciprocity among states.

VETERANS

Those who commit to serve their country deserve an equal commitment from their country, that promises made will not be broken later in life.



- Support Cost of Living Allowances (COLAs) to ensure a promise kept.
- Eliminate 180-day freeze before Military retirees can be hired to DOD Government positions.
- Honor our nation's health care promise to veterans.
- Assure TRICARE Prime or Standard health care benefits to the "gray area"—AF Reserve and Air National Guard retirees who are not eligible for these benefits below age 60.
- Advocate for grandfathered eligibility for burial at Arlington National Cemetery (ANC). Expand ANC to ensure operations with full military honors, well into the future.
- Support concurrent receipt for Chapter 61 military retirees; those medically retired for ailment or injuries before they could serve 20 years and qualify for regular retirement.



AFA IN ACTION

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

Fallen Warriors Portrait Project

By Bob Gehbauer

The walls of the Collin County courthouse in McKinney, Tex., are lined with portraits of fallen warriors and veterans, depictions created by artist and Air Force veteran Colin Kimball, an Air Force Association Member who's active with AFA's Seidel Chapter in Dallas.

Kimball began his Fallen Warrior Portrait Project in 2013 and it now includes some 76 paintings with nearly a dozen portraits joining the collection each year.

"I cannot live with forgetting their sacrifices," Kimball said. "Every portrait I do honors my [fallen] friend Frankie, a Marine PFC, and all who gave the ultimate sacrifice in Vietnam. That's my motivation for doing what I do."

The newest addition to the wall depicts former prisoner of war (POW) and U.S. Rep. Sam Johnson, a retired colonel who served 14 terms in Congress following a military career that included a MiG kill in the Korean War and nearly seven years as a POW in North Vietnam. Johnson died on May 27, 2020.



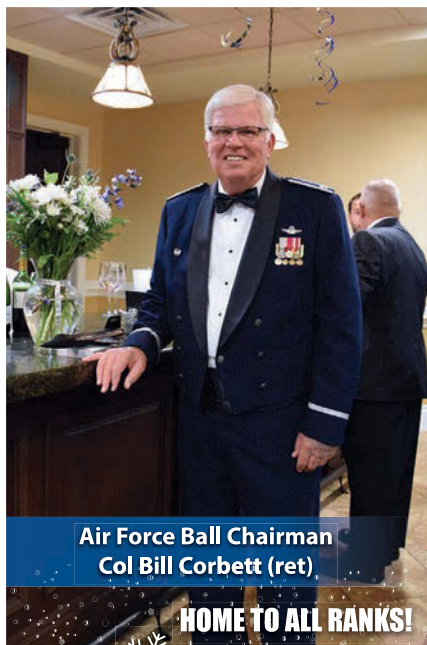
Pat Nugent

Artist, Colin Kimball, stands in front of his most recent painting of POW and veteran Sam Johnson who is part of the Fallen Warrior Portrait Project displayed at the Collin County Courthouse in Texas, along with Johnson's daughter, Beverly Briney.

Kimball's portrait was dedicated at a ceremony in the courthouse on Nov. 9, with Johnson's daughter and son-in-law, Beverly and Scott Briney attending. Also present were retired Lt. Gen. John "Soup" Campbell, the Seidel Chapter president; Chuck Daniels, the president of the Dallas Chapter of the Military Order of the World Wars; Judge Keith Self, Gulf War veteran; retired Col. Ken Cordier, fellow Hanoi POW; Chris Hill, Collin County Judge; and the members of the Commissioners Court.

