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Enemies are threatening U.S. cyber capabilities. See "Hacking the Space Force," p. 42. Director, Media Solutions 703.247.5829 kbrown@afa.org SUBSCRIBE & SAVE Subscribe to

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Declassify the Space Force

The whole point of a

Doomsday Machine is lost

if you keep it a secret.

ecrecy and surprise are to warfare what water and salt are to survival: You might get by without them, but your chances are vastly diminished.

Concealing knowledge, methods, plans, and capabilities keeps adversaries guessing. It imposes costs and enables deception. But U.S. national security strategy is built first on deterrence, rather than intimidation. America follows Teddy Roosevelt's admonition to "speak softly and carry a big stick" and invests in military capability not so it can invade or seize territory, but in order to deter and dissuade others from taking that risk.

Deterrence depends on two things: the ability to inflict pain on the adversary and the willingness to do so. To be credible, the United States must show at least some of its cards so adversaries understand our capability and readiness to strike when necessary. If the threat isn't credible, it's just a bluff.

Adversaries are aware of the Air Force's B-2, F-22, and F-35 stealth aircraft and how they can evade enemy air defenses. But the Air Force holds closely how they work and the tactics and

techniques pilots use to defeat air defenses. As the next-generation B-21 emerges from the shadows, the Air Force will continue to hide certain features while letting the world know it's coming.

Striking this balance between secrecy and

surprise, on the one hand, and transparency and deterrence on the other, is the challenge. Too often, secrecy wins.

Over-classification is an open secret in Washington. It's talked about in Congress. It's discussed in the Pentagon. Gen. John E. Hyten, the Vice Chairman of the Joint Chiefs of Staff, describes it with a single word: "ridiculous."

Knowledge is power, of course. It should surprise no one, then, that the power to classify information-in some cases to hold it hostage-is ripe for abuse. Once classified, it's hard to know what's being hidden or whether hiding it was even appropriate. As anyone who has ever worked in the classified world will tell you, classification moves rapidly in one direction-it's easy to classify something—and hardly at all in the other.

Matthew P. Donovan, the former Acting Secretary of the Air Force and undersecretary of defense for personnel and readiness, says over-classification affects every level of defense, from strategic funding decisions to building and executing war plans. "I've been in meetings in the Pentagon when competing for funding, where you can't talk about the capabilities of programs," he says.

How can anyone effectively judge whether an investment is prudent if its purpose and capability can't be discussed? They can't. Think that gets better when the budget goes to Congress? It doesn't.

Over-classification is responsible for the kinds of seams that cause intelligence and operational breakdowns, like those that led to 9/11, and contribute to combat deaths when commanders lack access to vital intelligence. They fuel rivalries when operators in special access programs are empowered to put the kibosh on other units' mission plans. They interfere with threat assessment. And they empower those "read in" on programs to sometimes lord it over those who are not.

For the Space Force, which operates in the most transparent of all domains, classification bars leaders from fully articulating threats and capabilities. While Space Force leaders have grown more comfortable over the past year describing weaponized space systems belonging to China and Russia, they are unable to indicate any counter-offensive capabilities.

While the U.S. has long seen space combat as off limits, China and Russia have no such compunctions. They see U.S. space assets as fair game for opening salvos, with the aim of blinding and disabling the communications, intelligence, and guidance capabilities that are America's signature military advantage.

Exactly what the U.S. would do-or even could do-in response is unclear. What is clear is that the U.S. needs to be plainer about its capabilities and also its potential response to threats.

"If we're going to be a force that is taken seriously and deters our adversaries, we need to start showing them things to deter them," says Space Force Lt. Gen. Nina M. Armagno, its director of staff. "We need to show them what we have."

> That's mighty hard to do when space capabilities and "need to know" are so finely compartmentalized across the intelligence and military communities that there's not even general agreement on whether it's wise to share more fully across agencies, let alone how. Pentagon

policymakers have wrestled with this issue for years-with little to show for it.

This problem won't be licked in the Pentagon, however. Donovan, now director of AFA's Mitchell Institute Space Power Advantage Research Center, has seen this as an Air Force operator, a staffer on Capitol Hill, and a leader in the Pentagon, and he argues no solution is possible without White House leadership.

A bipartisan national security commission on classification, appointed by the President and instructed to report recommendations within a year would be a good first step.

"We need a very disciplined, thorough and robust process to decide what to reveal and what to conceal, not only at the DOD level, but also at the National Security Council level," Donovan argues. "We need the same discipline applied to the decision calculus on how that program should be classified, who needs to know and when, and on [which] levels of warfighting, from the strategic to the operational and to the pointy end of the stick at the tactical execution level."

Those capabilities that are revealed must be exercised and demonstrated to test and inform the opposition. Those that are not, must remain hidden, and may only be exercised in simulators to avoid exposing the secret. Balance must be maintained.

The enemy, is not us. It's not the other agency, the other service, or the other office. Secrets must be shared among friends. But deterrence demands that adversaries know what can happen if they overstep in space, as in every other domain.

As Dr. Strangelove says in the Cold War classic film by that same name: "The whole point of a Doomsday Machine is lost if you keep it a secret!"

He might just have been speaking of the Space Force. 0



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LETTERS



John T. Correll, 1939-2021

With obvious poignancy, but infinite fond memories, I read John A. Tirpak's memorial tribute to John T. Correll in ["Air Force World," May, p. 32]. Permit me a brief historical sojourn down memory lane. Back in the 1990s-early 2000s I never visited AFA without making a stop to visit John in his office. I was what is now called a Region President, a Board member, and then National Secretary over a period of about seven to eight years and visited four to five times a year. My motivation(s) for visiting Correll varied from being a fellow North Carolinian and catching up on "home" to becoming more knowledgeable on Air Force/DOD issues, and finally to finding out what was really going on at the apex of AFA operations. I wasn't looking for "dirt"-and John sure as hell wasn't sharing any. But as a field leader, and then an elected National officer. I did want to hear all sides of issues so I could make more informed decisions/ share all sides of the equation with those out of my AOR-Colorado and the Rocky Mountain Region, at that time. I knew John had his finger on the pulse of all things DOD, Air Force, and AFA, and could put forth perspectives far above my pay grade. It occasionally made me look smarter; I liked that.

John's drive for truth and accuracy, and his ability to invoke "situational awareness" to his staff that sometimes earned them the "Literary Purple Heart" (with OLCs) are legendary.

My favorite Correll memory was his campaign against the Air and Space Museum and its misguided, politically correct wanna-be director (Martin Hewitt) regarding Enola Gay. It was a thing of beauty-perhaps could even be a textbook case history in journalism schools-to watch as John meticulously used factual, historical research to prepare a "battle plan" and then gathered and prepared his "army" of like-minded allies from the Military Coalition to overwhelm a basically defenseless enemy. "Defenseless" simply because they were way off-base from the git-go-and for all the wrong reasons.

The second recollection was [wheneyer] someone would point out that the

magazine didn't "have enough articles about the field" and demand that John fix that. I made that mistake myself once, but only once! The color would creep above John's collar and he would politely, but VERY pointedly, inform the perpetrator that as soon as they produced the written information/photos, AND the \$2,500.00 for each page, he would add it to the very next edition. I was often sitting close enough to John to hear what he said under his breath.

John Correll's passing is a huge loss to airpower in general, the Air Force, AFA, and to those of us who enjoyed/learned from his writings. I knew and respected him tremendously. He was brilliant; more importantly he had uncommon common sense. I am proud to say he was my friend. We all will miss him.

> Bill Croom Wilmington N.C.

I certainly will miss John Correll. He really knew aviation and wrote so well about the importance of airpower. He was a superb writer and very thorough researcher. I was lucky enough to exchange some emails with him. I give quite a few lectures on a variety of subjects and one lecture is on the hunt and sinking of the battleship Bismarck. John gave me some sources on the air search and naval search that I didn't even know existed. That was just an example of his vast knowledge. About the only thing I knew that he wasn't aware of was the Vinh wiretap operation and that was only because I had a friend in Air America. Air Force Magazine will have a difficult time replacing John Correll.

> William Thaver San Diego

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.



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Internecine Squabbles

There you go again ["Editorial: Rocking the Joint," May, p. 2.] The fight over control of intercontinental ballistic missiles was originally fought years ago when Gen. John Medaris commanded the Army's Redstone Arsenal with Wernher von Braun, of German V-1 fame, as his technical genius, vs. Gen. Bernard A. Schriever, the Air Force's ICBM guru. A political decision was made to give the plum to the Air Force.

Now, according to your editorial, the fight has been resurrected and the antagonist misses the whole point. The Department of Defense is in dire need of a total reorganization based upon mission, instead of individual uniformed military services, i.e. Strategic Forces, Tactical Forces, Service Forces, etc. Once the military [services] stop arguing about who gets the biggest piece of the pie and concentrate on doing the job, the safety of the country will be enhanced and the people's money more wisely spent.

Lt. Col. Bill Getz, USAF (Ret.) Fairfield, Calif.

The U.S. Army has developed a hypersonic long-range missile to challenge traditional long-range targeting capabilities of the U.S. Air Force and Navy, in "Claiming Itself an 'All-Domain' Force, Army Targets Long-Range Strike," May [p. 20].

Needless to say, Air Force leaders and strategists are not too agreeable with the Army's proposed techniques, tactics, and procedures.

As a former Air Force targets officer at the fighter wing, AOC/TACC, NAF, PACAF, PACOM and various joint and AF agencies, I continuously had to work with many overenthusiastic Army, SOF, and Navy operators and planners to get them to understand and work through the (Joint) Air Operations Center coordination system. I'm sure most services' targets officers now understand that in any given theater of operations, all forces must be dedicated to accomplish the theater commander's objectives. No single service can do their own thing without coordination with the other services. Whether it is deep strike or defense suppression-without coordination the Army could be striking targets that other services could be targeting, as well.

As I recall, it was difficult to convince an ally that they should consolidate their target list with the U.S. target list so we did not try to destroy the same targets at the same time, or at the wrong time such as when the U.S. counteroffensive needed to use their potential targets. In the joint arena, it was extremely difficult to convince the special ops people to coordinate their targets with the AOC, until I showed them I had produced exactly the same targeting materials for Air Force units that they wanted for their own target planning. I had numerous similar experiences over a 20-year period on Active duty and another 24.5 years as an AF civilian targets, HUMINT, MASINT, imagery, and geospatial intelligence officer and other capacities.

I have no problem with the Army developing a hypersonic missile capability, particularly for the the Indo-Pacific area, which covers one-third of the earth's surface, including thousands of miles of distances. Short of depending solely on nuclear weapons, it could be an effective strategic deterrent to adversaries like China and North Korea. US Indo-PACOM would control the weapon, of course.

Under tactical conditions, the hypersonic missile could be used to target high-value national leadership and command and control targets deep in the country where tactical operations and support are not practical. Coordination with the theater AOC would still be required.

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

Honor the Code

My congratulations and thanks to Lieutenant Colonel Piowaty for his succinct and spot-on letter in the May 2020 issue regarding the Honor Code at the Air Force Academy [p. 5]. When I first read about the latest honor scandal and how it was being handled, I was appalled. Why have an Honor Code if you aren't going to enforce it? His letter described perfectly the many negative ramifications introduced by abandoning the Honor Code. Count me among the very disappointed.

> James D. Mahoney Las Vegas

On Race, Unrest, and USAF

Following many years in senior or command positions, I can honestly tell you that with very few exceptions I cannot remember the race of any of the members of any of my organizations. It didn't keep track of what you were, all that mattered was who you were. This included your character and willingness to work. We focused on the mission, and we worked as a team and every individual was measured by their contributions to the team not by the color of their skin. Some had one strength and some had another. As a team, every person contributed to the best of their ability toward the good of the whole and the mission. We didn't believe that being red or yellow or Black or White made any difference.

What is happening to the United States military? If senior leadership lets CRT [critical race theory], race, or woke philosophy become determining factors you will gut the soul of the military's long-standing tradition of teams. Leadership, It will be on your watch and on your head if the military loses focus on defending the country. Creating division does not serve well for a cohesive military.

Remember, you are only as good as the legacy you leave. Don't let gutting the military team effort be your lasting legacy.

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

Lindbergh Defended

Lt. Col. Allen Parmet is entitled to his opinion, but he's not entitled to his own facts. So, let's look at some facts["Letters: No Hero," May, p. 7].

Lindberg was publicly chastised immediately when he accepted the Service Cross of the German Eagle from the Nazi government in 1938. For a brief period, he considered locating his family in Berlin. The events of Kristallnacht a month after receiving the decoration changed Lindberg's views entirely. He quickly canceled previous plans to move with his family. His inspection of the Luftwaffe, first in 1936 and again in 1938, were at the personal request of U.S. Chief of the Air Corps Henry H. "Hap" Arnold. Arnold's orders to Lindberg included detailed inspection of the state of readiness of the U.S. Army Air Corps, plus overseas evaluation of foreign air forces. Most historians agree, Lindberg was essentially an Air Attache working for the United States, engaged in official espionage of the Luftwaffe. He reported all he saw directly to General Arnold, who used the information to help improve the Air Corps.

The German decoration was presented at a dinner hosted by the U.S. Ambassador to Germany, Hugh Wilson. For his part, Wilson wrote of the controversy of accepting the medal, "Neither you, nor I, nor any other American present had any previous hint that the presentation would be made. I have always felt that if you refused the decoration, presented under those circumstances, you would have been guilty of a breach of good taste. It would have been an act offensive to a

guest of the ambassador of your country, in the house of the ambassador."

Lindberg did what he did in an official capacity, not because of any personal affinity.

> Maj. Ken Stallings, USAF (Ret.) Douglasville, Ga.

Master Mover

As someone who devoted years to the C-17 program while on the Air Staff and AMC staff during the most troubled years of the program, it was rewarding to read the story "Master of the Globe" [May, p. 34], but I was troubled by several aspects. The article said AMC was exploring ways to extend C-17s' life through rotations between high- and low-tempo units and corrosion environments.

I would have expected this to be a given in the management of any aircraft fleet. The article goes on to say that reconstituting the C-17 production line would be cost-prohibitive. Hopefully, some consideration was given to preserving tooling and design documents when the initial buy was complete. If not, steps should be taken now to salvage what can be saved. Surely using a proven design as the basis would be less costly than a full clean-sheet design even if both required a complete production facility starting from scratch.

The article ended with what I would call "magical thinking" about roles and missions that might require an entirely new design using stealth technology and soliciting Army and USMC input for future lift-a sure way to enable mission creep. It is past time to tell our sister services that if you want your equipment to move by air, it needs to fit the cargo box of a C-17. It is also time to recognize the lesson provided by the C-130. First flown in 1954, the basic design has been refined through countless variations and remains in production today, nearly seven decades later.

Any future replacement of the C-17 should consider a updated version with

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

It seems the C-17 is a "balls to the wall" carrier of logistical 'stuff' from Point A to Points B, C, D, and beyond. I like that! What concerns me, however, is the statement that McDonnell Douglas closed the Long Beach production line in 2015, and then "AMC is beginning to think about what a C-17 replacement might look like 20 to 40 years down the road."

Really?! Why close the production line on such a magnificent aircraft knowing it would be another 20 to 40 years before another one could take its place!! Seems to border on the ridiculous to me.

> Maj. Dean Hayes, USAF (Ret.) Bellevue, Neb.

I just read the article "Master of the Globe." I was disappointed to not see recognition of Lt. Gen. Ronald T. Kadish who was the C-17 program director from October 1993-August 1996 when the program was under heavy threat of cancellation. In my opinion, his leadership was the force that turned the program around.

> Lt. Col. Richard Simpson, USAF (Ret.) Dayton, Ohio

The image of a Globemaster III on pages 36 & 37 of the May 2021 issue had me scratching my head, as most markings such as the tail flash, Majcom, serial number, wing of assignment, etc., were all gone except for "USAF" on top of the right wing, the subdued USAF roundel on the empennage, and the U.S. Flag on the tail. But, then I noticed someone made sure to include ... the ANG Minuteman patch!

Go Guard!

Col. John Bradley, USAF/ANG (Ret.) Chattanooga, Tenn.

Not So Secret

The the beginning of the article, "The Battle for the Soul of JADC2" in your May issue [p. 44] greatly oversimplifies why the Battle of Britain turned out the way it did.

Yes, data from radar sites and ground observers, used in a way described many decades later as "The Dowding System," was a significant factor in the battle's outcome, but far from the only one.

6

The opening page photo caption refers to radar as a British "secret weapon," but the Luftwaffe was very aware of the radar stations and attacked them a few times in mid-August 1940. They were difficult to hit and considered not that important so the raids on them were stopped.

Another of the factors in the battle's outcome was Britain's superior production of new aircraft during that time, and Germany's consistent underestimation of how many serviceable aircraft the RAF had left as the battle went on.

One of the fighter aircraft, the Spitfire, in the hands of a skilled pilot, was equal to, or in some cases, better than the Luftwaffe's legendary M-109. After returning from another round of combat with the RAF, one of the Luftwaffe's best fighter pilots was asked in debriefing what he would like. He replied "a squadron of Spitfires."

> Lt. Col. Larry Griswold, USAF (Ret.) Asheville, N.C.

I would like to pass along my sincere appreciation to Douglas Birkey who authored the May Air Force Magazine article entitled, "The Battle for the Soul of JADC2." I thought the article was written exceptionally well and the historical examples provided are very relevant to the contemporary national security challenges we face today.

> **Richard M. Toney** Tampa, Fla.

Agility Counts

I look forward to flying on an electricpowered commercial passenger plane at 35,000 ft doing 500-600 knots (or better) on a trans-Pacific flight. Right now, I could fly on a battery powered plane doing 150 knots for a 30-minute flight at maybe 3,000 ft. When the power plant and battery (or other) technology allows us to create commercial and military aircraft powered by electric motors, then we will have a need to generate electricity and charge batteries at much greater than our current capacity.

With today's wind generators, watergenerated electricity and solar power, the needed power is just not going to be there. Nuclear power stations could make it happen, but they are not acceptable as Green energy and they produce that nasty radioactive waste. The answer is fossil-fueled power stations, at least for the present.

Someday, we will develop a way to

produce power on a much greater scale than today with little or no carbon emissions. That day is not today or 10 years from now, or maybe even 100 years from now. Until we develop something like fusion-powered plants to give us "unlimited" electricity, we must not go down the road to eliminating carbon fuels.

> Lt. Col. James Beach, USAF (Ret.) Albuquerque, N.M.

Davis, Hero

When I turned to the Heroes and Leaders page of your May edition [p.56] and read the Red Tail Commander piece, I was brought back to one of those memories that just stick with you, It was spring 1968 and I was closing in on departing Vietnam after an extended combat tour in F-100s and O-1Es. I had volunteered to extend my tour six months and was now at Phan Rang sitting alert in the F-100.

The alert shack was a popular place for generals and other dignitaries to visit. These visits were mostly a perfunctory event with the visitor going down the line of pilots quickly shaking hands and then out the end of the alert trailer. But this day was different. We all formed our line, I was first, and in walked a three-

star general. Being a very young lieutenant I didn't know who he was, but responded with the appropriate "sirs" as our wing commander led him down the line. Normally there was a quick exit but this time the general stopped, turned and said: "Sexton, when are you going home?" I was startled. This general not only had remembered my name, but a little something about me. I stood a little taller and blurted out something like soon or next month.

At that time, I knew very little about Tuskegee and the Red Tails but later learned their history and about the man who led them. It is clear now Gen. Benjamin O. Davis was an outstanding leader. But I learned that in 1968.

> Col. Michael E. Sexton, USAF (Ret.) Albuquerque, N.M.

Regarding the statement that Benjamin O. Davis Jr., became the second Black officer in the Army [and] "The other was his father Benjamin O. Davis Sr., promoted from the ranks in 1940 on sheer merit," is historically incorrect.

Fact: The first Black officer was Henry Ossian Flipper who graduated from West Point (Cullum #2690) with the class of 1877—not "the other" B. O. Davis, as implied. As a new second lieutenant, Henry O. Flipper was assigned to the 10th U.S. Cavalry Regiment at Fort Concho in West Texas. He became the first Black officer to command regular troops in the U.S. Army.

> Dr. R. Gary Mucho, USAF (Ret.) Los Alamitos, Calif.

Hold My Beer

What? Combat? Performance? Where? Hogwash! The F-35 is disqualified from any and all assignments for one reason: single engine! I screamed for one issue when Wright-Patterson [Air Force Base, Ohio] was awarded the contract: single engine! It's best that we should chomp all F-35's up for beer cans. Do it now ["Makeor-Break Time for the F-35," May, p. 40]! Capt. Michael W. Rea, DHS (Ret.)

Savannah, Ga.

More Collateral Damage

In your April issue, you printed a letter by Maj. (Ret.) Ken Stallings ["Collateral Damage," p. 6], in which he (1) claimed I advocated "the right of the Army to immediately launch a counter-fire mission within seconds of detection of incoming missile attacks," and (2) defamed my competence. As a matter of simple fairness, I wish to make a reply.

As to point one, I will simply state that the alleged advocacy appears nowhere in my letter.

As to point two, let me elaborate on the analysis we performed. It was conducted with the talents and collective expertise of the Boeing Company's then-operations analysis organization, consisting of many ex-service operators. We also had access to recent military veterans of Gulf War 1 who were familiar with the planning cycles of the Air Operations Center (AOC). Our results were briefed internally to Thomas K. Jones, who was formerly the deputy undersecretary of defense for strategic and theater nuclear forces in the Reagan administration, and a technical adviser to the Strategic Arms Limitations Talks (SALT). Jones was favorably impressed. This was likely occasioned from the coincidence that he had previously produced a Combined Arms Study to consider the scenario of a resurgent Iran on the heels of Gulf War 1. On June 29, 1993, Boeing Defense & Space Group hosted an all-day "Precision



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LETTERS

Strike Meeting" for Steve Head, Precision Strike Architect for the Office of the Undersecretary of Defense for Architecture. The lead Boeing presentation was Jones' study. That was followed immediately by our "Precision Strike Architecture Study." Our method was to model the architecture functional flows, sequences, execution times, and probability of function execution. By concatenating probabilities and normalizing by the integral of execution times, we were able to construct a unitary figure of merit with units of mission success probability/unit time.

The baseline architecture we modeled came out at 0.00034 target negations/ hour (one target kill in 122.5 days). This was distressingly at par with operational experience. The sensitivity studies showed great sensitivity to target mobility (worse), reconnaissance planning time (less was better), reconnaissance search capability (more was better), strike mission planning time (less was better), and strike search rate (more was better-up to a point). We then shifted to a conceptual architecture with existing assets that was independent of the AOC planning cycle, greatly reduced the planning times, and incorporated search capability in the weapon (a hunter-killer ALCM). With these improvements, the system productivity was estimated at 0.3089 negations/hour. Head was greatly interested in both the study methodology and its results and requested to receive a copy for his department. (As part of the day-long event, among other topics, Boeing also briefed a Rapid Response Missile study that concentrated on a series of Mach 3, 4, and 4.5 designs. Unfortunately, without improvements in the mission planning cycle, such a weapon would largely have arrived quickly at the wrong destination.)

This was not the last of the subject. In 1999 to 2000, Boeing Phantom Works embarked on the Affordable Moving Surface Target Engagement (AMSTE) Weapon System Trade Study (WSTS) for DARPA's Sensor Technology Office under Bruce L. Johnson (subsequently Dr. Tim Grayson), Stephen Welby, and Tom Darner, with support from the Air Force Material Command and the Air Force Research Laboratory. I was the System Architect, reporting to the AMSTE Chief Engineer, who reported to the AMSTE Program Manager. We were teamed with Northrop Grumman, Orincon, and Motorola. The AMSTE contract objective, in short, was to determine ways and

means of engaging moving surface targets with weapons guided externally by a networked surveillance architecture. We successfully applied the Precision Strike functional analysis methodology in great detail-I recall at least six levels of functional structure-to enable complete traceability of the engagement probability to the architecture parameters. Again, our DARPA managers were appalled (to say the least) when we initially reviewed with them the dismal result of the Precision Strike study but were heartened by the fact that we knew what the problems were, where to find them, and how to arrive at a satisfactory result. Which we did.

So, I think it is fair to say that having been vetted by a professional operations analysis staff, two former defense department officials, and a knowledgeable DARPA management team, our results were well-grounded and well-formulated. Michael J. Dunn

Federal Way, Wash.

 In the June/July almanac issue, we printed a typo that showed the B-1B to have an average age of 94.05. Obviously, this is incorrect. The B-1B average age is 33.42. We regret the error.—The Editors

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VERBATIM

Let It Wave



"Let me say, right off the bat, you have the coolest flag back there. I don't know if it's because it's new but ... it pops. It's got that 'new flag smell."

-Rep. Adam Smith, Chairman, House Armed Services Committee, to Gen. John W. "Jay" Raymond, Chief of Space Operations, doing his first in-person appearance to testify on the fiscal 2022 budget request, June 16.

Out of the

Chain

"After trying, and

failing, to address

sexual assault in

the military for

years, the time

has come to take

the prosecution

of sexual as-

sault crimes out

of the chain of

command. ... The

question before

us is not wheth-

er to update the

UCMJ, but how

to update the

ÚCMJ."

-Rep. Adam

Smith (D-Wash.),

Chairman of the

HASC, June 23.

Biden's Biden's Last Word ...



"I will not send another generation of Americans to war in Afghanistan with no reasonable expectation of achieving a different outcome."

-President Joe Biden, defending his decision to pull all U.S. troops out of Afghanistan after 20 years, even as Taliban forces advanced, and experts said the government would fall soon after the U.S. withdrawal.

... Their Lasting Impression



"Nations are judged by the manner and care with which they leave the field of battle-not just by future foes and prospective allies, but also by the eyes of history. The world is watching to see what we do-or don't do—for our Afghan allies in this life-or-death moment."

-Sen. Angus King (I-Maine), oped in Air Force Times, June 28.

Accelerate Change, Please

"The strategic environment has rapidly evolved and we haven't changed

fast enough. ... Competition and future warfare will be conducted across all domains simultaneously. ... It will be a trans-regional and global undertaking with complex actions and actors intertwined."

-Gen. Charles Q. Brown Jr., Chief of Staff of the Air Force, in a "posture" hearing, Senate Armed Services Committee, June 17.

SitRep

"It is important for those of us in uniform to be open minded and to be widely read. ... I've read Mao Zedong. I've read Karl Marx. I've read Lenin. That doesn't make me a communist. So what is wrong with understanding-having some situational understandingabout the country for which we are here to defend?"

-Chairman of the Joint Chiefs of Staff Gen. Mark A. Milley, responding to criticism about 'critical race theory" and the U.S. Military Academy during a House Armed Services Committee hearing, June 23.

FREEDOM TO DETER



"I know classification is holding us back. A lot of things are over-classified. ... If we're going to be a force that is taken seriously and deters our adversaries, we need to start showing them things to deter them. We need to show them what we have."

Lt. Gen. Nina M. Armagno, U.S. Space Force director of staff, in response to a question at AFA's Doolittle Leadership Center July 2.

Time to Act



"We can say definitively that China's actions show a sense of urgency. They see a future that is very different from the one we would want to see, and they are moving with a purpose to realize that future. Their efforts include a massive buildup of military power and a clear intent to use that military to create leverage on us, our allies and partners. ... We are together waking up to this challenge."

-Lt. Gen. Davis S. Nahom, deputy chief of staff for plans and programs, June 22, in Senate testimony.

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aveb Mezahdia/Pixabay

QUESTIONS & ANSWERS

Developing the Force

Lt. Gen. Marshall B. Webb commands Air Education and Training Command at JB San Antonio-Randolph, Texas, where he oversees recruiting, training, and education for all Air Force personnel. AETC, which trains more than 293,000 students annually, is in the midst of a technological revolution. The command is leveraging technology in the classroom, in dorms, and in selfpaced training that exchanges industrial-model training—one size fits all-to more customized, tailored approaches that are ultimately more efficient and effective. He spoke with Editor in Chief Tobias Naegele in July.

Q. Force Development has been your main focus. What does that mean to you?

A. What we have today, I call it "developing the Airmen 'need.'" This is a deliberate effort to maximize force readiness, ... building competencies that we think we need our Airmen to have, whether you're talking about officers or NCOs, because a competent empowered mid-career officer and NCO is the Air Force's asymmetric advantage-frankly, it's America's asymmetric advantage vis-a-vis the great power competitors, specifically China and Russia.

Q. How does that great power competition issue translate into curriculum changes in officer or NCO training?

A. Air University, through all levels of Professional Military Education (PME) has already moved out and is well on the road to establishing, by the 2022 time frame, ... 60 percent of the content be about [strategic]competition, meaning specifically China and Russia, and 40 percent of that 60 percent specifically about China. The way that we grew up as youngsters, we knew Soviet doctrine, Soviet organization, Soviet methods of combat, the Soviet mindset. I think it's fair to say we're nowhere near that [level of familiarity] with respect to China-not to mention that this is an Eastern mindset versus a Western mindset. ... It's really to be the way we were in the Cold War Soviet era, how we understood the Soviets. We need to be that way with China [today]. So we need to really focus our curriculum efforts, in all of the PMEs, whether it's SOS, Air Command and Staff College, War College, NCO Academy, senior NCO Academy. Because, back to my first point, ... this empowered NCO that understands Commander's Intent, mission-type orders, mission command, becomes very important. ... These are going to be small teams, working with other teams, led by mid-career officers and NCOs. And it starts with education and training. That's a generational lift but it's well underway, and we will have [it] fully inculcated in '22.

Q. What you just described is essentially the ACE framework-Agile Combat Employment. It's small units, operating in remote locations, with multi-capable Airmen doing lots of different jobs. How are you adapting training to support that concept?

A. This is another work in progress. What we see today, in July 2021, is that agile combat employment and multi-capable Airmen mean something a little different to PACAF, something a little different to AFSOC, it's something a little different to AMC-you get the point. I am in kind of the catbird seat from an

Lt. Gen. Marshall B. Webb is the Commander, Air Education and Training Command, Joint Base San Antonio-Randolph, Texas. He is responsible for the recruitment, training and education of Air Force personnel.



AETC perspective, along with the Air Force Expeditionary Center, which is really knee-deep in this. But we need to be developing what we think [is] ... appropriate at basic training and tech training. ... There are enough common threads that you can tell clearly where we're going: small teams that have to have good situational awareness, have to understand the big picture, have to understand mission command, have to be comfortable with making decisions in uncertain environments. Competence and empowered has to be part of the equation; these things are all fundamental.

Q. ACE seems to be about teaching somebody to be comfortable getting outside the box, adapting on the fly. And that changes the fundamental idea of what your are teaching and training, doesn't it?

A. Yes, that's true, but the American citizen that arrives at our gate today is a much different American citizen than the boomer generation, of which I'm, of course, a part. These citizens coming in have had a whole different experience, the world at their fingertips, called an iPhone. While it may be kind of a paradigm shifting mechanism for the Boomer generation, they adapt to this naturally.

Q. So you're saying military training is catching up to the modern individual?

A. That's right.

Q. In terms of curriculum, how does that change things?

A. There are some evolving changes with respect to basic training and ... tech training that are curriculum based. You can expect more small group dynamics and tactical skills decision- making, exercises and things like that. These will become more fundamental than they were before. But it is about mindset. [Letting trainees] utilize technology, even in Basic Training. WiFi access to learning modules that they can be doing in their dorms or off time and at their level of competency, and continuing that through tech school. You see a lot of fruit in the labors at tech school in this area, where we've been able to take immersive technologies and flipped classrooms, so Airmen have a facilitator in the classroom but it's not an

instructor at a whiteboard teaching a lesson. The acceleration on time to the competencies on a given skill is astronomical. Really impressive. ... Those taking part in this experimentation [are learning faster, and those who see them] are looking over the divider wondering, 'How do I get to be part of that?' Because it's just natural. It's a natural environment and it's one that I think derives a lot of satisfaction.

Q. That means you can move to more self-paced learning?

A. That's right. Back to this multi-capable aspect. We certainly want them to have a firm foundation in a basic skill set, but how much do we want to add on? ... That's the give and take. We all kind of intuitively understand you have to have a firm foundation in your primary career field. But gone are the days when you need—or you can afford—20 people working on a jet, because one guy does electronics and one guy does hydraulics and one does something else. We're not going to be able to do that. And by the way, these [young people] are fully capable and competent to take on more. So, it's really adjusting the rheostat knobs to where's the right level foundationally. What do we need to get to in tech school? What is good enough at tech school and can then be taught in the unit. This is about being lifelong learners, not just in school and then we're done learning once we graduate.

Q. Does that mean that for some people you can shave weeks of training?

A. It's possible....[But] we need to be responsible with who the field wants. Do they want someone earlier who has a basic competency and they teach the rest in the field, or would they rather we start the multi-capable aspects before we hand them to you? The jury's still out.

Q. Pilot training has been going through a rethink for a couple of years. Vance recently completed its last traditional class, so the future is here. What does that look like?

A. We have operationalized ... Pilot Training Next, or PTN. They were Edisons, inventing the light bulb, inventing the phonograph, inventing the good stuff. ... Now, at Vance, it's Henry Ford: It's assembly line production. They are taking those concepts ... and fully transitioned to winging our pilots at the end of the T-6 phase. Then, depending on their assignment, they go through the Air Mobility Fundamentals course or a fighter fundamental course, which is today of course, the T-38, and will be T-7 eventually. We just started a squadron's worth at Randolph, and we will make the decision later in the summer ... on whether we go to Laughlin and or Columbus to scale that out as well. The limiting factor is really equipment, because it's a lot of immersive devices. A wing has got to be ready for this. And if we haven't properly resourced them then we just can't scale it.

Q. What is the end state you hope to see?

A. What it will be when it's fully mature, is you get your assignment to Vance Class 23-01 or whatever, and your [Virtual Reality] goggles show up in the mail along with your laptop and your whatever devices you need to connect, and you get what we call early access to content, where you can do whatever level of pre-study you want. Then you keep all that when you show up at Vance and start your pilot training [where] you will have a diversity of training devices, which are, you know, basically, a seat with a cockpit that is reconfigurable to the type of aircraft you're flying, that connects through the cloud system and the data analytics, and you continue your training. Then it's a blend of simulators and real flights. That is not fully realized right now, but it's close.

Q. What about helicopter training?

A. We've run group trials, the first one just graduated in June. That was a helicopter-only track. This is a little bit of back to the future. I'm a helicopter pilot, by the way, and I went through Fort Rucker [Ala.,] as a helicopter-only guy in 1984-85. ... Flying [vertical lift only] can be done. And it's being done with this cohort that just graduated. This is a track we are pursuing, one, because [we] can, and two, frankly, because of the pilot situation we're in ... the pilot crisis effort. [Separating helicopter pilots allows for] ... 90 slots that we can free up for fixed wings, because the crisis is on the fixed wing side. The Air Force learning mentality has adapted over time, we're past saying [to qualified helicopter pilots who want to switch to fixed wing that they have to start from scratch. Now] they can go through a transition course, just like transitioning from an F-15 to F-35.

Q. Are we all done with COVID-19 and its aftermath? What did you learn given that experience that could make you better for the long-term?

A. We're not out of the woods. We're still fighting through it. ... We're not at a state where everybody is vaccinated because we're not ... obviously, mandating vaccinations. We see a ton of folks that have either already vaccinated when they come in or that volunteer to get the shots during those first weeks, but we still see cases. We still have to quarantine when we do have these isolated cases. So we're still in the midst of it. We'll see what happens with these other variants. In a lot of ways, COVID worked as an accelerant to really bring about needed changes. Chief Bass recently said, 'I can't believe we still do tests with paper and pencil'.... [COVID-19] kick-started how we do recruiting, with more online methodologies and more, modern ways of using technology....

Q. If you could pick three things that you changed and will stick with now, what comes to mind?

A. It would not be a blanket statement to say the whole Air Force [now] understands that ... WiFi is a necessity, as opposed to a convenience. People want to learn in their dorms ... I mean, that has been a fundamental game-changer for us: all access, all the time, to content for learning. It's proven out what General Kwast, my predecessor, said, that Airmen will continue to learn and seek out learning opportunities if given the choice. I think there was some skepticism about that but you see it play out. A second is the social distancing aspect. We didn't really have a flu season last fall, because guess what? People were staying physically distant, and they were washing their hands, and yeah, these fundamental things work. The last one, and I heard this play out from every senior leader visit that occurred down here-and we had a bunch, we had Secretary of Defense, Secretary of the Air Force, a couple of chiefs-it was the realization at the squadron level, even at the flight level, [that they had license to figure things out for themselves.] People said, 'Hey, sir, I've never led in a pandemic before.' Well, you know what? I said, 'I've never lived through a pandemic either. You have the tools to. You understand what the commander's intent is. Move out. Do the mission to the best of your ability.' Inevitably, every squadron commander that I heard talk to leadership said, 'I can't imagine a better time to lead in the Air Force because there are no left and right limits, I understand what my mission is, I've just got to figure it out.' That's true whether you're talking to a pilot, a squadron commander, at BMT, or tech school. They said, "The leadership said figure it out and go, and that's so motivating!" ... That sense of job satisfaction and sense of empowerment was palpable, and people really responded to it. That's the magic. That's the special sauce. 0

STRATEGY & POLICY

By John A. Tirpak

The Players Changed, But Digital Engineering and **Modeling Is Here to Stay**

ormer Air Force acquisition chief Will Roper raised eyebrows in 2018 when he proposed a "Digital Century Series" of guickly designed and fielded new fighters. The Air Force needed a better, faster way to innovate to stay ahead of Russia and China.

Roper is gone, but his revolution remains, and there's no going back, according to acting acquisition chief Darlene Costello.

The "pivot to a digital architecture and a digital acquisition approach" is critical to keeping up with China, Costello told an Air Force acquisition conference in July. China's command economy is unfettered by acquisition rules and can move with greater speed. While it took 30 years for China to match the F-15 with its J-30 fighter, "it only took 10" to match the F-22 with the stealthy J-20, she said.

"They're finding ways to do this faster. We must also," she stated. "The case for change has never been more acute than now."

Costello sent out a memo in May formalizing the requirements for digital engineering, agile software, and open-systems architecture, what she called the "digital trinity." This will allow USAF to "replace, automate, or truncate real-world activities" and pay benefits in time, cost, and precision.

The trends in acquisition programs are "not good," as it now takes 10 to 20 years to turn a requirement into a fielded capability, she said. The pace incentivized "bad behavior" among contractors, prompting some to favor long-term sustainment of aging platforms over new programs. Those timelines will put the U.S. permanently behind fast-moving adversaries.

"We want the industrial base to be robust," Costello said. USAF is "motivated to broaden that group," because competition tends to drive capability up and prices down. Digital will make that possible.

Fully digital acquisition and development was not an option until recently, Costello said, noting a "10,000 times" increase in computing power since 2000, with a corresponding plummet in the cost of data storage. Now aircraft can be designed digitally, producing not only blueprints for production, but 3D models whose performance can be simulated and tested before production ever begins.

While the model "may take as long" to design and build as a prototype airplane, modifications, upgrades, changes, and testing can be made with far greater speed, she said.

NUMBERS SPEAK VOLUMES

The Air Force has had great success with digital approach in its newest programs, Costello noted. The B-21 bomber and Ground Based Strategic Deterrent (GBSD) missile are exploiting digital methods, and they are considered two of the Air Force's best-run programs. Both are on schedule and within cost, and in the case of the GBSD, the design went through "six billion iterations" to find the exact sweet spot of cost and



It only took China 10 years to match the F-22 with the stealthy J-20. That's a problem.

performance, Costello said. That could not have been done with previous methods.

Boeing's T-7 trainer was also designed digitally, and that program went from "a computer screen" to first flight "in 36 months," Costello noted.

Some older systems are getting a hybrid digital treatment. With the A-10 re-winging, "we did not go and turn the entire A-10 into a digital model," just the elements that were needed, she said.

Likewise, for the B-52 Commercial Engine Replacement Program (CERP), the Air Force created a digital model "for the engines, connections, and interfaces, but not the entire B-52, per se." The approach is expected to shave "many, many months" off the development and installation of the new engines. Contractors are also proposing their engines digitally, with no paper changing hands, to ensure all stakeholders have access to the same models and same "ground truth," Costello said. Only after down-select will a "physical prototype" be produced.

She said programs like the A-10 and B-52, that use the hybrid approach, will be "e-programs," while "e-series" programs are those designed digitally from the start-like the T-7 and the Next-Generation Air Dominance fighter. With a digital "twin" in hand, the Air Force will be able to rapidly update these systems, or simply move on to their successors after a decade or so.

The T-7 goes together with 80 percent fewer assembly hours, and its software takes half as long to code as an aircraft designed the old way, Costello said. The digital approach will also allow USAF to "bake in" airworthiness, safety, and cyber certifications from the outset.

Costello said that the Air Force's digital acquisition "journey" is only in its infancy, though, and that the Air Force "writ large" is only at a "two or three" on a scale of 1-to-10, although some individual programs are already at a 10. "We are just ... making our plans, getting tools in place, doing our training, teaching people. ... We've got a ways to go."

SEE SOMETHING, SAY SOMETHING

Military and commercial aviators have known since the 1940s: If something weird occurs in the sky, best keep it to yourself. Eyes would roll and careers could be unmade by reporting strange lights or objects performing impossible maneuvers, even if those objects were also tracked by radar or other sensors, or there was gun camera footage verifying the sighting.

Not anymore. The Pentagon directed pilots, sensor operators, and others to report such incidents within two weeks. Under pressure from Congress, the Defense Department ordered combatant commanders (CCMDs), defense agencies, and field activities directors to promptly send such reports up the chain of command, under the assumption that if it's not "one of ours" it's a potential threat. A central clearinghouse of such documented reports, which are increasing, is being set up to figure out what's going on.

Deputy Defense Secretary Kathleen H. Hicks issued the order in a memo dated June 25, the same day Director of National Intelligence (DNI) Avril Haines issued her report, "Preliminary Assessment: Unidentified Aerial Phenomena (UAP)" (the new and improved version of the term "Unidentified Flying Objects"). The report was mandated by the last Congress, which ordered an unclassified report on the topic by the end of June.

Hicks said DOD personnel must observe and "report whenever aircraft or other devices interfere with military training." Safety and security at training ranges and installations depend on it, she said. The move coincides with a rising number of commercially available drones flying near or in restricted military or controlled civilian airspace, with a commensurate jump in the number of near-collisions with aircraft.

The DNI report, Hicks said, "confirmed that the scope of UAP activity expands significantly beyond the purview of the Secretary of the Navy," who's been running the UAP Phenomena Task Force. She directed the undersecretary of defense for intelligence and security (USD/I&S) to take on and "develop a plan to formalize" the mission now performed by the task force.

OPEN A NEW BLUE BOOK

Hicks directed the undersecretary for security and intelligence to:

■ Create procedures for reporting UAP phenomena and securing military test and training ranges,

■ Identify what's needed—staffing, money and authorizations-to set up a new UAP investigative organization

Coordinate the creation of this new organization with the Joint Chiefs of Staff, Service Secretaries and CCMDs, as well as the DNI.

The DNI report—prepared at the behest of Senate Intelligence Committee members such as Marco Rubio (R-Fla.) and mandated in the fiscal 2021 Intelligence Authorization Act-concluded that there's not enough "high-quality reporting" on UAPs to "draw firm conclusions" about what they are, or who they might belong to. It looked at military reporting of UAPs since 2004, many of which the DNI admitted "probably do represent physical objects" because they were tracked not only visually, but with sensors such as "radar, infrared, electro-optical, [and] weapon seekers."

In a few cases, these objects "appeared to exhibit unusual flight characteristics," according to the DNI report, saying this could be the results of sensor errors, "spoofing" by an adversary, or "observer misperception," and more analysis is needed.

Safety of flight is clearly in peril, the DNI said, noting that pilots must contend with "an increasingly cluttered air domain." Moreover, if the UAPs are foreign intelligence collection platforms, they pose a threat to national security. They would be a sign that an adversary has developed "either a breakthrough or disruptive technology."

A clearinghouse of reports will make it possible to use a whole-of-government approach to figuring out what UAPs really are, the DNI cited, but that activity could become "resource intensive" and will need further investment.

The DNI acknowledged that there is "stigma" attached to reporting UAPs, and while that's diminished with more open discussion of the phenomena, "reputational risk may keep many observers silent, complicating scientific pursuit of the topic."

IS IT CHINA?

The DNI looked into 144 reports from government sources, of which 80 involved corroboration with "multiple sensors." The objects observed are probably of "multiple types," the DNI said, but probably fall into one of five categories: "airborne clutter, natural atmospheric phenomena," U.S. government or industry secret projects, "foreign adversary systems," or "other." It acknowledged the possibility that they "may be technologies deployed by China, Russia, another nation, or a non-governmental entity."

In 11 of the cases, pilots reported a near-collision with the object, the DNI reported.

There was "some clustering" of sighting during training events and at training grounds, as well as some common denominators about UAP "shape, size, and particularly, propulsion." In 18 of the events scrutinized, the object exhibited "unusual flight characteristics," such as hovering, moving against the wind, abrupt maneuvers, high speed, or extreme acceleration "without discernible means of propulsion." These incidents are getting continuing scrutiny, according to the report.

The DNI said it's waiting on the Air Force to provide more data on some of its encounters with UAPs.

"Although USAF data collection has been limited historically, the USAF began a six-month pilot program in November 2020 to collect in the most likely areas to encounter UAP and is evaluating how to normalize future collection, reporting, and analysis across the entire Air Force."

CLASSIFIED ANNEX

While the UAP report was unclassified, a classified annex provided to the Senate Intelligence Committee included information obtained through the FBI; the National Geospatial-Intelligence Agency; national means of signals intelligence, measurement, and signatures intelligence, and human intelligence. It also identified specific threats to national security in UAP cases, as well as any information pointing to an adversary having obtained "breakthrough aerospace capabilities."