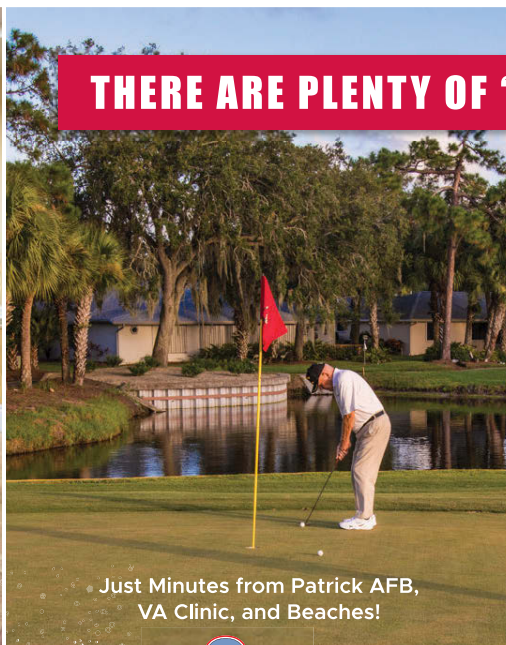
A fighter pilot who performed with the Thunderbirds, Johnson was a true Texas hero, whose 29-year Air Force career saw him fly dozens of combat missions in Korea in the F-86 Sabre and in Vietnam in F-4 Phantoms. Johnson was released from Vietnamese custody during Operation Homecoming, in February 1973, weighing only 120 pounds and with permanent damage to his hand and leg.

A Life Member of AFA and member of the Seidel Chapter, he earned AFA's Lifetime Achievement Award in 2013.



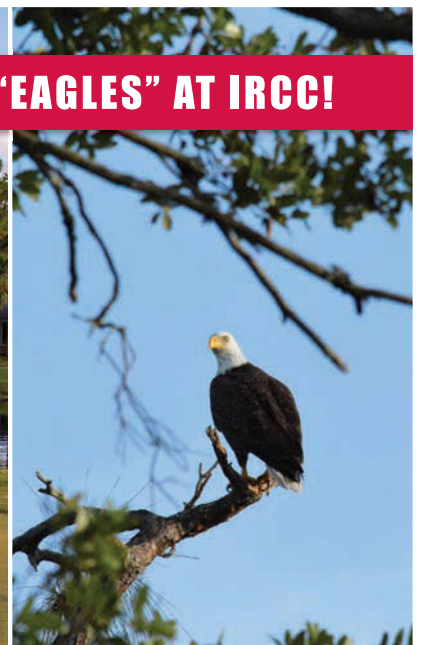
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AFA IN ACTION

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

Happy Birthday, Space Force!

The Space Coast AFA Chapter in Florida, working with Lamar Advertising, bought space on three digital billboards celebrating the U.S. Space Force's first birthday. Two of the celebratory signs were on I-95 (one north and one south bound) and the third was on US-1. All were illuminated through late December. The chapter is near Florida's Cape Canaveral Space Force Station and Patrick Space Force Base.



Pat Nugent

AFA Helps Bring USO to Lakenheath

By Jennifer Hlad

The USO began considering RAF Lakenheath, U.K., as a possible location for a USO center in 2016, at the request of the 48th Fighter Wing commander at the time, then-Col. Robert G. Novotny. But a lack of space and commitments to support deployed forces elsewhere put the idea on the back burner—until the 2019 short-notice deployment of the 494th Fighter Squadron to Al Dhafra Air Base in the United Arab Emirates over Christmas. That's when the Air Force Association stepped in.

AFA President Lt. Gen. Bruce "Orville" Wright learned that the families at Lakenheath needed some extra support, so he called on the USO to help. The USO responded immediately with programs and care packages, but also revisited the idea of a center.

The RAF Lakenheath USO center is slated to open March 1. A USO center in Poland should open around the same time.

The Lakenheath center will support the military population of nearly 10,000, plus the 12,500 family members and more than 1,800 civilian employees currently at the base—and will also support all personnel attached to the two F-35A squadrons coming to the base in late 2021, explained Walt Murren, USO's Europe vice president.


"We're going to continue to expand our mission, and especially with the F-35s coming in, that's going to be important for us to be there for their reception, for the integration of their families into the community," Murren said.



Though Lakenheath is in England, where "they speak almost the same English as we do," it is still a foreign country, he said, adding that "during the week the sidewalks roll up, you know, when it gets dark, and there ain't much to do."

Once the USO center is open, he said, "There's going to be a lot for people to do, and there's going to be a lot of opportunities for people to volunteer. It's going to give people a lot of activities because we always take care of our communities."

Working to open the first USO center in the United Kingdom has not been without challenges, Murren said, but the USO was able to gain tax-exempt status from Her Majesty's Revenue Service, and the 48th Fighter Wing helped them find space for the center in a former library that is centrally located between single service members and families.