Senate Intelligence Committee Chairman Mark Warner (D-Va.) said he's been briefed on UAP phenomena for the last three years, and "the frequency of these incidents only appears to be increasing." It's essential the U.S. "understand and mitigate threats to our pilots," whether those threats come from drones, balloons, or "adversary intelligence capabilities."

Rubio, in a statement timed to coincide with the DNI report's release, said military operators have too long been "ignored and ridiculed" with regard to UAP reports. He called the DNI report "an important first step" in understanding such incidents, but "just a first step," and he pledged that the committee will work with the Pentagon to further explore the subject. 0

AIRFRAMES

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A USAF C-130J Super Hercules from Yokota Air Base, Japan, performs low-level maneuvers during RED FLAG-Alaska 21-2 on June 25. RED FLAG-Alaska 21-2 is a Pacific Air Forces exercise that provides realistic training in a simulated combat environment. A series of commander-directed field training exercises provide joint offensive counter-air, interdiction, close air support, and large-force employment training.

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service and they read them





Incoming cadets from the class of 2025 receive instruction from upper-classmen as they arrive at the U.S. Air Force2 Academy for in-processing (I-Day), on June 24 in Colorado Springs, Colo. I-Day marks the start of their journey to becoming a commissioned officer in the U.S. Air Force and Space Force. After haircuts and immunizations are given and uniforms issued, the brand-new cadets will take the oath of office and officially become basic cadets. The next day, a swearing-in ceremony conducted by the commandant will formally kick off six weeks of basic cadet training.



AIRFRAMES

KC-135 Stratotanker pilots prepare to refuel F/A-18D Hornet aircraft during a mission supporting Dynamic Force Employment at AI Udeid Air Base, Qatar, May 20, 2021. DFE is an operational platform that allows our forces to be strategically predictable and operationally unpredictable.

CARLOR LACTOR COTACT OF SET





Air Force Chief of Staff Gen. Charles Brown Jr. speaks to a virtual audience on how the Air Force is adapting to what he called the "changing character of war" during a July 1 Atlantic Council event.

Air Force Must Match Changing Character of War

Future conflicts will be different. Permissive access is a thing of the past.

By Abraham Mahshie

ir Force Chief of Staff Gen. Charles Q. Brown Jr. is fashioning a fighting force to match what he describes as the "changing character of war," one where all domains are contested and capabilities matter more than numbers, he told the Atlantic Council on July 1.

As the United States moves away from the Middle East theater and focuses on meeting the challenges of great power competition with China and Russia, Brown questioned the mainstream thinking that America needs to win with quantity of fighter aircraft.

"Our competitors have worked to ... erode what I would call our comparative advantages."-Gen. **Charles Brown** Jr., USAF Chief of Staff

Rather, he focused on the mix of capabilities required to overcome a technologically advanced adversary. He also called for a willingness to experiment in the digital realm while staying vigilant to counter rising cyber threats.

"Our future conflicts will be different," he said, underscoring how Mideast conflicts are winding down.

"Our future adversaries will not allow us permissive access like we've been accustomed to in the past, and [we] will be contested at every level, in every domain, and I would submit that we are contested today," he added.

A technologically more advanced adversary in

China or Russia requires a more advanced aircraft.

The Air Force asked to retire a total of 201 legacy aircraft in its 2022 budget request and it will buy 91 new ones, as it looks to posture itself to keep pace with peer adversaries. Planning for the fiscal 2023 budget is underway amid a fiscally constrained environment, and Brown said the service is contemplating what the future force needs to look like.

"It's easy for us to talk about numbers, and we're also talking about capability," he said, giving an example of a comparison between the F-86 and the F-35. "What I really look at is the capabilities required ... [as] we look at where the Air Force needs to be about the 2035 time frame."

Brown posed that the United States Air Force now possesses "some" of that capability, what he described as a mix of air superiority, global strike, command and control, and intelligence, surveillance, and reconnaissance.

"I want to make sure we have the right mix of capabilities with the right numbers to make it come together," he said.

WORRYING ABOUT CYBER

Brown admitted that in the last couple of decades, adversaries have looked for America's military weaknesses and increasingly targeted the cyber domain.

"The internet security environment has changed," he said. "Our competitors have worked to blunt our capabilities and erode what I would call our comparative advantages that we had as an Air Force, as a joint force."

The impact of cyber interference by adversaries is one that plays out on a daily basis in the lives of Americans, Brown said, offering by way of explanation all the information that can be manipulated on an iPhone.

"We got to be able to be in a position to move information," he said. "That's why the Advanced Battle Management System for us is really how we move information, how we move data, to help improve decision-making well ahead of a crisis."

The fast and secure movement of information must be able to flow from senior leaders to lower-level commanders, but it also means working when that information flow is disconnected or incomplete.

"It's better to be better prepared with information upfront, so if you're disconnected, you have an aspect of kind of what's going on," he said. "You want to be able to have the right information, bring those data sources together, and then be

able to use various tools to parse through the information you need to know."

In a recent Kessel Run interview, Air Combat Command's Deputy Commander, Lt. Gen. Christopher P. Weggeman, described the need for a rapid system of information distribution that is decentralized.

He used an analogy of an Apple Store as headquarters and the end-point devices, such as phones, tablets, and applications to explain the Air Force needs.

"We need an ecosystem that can both be centralized, but [also] rapidly distributed and decentralized, and can work decentralized," he said. "Whether when we're connected to the backbone at a high, high, rate of speed; and be highly insightful using AI [artificial intelligence] and ML [machine learning], and be able to do the same when it's disconnected."

Then there is the need to "quickly transition between connected and disconnected states; that's kind of the federated and distributed command and control architecture we need" to be competitive against Russia and China.

Brown said as adversaries test the gray zone boundaries of cyber warfare, the risk for miscalculation rises.

"I personally have been thinking about ... the norms of behavior in cyber," he said. "You look at some of these most recent events that have transpired, because that could lead to a miscalculation."

The Air Force needs to continue down the path of digital engineering while remaining cognizant of the risks of operating in the cyber and digital environment, according to Brown.

He offered the example of joint all-domain command and control.

"There is value in this rapid experimentation approach because it's a way for us to disrupt how we do business," he said.

Brown said new risks must be taken to realize the Air Force of the future.

"We can't do the same thing and expect a different result if we're going to change ourselves for the future," he noted.

"This is an opportunity for us to look at some things that we disrupt, how we do things on a normal basis," Brown added, while noting his observation of what is done in the tech sector that can be tried at DOD. "It's an opportunity for us to take a hard look and go experience certain areas, and the aspect of being able to ... fail fast, but fail forward." 0



Airmen speak with reporters about the new innovative **ABMS On-ramp** 2 at Joint Base Andrews, Md. The effect ABMS is attempting to achieve is joint all-domain command and control. JADC2 is meant to accelerate the speed of the kill chain by connecting sensors to shooters.

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Will Adversaries Team Up to Challenge U.S. Space Superiority?

Russia and China may work together in the new warfighting domain.

> **U.S. Space Force** leaders are concerned about growing space capabilities from China and Russia, such as the **Russian** "nesting doll" satellite that can deploy a kinetic weapon.

By Abraham Mahshie

anctions are crushing Russia's efforts to counter American space superiority, but analysts have a rising concern that Russian President Vladimir Putin may link up with China's wealth to develop the weapons that **Capabili**could stop American warfighters in their tracks.

Chief of Space Operations Gen. John W. "Jay" Raymond has warned that America's adversaries are already operating as if space was a warfighting domain, exhibiting ground and space-based weapons capabilities that can target vulnerable American satellites. House Armed Services Committee Chairman

"They are building the means ... to ... eliminate **U.S. space** ties."-Col.

Douglas Loverro, USAF (Ret.)

Adam Smith (D-Wash.) told Air Force Magazine on June 29 that satellite survivability and redundancy were his priorities for fending off adversaries, but a closer look at the budget was necessary.

"I don't think 'catch-up,' is the right [phrase]," Smith said when asked about American space weapons compared to adversaries in a Defense Writers Group discussion. "We're not behind in this area."

The chairman said his priorities were cost-effective launch and the survivability of satellites and command and control systems.

The dropping cost of launch in America's domestic capability has had the dual effect of robbing Russia of needed dollars to support its military space pro-

gram, retired Col. Douglas Loverro said at a June 28 Center for Strategic and International Studies forum on Russia's evolving military capabilities in space.

Loverro, who served as deputy assistant secretary of defense for space policy from 2013 to 2017, also described Russia's July 2020 test of a co-orbital satellite that aligned with an American spy satellite and fired a projectile in space.

"They view this as a decisive factor," Loverro said. "Certainly, they are building the means, as best we can tell, to go ahead and make sure that they can eliminate U.S. space capabilities if war does occur."

The Russian capability is despite a drop in oil prices that has cut into Moscow's revenue, coupled with crushing American sanctions related to the invasion of Crimea in 2014. Russia's

"Diplomatically, Russia is trying to reign in U.S. efforts by going ahead and aligning with China and other BRICS nations [Brazil, Russia, India, China, and South Africa]," he added, describing UN efforts to limit the presence of weapons in space. "Those are clearly designed to try to slow down U.S. progress in this area."

Russia and China jointly submitted a UN resolution in 2008 to limit space weapons, but of late, their cooperation has gone further. Recently, the two cooperated on the Chinese space station and signed a memorandum of understanding on a potential lunar base. Commercial cooperation between two of America's chief space adversaries can easily extend to military applications, the expert panel argued, even though historical differences may arise.

"Russia has experience on deception in space," Loverro said. "Russia has experience that is incredibly valuable to a technologically advanced, but operationally inexperienced China." As the former head of NASA's human spaceflight program, Loverro also qualified Russia's malicious expertise as more in the cyber realm while he viewed China as more advanced in

he said. Former commander of U.S. Strategic Command and Air Force Space Command retired Gen. C. Robert Kehler spoke to his Cold War-era knowledge between the two communist countries. "I think it remains to be seen what that partnership really does," he said.

commercial space and launch programs have also taken a hit in recent years, depleting resources to invest further.

Loverro said Russia's 10-year space development budget, released in 2016, called for \$53 billion, but Moscow could only afford to commit \$10 billion.

TEAMING UP WITH CHINA

the space domain.

"The combination of those two could be very dangerous,"

"During the Cold War, from my perspective, when Russia and China said that they were working together, they were going to cooperate on things, they have never seemed to me to be natural partners," Kehler explained. "I don't know it's going to result in anything that's meaningful here."

Loverro offered the last word about the increased proximity of civil space cooperation between Russia and China.

"That represents a very dangerous position for us because Russia has the operational space knowledge, China has the technology and the funding," he said. "Together, they can be a significant competitor for the U.S., and certainly their ambition remains to be a great space power."

Smith hedged when asked if the \$17.4 billion Space Force budget request was correctly apportioned to meet the threat posed by America's space adversaries.

"More or less, I think that the Space Force budget is correct," he said. "I've got to do a deeper dive on that to really understand it, but I think it's moving more or less in the right direction."

Smith was less certain that a combined Russia-China team was percolating to challenge American space superiority, but he said the U.S. should prepare regardless.

"I don't think anyone has any idea whether or not Russia and China are going to team up," he said. "But whether they team up or not, we need to be ready for it. We need to be able to protect our systems, and we need to be able to deter our adversaries from attacking them in the first place."



The first product of the Advanced Battle Management System is a communication pod that will fly on the KC-46 tanker, enabling the F-35 and F-22 fighters to communicate and share data for the first time. The pod is called Capability Release 1.

New Plan for ABMS

Smaller budget, but clearer schedule.

By Brian W. Everstine

he Air Force is adjusting its plans for the Advanced Battle Management System (ABMS) after a skeptical Congress cut last year's budget request to develop the new concept in command and control almost in half. For fiscal 2022, officials are asking for less money for ABMS and seeking to buy their first real capability: data link pods that will enable the KC-46 tanker to help F-35s and F-22s share data.

"It is important that we view the development of this command and control support system as something different [from]... traditional acquisition and procurement programs," said Air Force Vice Chief of Staff Gen. David W. Allvin. ABMS, he said, is "different, which is why we're going to need to be very transparent with what we're doing [and] how we're approaching it.

The first ABMS deliverable is Capability Release 1 (CR-1), a new pod for KC-46s that will allow F-35s and F-22s to share data for the first time. The Air

"Perhaps we hadn't laid out a clear enough path to justify the funds that we were requesting." -Gen. David Allvin, USAF Vice Chief of Staff

Force wants between four and 10 pods in fiscal 2022 to enable data processing and sharing at the "tactical edge," said Brig. Gen. Jeffrey D. Valenzia, the ABMS Cross-Functional Team lead.

The second new product planned, Capability Release 2 (CR-2), aims to speed up decision-making for homeland defense missions led by U.S. Northern Command and the North American Aerospace Defense Command. That capability will use cloud computing, fiber-optic networks, artificial intelligence, and other new technologies to accelerate how those defending the homeland take in new intelligence and make command decisions.

"The combatant commands are still challenged with potential threats over the horizon that they need to characterize and make better decisions on more rapidly," Allvin said.

Requirements for both programs were defined in prior ABMS experiments, and sometime this summer NORTHCOM will lead its own Global Information Dominance Experiment, incorporating inputs from the other combatant commands to

further define what is needed next.

Because ABMS seeks to go beyond merely replacing the E-8C Joint STARS platform and instead take a whole new approach to command and control, the Air Force has struggled to clearly articulate what exactly it expects to acquire and how to justify the millions of dollars in funding it has sought. In fiscal 2021, Congress cut the Air Force's ABMS funding request by 50 percent, forcing leaders to cancel planned experiments and delay initial acquisition plans. Now the Air Force is trying to be more transparent about the timeline for its KC-46 pod and its acquisition strategy going forward.

"There is not a fighter aircraft that comes out on the end of this," Allvin said. "But, as we learn things through ... the design experiments that we're doing, and that we will continue to do with the capability releases, we're understanding how we need to adapt our current infrastructure."

The Air Force Rapid Capability Office, the program executive for ABMS, is expected to have a full cost estimate for CR-1 early this summer and another for CR-2 as requirements are firmed up.

In all, the Air Force is asking for \$204 million for ABMS in fiscal 2022, after last year's \$302 million request was cut to \$158 million.

"We understood that when Congress looked at it, it wasn't clear enough, "Allvin said. "That perhaps we hadn't laid out a clear enough path to justify the funds that we were requesting. So we had to look ourselves in the mirror and say, 'We need to better align ourselves to be able to articulate more clearly what we want to do.""

Allvin said this year's funding request is more closely aligned to specific capabilities as a result.

Of this \$204 million, just over half is for the Capability Release 1 pods; most of the rest is for CR-2 to get at "how we can accelerate that command and control process" with technology, Valencia said. A small amount funds "baseline investments in data management," he added.

As more ABMS requirements are defined, Allvin said, budget requests will likely grow. "But we want to ensure that what we're asking for, we can articulate as well as possible," Allvin said. He wants Congress "to have confidence in providing those resources to us."

GBSD Development Hinges On New Nuclear Posture Review

By Brian W. Everstine

After some lawmakers questioned the need for the Ground Based Strategic Deterrent (GBSD) program, top Defense Department leaders said June 23 that its future will depend on a review of the military's nuclear posture.

The Pentagon is asking for \$1.1 billion to fund the GBSD program in the DOD's fiscal 2022 budget request, while the first test flight of the Minuteman III replacement is planned for 2023.

Defense Secretary Lloyd J. Austin III told members of the House Armed Services Committee the long-term "valuation" of the program will be part of the Pentagon's next Nuclear Posture Review (NPR).

"We'll take a deliberate and earnest look at where we are and where we need to go in the future," Austin said.

The Defense Department's last Nuclear Posture Review, released in early 2018, supported the GBSD program along with other new nuclear programs including the B-21 bomber, the Long-Range Standoff (LRSO) Weapon, nuclear command and control, and the Ohio-class submarine replacement.

These initiatives would also be funded under the administration's 2022 budget request, which also includes \$609 million for LRSO in addition to GBSD funding.

Austin said the upcoming NPR will include "deliberate work with the services to make sure that we are meeting the most pressing need."

The notion that Austin has made any decision on the future of the GBSD is premature, he said.

"I think it deserves the right amount of effort and attention, and we'll make the best choices," he said. "But these choices need to be informed by the posture review to make sure we have the right balance here."

Military officials, including leaders in the Air Force and U.S.



Screenshot

Defense Secretary Lloyd Austin III speaks during a House Armed Services Committee hearing on June 23.

Strategic Command, have said modernizing the ICBM leg of the air-land-sea triad is needed and that time is running out. Chairman of the Joint Chiefs of Staff Army Gen. Mark A. Milley, testifying alongside Austin on June 23, said he does not recommend taking any money away from nuclear modernization. The recapitalization of the triad, including the GBSD, is "critical to our nation's security," he said, and delaying it by up to 12 to 15 years would create a gap.

Rep. John Garamendi (D-Calif.) repeated during the hearing that USAF officials have told him the lives of current ICBMs can be extended and that a replacement can be delayed into the 2030s. Milley, in response, said his position is that investment in GBSD needs to continue "without delay." G

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A B-21 Raider in an artist's rendering was released in July. Designed to perform long-range conventional and nuclear missions and to operate in tomorrow's high-end threat environment, the B-21 will be a visible and flexible component of the nuclear triad.



Latest B-21 Bomber Image Displays **Novel New Window Configuration**

By John A. Tirpak

The Air Force's newest rendering of the secret B-21 bomber shows an exotic layout of cockpit windows. The image, the third released so far, offers a new oblique view of the aircraft from below its port side, suggesting a deeper keel and wider weapons bay than that of the B-2 bomber it will succeed. But the air intakes, which have been redesigned, are obscured.

The new B-21 Raider image was published July 6 along with a new fact sheet. The Air Force identified it as an "artist's interpretation." It shows the aircraft taking off from Edwards Air Force Base, Calif., where it will be flight-tested beginning early next year. The prior official illustrations were released in January 2021 and in February 2016.

The new picture shows a triangular, curved main forward cockpit window and a wide, arcing side window with no apparent interior framing. That departs from earlier views which showed B-2-style windows. Just aft of the side window is the Air Force Global Strike Command (AFGSC) badge and stenciling for ground rescue instructions.

The nose of the aircraft confirms a more pronounced "Beak" or "Hawk's bill" than on the B-2 Spirit, which the B-21 generally resembles. The underside of the aircraft seems to be deeper than the B-2, although details are obscured. When compared with the artist's rendering released in January, the B-21 seems to have a greatly pronounced chine, or flattened leading edge, which then tapers into the blended-wing fuselage. This chine also marks a departure from the B-2, which has a more classic wing-like chord shape in cross section.

Northrop's stealthy YF-23, which lost out to the F-22 in USAF's Advanced Tactical Fighter competition some 30 years ago, also featured extended chines on the leading edges. The company's X-47 autonomous carrier aircraft demonstrator featured an extended Hawk's bill like that on the B-21.

The image obscures details of the B-21's air intake, which underwent a "major redesign," according to Program Executive Officer Randall G. Walden. He told Air Force Magazine early this year such a change is typical for a complex new aircraft program. New aircraft often have "installed engine inlet/exhaust

integration issues that have to be resolved," he said. Previous images have shown the intakes as shallow and straight-edged, unlike the B-2's scalloped, rounded, and deep intakes.

Also absent from the new image is any detail of the exhaust, although it continues to show a tapered, pointed single tail in silhouette.

The image also suggests a two-tone paint scheme on the aircraft, with lighter gray above and darker gray below. There's a sharp color break below the window, and the AFGSC badge is in dark gray, whereas such markings are in light gray on the B-2, to better contrast with that aircraft's FS 36118 overall "Gunship Gray" paint scheme.

The January 2016 image also revealed that the B-21 rests on two, two-wheel main landing gear, while the larger B-2 has four-wheel bogeys on each side. The new image suggests a thickening of the outer wing as well.

The new fact sheet released with the image mentions major program milestones and emphasizes the jet's open-mission systems concept, which will make upgrades easier and quicker to incorporate. It does not provide any details on performance or dimensions but notes that the first B-21 operating base will be at Ellsworth Air Force Base, S.D.

The fact sheet also mentions that the B-21 is part of the "larger family of systems" for conducting conventional longrange strike. This family includes "intelligence, surveillance and reconnaissance, electronic attack, communication, and other capabilities," the Air Force said. The fact sheet confirmed that the B-21 will be nuclear capable and is "designed to accommodate manned or unmanned operations. ... It will be able to employ a broad mix of stand-off and direct-attack munitions."

The B-21's name "Raider" honors the Doolittle Raiders who conducted the first bombing of Japan of World War II in retaliation for that country's attack on Pearl Harbor, Hawaii. The April 1942 strike was carried out by B-25 Mitchell bombers flown off the aircraft carrier USS Hornet. The designation "B-21" refers to the first Air Force bomber of the 21st century.

The average procurement unit cost of the new bomber is \$550 million in base year 2010 dollars; inflated to 2019, the cost is \$639 million each, the fact sheet said. ٥

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Austin Recommends Assault Cases Not Go Through Chain of Command

By Brian W. Everstine and Greg Hadley

Defense Secretary Lloyd J. Austin III recommended the military establish a separate track for prosecuting sexual assault and related crimes, rather than within the chain of command in June, despite objections from the Joint Chiefs of Staff. Days later, he promised to back 82 recommendations offered by the Independent Review Commission on Sexual Assault and Harassment in the military.

The commission's recommendations focused on four areasaccountability, prevention, climate and culture, and victim support and care-concluding "there is a wide chasm" between what commanders think is happening in their commands and what service members describe as their experience. "As a result, trust has been broken between commanders and the service members under their charge and care," the report said.

Despite a "zero tolerance" policy on sexual harassment and assault, "zero tolerance is actually 100 percent tolerance," one NCO told the commission.

"The military justice system is not equipped to properly respond to special victim crimes," the report said. "Critical deficiencies" in the workforce, outdated social norms among service members, and a lack of data about crimes remain problems.

"There is a direct link between unhealthy command climates and mission failure," the report said, suggesting "too many small units have unhealthy command climates."

More than a dozen of recommendations focus on changes to the Uniform Code of Military Justice. Austin directed Deputy Defense Secretary Kathleen H. Hicks to develop a 60-day "roadmap" for implementing those changes, including criminalizing sexual harassment under the UCMJ. Dedicated offices under each service secretary will be established to prosecute "special victims crimes," including domestic violence, child abuse, and retaliation within chain of command.

The IRC's other proposed changes for the military justice system include hiring independent, trained investigators for sexual harassment, mandatory involuntary separation in the event of substantiated complaints, new military justice personnel to handle special victim crimes, Military Protective Orders for victims of sexual assault and related offenses, and expedited processing of proposed executive orders related to special victim crimes.

Austin also directed service leaders to "standardize all non-judicial punishments" and to establish a separation process for substantiated sexual harassment offenders.

New York Democratic Sen. Kirsten Gillibrand applauded Austin's actions, but said she would continue to press ahead on legal changes to ensure that Austin's decision cannot be easily reversed by a successor.

"The fact that we have a Secretary of Defense who says we should take sexual assault and other related crimes out of the chain of command, and that it does not affect good order and discipline and does not affect the ability of command control, is revolutionary and groundbreaking," she said. But legal changes are essential, she said, explaining: "I just want to do it in the right way." ۵

Pentagon Cancels JEDI Contract

By Brian W. Everstine

The Pentagon on July 6 canceled the massive and controversial \$10 billion Joint Enterprise Defense Infrastructure (JEDI) cloud contract after years of challenges to its award to Microsoft.

The Defense Department said the move comes because the contract, which has been long delayed due to those challenges, no longer meets its requirements. The department is now looking to a new multi-vendor replacement, called the Joint Warfighter Cloud Capability. While the Pentagon will reach out to industry for additional providers, "research indicates" that Microsoft and Amazon Web Services are the only providers able to meet requirements, according to DOD.

"JEDI was developed at a time when the department's needs were different and both the [Cloud Service Providers'] technology and our cloud conversancy was less mature," acting DOD Chief Information Officer John Sherman said in a statement. "In light of new initiatives like [joint all-domain command and control] and AI [artificial intelligence] and Data Acceleration, the evolution of the cloud ecosystem within DOD, and changes in user requirements to leverage multiple cloud environments to execute mission, our landscape has advanced and a new way-ahead is warranted to achieve dominance in both traditional and nontraditional warfighting domains."

The Pentagon in October 2019 awarded the JEDI contract to Microsoft, with Amazon Web Services (AWS) and Oracle quickly challenging the process of the contract award. AWS, an expected favorite for the award, challenged it in court, saying it was denied because of the Trump administration's views on then-Amazon CEO Jeff Bezos.

Oracle on June 30 filed a brief to the U.S. Supreme Court aiming to overturn an initial ruling that said potential conflicts of interests in the award did not affect the company's position.

Microsoft, in a blog post, said it understands the department's rationale, based on a likely years-long litigation battle. The company said it is confident that it will "continue to be successful" as the Pentagon moves forward for the next contract.

Amazon, in a statement, also said it agreed with the Pentagon's decision to move on from JEDI.

The delayed progress on JEDI came as the military pushed ahead on cloud-based capability on high-tech initiatives such as joint all-domain command and control and the Air Force's Advanced Battle Management System, which will depend on secure and fast, cloud-based data for its mission to speed up data sharing and decision-making. JEDI aimed to bring the efforts under one DOD-wide umbrella, while individual services moved ahead on their efforts. 0





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REGISTRATION NOW OPEN

USSF Selects First 50 Officers to Transfer from Other Services

By Abraham Mahshie

Out of a pool of more than 3,700 applicants, the first 50 Active-duty Army, Navy, and Marine Corps volunteers were announced for transfer to the Space Force beginning in July. A second tranche of 350 transfers will be announced in July to match Space Force specialties including space operations, intelligence, cyber, engineering, and acquisition.

The highly competitive process continues the organic growth of the military's newest service, joining 5,200 Air Force transfers.

"We are overwhelmed by the number of applicants, and the outpouring of support our sister services have provided as we've partnered together to design the Space Force," said Gen. David D. Thompson, vice chief of space operations, in a June 30 press statement.

The total manpower of the Space Force is roughly 12,000 Guardians, with some 6,000 civilians and 5,500 military as of June 15. An undisclosed number of Air Force Airmen also continue to support the Space Force in an administrative assignment capacity.

A Space Force spokesperson told Air Force Magazine June 30 that the force is onboarding the first 50 transfers from other services in fiscal 2021, which ends Sept. 30. The July announcement of 350 more transfers will be onboarded in the 2022 fiscal year.

New Guardians will join the force on a staggered approach according to their own individual schedules rather than a single transfer ceremony.

"When we will get to 16,000 depends on a lot of future transfers," the spokesperson said of the number of Guardians Gen. John W. "Jay" Raymond has said will encompass a "lean" new fighting force.

The Space Force is also expected to voluntarily absorb units and mission sets from other services, including the Navy and Army. The timeline for which units will be incorporated into the Space Force and how many service members will be asked to voluntarily transfer is still to be determined.

"It's being worked and more information will be released in the coming months," the spokesperson said. ٥

Donald H. Rumsfeld, 1932-2021

By Greg Hadley

Donald H. Rumsfeld, who made history as the first man to serve as Secretary of Defense for two Presidents and oversaw the beginning of U.S. wars in Iraq and Afghanistan, died June 30 in Taos, N.M. He was 88.

Rumsfeld served as a congressman from Illinois' 13th District, director of the Office of Economic Opportunity, U.S. Ambassador to NATO, and White House Chief of Staff, in addition to two stints as Defense Secretary. He was a Cabinet-level aide of President Richard M. Nixon before becoming the youngest Defense Secretary ever under President Gerald R. Ford in 1975. He then returned to the Pentagon as the second-oldest person ever to lead it, in 2001, under President George W. Bush.



Former United States Secretary of Defense Donald Rumsfeld at the 2011 Conservative Political Action Conference.

"I was saddened to hear today of the passing of former Secretary of Defense Donald H. Rumsfeld," current Secretary of Defense Lloyd J. Austin III said in a written statement issued by the Pentagon. "Mr. Rumsfeld had the singular distinction of holding that post for two nonconsecutive tenures, serving as both the 13th Secretary of Defense and the 21st. He also served in the U.S. Navy in 1954-57 as a pilot and a flight instructor, and he continued his service as a Reservist until 1975, when he became Secretary of Defense for the first time.

"Over the decades of his remarkable career, from Congress to the White House to the Pentagon, Secretary Rumsfeld was propelled by his boundless energy, probing intellect, and abiding commitment to serve his country."

Rumsfeld's second tenure in the Pentagon coincided with one of the most consequential periods in modern American history. After the terrorist attacks of Sept. 11, 2001, Rumsfeld oversaw the planning and execution of wars in the Middle East that wound up two decades. More than 6,000 American troops have died in the region since, and estimates have pegged the financial cost in the trillions of dollars.

Rumsfeld claimed Iraqi dictator Saddam Hussein possessed weapons of mass destruction in explaining the Bush administration's justification for an invasion of the country. No such weapons were ever found, and he would admit years later to making "misstatements" on the topic.

Rumsfeld also became embroiled in the controversy surrounding torture and prisoner abuse in Abu Ghraib, Iraq, and subsequent revelations about "enhanced interrogation techniques" used by the U.S. government at Guantanamo Bay, Cuba.

In the Middle East, Rumsfeld deployed a strategy of smaller, more mobile ground forces with a reliance on more airstrikes, moves that were dubbed by some as the "Rumsfeld Doctrine." But as the wars dragged on, he came under increasing criticism, culminating in a number of retired generals and admirals publicly calling on him to resign in 2006. Although President Bush initially defended him, Rumsfeld resigned after the '06 midterm elections.

"Secretary Donald Rumsfeld was an exceptional leader who dedicated decades of his life in public service to this nation," said Rep. Mike Rogers (R-Ala.), ranking member of the House Armed Services Committee. "On Sept. 11, 2001, Donald was there to help lead our nation out of one of our darkest days, including running into the Pentagon to assist the wounded and survivors. I also appreciate his help to lay some of the early groundwork for the Space Force." 0

FACES OF THE FORCE



Tech. Sgt. Michael Walker received the 2021 Air Force Sergeants Association William H. Pitsenbarger Heroism Award, an annual recognition to an enlisted member who has performed a heroic act, on

or off duty, resulting in the saving of life or the prevention of serious injury. Walker was credited with helping save the lives of 28 people while off-duty in 2020 during an active-shooter incident in the Westgate Entertainment District in Glendale, Ariz. Walker was having dinner with friends when he noticed people running outside the restaurant, followed by the sound of multiple gunshots. He ran to the entrance to barricade the doors where he stood some 10 to 15 feet from the shooter. "All I could think about was locking the doors and getting people safely inside," Walker said. He guided the staff and customers into the kitchen to hide, told them to barricade the doors, then retrieved the keys to the restaurant's front doors and Walker exited the building to close garage-like rolling security doors from the outside, putting himself at risk.



Acting Secretary of the Air Force John P. Roth presented seven Air University Airmen with the 2021 Secretary of the Air Force Leadership Award during a ceremony May 11 at Maxwell AFB, Ala. The award recognizes AU students, cadets, faculty, and staff who exhibit exemplary leadership, character and ethical behavior in the educational environment. This award represents AU Airmen who are the "best of the best" in their respective category. The recipients are: U.S. Space Force Maj. Kyle Keith, Faculty/Staff Field Grade Officer category, Curtis E. LeMay Center for Doctrine Development and Education; Capt. Tamara Merritt, Faculty/Staff Company Grade Officer category, Air University International Officer School; Master Sqt. Jaime Matekaitis, Faculty/Staff Senior NCO category, Airey NCO Academy, Tyndall Air Force Base, Fla.; Jason Womack, Civilian category, Ira C. Eaker Center for Leadership Development; Master Sgt. Charles Simper, Student-Senior NCO category, Air Force Senior NCO Academy.



Capt. Taylor Bye was forced to land an A-10C after a catastrophic gun malfunction prevented her landing gear from deploying, causing aircraft panels to fly off, and sending the canopy soaring. Managing to safely land the aircraft on April 7 with minimal damage to the runway at Moody Air Force Base, Ga., earned her the Air Combat Command Airmanship Award. Bye said, "The amazing thing about the A-10 is even though all these things happened, I had two perfectly working engines and hydraulic systems."



The remains of U.S. Army Air Forces Tech. Sgt. Alfred Turgeon were identified Jan. 13 after the Army used DNA analysis from remains buried in Europe. Turgeon was received with honors at Evergreen Washelli Cemetery in Seattle. On Aug. 1, 1943, Turgeon served as a B-24 gunner and radio operator during **Operation Tidal Wave** at Ploesti, Romania, His unidentified remains were buried as "unknown" in the Hero Section of the Civilian and Military Cemetery Romania, then later moved to Belaium.



The USAF Thunderbirds flew with a quest, Ultimate **Fighting Championship** (UFC) Hall of Famer Forrest Griffin, aiming to attract UFC fans to fields which Air Force Recruiting Service finds especially hard to fill. UFC's huge social media following let Griffin share his experience with a vast group of potential recruits. "I can honestly say ... [it] was one of the most incredible things I've ever done in my life, and I'm honored to have shared as much time as I have with the men and women of the Air Force," Griffin said.



Retired Gen. Maryanne Miller, former head of Air Mobility Command, and retired Gen. Robin Rand, former head of Air Force Global Strike Command, were presented the Order of the Sword-the highest honor and tribute enlisted Airmen can bestow upon a commissioned officer-at JB McGuire-Dix-Lakehurst, N.J., and Barksdale AFB, La., respectively, on April 23. Some 250 such senior officers and civilians have been so honored since the first award in 1967. USAF Airmen are the only U.S. service members who bestow such an honor. port USAF families.



The Air Force Women's Initiative Team won USAF's Diversity and Inclusion award for creating DOD's pregnancy policy allowing pregnant Airmen to participate in Professional Military Education and driving the initiative that authorized braids and ponvtails for female Airmen in uniform. The team also updated the service's aviator height standard and pushed for DOD's first maternity flight duty uniform. David Frank earned the individual award for his role as the co-chair on the Women's Initiative Team.



Air Force Reserve Key Spouse Mentors from around the country came together virtually for a conference May 7 to share their ideas, struggles and best practices. The conference also provided quidance and education on a host of Reserve programs available and resiliency and wellness techniques. Janis Scobee and Edith White, AFRC Key Spouse Mentors, hosed the event. The Key Spouses are commander-appointed and serve as a resource to command teams in an effort to sup-

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

Pegasus Power What It's Like Aboard the **New KC-46 Tanker.**

By Brian W. Everstine

s the flight of four F-16s approaches the Air Force's next-generation tanker, the boom operator presses a few buttons on a digital display in front of her and the jet's boom In May, two system springs to life. more major

A large black-and-white screen sharpens to a clear problems image. It shows the refueling boom lowering from the rear of the plane and beginning to move side to arose with side and up and down, testing to ensure it is ready the KC-46, to offload about 5,000 pounds of fuel to each Viper. bevond the A familiar "fasten seatbelt" ding plays to passengers long-standto announce the start of the refueling—a reminder ing issues that the KC-46, at its heart, is an airliner.

The KC-46 is the sole Pegasus playing in Air with the Mobility Command's (AMC's) large-scale Mobility **RVS and the** Guardian 2021 exercise, AMC's premiere training **boom.** event held every two years. This year's iteration is focused on new ways of fighting and the development of new technology. Air Force Magazine attended the waning days of the exercise and is the first independent news organization to fly on a KC-46.

The tanker's envelope has expanded to fuel more

aircraft, and the May 25 morning is perfect for the Remote Vision System (RVS) to show its capabilities. "Got 'em in sight," the boom operator says over the radio.

Buzz 21, the first of the four F-16s from the Ohio National Guard, pulls up behind the KC-46, call sign Fred 11. When the black-and-white view of the F-16 is clear through the jet's 3D view from the end of the boom, you can make out the hoses extending from the pilot's oxygen mask, as well as the patches on uniform sleeves.

However, even with the 3D goggles, depth perception is difficult. Moving the refueling boom around the F-16's canopy to then line up with the receptacle, flying at 290 knots, is a delicate process. While wearing the goggles, the center of the screen is sharp, but when you look to the edge of the screen, it gets blurry and disorienting.

The camera feed does not accurately show the end of the boom-there's about another foot and a half beyond what is visible on the screen, so boom operators use the shadows to gauge where the tip is before connecting to the receptacle. If there's no shadow-on a cloudy day, for example-the operator

This KC-46 is the sole Pegasus in Air Mobility Command's large-scale Mobility Guardian 2021 exercise, AMC's premiere training event held every two years. This year's iteration is focused on new ways of fighting and the development of new technology. Air Force Magazine attended the waning days of the exercise and is the first independent news organization to fly on a KC-46.

has to rely on experience, rather than technology, to make the connection.

The weather above Lake Huron, Mich., after taking off from Oscoda-Wurtsmith Airport—a former USAF base that closed in 1993 and has become a depot and maintenance facility for Kalitta Air—is ideal for showcasing the existing RVS capability that day. A high cloud ceiling prevents the direct-sunlight washout that has plagued the system-during an earlier sortie in the exercise, the screen washed out while a gigantic C-5 attempted to refuel. The only shadow darkening part of the screen comes when the KC-46 lines up directly between the sun and the receiver. That only happens a couple times as the tanker runs its tracks, but when it does, it makes depth perception a little more difficult.

A set of three screens above the main one shows a blurry, wide-angle view of the rear and side of the KC-46, highlighting the heat signature of the F-16 engines.

The first connection with Buzz 21 takes a couple tries, as the operator pulls the boom back several feet to avoid

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scraping the F-16. "Money," the instructor says as the connection is made. Buzz 21 takes on its fuel and moves to the right side of the jet. Buzz 22 moves in from the left to take its turn for fuel.

With the ideal daytime conditions, the refueling was "pretty by the book," said Staff Sgt. Ryan Edsall, a boom operator with the 344th Air Refueling Squadron, who was the instructor on the flight. While the daytime can bring issues with glare and shadows, the RVS system is best at night, he said.

SCENARIO OF THE DAY

The F-16s are providing defensive counter-air coverage to protect bases in the region from an advancing force, which for the exercise had contracted "Red Air" to simulate Su-35s and Su-30s. It's "Day 30" of the war, and the enemy is at about 75 percent capability, with simulated SA-8 short-range, air defense systems protecting its key locations across the border. Earlier in the exercise, aircrews focused on tactics for a high-end fight, including takeoffs in radio

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F-16s from the **Ohio National** Guard pull up behind the KC-46, call sign Fred 11, near Lake Huron during Mobility Guardian 2021. The call sign is a small diversionary attempt used during the exercise, since "Fred" is a nickname for the C-5.



silence and the first KC-46 night-vision landing. Even the jet's call sign, Fred 11, is a diversion during the exercise since Fred is a nickname for the C-5. KC-135s are going by Herk, KC-10s are going by Moose, in a small attempt to deceive a would-be enemy.

The tanker is flying a track over Lake Huron to refuel the F-16s, and a nearby KC-10 is refueling two A-10s as part of the exercise. Because of the "stiff boom" Category 1 deficiency on the KC-46, one of several remaining with the program, it can't refuel the Warthogs because lighter and slower aircraft such as the A-10 have a difficult time disconnecting after refueling. During a pre-mission brief, planners said KC-135s and KC-10s would have to be on standby if A-10s needed fuel, because the KC-46 couldn't help.

AMC on May 26 said the KC-46 can refuel F/A-18A-F and E/A-18Gs using its drogue without restrictions. The Pegasus can pass fuel, with varying restrictions, to B-52s, C-17s, F-15s, F-16s, F-35As, HC/MC-130Js, other KC-46s, E-3Gs, C-5Ms, RC/TC-135s, F-22s, and B-1Bs. In the coming months, the aircraft is projected to be able to receive limited aerial refueling certifications and clearances for CV/MV-22s, E-8s, B-2s, and P-8s.

The boom operator makes the connection with Buzz 22, Buzz 23, and Buzz 24 on the first try. Then with the operational refueling requirements of the day's mission complete, the nearby KC-10 swings over and practices making connections with the KC-46. Each time the massive KC-10 connects, the smaller KC-46 shudders passengers who feel a slight push forward.

FLYING THE KC-46

In the cockpit, the KC-46's avionics and situational awareness show how advanced it is compared to the older KC-10s and KC-135s. The pilots have plugged the flight path into the jet's navigation system, and it flies itself on a refueling track. Aside from the better air-conditioning, this is one of the biggest upgrades after coming from a KC-135,

said mission pilot Capt. Daniel Dixon, with the 344th Air Refueling Squadron at McConnell Air Force Base, Kan.

"It's a lot smoother to fly," Dixon said. "It flies itself a lot more. That allows us to focus on tactical data link and the bigger picture-the other threats to the aircraft-and pay attention to the flight at large, rather than maintaining our air speed and bank angle and making sure that we stay within our airspace."

The co-pilot on the mission changes one of the screens in front of her to a camera view of behind, showing the KC-10 connecting to the boom.

Another screen in front of the pilots displays the jet's Tactical Situational Awareness System, bringing in information collected through line-of-sight and beyond-line-of-sight links, displaying nearby jets and threats into an easily viewable display for the aircrew to know what's around them. This is built in to the KC-46, while the KC-135 relies on a roll-on system for a similar capability, but those are only available in small numbers, are owned by Air Combat Command, and sit in the back of that plane instead of in front of the pilots. A key focus of Mobility Guardian was integrating the KC-46's system with other Tactical Data Link Systems across the mobility fleet.

FIXING THE MAIN PROBLEM

USAF officials have long said the situational awareness upgrade is a major focus of the KC-46 program, and pilots who have flown the jet told Air Force Magazine it is a huge upgrade, though they are taking small steps to move toward full capability.

The jet's biggest and most famous issue is the set of cameras, screens, and sensors connecting the boom operators to the receiving aircraft. Boeing and the Air Force announced in 2020 that they had reached an agreement to overhaul the whole system with new cameras, displays, and sensors. The current black-and-white video feed will be replaced by a color 4K view. The boom will be affixed with a new actuator to alleviate the stiffness issue, which will allow the A-10s to be able to connect with the KC-46.

Included in the new "RVS 2.0" package will be a laser ranger for aircraft distance measurement and augmented reality to assist with the boom operations, which should address the problems of depth perception and accurately show the length of the boom itself.

New screens will replace the current ones in the boom operator position, which is reminiscent of a remotely piloted aircraft operator's cockpit. The new screens and systems will actually move the entire position a few inches, causing a third seat used by instructors and guests to be shifted from the middle to the side.

Boeing will cover the cost of the new RVS system, which is in addition to more than \$5 billion in extra costs the company has absorbed.

RVS 2.0 is currently undergoing its preliminary design review, and AMC Commander Gen. Jacqueline D. Van Ovost told Air Force Magazine in an interview she has seen some of that work, and "our boom operators have seen that work, and they are pretty happy with what they see. So, I'm cautiously optimistic."

As more boom operators have worked with the current system, they have become more confident in working around RVS issues. AMC now wants to open its envelope to more training sorties with combat aircraft. Air Combat Command leaders have flown on KC-46s and seen how it operates and have said "'OK, let's do this with fourth-generation airplanes," Van Ovost said

The new system will start to be installed on delivered KC-46s in 2023, and it will be incorporated on the production line the following year. In the meantime, Boeing has also developed an interim RVS "1.5" using software upgrades to improve the system's image quality. While the interim step is welcomed by the Air Force, service leaders have said the priority is the full 2.0 overhaul and 1.5 can't change that timeline.

MORE DEFICIENCIES

In May, two more major problems arose with the KC-46, beyond the long-standing issues with the aircraft's RVS and the boom. The issues center on the aircraft's receptacle drain line tubes and Flight Management System and the Air Force said they will be fixed at Boeing's expense.

"There are no operational restrictions on fielded KC-46s due to either of these deficiencies, nor do they affect [Air Mobility Command's] plan for KC-46 Interim Capability Release," said USAF spokesman Capt. Joshua D. Benedetti in a statement. "The [System Program Office] and Boeing have established operational processes and maintenance procedures to mitigate impacts and ensure the issues do not add extra risk to personnel, aircraft or operations."

The air-refueling receptacle drain line developed cracks in low-temperature conditions, according to the Air Force, and Boeing is redesigning the drain tube to address the issue.

The aircraft have also suffered isolated incidents of Flight Management System instability during operations. Boeing and subcontractor GE Aviation identified the need for a long-term software fix, and for the short-term, Boeing is developing updated procedures to ensure the system's stability in flight.

Sun and background can create dark images

Months before, the Air Force resolved two other Category



Sun and background can create washed out images



These photographs, shown during a presentation during the 2020 Airlift Tanker Association conference, show problems with the KC-46's troubled remote vision system in both shadows and direct sunlight and examples of "adequate" images during ideal settings.

Airman 1st Class Crissy Hall, left, and Staff Sgt. Ryan Edsall, both boom operators, operate a KC-46's refueling system during a May 25 flight. Problems with the Pegasus' RVS caused boomers to develop workarounds, but those become more difficult when there are multiple aircraft waiting to take on fuel.



1 deficiencies on the KC-46: a duct clamp that moved excessively and a drain mast on the outside of the tail that could potentially break loose.

Hundreds of less serious Category 2 deficiencies with the aircraft persist, defined as issues that do not impact the safety of flight and have workarounds in place to continue operations.

A DEFICIENCY IN ACTION

One of these Category 2 deficiencies is a feature that was designed to improve safety and ease the burden on boom operators, but is not working as designed due to a software flaw. The Air Force on its own implemented a workaround as the service and Boeing wait for more pressing issues to be solved first.