"This is really a very special USO center," Murren said. "We have not since our beginning, ... almost 80 years ago, we have not had a USO in the United Kingdom, even though we've had probably hundreds of thousands of troops, if not millions of troops" there. "It's about time." 

By John T. Correll

AN AIRMAN IN THE FIGHT

Pitsenbarger chose to remain under enemy fire to care for and help defend the wounded.

In the early afternoon of April 11, 1966, Charlie Company, an element of the U.S. 1st Infantry Division, flushed a Viet Cong (VC) platoon, killed several of the VC, and pursued the others deeper into the dense jungle east of Saigon.

The Americans had no idea they were walking straight into the base camp of the Viet Cong battalion known as D-800, a first-line unit with 400 troops, plus available backup. Charlie Company, with a strength of 134, was soon isolated and encircled.

The fighting grew desperate. Before it was over, all but 28 of the U.S. troops would be wounded or killed. The triple-canopy jungle was too thick for Huey reinforcement helicopters to land, but there was a gap nearby just wide enough to lower a litter on a hoist line 100 feet to the ground.

Two Air Force HH-43 Pedro rescue helicopters were dispatched from their base at Bien Hoa in Vietnam to pick up the wounded. The first extractions were awkward. The Army was unfamiliar with rigging the equipment, and the litters snagged repeatedly in the trees. The Pedros had no direct contact with the soldiers.

One of the pararescue jumper medics—popularly known as PJs—was A1C William H. Pitsenbarger, 21. He had been in Vietnam for eight months and had been awarded the Airman's Medal for bringing a wounded Vietnamese soldier up from a burning minefield.

Pitsenbarger convinced his HH-43 pilot to put him on the ground with Charlie Company and leave him there to prepare the litters and hoist and to coordinate the extractions. He went down on the forest penetrator, holding his medical kit, his M-16 rifle, and an armful of splints.

"At times the small-arms fire would be so intense it was deafening and all a person could do was get as close to the ground as possible and pray," said Lt. Martin Kroah, leader of one of the Army platoons. "It was on these occasions that I saw Airman Pitsenbarger moving around and pulling wounded men out of the line of fire and bandaging their wounds. My own platoon medic, who was later killed, was totally ineffective. He was frozen with fear, unable to move."

The HH-43s had picked up nine wounded soldiers when one of



A1C William Pitsenbarger stands next to an HH-43 helicopter in Vietnam.

U.S. Air Force

them was hard hit by automatic weapons fire. The crew cut loose the dangling litter and the helicopter managed to limp—out of commission—to a landing field. Ground control told the other Pedro that with the area under such intensive attack, no more extractions could be attempted that day.

Pitsenbarger gave his handgun to one of the wounded who could not hold a rifle and ran from place to place, gathering ammunition from the dead and taking it to those who were running short. "Pitsenbarger continued cutting pant legs, shirts, pulling off boots, and generally taking care of the wounded," said Army Sgt. Charles F. Navarro. "At the same time, he amazingly proceeded to return enemy fire whenever he could. During his movement around our perimeter, he would scramble past me and deliver a handful of magazines."

The VC stepped up the attack in the late afternoon. Snipers in trees shot soldiers in the back as they lay prone in the firing position.


Pitsenbarger was shot four times. Struck in the back, shoulder, and thigh, he kept working and fighting until the fatal round

struck him in the head. He died about 7:30 p.m.

The enemy mounted three massive assaults around the perimeter. Charlie Company survived the night only by calling in artillery almost on top of itself. Reinforcements finally broke through at dawn.

The commander of the Aerospace Rescue and Recovery Group nominated Pitsenbarger for the Medal of Honor, but the recommendation was marked down to an Air Force Cross by Military Assistance Command Vietnam.

More than 30 years passed before a group of Pitsenbarger supporters were able to get his case reopened. "I felt at the time, and still do, that Bill Pitsenbarger was one of the bravest men I have ever known," said former Army Lt. Johnny Libs, one of the surviving platoon leaders.

With strong backing from the Air Force and concurrence of the Joint Chiefs of Staff, Pitsenbarger was posthumously awarded the Medal of Honor. His father accepted the award Dec. 8, 2000, on his behalf. 

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