The issue is with the aircraft's Aerial Refueling Software, which has preset limits for different types of receivers-aircraft needing fuel-to control the boom's independent disconnect system. Simply put, the system automatically selects the left/ right and up/down limits for the boom to stay connected to a given receiver, and if the movement exceeds the envelope for that aircraft, the boom automatically breaks away to avoid damage.

However, the presets in the system are not accurate for each receiver, so boom operators, before each connection, have to override the automatic preset limits and input correct ones. The problem was a Category 2 deficiency on the KC-46 before the workaround was implemented.

"The Air Force is aware of the KC-46 receiver preset issue," Air Mobility Command said in a statement. "[AMC] implemented a workaround for boom operators to manually adjust the KC-46 Receiver Presets and closed the CAT II DR for Enhancement. The issue does not impact operational use of the boom, nor will it keep the aircraft from eventually being fully operational. AMC will address a long-term fix for this issue during follow-on upgrades once solutions are met for higher

priority deficiencies."

Boeing said it is working "on a plan to address the issue in a future software revision. In the meantime, operators have a workaround to continue refueling operations."

Air Force Magazine witnessed the workaround firsthand during the flight of F-16s over Lake Huron. As the first F-16 lined up to receive fuel, the boom operator prepared the refueling system, and the instructor on the flight inputted F-16 into the software. The controls are in a mostly black touchscreen on the lowest panel of the Aerial Refueling Operator Station.

The selection adjusts the green/yellow/red lines on the main monitor that shows the boom and the receiver aircraft trailing behind. The instructor then changes the individual settings to the correct ones, referencing a list of receivers. This changes the length of the color line on the RVS to the correct threshold for the receiver. The system then must be reset between each receiver, as the boom operator also changes the settings for how much fuel will be passed.

After the first Viper broke away, the instructor pilot repeated the process of selecting F-16 as the receiver and then again overrode the preset limits.

Boom operators said the workaround is not a big deal when there's just one receiver, such as another tanker or airlifter. However, when there's a flight of multiple aircraft, such as these four F-16s, the process takes a small amount of time between refuelings. Additionally, if there is just one boom operator on the flight, it takes attention away from this process, an issue that was alleviated in this recent mission by having the instructor handle the resets while the boom operator focused on refueling.

"KC-46 aircrew continue to familiarize and increase skills aboard the aircraft," AMC said. "Their experiences and feedback are critical to identifying improvements in order to provide the best possible weapons system to the Joint warfighter."

While the KC-46's automatic disconnect system uses the software settings, the independent disconnect system in

At McGuire, a Wing Girds for Change

A KC-10 Extender took off into the dark and rainy New Jersey sky after a short weather delay to link up with F-22s flying over the Atlantic Ocean, marking the end of an era.

The June 30 flight was a historic one for the Air Force's second-oldest squadron. It was the last time a KC-10 assigned to the 2nd Air Refueling Squadron (ARS) would fly.

The remaining Extenders from the 2nd ARS have shifted to the 32nd ARS within the 305th Air Mobility Wing, which will become a "super" squadron until the last KC-10s at JB Mc-Guire-Dix-Lukehurst, N.J., retire in 2024. The base will bring on 24 KC-46s. McGuire had 32 KC-10s before retirements began.

"Today, we're officially a KC-46 squadron," 2nd ARS Commander Lt. Col. Nicholas Arthur said in a July 1 interview, with the image of a KC-10 still on his uniform name patch. "Our folks that are still qualified on the KC-10 will continue to fly with the other KC-10 squadron until we send them all to training or they get other assignments."

The process started in earnest about six months ago at McGuire, with the first crews heading to Altus Air Force Base, Okla., to train on the KC-46. There are now six crew members at McGuire gualified on the KC-46, with the number expected to grow before the Pegasus arrives in November.

In the meantime, the squadron is revising its processes and programs to shift from Extender operations to the Pegasus. The squadron's readiness status dropped, taking the 2nd ARS off of the list of units that could deploy. However, since tankers are in such high demand, remaining qualified aircrews will still deploy with the 32nd.

The Airmen were originally expecting to stop deploying in the spring to prepare for the conversion, but operational requirements increased with the Afghanistan drawdown and other combatant command needs, so these deployments will continue until October.

"Until we send our folks to training, we're still going to actively deploy them as KC-10 Airmen because our requirements as a community don't really go away. Every jet we send to the boneyard, our requirements drop a little bit, but there's still a heavy demand for tankers, and that doesn't change just because we're going to convert, and we just have to learn to adapt and make it work," Arthur said.

the KC-10 is selected manually at the operator station in the rear of the plane.

The Air Force and Boeing did not provide a timeline for a possible software fix, other than saying more pressing issues will be addressed first.

PREPARING FOR OPERATIONS

The tanker during the May 25 mission was tail number 76026 from McConnell, the biggest operating base for the KC-46 with more than 100 aircrews trained and flying the jet. The base has sent their KC-46s on an around-the-world mission including a stop at the Dubai Air Show, and on training events in the Pacific and in Europe. Air Mobility Command will offer the KC-46 to U.S. Transportation Command for limited operations as soon as the summer of 2021.

KC-46 crews used the exercise's operations tempo, and the small, towerless airfield, to practice flying in a combat environment. During the May 25 flight, the KC-46 did a "tactical arrival," or a "teardrop" landing. This involved approaching

To be able to fly the KC-46, pilots head to Altus or another KC-46 location for three months of qualification training, with another one to two months of additional mission qualification training at McGuire. The New Jersey base will bring some instructors in to help, but as the training requirements increase, those training TDYs will continue.

On the maintenance side, the 605th Aircraft Maintenance Squadron (AMXS) has become a sort of "hybrid" unit with an initial cadre of 41 Airmen being trained on the Pegasus, said Master Sgt. Sydney Melton, the 605th AMXS KC-46 Pegasus lead production superintendent. These Airmen go through 16 to 30 days of "Type 1" training at Altus, with different training times for different Air Force Specialty Codes, and then another 30 days of "on the job" training where they are actually turning wrenches on the aircraft, he said.

The KC-46 has new technology in the cockpit and throughout the jet, which will be a change for Airmen used to operating on lower-tech legacy tankers. For communications/navigation maintainers, that will mean some more complicated work.

"There's going to be some challenges there, but we're ready for it," Melton said.

A good thing for McGuire is that multiple bases have already shifted from legacy tankers to the KC-46, and the units communicate their own lessons learned to make the stand-up go more smoothly.

"Every base, both Active and Reserve, is doing everything they can to set us up for success, so it's pretty cool to see that. A lot of the times, it's sink or swim. Figure it out. Make the mission happen," Melton said. "So, to see that we're getting that kind of support from other bases that don't owe us anything is pretty awesome."

In the past few months, maintainers have watched five KC-10s leave to go to the boneyard after years at McGuire.

"It's kind of an eerie feeling to know it's going and never coming back," Chappell said.

"It's a first love type thing," Arthur said. "I understand the decisions that were made and why they were made, and, you know, it is an expensive, old airplane to operate," he said. "But yeah, you know, you're always going to love your first airplane."

the runway from the wrong direction and doing a sharp turn and climb, to turn around and land quickly.

"Traditionally, tankers [fly] very wide patterns, come in and fly [a] very smooth, precise approach to land. We're used to taking off and landing from the same field at Al Udeid [Air Base, Qatar] or Al Dhafra [Air Base, United Arab Emirates], which is very safe, controlled. And so there's not a lot of threats nearby," said Maj. Thomas Gorry, the chief of group training with the 22nd Operations Group at McConnell.

The KC-46 program brings together aircrew from different backgrounds. Gorry comes from a C-130, which regularly flies tactical approaches to austere airfields, so he wanted to bring that approach to the KC-46.

"When you're thinking about that next fight, the airfield you're landing and taking off from might not be as secure, so the tactical arrival is another piece to that puzzle that we're not just good at yet," he said, adding, "We just don't know where we're going to be landing next. It's not going to be [Al Udeid], and it's not going to be Dhafra." O

The Classroom on Your Head

Air Education and Training Command embraces virtual and augmented reality for all.

Col. Robert Masaitis works an MC-130J Commando II aircraft virtual reality maintenance training program during an Air Education and Training Command Integrated Technology Platform demonstration April 15 at Cannon Air Force Base, N.M.

By Amy McCullough

Airman Basic Cody Alfred has always played video games, so when offered the chance to take the virtual reality (VR) version of the Fundamentals of Aircraft Maintenance course at Sheppard Air Force Base, Texas, he jumped at it.

Alfred, who is assigned to the 362nd Training Squadron, is training to be an F-35 crew chief. It took him 23 days to complete the traditional course, which included a lot of PowerPoints and time in a classroom before venturing out to the flight line to work on a real aircraft. But once he put on the VR headset, Alfred said he was having so much fun with the training, he breezed through the course in just six days.

The instructors "told me I could take breaks, ... but I didn't want to because the program was just, I wouldn't say fun, because this is for professional use, but it was really engaging and the quality of training that it provided me, I just wanted to keep doing it," Alfred said.

The virtual reality lab at Sheppard is about 44 feet by 35 feet, with VR stations located every 10 feet along the wall, each separated by a curtain. There is a computer monitor in front of a table at each station, and the student stands on a mat donning the VR headset.

"I wouldn't say [VR training] was fun, because this is for professional use, but it was really engaging."

Cody Alfred, F-35 crew chief trainee, Sheppard Air Force Base, Texas

Once they put on the goggles they are immersed in a realistic three-dimensional world.

One scenario, dubbed "a day in the life," looks to mimic what a young Airmen will experience once they get to their first operational unit. After putting on the headset, the student finds themself inside a virtual break room. When the flight chief walks into the room, the student is directed to follow them into a hangar, where a C-130 is waiting. Once in the hangar, the flight chief-an artificially intelligent instructor-gives out daily assignments, all of which are connected to course training requirements. After being assigned a task, the student is then paired up with a virtual seven-level trainer who walks them through the process.

"One of the big ones that we show off is the wheel -Airman Basic and tire change. There are three different opportunities for the students to learn. One is to watch the exemplar, or that seven-level experienced mechanic, do the repair. That artificially intelligent-powered non-player character is capable of doing the task without any human influence, so the student can watch the entire process happen," said Tech. Sgt. Kyle Ingram, Fundamentals of Aircraft Maintenance Instructor Supervisor at the 362nd Training Squadron. "Then they can do what is sort of like a guided tour, [where] they can do the task themselves, but they have the instructor and the virtual instructor over their shoulder telling them what to do. Finally, they can do the entire task on their own."

The computer picks up the student's motion and is able to determine where they are reaching inside their three-dimensional environment, and instructors can watch their work in real-time on the screen.

"We get to see everything they're doing live and ... show them pointers or, you know, give them kudos," said Ingram.

For Alfred, the class not only kept him engaged, but it allowed him to move at his own pace. As a hands-on learner, the ability to repeatedly conduct a task also helped him develop the muscle memory necessary to do his job.

LEARNING AND CHANGING

This type of learner-centric model is key to training future Airmen, said Maj. Gen. Andrea D. Tullos, commander of 2nd Air Force, which is responsible for graduating some 150,000 joint force personnel from about 3,400 courses each year. Tullos said people often think of 2nd Air Force as a "one-sizefits-all" factory line that pushes out students exactly the same way each time, but "our vision is very different."

"One of the lessons we've learned is that we're going to have to be flexible enough that different subjects and different kinds of training are going to require different kinds of technology," she said.

Nineteenth Air Force, which trains more than 32,000 U.S. and allied aircrew each year, first started looking at virtual reality back in 2017 under the Pilot Training Next program. It didn't take long for Air Education and Training Command leaders to realize that if they were going to "build bigger, better, faster pilots" then they "probably should also have maintainers that are on the same path," said Detachment 23 Commander Maj. Jesse Johnson.

Johnson's detachment is made up of 11 people, including nine aircraft maintenance Airmen, a software developer, and



Airmen at Whiteman Air Force Base, Mo., show their new virtual reality welding trainer to Maj. Gen. Brian Borgen in July.

an administrator. Their directive was to "go out and modernize maintenance training," through what was initially called "Maintenance Training Next," he said.

Though similar to Pilot Training Next, there were plenty of differences in the two programs. For one, aircraft simulators have been around for a long time, but Johnson said there was nothing comparable for maintainers, "particularly in the virtual reality space, or in the digital space at all."

"So, what we found very quickly is that they were able to move faster than us because they could go out and adapt already present technology to meet their mission needs, and they were able to develop faster," Johnson said. "We had to start from scratch."

The technology needs also differed. Tullos said the VR goggles student pilots wear, for example, are just fine for an hour and a half sortie, but they are too heavy for a maintainer



Command Chief Master Sgt. Juliet Gudgel uses aircraft maintenance augmented reality training goggles during a visit to Sheppard Air Force Base, Texas, Jan. 31, 2019. Sheppard is on the leading edge of using such technology in technical and pilot training, part of the innovation initiative encouraged by AETC.



An Airman demonstrates the new virtual reality training station at Little Rock Air Force Base, Ark. With the opening of the base's Virtual Reality Maintenance Center, the base has 10 training stations that will afford maintenance Airmen the ability to become more proficient on mission-essential tasks.

who might spend eight hours working on a virtual aircraft. It's important "that we're not trying to pick one thing and then force feed it to what are 265 different specialties," Tullos told Air Force Magazine. "So, there's been a lot of testing, and I'm not going to say failing, but learning and changing, and learning from each other."

LESS CLASSROOM, MORE HANDS-ON

Johnson said his detachment first started researching human performance factors necessary to create a great maintainer, and then they compared that to the traditional classroom.

"We built this course focused on adaptive immersive learning technology, so [augmented reality and virtual reality (AR/VR)] to really be able to get the student into a hands-on environment faster ... less classroom, more hands on," he said. "Then we took that to a proof-of-concept test where we ran approximately 30 students through the course and gathered a whole bunch of data about their performance."

Johnson said the feedback showed the proof of concept, which closed out in October of 2020, didn't quite meet all the expectations, but it met enough to prove the process worked well for today's students, most of whom are technologically minded. Those participating in the proof of concept completed the course in about half the time and came within seven percent of the academic average of the long-standing crew chief fundamentals course, Johnson said.

"Soon after we did the proof of concept, we kind of took a bigger mission look at what we were doing. ... The epiphany was, 'Hey, modernizing the classroom is not a maintenance problem, it is an Air Force problem, so we need to start thinking about how to apply modern learning techniques and practices in every classroom in enlisted skills training,"

Johnson said. It was at that point, in November 2020, when Maintenance Training Next became Technical Training Transformation, or T3, with the goal of modernizing all initial skills training, Johnson said.

The initial proof of concept allowed real-life instructors to make corrections as needed and included what is called experiential learning, taking such things as environmental safety hazards into consideration. For example, in the wheel and tire change scenario, if a student attempts to remove a safety wire, but is not wearing safety glasses as required, the wire will hit them in the eye in the virtual world and the screen will turn red, letting them know immediately they have done something wrong.

Johnson said the hope is that version 2.0, which is slated to be released in January 2022 with a final version due in June 2022, will be presented in what he called "E-1 affordable hardware."

"We want whatever the course is delivered on to be affordable to the student, and [for] the student [to be able to] access it, not only on a virtual reality headset, but we eventually want to scope it down to where their personal electronic device or their cell phone is capable of delivering a majority of the content as long as it can be secured properly," he said.

'GREAT WORK, NOW WHAT?'

Johnson's team briefed Air Education and Training Command boss Lt. Gen. Marshall B. "Brad" Webb on their progress in May 2020, and the response was, "How do we scale and sustain this effort? So basically, 'Great work, now what?'" Johnson said.

His team has spent most of 2021 trying to answer that question.

They remained focused on updating the original proof of concept for the crew chief fundamentals course, which is a very technical, hands-on course that graduates some 4,500 students a year from Sheppard. But they also sought a much smaller schoolhouse that doesn't require as much handson training. They landed on the 2G0X1 Air Force Specialty Code—logistics planning—and offered to build them a course with various learning modalities at no cost to them, Johnson noted. That course will be released in January 2022, around the same time as the crew chief fundamentals version 2.0.

"Our goal is not just virtual reality or augmented reality courses, we want to present every single learning objective in the Air Force in a variety of modalities so that we can reach every single type of learner that comes into our doors," he said. "So, if a student learns better by listening, we want them to be able to click a button and listen to the lecture in an audible format when they go for a run. Or, if they like watching You-Tube videos, we want them to be able to watch the lecture on a video and maybe watch a hands-on demonstration in a video, and then turn to a virtual reality and augmented reality when they want to practice."

Although the effort to incorporate AR/VR technology into USAF training was well underway before COVID-19 essentially forced everyone to learn how to live in a digital world, the pandemic "in a lot of ways proved" the validity of this type of technology "in the modern Air Force," Johnson said.

UNEXPECTED CASH FLOW

There were financial benefits as well. Because of the uncertainty in the U.S. economy due to the pandemic, the Air Force experienced record-high retention numbers, so it didn't need to bring as many students into the pipeline as it had originally expected. "We were able to invest some dollars to sort of buy forward, because we knew the Air Force was not going to be able to numerically produce the number of Airmen during COVID that we would have in a normal year," Tullos said. "So, there was a little extra money there for us to take some risk with."

Some of the money that typically would have been spent producing Airmen went to new technology necessary for the classroom of the future, such as tablets and wireless technology—the backbone of this new infrastructure.

"We're not sacrificing quality. We always do quality first, but what we're finding is that we can actually train the Airmen faster, and I believe it's because this is the way they're comfortable learning, so their retention is higher and they're more active in the classroom. They're more enthusiastic learners," Tullos said.

What kind of long-term impact this might have on the pipeline, however, remains to be seen. Tullos said there are courses right now using approved augmented reality and virtual reality technology and their trainees are meeting the standards. There are courses, she said, that know they want more tech, and some that are standing by to see how this all plays out.

"Most of our classes haven't really figured out where on that spectrum the blend lies. Is it at 40 percent? Is it at 60 percent? How much is too much, and how much is not enough?" Tullos said. "It's going to take some time to convert from the way we have the curriculum set up now until the way we want it to be in some future state. Some of those courses are deliberately waiting for the lessons learned because they know at the point that they do it, they just want to go all in. They don't want to be the ones to go through the testing and in the phasing. They want to learn from everybody else and ... skip a generation."



Senior Airman Bryce Whitney reviews a technical order for a B-1B using a virtual reality simulator at Dyess Air Force Base, Texas, on Aug. 3, 2020. VR systems enable Airmen to complete core-level training and could reduce total training time by over 90 percent.

The National Space Defense Center at Schriever Air Force Base, Colo., brings together all the services and intelligence agencies. Lt. Nicole Breen watches over the shoulder of Air Force cyber systems operator Master Sgt. Kenneth Bangay.

Hacking the Space Force

Critical space capabilities are vulnerable to digital attack.

By Shaun Waterman

he full-scale overhaul of Space Force acquisition announced in April has been presented as a matter of speed and agility. The LA-based Space and Missile Systems Center (SMC), which spends 85 percent of the Pentagon's space budget, will be elevated to a Space Force Field Command, headed by a three-star general. **"We're n unique.**"

The new Space Systems Command (SSC), with a \$9 billion annual budget, "will rapidly identify, prototype, and field innovative, space-based solutions," said the Space Force announcement. The reorganization will "further ... our focus on accelerating the pace of acquisition," added Lt. Gen. John F. Thompson, SMC's current two-star commander. to reduct the space force announcement of acquisition, added Lt. Gen. John F. Thompson,

Agility in acquisition is vital, but experts say there's another reason—arguably even more urgent—that the new Space Force has to reinvent the way it develops, buys, and fields satellites and ground systems: They have to ensure they are building in cybersecurity to protect against hacking by online spies and enemy cyber warriors.

The *raison d'etre* of the new Space Systems Command is to "pivot ... from today's peacetime architecture, ... which was never envisioned to conduct offensive or defensive operations," to new more resilient systems that could survive kinetic and cyberattacks by near-peer adversaries, Cordell A. DeLaPena Jr., the program executive officer

"We're not unique. We fool ourselves if we think that we're unique and untouchable—we're not.—Scott Kordella, MITRE Corp. for SMC's Space Production Corps told Air Force Magazine.

A SPACE CYBER TEST RANGE

As the acquisition reorganization moves ahead, Space Force engineers at SMC are laying the foundation for a Space Cyber Test Range—a digital environment where hardware models of new satellites, and virtual copies of their ground control systems, can be cyber-attacked by red team penetration testers to find vulnerabilities, so they can be fixed. The range will also be used to train satellite operators to defend their systems against such attacks.

"We are building a virtual environment where the pen testers can come in and conduct their test events in as close to real operational conditions as we can get," Tyrone Berthiaume, chief information officer of SMC, explained. He said the test range would include flat sats—hardware models of a satellite system, socalled because they typically lay the various electronic components out flat on a workbench—and also digital twins of Space Force ground infrastructure, the Earth stations that communicate with and control the satellites in orbit. The range will even allow red teams to simulate attacks against the RF radio links that enable communication and control.

The Space Cyber Test Range is the most advanced of a series of cybersecurity testing and simulation initiatives SMC plans on rolling out as it transforms into Space Systems Command and works to make the vision of the Space Force as the first fully digital military service a reality, Berthiaume said.

The range will leverage the infrastructure of the National Cyber Range (NCR), which provides operationally realistic cyberspace environments for test and evaluation, as well as training. Using the NCR infrastructure has enabled Berthiaume to develop this novel capability on the cheap-it's funded for three years with just \$5 million from the Air Force Cyber Resiliency Office for Weapons Systems, known as CROWS.

The Space Cyber Test Range, being built at the Pacific Northwest National Lab, a Department of Energy research contractor in Richland, Wash., will be a digital testbed, which SMC engineers will be able to access to employ specially designed pen-testing tools, tailored for the unique characteristics of space systems, against new satellites as they are being prototyped, developed, and built.

The range will go live by 2022 if all goes according to plan, Berthiaume said: "We have a test plan as our final checkout that we're going into here during the summer. If the tests are successful, we should be [at Initial Operational Capacity, or] IOC by the end of this calendar year," and fully operational by 2023.

CYBER ATTACKS: WHEN, NOT IF

And that's not a moment too soon: Unclassified threat assessments show that vital U.S. space assets are increasingly vulnerable to a range of emerging threats. However, hacking is a much lower-cost way of interfering with a satellite than kinetic or directed-energy attacks, and can more easily be scaled across multiple targets, according to the Aerospace Corp. And because many cyberattacks are reversible and can be hard to attribute, they offer an adversary a much greater opportunity to hide their hand—or at least preserve some plausible deniability-said Craig Miller, president of government systems at Viasat Inc., which provides satellite hardware and services to DOD.

"Someone can launch a cyber attack, and there're ways to obscure it and obfuscate it, so that it's difficult to find the source. ... And they're also often reversible, you can turn them off, or you can stop them, whereas other effects [like kinetic or directed-energy attacks] cause permanent damage, and it's much clearer who did it," he said.

The low cost character of these attacks makes it a matter of when-not if-they'll be employed, Miller said. "The nonattributable, nondestructive nature of cyber makes it far more likely that it'll actually be employed. And that's the real danger of cyber attacks-you're going to see them."

Satellites are vulnerable, noted Miller, because they remain operational for decades. "Some of this hardware has been in space for 20 years. And it's '90s vintage hardware with '90s vintage security and, in some cases, '90s vintage operating systems that are very vulnerable."

That vulnerability isn't merely theoretical. In 2019, security researchers found a series of critical flaws in a software package called VXWorks, which provides real-time control for many satellite communications systems. The researchers worked with Wind River, who make VXWorks, and who produced a patch for the affected systems. Modern satellites typically allow for updates and patches to be applied to onboard software, but legacy space systems don't have this capability.

Traditionally, in SMC acquisition programs, "the emphasis was always on meeting warfighter mission requirements, rather than cybersecurity requirements," said Cristina Chaplain, who retired last year as director of space systems for the Government Accountability Office. "Cyber didn't get much attention [in SMC] until just the last few years."

Space systems, both military and commercial, are also tremendously complex, pointed out Scott Kordella, a senior adviser on space systems at MITRE Corp., which runs many federal technology research centers. "The key components of any satellite architecture are the space vehicles, the ground systems, and the terminals. And for each of those, there are systems, subsystems, and components."

Cybersecurity experts say that kind of complexity typically makes systems easier to attack, since it increases the number of possible points of failure.

SECURITY THROUGH OBSCURITY

Kordella said it helped to think of space systems in two parts: "90 percent of space systems are like other systems, communication systems or health care systems. ... They use the same IT as those other systems. But 10 percent is unique, the radiation hardened processor that goes on board the space vehicle," for instance.

The 90 percent of space systems that employ commodity IT are vulnerable in the same way those IT systems are vulnerable in meat processing, or pipeline operations, said



Unclassified threat assessments show that vital U.S. space assets are increasingly vulnerable to a range of emerging threats. A National Reconnaissance Office Launch-82 vehicle, on a Delta IV Heavy rockets, stands tall at Space Launch Complex-6 at Vandenberg Space Force Base, Calif., April 25.

Each component of satellite architecture contributes to a complexity that increases the number of failure point possibilities and thus makes the system more vulnerable to attack. Here, range operations squadron personnel track the flight of a SpaceX Falcon 9 launch at the Western Range **Operation Control** Center, Nov. 21, 2020, at Vandenberg Space Force Base, Calif.



Kordella. "We're not unique," he added, "We fool ourselves if we think that we're unique and never touchable—we're not."

At the same time, the broad deployment of such commodity IT systems means that there is much value to be gained by information sharing among users—both within the space sector and beyond it. Kordella urged the national security space community "to be less introspective and internally focused on our uniqueness and instead, look for those common connections and ... recognize that we don't have to reinvent the wheel, ... we have the opportunity to share with other sectors and benefit from them."

The security of the remaining 10 percent of space systems, Kordella said, "is often very classified, and very exclusively addressed by a small group of people. We've come up with some very clever ways to address that," he said, calling those components "highly protected."

But that security through obscurity approach to the on-orbit components of space systems may not last.

As part of the standup of SSC, DeLaPena explained, "we're fundamentally changing how we buy satellites into a more modular open system architecture, with standard interfaces to plug-and-play payloads." But that model implies open, published standards, which blows away at least part of the protection provided by classified system architectures.

The design of a processor or other system element might still be secret, but the way it communicates with other system components on the satellite has to be public, to ensure that other vendor systems can "plug-and-play."

And the unique character of many space systems components is a double-edged sword, from a security point of view. There is a huge ecosystem of tools—like vulnerability scanners or pen testing frameworks—that can be used to test the security of conventional IT systems. But they mostly don't work on satellite systems, explained USSF Capt. Matthew Preszler, part of the SMC Production Corps Test and Evaluation team focusing on cyber.

"Our satellite systems run on data buses, not like typical

[Internet Protocol, or] IP networks, so we need specialized tools to conduct this pen testing," he said. The pen testing tools his team currently has in Pathfinder development "will allow us to emulate typical hacker attacks, like man-in-themiddle or replay type attacks" on the unique architecture of satellite systems.

THE NEED FOR SPEED

The pen testing tools are phase one of an ambitious vision Preszler is in charge of realizing: The Satellite Penetration-test Environment, Evaluation, and Demonstration, or SPEED—a set of digital tools that engineers will be able to use to test and evaluate the cybersecurity of space systems throughout the entire acquisition cycle.

SPEED is currently just a concept, but the phase one pen testing tools are already in development and will be ready for internal testing by September, according to Preszler, who added that they hoped to use them to test vehicles in the 22-strong GPS IIIF satellite constellation, which went into production last year and is scheduled to start launching in 2026.

Two further phases of SPEED are planned, Preszler said. The second phase involves building a fully digital model of a space vehicle. The Space Cyber Test Range currently under development uses flat sat model satellites with hardware and software components, but Preszler points out that a totally digital model will be "available and accessible from multiple locations." Attacking such a digital model will help uncover cybersecurity vulnerabilities the real satellite has, which can then be fixed or mitigated during manufacture.

The third and final phase, he said, is developing security tools that can monitor a satellite's internal system to detect malicious activity the way conventional cybersecurity software—like intrusion detection and prevention systems —monitor regular IP networks.

All the tools developed under SPEED will be available to Space Cyber Test Range users from all three acquisition corps in SMC, Preszler said. The stand-up of Space Systems Command will build on an earlier reorganization, dubbed SMC 2.0, which created three acquisition corps to handle different phases of the space systems life cycle: The Development Corps for design and prototyping; the Production Corps for manufacturing; and the Enterprise Corps for sustainment and communications once the vehicles are on orbit.

"The three corps are mapped to the acquisition life cycle," explained Preszler. "And depending on what stage a system is in, that drives the type of [cyber] testing that will occur." In the Development Corps phase, "where they're pulling together initial requirements and initial designs of the system," cyber testing was likely to be based more on "tabletop-type activities, where it's more a matter of reviewing the architecture of the system." During the Production Corps stage, "that's when you're actually getting hands on to a system or model" to use penetration testing and other offensive tools to find vulnerabilities. Finally, in the Enterprise Corps, cyber testing "turns into the sustainment-type risk management framework, activities in which we're conducting recurring cyber assessments on the system in order to get authority to operate," and fulfill other security requirements.

The aim, said DeLaPena, is that "regardless of the contractor, regardless of the processes, these will be a standardized set of cybersecurity test tools and processes that are going to be available and somewhat standardized across all the [acquisition] programs" being run by SMC.

And they'll be available even beyond that. Once a satellite is launched, it belongs to Space Operations Command, or SpOC. At that point, its cybersecurity becomes the responsibility of Space Delta Six, the SpOC element in charge of defensive cyber operations.

Berthiaume said that the Space Cyber Test Range development effort was "partnering heavily with Space Delta Six, to ensure that the lessons learned from the operational community are identified and brought forward as far left as we can get into the acquisition life cycle, so that our future systems have that cyber resilience baked in from the beginning."

And the exchange goes both ways, he added, noting that the range team hoped to use it to help train cyber defenders, "so that when they get to the operational community and they're embedded with the flight commanders, they will be able to identify vulnerabilities or adversary presence based on their experiences in the simulators and the test ranges that we're building and take the appropriate actions," which they'd rehearsed running digital models of their craft.

The range might even eventually be available to commercial satellite operators providing services to Space Force, according to DeLaPena. "We are planning to partner with the commercial augmentation teams and then the commercial SATCOM teams," he said, "but at this point, we're too early in the planning cycles to really say who would use them."

A DIGITAL ECOSYSTEM

The Space Cyber Test Range and other virtual tools were all part of the vision of Space Force as the first fully digital military service, DeLaPena said.

And that digitization would help improve the cybersecurity of the space systems SMC is building in myriad other ways, pointed out Kevin Coggins, a Booz Allen Hamilton vice president who helps lead the company's digital engineering efforts. "The documentation for these systems is 1,000 pages long. And there are lots of changes because space systems interface with everything, and it all has to be compatible and standards are constantly changing. If those changes are propagated manually, how many errors do you think are going to creep in there?" Multiple contractors maintaining paperbased documentation merely multiplied the possibility for errors that could result in a security vulnerability, he added.

By contrast, digital documentation would allow the use of automated validation tools, so that "if there are errors, they're identified and fixed." And it would allow new security or other requirements to "ripple through" the documentation on multiple projects.

DeLaPena added that security was only the beginning of the benefits that digital engineering could bring to Space Force.

"At every phase of the acquisition, from the analysis alternatives to development to production to sustainment, at every phase, the technical baseline is defined digitally. So, as the technical baseline matures, that [digital documentation and data] is now available to do things like testing, modeling and simulation, as well as 3D manufacturing and 3D printing in the manufacturing process, and even potentially the follow-on use of artificial intelligence [to analyze that data and provide improvements] in sustainment," he said.

Shaun Waterman is a freelance journalist in Washington, D.C., covering cybersecurity and defense technology.



A SpaceX Falcon 9 rocket lifts off on June 17 from Space Launch Complex-40, Cape **Canaveral Space** Force Station, Fla., carrying the fifth **GPS III satellite** for Space Force. Officials hope that a new set of digital cybersecurity tools will be used by the time USSF fields **GPS IIIF satellite in** 2026.

Future Fighter Force

Fewer types, more rapid refreshes, and a shortterm reduction in purchases are USAF's latest recipe for modernizing the fighter fleet.

By John A. Tirpak

he Air Force's fighter fleet of the 2030s will strongly resemble that of the 1980s. Familiar jets like the F-15, F-16, and even the 1970s-vintage A-10 will remain. The 2000's-era F-22 will be phased out. The F-35, still in production, will become the backbone of the fleet, supplemented by one or more new designs still to be developed. This is how the Air Force is balancing Clinton Hinote, today's requirements with those of the future.

The new fighters will include at least one Next-Generation Air Dominance (NGAD) design, digitally

"will flv multiple versions of air superiority

aircraft over a career."— Lt. Gen. S. USAF requirements chief

Future pilots engineered, and potentially optionally manned.

"We are in a position of transition," Chief of Staff Gen. Charles Q. Brown Jr. told the House Armed Services Committee in June. The Air Force must retire some of its existing force to find savings it can use to develop new aircraft that can deter and defeat great power competitors like China; failure to act now, he warned, raises the "distinct possibility" that China could defeat the U.S. in a future air war.

A next-generation challenge to modern Chinese fighters and long-range missiles is "closer than we think," said Lt. Gen. S. Clinton Hinote, Air Force deputy chief of staff for strategy, integration, and requirements in May. The unveiling of long-range fighter plans, he said, is part of a "transparency" campaign meant to alert Congress to the threat posed by China and the need to move rapidly toward a force that can handle it.

"The time is absolutely coming where the combination of something like a J-20 with an advanced ... missile is a threat to air superiority for the United States," Hinote said. The J-20 is China's first stealth fighter and is now fielded. It poses a risk, Hinote said, that "we've got to address."

The new plan awaits the reality check of a tactical aircraft study now underway by USAF, the Pentagon's Cost Assessment and Program Evaluation (CAPE) office, and the Joint Staff. It will assess the fighter plan's affordability and technological

The F-35 will remain the "cornerstone" of USAF's air superiority fleet, says Gen. Charles Brown Jr., Air Force Chief of Staff.

feasibility in the context of both "fight-tonight" needs and the capabilities of the other services, and will inform the fiscal 2023 budget and the five-year spending plan that should come with the next defense budget request. (No such five-year outlook was included this year).

The tacair study will not provide "the exact answer [to] what is the exact mix," because "the facts and assumptions based on the threat will change over time." It will, however, project a force structure for the 2035 to 2040 time frame.

Brown dropped the first big hint about the future fighter force structure in May, when he said the service will cut back from its seven-fighter force structure to "four-plus one:" the F-35—which he called the "cornerstone" of the force; the



Master Sgt. Anthony Haney marshals an F-15E Strike Eagle June 12, 2019, at Mountain Home Air Force Base, Idaho. New fighter plans aim for the F-15EX to eventually take on the F-15E's ground attack role.

new F-15EX; the F-16 or a successor jet; and the NGAD, plus the A-10.

Brown conspicuously left out the F-15C/D and E, as well as the F-22. The F-22 inventory will be too small to affordably operate, officials explained later, saying the Raptor will not be upgraded much past 2030.

"The F-22 is still undergoing modernization," an Air Force spokeswoman said, and "there are no plans to retire it in the near-term." This includes upgraded F-22 sensors, improvements to stealth surfaces and capabilities, and the addition of new technologies developed for the F-35.

"Now is a good time for us to be able to talk about how we're going to bridge" from the F-22 to NGAD, Hinote said. The Raptor will phase out in the "2030-ish time frame," he noted, when it will be 25 years old and by which time NGAD could be in its second iteration. Although the F-22 has good bones, it "has its limitations," according to Hinote.

"We can't modernize our way out" of the air superiority problem "just using an updated F-22," he said. While USAF is prepared to take some risk in various missions, air superiority "is not one of them," Hinote added.

Lt. Gen. David S. Nahom, deputy chief of staff for plans and programs, said the Air Force can no longer afford to sustain seven aging fighter fleets.

"About 44 percent of the Air Force fleet is now flying beyond its design service life," Nahom noted. The seven fleets have to be consolidated "down to something manageable."

Brown pointed out the F-15C has already outlived its planned life expectancy, and cannot be economically extended. The F-15EX represents an upgrade as it backfills the retiring F-15Cs—which are speed- and load-limited—and will eventually also take on the F-15E's ground attack role. Brown told the House Armed Services Committee in June that, with the fighter force's average age stubbornly fixed at 28 years, buying the F-15EX is the quickest way to lower that figure.

New-build F-15EXs cost about the same as new F-35s, but they can be fielded faster and are cheaper to operate, the Air Force argues. The service can upgrade F-15C squadrons with EXs and be back in business within a few months. Upgrading to the F-35 is much more complicated, requiring new military construction, new ground support gear, and extensive pilot and crew training, but the F-15EX is still a fourth-generation fighter.

"Pre-decisional" talking points prepared for Brown's presentation show the service has tightly bounded ideas about what the future fighter force will look like. Through 2026, the Air Force envisions cutting 421 fighters, and replacing them with just 304 new ones, for a net reduction of 117 airframes the largest cut since the early 2010s.

All 234 F-15Cs could be gone by the end of 2026, replaced by just 84 new F-15EXs, although Air Force plans indicate it would add 60 more F-15EXs in later years; in all, the Air Force's contract with Boeing includes options to build up to 200 EXs, in total. With two more weapon stations than the C model, conformal fuel tanks for extra range, and the ability to carry outsize long-range weapons, both for air-to-air and air-to-ground missions, the EX will be, as the talking points describe it, a "weapon truck."

Brown assured the Senate Armed Services Committee in June that the F-22 will be "with us a while." Upgrades will continue up to the 2030s, but the talking points assert it "cannot be made competitive against the threat two decades from today." Older F-16s are also going away. Retiring the 124 "pre-Block" F-16s will leave 812 aircraft to be modernized with new radars and other gear by the end of 2026.

More will likely head to the boneyard: The talking points indicate about 600 F-16s can "provide affordable capacity for the next 15-plus years," in both permissive and "competitive" air theaters, but an "eventual replacement" must be developed that can affordably perform missions like countering violent extremists and defending the homeland.

If operating and support costs could be brought down to acceptable levels, "the F-35 could fill this role," according to the brief. Otherwise, the Air Force will have to seek "an alternative platform," notionally labeled the Multi-Role Fighter-Experimental, or MR-X. The decision point for this new system is "six to eight years away" according to the document, dated April 2021. The MR-X would be a "clean sheet, open mission system-designed fighter."

Brown has said that the F-16 replacement must be affordable to buy and operate and need not be as stealthy as an F-35. He speculated that F-35 operating costs could be reduced if it were saved for high-end missions and not flown as often or as hard, or used for missions not requiring stealth or high-end sensors.

The Air Force plans to buy 220 new F-35As over the next five years. Service officials have said they prefer to significantly increase their annual buy of the F-35A from the 48 or so of today only when the Block 4 model is in production, circa 2025. They want to bring down operating costs that, right now, are "unaffordable," said F-35 Program Executive Officer Lt. Gen. Eric T. Fick.

Cuts to the A-10 fleet, from 281 aircraft today to 218, mean cutting two of nine squadrons by 2023. Those units will get new missions and the remaining aircraft will gain new wings and mission gear to fly into the mid-2030s. By then, Hinote said, the A-10 will no longer be viable.

The A-10's "lack of survivability in the evolving global threat environment and its singular capability set render it ineffective in the needed role of affordable capacity" as it can't do the suppression of enemy air defenses, homeland defense, or defensive counter-air missions, according to the talking points.

Hinote said the Air Force isn't looking to create "another non-survivable close air support aircraft" like the A-10. Future battles likely won't happen along a well-defined front, but will rather be "more distributed," happening in disparate locations. This is driving the debate in the Pentagon about other services' insistence on developing their own long-range strike systems, he said, and future close air support is going to "feel much different" than it does today.

LOOKING TO THE FUTURE

The Next-Generation Air Dominance systems are the wild card in the Air Force's fighter plans. Funded at more than \$1.5 billion in the fiscal 2022 budget request, the program remains largely secret.

Some facts have been revealed, however. The first NGAD flew in 2020, setting records for altitude and possibly more in the process, said former Air Force acquisition executive Will Roper last September. Brown told the House Armed Services Committee in June that he expects NGAD to be a "multirole" aircraft, able to attack ground and airborne targets. He indicated ground attack capabilities may be needed to "ensure ... that it can survive." The aircraft must have "full spectrum stealth," according to Brown's talking points.

The NGAD has always been described as a "family of systems" likely to include unmanned escort aircraft for missions like defense suppression, electronic attack, and as a flying extra magazine for weapons. But Roper has said that the core of the system will be an aircraft.

Roper also said the NGAD concept is to rapidly design, develop, and field airplanes using the digital thread construct, but in limited numbers; perhaps as few as 50 to 100. To keep the technology fresh, the next iteration—or a competing design—would be fielded within five to 12 years, and the previous model retired. This would also save on decades' worth of sustainment costs, while not "locking up" the fighter market with a single contractor for decades at a time. In fact, constant design would keep more fighter houses busy and open the door to smaller outfits which could maybe design a new fighter but lack the facilities to build it, Roper argued. By "owning the technical baseline," USAF will be able to hand a design to another company to build it, or make parts for it.

It's also been suggested by senior USAF officials that there could be two variants, or multi-aircraft configurations of NGAD: one optimized for the long ranges of the Pacific, another for the relatively shorter distances of the European theater.

Hinote said he doubts it will take 10 years for the first NGAD to be fielded, even though it's on an "event-driven" schedule.

"We still have to make it real," he said, but he's impressed with its progress, as are "the airmen who are flying it." For him and members of Congress who've been cleared into the program, "seeing is believing," he added. Hinote declined to confirm or deny if a second NGAD type is in development.

Not yet clear is what role will be played in the future fighter mix by autonomous or remotely piloted aircraft. The Air Force is exploring Low-Cost Autonomous Attritable Systems (LCAAS); uninhabited aircraft cheap enough that their loss in combat would be bearable over a campaign. In May, Brown said ambiguously that recent wargames indicated the proper mix of manned and unmanned combat aircraft in the 2030s will be "some of both."

Hinote noted that NGAD itself will be "optionally manned," and that it may not be a "one-for-one" replacement for the F-22, given the role to be played by NGAD's unmanned escorts. But the unmanned fleet will be "force multipliers," Hinote added, especially if many of them don't need a runway to take off or recover. That could be a game-changer in a future conflict, multiplying the number of locations an adversary like China would have to target.

The fiscal 2022 budget request sets the stage for these changes with planned retirements of 42 A-10s, 48 F-15C/Ds, and 47 F-16C/Ds; against those cuts, the Air Force plans to purchase just 48 F-35As and a dozen F-15EXs. In addition, the Air Force asked for another 12 F-15EX jets in its unfunded priorities list submitted to Congress in June, but did not included F-35s on that list. Congress could always add more, as it has done in recent years, but Brown's talking points show the service plans to request only 43 F-35s a year until the Block 4 version is available.

As cutting-edge as the F-35 is, its roots date back decades, Hinote staid. The technology "is somewhere in the neighborhood of 30 years old."

"We are inventing how to think about an Air Force" where aircraft serve a "decade, two decades, but it's not any longer than that," he said. As the service "harnesses the power of digital design ... and gets us to design-centered acquisition," future pilots won't spend their careers flying one plane, he suggested. Instead, they will fly "multiple versions of air superiority aircraft over a career." That, Hinote said, should be exciting to today's fighter pilots.



AIRTORD

An Air Force Lockheed U-2. During the Cold War in the early 1950s, the United States government sought an aircraft to monitor activities in the Soviet Union. Lockheed's Kelly Johnson submitted an unsolicited proposal and promised delivery of a prototype in eight months.

By Serhii Plokhy

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he Cuban Missile Crisis was so named because of the nuclear-tipped ballistic missiles that the Soviet Union deployed to the island in the late summer and fall of 1962. The crisis started Oct. 14, 1962, with the discovery of the Soviet missiles, and its most intense period ended 13 days later, shortly after the shoot-down of an American U-2 and the death of its pilot. Now, nearly six decades later, newly discovered evewitness accounts from Soviet officers involved in the shoot down provide a unique and surprising perspective Maj. Rudolph on what is arguably the critical turning point in the Anderson was whole affair.

On Oct. 14, a U-2 Dragon Lady surveillance air- killed over plane photographed evidence of the Soviet ballistic Cuba during missiles on the island. From then on, President the October John F. Kennedy and his advisers would base their 1962 crisis. His decisions on intelligence from U-2 overflights of the regrettable death island. Ten days later, the Strategic Air Command may have been went to DEFCON (Defense Condition) 2, making instrumental Soviet leader Nikita Khrushchev believe that the in averting a United States was preparing to attack not only the nuclear war. Soviet positions on Cuba but also the Soviet Union itself. That softened Khrushchev's position in negotiations with Kennedy.



shot down and

On Oct. 27, a U-2 plane piloted by Capt. Charles (Chuck) Maultsby lost its way over the North Pole, straying into Soviet airspaces over Chukotka and causing a scare in Washington that the Soviets might mistake that flight as the final preparations before a strike on Soviet territory. That same day, Maj. Rudolf Anderson, piloting another U-2 over Cuba, was shot down by a Soviet surface-to-air missile (SAM), adding to the crisis and arguably the most dangerous 24 hours in the history of the world. Anderson was killed, turning a diplomatic crisis into a shooting conflict at risk of escalating into a full-blown nuclear war.

Neither Khrushchev nor Kennedy wanted a global war, however, and the shoot down drove Kennedy to intensify his efforts to reach a peaceful resolution. He offered Khrushchev a secret deal: He offered to remove American ballistic missiles from Turkey in exchange for Khrushchev removing his ballistic missiles from Cuba.

This much is well documented in the history books. What is barely known, even today, is that the downing of Anderson's U-2 was not executed on the orders of the Kremlin, but was instead a sign that Khrushchev was losing control over his troops: Newly released Russian documents show that the U-2 was shot down against explicit orders from Moscow, which had directed Soviet troops in Cuba not to fire at the American airplanes. The shoot down and the fear that it might lead to all-out war suddenly became a key factor in Khrushchev's decision to accept Kennedy's offer and end the conflict.

This is the story of how that happened.

By the morning of Oct. 27, few people in the Cuban leadership—or among the Soviet commanders in Cuba—doubted that an invasion was imminent. The evidence was right there in the sky above Cuba. It came with the noise of U.S. Navy Vought F-8 Crusader aircraft, supersonic fighters that could also be used as bombers and surveillance planes. Since Oct. 23, they had been crisscrossing Cuba on a regular basis, focusing on Soviet ballistic missile sites and military installations.

The unceasing Crusader overflights wracked the nerves of Soviet commanders on the island and lent credibility to Castro's panicky claims that the Americans were coming. "Every hour there were dozens of planes overhead," recalled Gen. Leonid Garbuz, the deputy commander of the Soviet troops in charge of combat readiness. "The roar of motors shook the air. The atmosphere was that of a mass airstrike with bombs dropping. The Americans were conducting a psychic attack." Psychological warfare was not part of the American strategy, but the American commanders did hope the Soviets would become so used to American planes in the air that when the time came for an airstrike they would be caught off guard, unable to distinguish bombers from reconnaissance aircraft.

On the evening of Oct. 26, Garbuz was summoned by his commanding officer, Gen. Issa Pliev, a former cavalryman and a hero of World War II, who was personally trusted by Khrushchev. The discussion, remembered Garbuz, focused on "what they [the Americans] had uncovered and what they hadn't... because tomorrow they could be fired upon and we'd have to decide what to remove and what to replace." The generals concluded that many of the ballistic missile sites had been discovered by the Americans. "And we reported to Moscow—I wrote it in my own hand rather quickly—that our opponent had managed to uncover some strategic areas," said Garbuz. Pliev sent a telegram drafted by Garbuz to Moscow reporting that: "A decision has been made to use all available anti-aircraft resources in case of a strike against our sites by American aviation." Khrushchev and Marshal Rodion Malinovsky, the Soviet minister of defense, would approve the decision later that day, but it had gone into effect immediately.

READY AND WAITING

The Soviet troops on Cuba spent the night of Oct. 26 getting ready for the attack they expected to begin at any minute. It did not come. "The day dawned, but it was quiet, and the radar found no targets in the sky," recalled Major Nikolai Serovoi, an officer on duty at the headquarters of the 27th anti-aircraft division in Camagüey in central Cuba. "But everyone's nerves were strained to the breaking point, and people were weary after a sleepless night," said Serovoi.

Around 8:00 a.m. on Oct. 27, with tropical rain picking up and the worsening weather making an attack less likely, Pliev beat a retreat, issuing a new order to his troops, Serovoi said. "We were ordered to go on duty in smaller units and fire only in case of direct enemy attack." The order marked the start of a second consecutive 24-hour shift for Serovoi, who remained at his post.

An hour later, radar in Camagüey located a target—an airplane approaching the eastern tip of the island at an altitude of more than 20 kilometers. The plane was piloted by U.S. Air Force Maj. Rudolf Anderson of the 4080th Strategic Reconnaissance Wing. He had taken off in his Lockheed U-2F from McCoy Air Force Base in Florida and was picked up by Soviet radar at 9:12 a.m. Havana time, entering Cuban airspace over Cayo Coco Island in central Cuba.

At 9:20 Anderson was already flying over the headquarters of the Soviet air defense division in Camagüey. He then flew south to the town of Manzanillo, turning east toward Santiago de Cuba and passing over Guantanamo Naval Base before making a sharp eastward turn and heading over the northern shore toward Banes, a town in Holguin province. Anderson spent more than an hour in Cuban airspace, maintaining



An early image of missile bases under construction at San Cristobal, Cuba, shown to President John Kennedy on the morning of Oct. 16, 1962. A Department of Defense map used for a televised briefing to the public on the **Cuban Missile** Crisis. The map shows the range of medium-range (1,100 nautical miles) and intermediaterange (2,200 nautical miles) nuclear missiles based in Cuba.



radio silence despite Soviet radio signals that asked him to identify himself. His cameras clicked the whole time, capturing new pictures of Soviet missile sites.

The Soviet officers knew exactly what was going on: The positions they had built with such effort were being exposed. At the command post of the 27th Anti-Aircraft Division in Camagüey, Serovoi was besieged with demands from regimental commanders to allow them to shoot down the intruder. Eager to see action at last, they readied their Dvina S-75 surface-to-air missiles, the same sort that shot down Capt. Francis Gary Powers in May 1960 over Russia.

Serovoi called Pliev's headquarters, located in an underground bunker at the El Chico estate near Havana, where the duty officer was Gen. Stepan Grechko, 52, chief of staff of the Moscow air defense region. Grechko had been dispatched to Cuba to serve as Pliev's deputy in charge of air defense. Sosnovoi told Grechko: "The unit commanders are insisting that the reconnaissance plane be destroyed."

Grechko did not know what to do. Pliev was not around. Struggling with kidney disease and, after a sleepless night, he went to get some rest. Garbuz reached the command post around 10:00 a.m., recalling later that Grechko told him that "a 'guest' has been circling around us for more than an hour. I think the order has to be given to shoot down the American plane because it can discover our positions to their fullest extent, and the reconnaissance data will be known to Washington in a few hours." Both generals knew that Pliev issued a prohibition against shooting at the American planes without his direct orders, but he was out of reach.

Grechko probably felt that the decision was now up to him, since air defense was his responsibility. After "the radar man said he would go back to Guantanamo in five minutes," recalled Garbuz, "Grechko said, 'I have made a decision to shoot him down." He added to Garbuz: "I guess we'll both answer for it." Garbuz agreed. "We both

were responsible," he admitted decades later. In Camagüey, Serovoi received the order to open fire.

Precious time had been lost, however, and for a while it looked as if no shots would be fired. The U-2 had disappeared from the radar screens, but the order remained in force. A few minutes later, when the U-2 reappeared after making a turn over the eastern tip of the island and proceeding westward toward Havana, Serovoi's men were ready.

At the SAM launch site near the town of Banas, the commander of the SAM battalion, Maj. Ivan Gerchenov, his chief of staff, Capt. Nikolai Antonets, and Lt. Aleksei Riapenko crammed into the cabin of the R-12 launcher and followed the target on the radar screen. "Destroy the target with a salvo of three!" Grechenov said, as Riapenko later recalled. "I switched all three firing channels to BR mode and pressed the 'Fire' button of the first channel."

The missile took off from the launch pad. "Then I reported: 'Target locked in!' The first missile had already been in flight for nine or 10 seconds when the commander ordered: 'Fire two!' I pressed the 'Fire' button of the second channel. When the first missile exploded, a cloud appeared on the screens. I reported: 'One, explosion. Target connected. Target damaged!' After the explosion of the second missile, the target abruptly began to lose altitude, and I reported: 'Two, explosion. Target destroyed!""

SHOT DOWN

The news about the shoot down of Maj. Rudolf Anderson's U-2 over Cuba reached U.S. Secretary of Defense Robert S. McNamara at the White House in the middle of a meeting of Kennedy's executive committee, a gathering of his closest advisers.

"The U-2 was shot down," McNamara said, interrupting the discussion.

Kennedy responded in disbelief. "A U-2 was shot down?" His brother, U.S. Attorney General Robert F. Kennedy, asked if the pilot had been killed. "The pilot's body is in the plane," answered Gen. Maxwell D. Taylor, the Chairman of the Joint Chiefs of Staff. The plane had been struck by a surface-to-air missile, he reported, evidence that it had been fired by the Soviets, rather than Cubans.

"Well, ... this is much [more] of an escalation by them, isn't it?" the President asked, to which McNamara responded, "Yes, exactly." Kennedy was trying to make sense of what had just happened in the context of two letters he'd received from Khrushchev in the prior 24 hours. "How do we explain the effect of this Khrushchev message of last night and their decision [to shoot down an American plane]?" the President asked. McNamara answered: "I do not know how to interpret it."

A NEAR MISS

Marshal Rodion Malinovsky, the Soviet minister of defense, reported to Khrushchev on the latest developments in Cuba sometime after 10:45 a.m. Moscow time on Oct. 28. He knew that he had fouled up: His troops had shot down the plane in spite of direct orders not to open fire unless attacked.

In a terse report, Malinovsky laid out the facts. He began with information about the U-2 overflight, which photographed the "combat disposition of the troops" for 1 hour and 21 minutes. "With the aim of not permitting the photographs to fall into U.S. hands, at 18:20 Moscow time, this aircraft was shot down by two anti-aircraft missiles of the 507th Anti-aircraft Missile Regiment at an altitude of 21,000 meters. The aircraft fell in the vicinity of Antilla; a search has been organized."

Malinovsky unequivocally stated that it was his troops who had shot down the plane but gave no assessment of their actions and named no names. In lieu of explanation—if not an excuse for what had happened—Malinovsky added: "On the same day there were eight violations of Cuban airspace by U.S. aircraft." We do not know what Malinovsky told Khrushchev in private, but this much is clear: In this case, the Soviet military literally managed to get away with murder. Malinovsky's message to Pliev, who had lost control of his own deputies and allowed the incident to take place, contained scant criticism despite the gravity of the situation, but signaled a sense of the error. "We believe that you were too hasty in shooting down the U.S. U-2 reconnaissance plane," cabled Malinovsky to Pliev later that day.

The Soviet premier's aide, Oleg Troianovsky, recalled, "Khrushchev was seriously alarmed by the news that an anti-aircraft missile had been fired on the orders of a middle-rank Soviet commander. He was keenly aware, as were all of us, that in the situation that had arisen, when nerves were strained to the breaking point, a single spark might cause an explosion."

Khrushchev summoned a meeting of the Presidium, the decision-making body of the Communist party. "I have called you all together to take counsel and consider whether you agree with such a decision," said Khrushchev, concluding his opening remarks. The "decision" was already there: He was simply asking for approval. He had a two-pronged strategy: "If an attack is provoked, we have issued an order to inflict a retaliatory strike." Then came his "peace" proposal. "We agree to dismantle the missile installations," he said, according to the terse protocol of the meeting. No dissent was recorded. Khrushchev got his authorization.

Khrushchev dictated a draft of a new letter to Kennedy. In a conciliatory gesture, he wrote: "We have therefore instructed our officers (and those resources, as I have already informed you, are in the hands of Soviet officers) to take appropriate measures to stop building the aforementioned installations, to dismantle them, and return them to the Soviet Union," he wrote.

The most dangerous stage of the crisis was effectively over. Maj. Rudolph Anderson's death was not without purpose. It may have helped prevent a nuclear war.

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President John Kennedy, right, meets in the Oval Office at the White House with U.S. Air Force Gen. Curtis LeMay, second from right, and reconnaissance pilots who flew the Cuban missions. Third from the left is Maj. Richard Heyser, who took the first photos of the Cuban missiles.

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BUILDING AN AGI EORCE

America needs an offset strategy built on speed, adaptability and a robust, dynamic aerospace industry.

Rather than invest 30 years to develop a successor to the multi-mission F-35A, the authors argue a more competitive, flexible approach to aircraft development could help the Air Force field a more diverse and dynamic set of capabilities in the future.

By David A. Deptula and Heather R. Penney

o secure America's interests around the world, the U.S. military must be able to deter and defeat adversaries throughout the threat spectrum. This includes China and Russia at the top end, nuclear ambitious Iran and North Korea at the mid-tier, and non-state actors in the Middle East and Africa at the low end of the threat spectrum. Given what is at stake at each level, addressing these threats is not optional. Each demands smart, credible options that rely on a balanced force design.

The U.S. Air Force provides some of the most crucial capabilities against all these geographically disperse and technically complex challenges. Because its core service missions are air superiority; global strike; global mobility; intelligence, surveillance, and reconnaissance (ISR); and command and control, the Air Force provides greatly needed policy options to U.S. national security leadership that no other service departments can deliver. The demand signal of multiple, concurrent worldwide responsibilities, however, is straining the Air Force.

Simply said, the Air Force is too old, too small, and too fragile for what the nation expects of it. David Ochmanek, a respected and experienced defense analyst, aptly sums up the impact of these dynamics when it comes to U.S. competitive advantage: "In our wargames, when we fight Russia and China, blue gets its ass handed to it."

While advanced capabilities will certainly be important to prevailing in these future challenges, leaders must also seek additional points of advantage. The simple reality is that it is no longer a safe bet to assume that the United States will possess a unilateral technological advantage. Countries like China are

aggressively pressing forward-and perhaps even outpacing the United States-in zones like machine learning.

Neither the Air Force nor the aerospace industrial base are structured to rebalance the force to exploit the potential advantages of these attributes. Instead, they have developed a procurement and sustainment model that favors maintaining and upgrading legacy weapon systems; developing multi-role, multi-function platforms; and procuring budget economies by reducing type diversity.

However, U.S. aerospace forces can no longer spend decades in a quest to secure the most exquisite capability, nor use capability as a reason to reduce capacity. We cannot do more with less.

This calls for securing new points of force design advantage: quantity, diversity, adaptation, and speed. These attributes, paired with a continual focus on quality and advanced capability, will prove crucial to achieving future success.

SMALLER AND OLDER

In 1991, Operation Desert Storm showcased the Air Force's overwhelming operational advantages in stealth, information superiority, and precision. Many U.S. leaders have assumed those advantages would endure. Instead, this perceived superiority evolved into complacency and atrophy in procurement and development.

In the wake of Desert Storm, the American defense establishment entered a decade-long "procurement holiday" during which new programs were curtailed, deferred, or canceled altogether, while force structure was cut dramatically. The Air Force absorbed the deepest budget cuts of all the services in the decade following the Gulf War and the service has never recovered. From 1989 to 2001, Air Force procurement spending suffered a loss of 52 percent of its acquisition budget. In contrast, the Army and Navy procurement budgets lost roughly 30 percent. Looking at sheer numbers, the Air Force fighter aircraft inventory declined from roughly 4,400 to around 2,000 over the past 30 years—55 percent. The bomber inventory dropped from 327 to 157, more than 50 percent.

The deterioration of the Air Force now puts U.S. national security at risk.

Recovery will be difficult. The aerospace industry suffered as a result. Reduced market demand led to consolidation, reducing the opportunity for competition, and altering business models and incentives. With fewer new programs to entice and sustain companies, the number of qualified prime contractors declined from 51 firms in the 1980s to just five today, only three of which can build aircraft.

Former Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics, Will Roper, sought to reverse that trend. "Right now we are down to just a couple of companies who can build tactical airplanes for us," he said. "We need to do everything in our power to start opening up that envelope again."

Air Force buying behavior is what has created current industry dynamics. Today, production primarily serves to secure future modernization and sustainment business, rather than as a primary profit driver. The result is that firms closely guard data rights and other intellectual property and benefit the longer a weapon system remains in service. But what's good for business is not necessarily best for national security. As aircraft age, sustainment and modernization costs grow, inevitably squeezing procurement spending. That threatens future innovation, adaptation, diversity of thought, and transformation.

The Air Force—and the defense aerospace industry—must create a new force design. Dependence on a few highly capable, multi-role, multi-function aircraft has contributed to the shrinking of the size and diversity of the force. In its wake is a force too small and too homogenous to be effective in high-end combat, yet too exquisite and expensive at the low end.

The optimal future force design will still need to have highly advanced technologies to compete with sophisticated peer adversaries, but the Air Force must also be able to field many different new systems rapidly and in quantity, and it must be able to quickly adapt, shift, and modify its forces and operational architectures. The future demands a new force design that rebalances the attributes of quality, quantity, diversity, adaptation, and speed.

Traditional offset strategies seek out game-changing technological leaps to gain an edge, but these require time and investment to develop. Add to that the increasingly complex and layered acquisition bureaucracy, and time frames stretch even further. Against a technological peer like China, adaptation and speed will be USAF's critical combat advantage. Time, therefore, is the new offset: The nation that develops, fields, and adapts faster will wield the advantage.

SYMMETRY AND OFFSETS

In symmetrical competitions, two opposing sides compete on similar merits. Both sides might share similar force designs and pursue similar technologies, strategies, or strengths. As a consequence, symmetric contests point toward attrition warfare, where victory can be secured through superior numbers.

An offset strategy, on the other hand, shifts the competition away from symmetry. In pursuit of an offset, one competitor cultivates an area of strength to gain an advantage over the other's weakness. This can compensate for a numerical weakness and even lead to a long-term advantage.

America's first offset strategy originated in the wake of World

War II. One of America's principal advantages in the Second World War was its production might. Indeed, the Allies' victory is often credited to America's "arsenal of democracy," which produced 12,692 B-17s and 18,190 B-24s during the four-year war.

Throughout World War II, the United States maximized every attribute of force design: quality, quantity, diversity, adaptation, and speed. When the war ended and the manufacturing base returned to commercial production, defense leaders faced a quandary. In the 1950s, the CIA assessed that the Soviet Union could field about 175 divisions along the European central front, with another 125 divisions in reserve that could be deployed within a month. The United States, by comparison, had 29 Army and Marine Corps divisions, with only seven in reserve. Unable to match those superior conventional forces, U.S. defense leaders focused instead on superior science and technology. President Dwight D. Eisenhower shifted the competition into the nuclear realm, where America's lead in nuclear weapons development provided a unique edge. His administration's "New Look" strategy required the military and its industrial partners to develop and field a broad range of advanced nuclear weapons and delivery systems.

Small nuclear munitions would be used for battlefield engagements, while the U.S. would seek to deter strategic escalation by holding the Soviet heartland at risk through massive nuclear retaliation. Supersonic aircraft like the F-102, F-104, F-105, and F-106 provided speed to both offense and defense missions. This deterrence approach worked. Those conflicts in which the United States did fight were smaller in scale did not involve direct, overt war with the Soviet Union.

Acquisition programs in this era prioritized capabilities optimized to counter the Soviet Union in a potentially nuclear context. The Century Series fighters, although often maligned for their performance in Vietnam, proved relatively versatile and adaptable to a conflict for which they were not designed, largely because of their loosely coupled and federated mission systems. Their internal avionics architectures were flexible enough that they could be modified to perform roles that not envisioned by their original designers.

While the physical design and aerodynamic attributes of the aircraft were fixed, the speed of development and the federated adaptability of these aircraft enabled the Air Force to meet unexpected operational demands.

The F-100, developed in the wake of the Korean War, was a direct attempt to counter Soviet airpower above Europe and in continental defense missions over the United States. When the Vietnam War erupted in 1965, the F-100 proved inherently adaptable for a range of other missions, including close air support, electronic warfare, and as "Fast FAC" forward air controllers.

The F-105 Thunderchief "was designed to fight a nuclear war in which the delivery of one nuclear weapon at low altitude and high speed was all that was required." Yet the F-105's primary operational use was as a conventional bombing aircraft in Vietnam. It served as a "Wild Weasel" to defeat enemy surface-to-air missiles and eventually was modified to conduct specialized all-weather, night bombing. Though not well-suited aerodynamically for these roles, it had the fundamentals to adapt.

But as adaptable as these aircraft were, the Air Force identified some key liabilities in the force they had designed to fight the Soviets. Vietnam, as a proxy war, was a testing ground for U.S. capabilities and tactics—and the Air Force found itself lacking. Two key areas stood out: the need to improve bombing mission effects, and the vulnerabilities of its aircraft to enemy surface to air defenses.

Because of the imprecision of unguided bombs, aircrews often

had to revisit targets to ensure their destruction. The infamous Thanh Hóa Bridge, for example, survived more than 700 sorties, costing the U.S. 29 aircraft. Driven to rethink the strategy, the U.S. began developing laser-guided bombs for increased target accuracy, improving the overall effectiveness of attacks. By 1968, the first F-4s had been adapted to fly with "Pave Knife" targeting pods and "smart" laser-guided bombs. The Thanh Hóa Bridge finally fell in 1972, when a dozen F-4s, each employing two precision guided bombs, destroyed it.

Similarly, Soviet air defenses used in North Vietnam meant that every strike aircraft seeking to penetrate that air space needed four jamming aircraft to get through. Even then, aircraft were still shot down at alarming rates. The United States lost 15 B-52 bombers in 12 days during Operation Linebacker II, the very same aircraft developed to strike deep into the heart of Soviet territory. The takeaway was clear: Jamming was not sufficient; the U.S. needed a way to evade Russian air defenses. The answer was stealth.

The Defense Advanced Research Projects Agency (DAR-PA) and the Air Force awarded both Northrop and Lockheed individual contracts for the Experimental Survivable Testbed (XST) program in 1975. Pursuing different approaches to reduce aircraft radar signatures, Lockheed went on to develop Have Blue, which would evolve to become the F-117, the first operational stealth aircraft, fielded in 1983. Northrop created the next generation of stealth in the smoothed form of the B-2. Stealth would become a long-term advantage for U.S. forces, embodied in the B-2, F-22, F-35, and the future B-21.

Precision-guided weapons and stealth were just two examples of the advanced technologies that came to comprise the Second Offset. Improved intelligence, surveillance, and reconnaissance (ISR) and precision navigation like GPS proved critical to enabling better targeting, and advanced processors were also key to increasing sophistication of aircraft and weapons. Together, these technologies had a synergistic impact on U.S. operations: we could be more lethal and survivable with our smaller force.

As then-Secretary of Defense Harold Brown described in 1981, "technology can be a force-multiplier, a resource that can be used to help offset numerical advantages of an adversary."

BETTER AND SMALLER?

The overwhelming success of Desert Storm in 1991 validated the theory of the Second Offset, that smaller could be better. The the fall of the Soviet Union that same year left the United States as a sole superpower. The Second Offset was now used not to compensate for a smaller force, but to justify cutting the force. By being better, the U.S. military could get smaller. In 1993, the Air Force reduced fighter wings from 36 to 27, and the Bottom-Up Review—completed that same year—cut even deeper, to 20 fighter wing equivalents.

Later, the B-2 and F-22 programs were curtailed. The B-2 dropped from 132 planned aircraft to just 21; the F-22 was cut from 750 to 339 and ultimately to 187 aircraft. Older legacy platforms that were supposed to be replaced, like the B-52, B-1, and F-15, instead had to be retained to support the high operational tempo driven by unanticipated conflicts.

With new starts curtailed, the aerospace industry adapt, optimized for the business they had and could project. They gave up their traditional core competencies in aerospace design and production capacity in favor of business models built on upgrades and sustainment.

Years of deferred recapitalization have harmed the Air Force and the aerospace industry that supports it. Engineering teams are not experienced in new designs or skilled manufacturing



Systems like the XQ-58A Valkyrie, shown here during a test demonstrating the separation of the ALTIUS-600 small UAS aim to maximize the combat potential of a size-constrained USAF. China may already be ahead of us, though.

because companies have been focused on sustaining the past. This lack of expertise, coupled with the Department's pursuit of ever-more complex, multi-role aircraft, means that it now takes decades to field any new system. In the meantime, legacy aircraft are getting older and more expensive to sustain. That leaves less money to develop and buy next-generation aircraft.

The result of cuts directed by the Air Force, DOD, the White House's Office of Management and Budget (OMB), and Congress have combined, over the years, to yield a force unable to realistically match the strategies it is charged with executing. Planners have failed to realize that rather than a "silver bullet" force, the Air Force now teeters toward a hollow force, with too few legacy and "next-generation" aircraft to be effective.

A NEW OFFSET STRATEGY

Past U.S. offsets focused on advanced technologies, but that is not the only option. Offset strategy can focus on many attributes: quality, quantity, diversity, adaptation, or speed. Force designers can dial up any one of these attributes to yield the desired advantage.

■Quality refers to advanced technologies and is often synonymous with "capability." Leaps in technology shaped U.S. military dominance for over 40 years—technologies like stealth, precision strike, highly accurate navigation and timing, and global reach defined the Air Force for a generation. But given the long lead times needed to field new technologies, and the technological abilities of our adversaries, this is an advantage that may not prove enduring.

■Quantity is reemerging as an essential element of force design, driven by the need to: effectively cover geography with tempo and mass; present adversaries with sufficient complexity to complicate their targeting and operational strategy; and withstand attrition in contested environments while remaining operationally resilient and effective.

■Diversity describes the need for different capabilities in each mission area; for example, having three types of bombers—B-52s, B-1s, and B-2s—provides commanders options and complicates adversaries' planning, defenses, and targeting.

Adaptation ensures the ability to both field new capabilities and modify existing weapon systems and to pursue new operational concepts.

Speed is about the pace at which the United States inno-

vates. Developing new capabilities and fielding them in operationally significant quantities pressures adversaries by creating new unknowns. Accelerating change is crucial to disrupting adversary awareness, understanding, decision, and action. When optimized, this pace exceeds adversaries' ability to adapt.

TIME AS THE NEW OFFSET

Today's Air Force reflects decades of choices that prioritized quality over any other attribute. To achieve a competitive advantage now, the Air Force must pivot to harness the advantages of adaptation and speed. In a world where peer adversaries have technological parity or even a genuine lead in some areas, the real strategic offset now is time. Speed of adaptation must now drive all the other attributes of force design.

Stealth was once an exclusive U.S. capability, but America's adversaries have been pursuing stealth as well as advanced air defenses to counter low-observable aircraft for decades. Today, therefore, stealth is a baseline from which to compete, not by itself a strategic advantage.

In 2014–15, DOD leaders proposed a so-called "third offset," built around a suite of emerging technologies including "autonomous learning systems, human-machine collaborative decision-making, assisted human operations, advanced manned-unmanned systems operations, and network-enabled autonomous weapons and high-speed projectiles." These technologies, like past offsets, aim to maximize the combat potential of a size-constrained U.S. force. However, many observers now believe China is ahead of the United States in machine learning and artificial intelligence.

China is aggressively pursuing hypersonic missiles such as the DF-17 boost-glide and the Xingkong-2 hypersonic waverider vehicles. While debate may surround the maturity and capabilities of these efforts, what is clear is that these third offset technologies will not be the sole advantage of the United States.

Time, paired with continued technological innovation, may be a better offset strategy. Operationalizing new capabilities at speed can become a new asymmetric advantage. Technologies still matter, and advancing capability still matters, but these innovations do not need to be massive game-changers in the traditional sense nor confer decades of advantage. Instead, rapid adaptation should be the focus. The United States must be able to field a force that can present unexpected force mixes with unanticipated operational architectures at speed.

A force design that could support such an offset strategy requires the constant advancement of technologies that can be fielded in either mission-specific or simple-function types. Doing so imposes uncertainty on adversaries, making possible unpredictable force compositions. At a technological level, this force design constantly innovates, fields, adapts and changes at a pace that fundamentally disrupts adversaries' strategy and operations.

There are three crucial elements to this strategy:

■ **First**, the United States must be able to field new capabilities faster than it has in recent decades.

• Second, the United States must be able to field a technology or adaptation faster than the adversary can negate that capability. Being "faster than red" enables U.S. forces to operate inside adversary adaptation cycles.

■Third, the United States must field new capabilities fast enough to be operationally relevant, meaning that rather than demanding 100 percent perfection before a system can be fielded, the Air Force must focus instead on quickly getting even nascent' capability to the warfighter.

Today's defense enterprise is not positioned to compete in this new kind of offset, however. The U.S. aerospace industry must accelerate the pace of fielding and integrating new capabilities. The Air Force must be able to rapidly connect, command, and create surprising new force compositions to confront adversaries. It needs advanced and unorthodox systems that can disrupt adversaries' ability to understand, predict, and target U.S. or allied operational architectures.

After 30 years of constrained investment and "smaller but better" thinking, the Air Force can now use market incentives to help expand the aerospace industry and incentivize rapid development. Launching new production starts every five to seven years and maintaining multiple production lines at once may seem ambitious today, but doing so promises important benefits, including more strategic options, higher quality products, and increased creativity in the industrial base.

THE INDUSTRIAL BASE

Since the 1990s, Air Force acquisition trends have prioritized economies of force—maximizing the mission roles of any single



At its peak, fighter production reached 2,700 of six different types. Production numbers and diversity dropped off radically in the 1960s, but a stable total fighter inventory also indicates the service began to retain aircraft across a longer service life. What is largely remembered as the Reagan buildup in the 1980s is actually a fleet turnover, where aircraft designed in the 1970s, the F-15 and F-16, replaced earlier types.

Fighter Production and Inventory, 1950–2015.

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weapon system-to the continuing detriment of the industrial base. In prioritizing highly advanced technologies over quantity, speed, or adaptability, DOD drove the market to consolidation. While the Air Force gained extremely capable, multi-role platforms that negate the need for alternate mission-focused or single-role systems, the price paid was reduced diversity and quantity of aircraft.

Homogenizing the Air Force inventory decreased the number of business opportunities for industry to compete and win new business. As a monopsony system, defense companies are reliant on a single major customer-the U.S. Department of Defense-and its political components, including the administration and Congress. Companies must adapt to DOD buying trends and to legislation that controls, and in some cases blocks, exports. Some companies exited aircraft design, development, and production, either entirely, or narrowing their focus to subsystems. Others were acquired by larger companies. Still others adapted by focusing on winning major bids and then making up lost profit on future upgrades and sustainment. Consolidation allowed major defense contractors to survive the capricious nature of defense procurement, but it leaves the Air Force with few options to build the future force.

CONSOLIDATION

In 1950, 19 companies could build military aircraft. Today, only three are left: Northrop Grumman, Boeing, and Lockheed Martin.

Instead of building everything, these prime contractors partner with a range of suppliers to spread both risk and reward. Integration is a critically valuable skill. In addition to integrating components, software and processing power are emerging as linchpins of combat aircraft design, combining advanced sensing, data links, autonomy, artificial intelligence, machine learning, man/machine-teaming, and other software-enabled functions. The F-35, by far the most advanced operational aircraft in the world, has over 8 million lines of source code and another 16 million lines in its sustainment, mission planning, and maintenance support equipment.

In this world, the data rights for the platform and the software architecture are critical assets for the original equipment manufacturer. Government concerns about these data rights are understandable, because "vendor lock" is a real worry. But for manufacturers uncertain about future procurement volumes, securing data rights ensures future profit from sustainment and modernization contracts. Owning the data rights for follow-on sustainment and modernization programs, in fact, is the key to their future profitability.

SOLVING THE PUZZLE

The Air Force can change this paradigm and achieve quality, quantity, and adaptation at speed, but must make changes for that to happen. It must expand the aerospace industrial base, enhance the integration skills of both industry and its Airmen, and shift industry's main profit centers away from sustainment and back into design and production.

To achieve that the Air Force should:

1. Expand the defense aerospace industrial base. The Air Force can use areas of rapid technological development to bring in new companies and provide them key design experience. Providing ongoing competitive prototyping programs will enhance the expertise of new and established design

teams. Future joint aircraft programs should be avoided. Increasing the number of new-start competitions, even if they are smaller, will drive increased competition, innovation, and design diversity while allowing companies future competition opportunities. This gives the nation strategic depth of capability and cultivates seasoned talent and experience.

2. Enhance the integration skills of design teams by pursuing a strategy of rapid adaptation. Integration expertise is crucial to accelerating change in the battlespace. Experimentation with open mission systems, modular avionics architectures, containerization, and adaptive networking will be crucial developing both technologies, software, and skills at the system and operational level. The skill and creativity of teams to conceptualize and integrate complex systems will provide strategic and operational advantages in a peer contest.

3. Shift the defense aerospace industry's major profit center away from sustainment and into innovation and production. With industry's major business lines in sustainment and modernization, they are incentivized to perpetuate the status quo force design and protect proprietary programs. Shifting the profit model more toward production will encourage innovation and rapid fielding. The Air Force can accelerate development and fielding cycles by maintaining on-going competitive prototyping programs and holding more frequent new-start competitions, keeping multiple production lines hot, and maintaining a younger fleet age. It should also invest in adaptive and affordable manufacturing technologies and accept and proactively manage smart risk by prioritizing rapidly fielded iterative improvements over perfect systems.

The United States does not have an exclusive hold on developing advanced technologies. Other nation statesmost worryingly, China-are competitive in key areas like machine learning, artificial intelligence, and computation and processing. The global proliferation and acceleration of technological development means the old strategy of relying on technology alone to offset a smaller fleet no longer works. The system we have developed requires decades to develop and field new capabilities, and in competition with China, they may be late to the game. Adaptation will be the new advantage, and time the new offset.

To field advanced capabilities at the speed warfighters need, the defense industrial base must expand. This can only be accomplished by changing Air Force acquisition. Reforms alone cannot deliver the force the nation needs-a robust, vibrant, and competitive defense industry will.

U.S. defense aerospace companies employ some of the world's greatest engineering talent and possess the ingenuity and manufacturing skill to build the best aircraft in the world. By changing the way it does business, the Air Force can build upon these strengths and expand the options in the marketplace. Business follows the money. Moving profit incentives from sustainment to R&D and production is the best way to achieve rapid adaptation. G

Lt. Gen. David Deptula, USAF (Ret.) is dean of AFA's Mitchell Institute for Aerospace Studies. Heather Penney is a senior fellow at the Institute. Download the entire paper at https://mitchellaerospacepower.org/ building-an-agile-force





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



Candidates for National Office and the Board of Directors.

The Air Force Association Nominating Committee met by video conference on May 1, 2021, and selected candidates to send forward for National Officer positions and National Director positions on the Board of Directors. The Committee consists of three past Chairmen of the Board, one person selected by each of the two Vice Chairman of the Board, two representing each geographic area, and one person each representing the Total Air Force, Air Force veterans, and aerospace industry constituencies. The slate of the candidates will be presented to the delegates in September.

CHAIRMAN OF THE BOARD



Gerald R. Murray, King Mountain, N.C., nominated for a third-year term as Chairman of the Board, joined AFA in 1994, becoming a Life Member in 2002. Murray served 30 years in the Air Force, culminating as the highest-ranking noncommissioned officer in USAF, the 14th Chief Master Sergeant of the Air Force. Prior, he performed various duties in aircraft maintenance and logistics with F-4, F-16, and A-10 aircraft, and as a command chief master sergeant at wing, numbered air force, and major command levels. Murray's previous AFA involvement has been as a National Director, on the Membership Committee, Chapter 331 President, Force Capabilities Advisory Group member, AFA National Director at Large, and as the Georgia and Utah State Delegate. He earned a bachelor's degree in business administration from Saint Leo University in Florida and an associate of applied science in aircraft systems maintenance technology from the Community College of the Air Force. Murray has received the Air Force Distinguished Service Medal, a Bronze Star Medal, Defense Meritorious Service Medal, four AF Meritorious Service Medals, and three AF Commendation Medals. Additionally, he was the 1991 recipient of the Air Force Gen. Lew Allen Trophy. He has volunteered as an AFA Emerging Leader Mentor, with the AFA Focus on Defense Forum, and with the Top of Utah Military Affairs Committee. Murray currently serves on the USAA Board of Directors, the Air Force Association National Board of Directors, the Air Force Museum Foundation Board of Trustees, the Air Force Enlisted Village Development Council, and the Air Force Memorial Foundation.

VICE CHAIRMAN OF THE BOARD, FIELD OPERATIONS



James W. Simons, Minot, N.D., nominated for a second-year term as Vice Chairman of the Board, Field Operations has been an AFA member and Community Partner since 1995. Simons has held AFA positions including David C. Jones Chapter President and Treasurer, North Dakota State President, and the North Central Region President. He was a charter member of the AFA Field Council and also served on the National Membership Committee. Simons has received the Air Force Association Medal of Merit; Exceptional Service Award; Chairman's Citation (2009); National Member of the Year (2014); and the Mary Anne Thompson Award (2009). He previously served AFA as the National Director, Central Area. Simons earned a bachelor's degree in criminal justice from Michigan State University, a master's degree in systems management from the University of Southern California, and a master's degree in administration of justice form Wichita State University. A retired U.S. Army Military Police Officer of 18 years, Simons is currently a financial adviser for a financial services company. His volunteer work includes treasurer of a local community group and videographer at a community church. He is involved in Arnold Air Society/Silver Wings and is a member of the 2021 Wings Society.

VICE CHAIRMAN OF THE BOARD, AEROSPACE EDUCATION



Stephen K. Gourley, Aurora, Colo., nominated for a first, one-year term as Vice Chairman of the Board, Aerospace Education, joined AFA in 2007 and has served as the Mile High 127 Chapter President and Colorado State President and Executive Vice President. He is currently serving as Colorado Mile High 127 Chapter Vice President, Aerospace Education, and State Vice President, Veterans Affairs. Gourley also serves as Aerospace Education Council's Co-Vice Chairman, on the AFA Strategic Planning Committee, and is the Director of StellarXplorers. He received the Colorado Medal of Merit; Exceptional Service Award; and Presidential Award for Excellence; as well as National level Medal of Merit Awards and a Special Citation, and a Chairman's Citation. Gourley earned a bachelor's degree in astronautical engineering and a master's degree from the Massachusetts Institute of Technology and a master's degree in national resource strategy from NDU. He retired from

the USAF after more than 26 years of service in the space field, working in science and technology; research, development, test, and evaluation; and operations. He currently works as the president of an engineering and management consultant company.



Mark J. Lewis, North Potomac, Md., nominated for a first, one-year term as Vice Chairman, Aerospace Education, has been an AFA Life Member since 2004. Lewis earned a bachelor's degree in aeronautics and astronautics; a bachelor's degree in earth and planetary science; a master's degree in science; and a doctorate in science from the Massachusetts Institute of Technology. He received the USAF's Exemplary, Meritorious, and Exceptional Civilian Service Awards and the Secretary of Defense Outstanding Public Service Award, to name a few. He was Chief Scientist of the USAF (2004-2008). From 2010-2011, Lewis was President of the American Institute of Aeronautics & Astronautics, subsequently serving as chair of the AIAA Foundation which funded student scholarships and design competitions. He served as the Director of the Science & Technology Policy institute (2012-2019), and is a professor emeritus at the University of Maryland where he was a faculty member for 25 years. Lewis was the Director of Research & Engineering in the

DOD, and also acting Deputy Under Secretary of Defense for Research & Engineering. Lewis is a member of the International Academy of Astronautics, a Fellow of the American Society of Mechanical Engineers, a Fellow of the Royal Aeronautical Society, and an honorary Fellow of the American Institute of Aeronautics & Astronautics. He has also authored more than 320 publications, and is currently the executive director of NDIA's Emerging Technologies Institute.

NATIONAL SECRETARY



Robert "Bob" George, Ogden, Utah, nominated for a first, one-year term as National Secretary is a Life Member of AFA, joining in 1978. He has served as AFA's Arizona State President, Rocky Mountain Region President, Arizona Chapter President, Vice President, and Chapter officer and was recently elected to serve as an AFA Board member. Ogden earned a bachelors degree in political science from the University of Nebraska and a master's degree in business finance from Webster University in St. Louis. He commissioned in the Air Force as a second lieutenant and entered flight training at Craig Air Force Base, Ala., in 1972. Over the next 28-plus years he served as an officer in munitions, aircraft maintenance, weapons safety, logistics and acquisition. His last assignment was as director, air-to-surface munitions at Hill Air Force Base, Utah, where he procured expendable munitions, explosive ordnance disposable tools, and missile components, and also managed the worldwide munitions stockpile. In 2019, George retired from

Young's Engineering Services, Inc., which he co-founded, serving as vice president of operations; security officer; and EEO officer.



Michael J. "Mike" Liquori, Springfield, Mass., has been an AFA Life Member since 2000. He received his bachelor's degree in mathematics from Boston University and a master's degree in managerial economics from the University of Oklahoma. He is a retired lieutenant colonel having served on Active duty for 12 years and as an Individual Mobilization Augmentee in the Air Force Reserve for 13 years. He is a member of the Martin H. Harris Chapter (Fla.) where he has served as President, Executive Vice President, AF Gala Chairman, AWS Awards Chairman, AWS Golf Chairman, and webmaster. Liquori was selected as an AFA Emerging Leader in the 2014-2015 class. He currently serves as a National Director at Large on AFA's Board of Directors. At the national level he has served as Chairman of the Membership Committee and Audit Committee and he has also previously been a member of the Field Council, Nominating Committee, and Finance Committee.

Liquori received an AFA Medal of Merit, Exceptional Service Award, and a Chairman's Citation. He currently works in the real estate development/asset management field in Orlando, Fla.

NATIONAL TREASURER



Charles L. Martin Jr., Fort Mill, S.C., nominated for a third-year term as National Treasurer. An AFA Life Member since 1977, Martin has served as AFA National Treasurer, on the Finance Committee, and the Fresh Look Initiative Committee. Martin has received the AFA Special Citation; AFA Medal of Merit; AFA Colorado Chapter Meritorious Service Award and Certification of Appreciation; and AFA Scheidecker Award. He earned a bachelor's degree in economics from Manhattan College, N.Y., and an MBA in accounting from Michigan State University. Retiring after 28 years in the USAF as a comptroller, he served in executive staff or volunteer positions in national not-for-profit associations. Chuck holds certifications as an Internal Auditor and an Association Executive. His volunteer memberships now include the S.C. Governor's Task Force on Military Organizations, VFW, Indian Land Post-Investment Committee, Sun City Carolina Lakes Finance & Investment Committees, and Audit Committee, American Academy of Audiology.

NATIONAL DIRECTOR AT LARGE

The Nominating Committee submits four names for National Director at Large. Two will be elected for a three-year term. (Only two names were submitted this year)



Mark Tarpley, Edmond, Okla., an AFA Life Member, joining in 1989. He retired as a colonel from the USAF after 27 years. Tarpley served as a navigator (AC-119K, KC-135,RC-135, and E-3), war planner, Air Staff planner, Expeditionary Operations Group Commander, and Inspector General. He received the Air Medal seven times (1972 to 1981); the Vietnam Service Medal (1972); the Legion of Merit Medal (1998); the Defense Meritorious Service Medal (1991); and the Meritorious Service Medal (1984). Tarpley has held various AFA offices including: Gerrity Chapter Vice President Aerospace Education (2005-2010); Gerrity Chapter Vice President (2013-2015); and Oklahoma State President (2015-2017). He has served as a Field Council Advocacy Subcommittee Chair (2014-2017); on the Aerospace Education Council (2017-present); Advocacy IPT Committee (Chair 2017-2020); and on the Strategic Planning Committee (2020). Tarpley received the AFA Medal

of Merit Award (2011); AFA Exceptional Service Award (2013); AFA Chairman's Citation (2017); and the AFA Member of the Year Award (2020). He has over 15 years of leadership experience at AFA Chapter, State, and National levels.



Jacqueline C. Trotter, Warner Robins, Ga., is an AFA Life Member, joining in 2005. She has served as the AFA Georgia State President and Southeast Regional President. She received AFA's Medal of Merit Awards (1993 and 2017) and also the Exceptional Service Award (2020). Trotter earned a bachelor's degree in communications from Southern Illinois University. She served in the public affairs and media relations field as a civilian and in the USAF for over 40 years. She worked for the Red Cross as the director of community services and worked as the Chief of Media Relations for Air Force Reserve Command News Service, and as Chief, Publications Management for Air Combat Command. Trotter is currently retired and working as a volunteer in several community organizations.

NATIONAL DIRECTOR, WEST AREA

The Nominating Committee submits two names for National Director, West Area, who will be elected for a three-year term. (Only one name was submitted this year)



Roberta Pike Oates (Bobi), a Life Member since 1994, is currently the Thunderbird Chapter President and Southwest Region President. She is also a member of the Field Council. Oates is the face of AFA at both Nellis and Creech AF bases in Nevada, and incredibly involved with Airman and Guardians at both. She is a retired U.S. Air Force aircraft maintenance Senior Master Sergeant, with 23 years of service (1976-1999). She was handpicked as one of four individuals to stand up the Air Force's first Remote Piloted Aircraft Predator Squadron at Creech Air Force Base. As Production Superintendent for the 11th Reconnaissance Squadron she led the initial Air Force Cadre of Maintenance personnel through training at the UAV training center at Fort Huachuca, Ariz., then on to Taszer, Hungary, for the first Air Force Deployment in support of Operation Joint Endeavor. During her Air Force career, she served at several overseas and stateside bases in various Aircraft Maintenance

positions. After retirement she worked at Armed Forces Bank, starting as a part-time teller, later becoming the Exchange Branch Manager. Oates is very involved in the state and local community supporting Veterans and their families. She is the connector between them and the information they need.

NATIONAL DIRECTOR, CENTRAL AREA

The Nominating Committee submitted one name for National Director, Central Area, who will be elected for a two-year term.



Susan B. Mallett, Montgomery, Ala., an AFA Life Member, joining in 1993. A member of the Montgomery Chapter she has served as South Central Region Aerospace Education Vice present since 2007 and as the Central Area National Director since 2020. She currently serves as National Director, Central area. Mallet is also on the AFA Aerospace Education Council and Membership Committee. She received the AFA Medal of Merit Awards (2009, 2013, and 2016); the Distinguished Sustained Aerospace Education Award (2012); the Chairman's Achievement Award (2017); and the AFA Member of the Year Award (2019). She currently works for Civil Air Patrol National Headquarters as their Education Outreach Manager.

90th Missile Wing Center Renamed the Johnigan Center for Airmen and Families

By Chequita Wood

The Airman and Family Readiness Center at F.E. Warren Air Force Base, Wyo., was renamed the Johnigan Center for Airmen and Families in honor of Irene Johnigan by the 90th Missile Wing on June 18.

Johnigan, a long-time supporter of F.E. Warren Air Force Base Airmen and the surrounding community, was the former AFA Cowboy Chapter President. Among the attendees at the ceremony were many who directly benefited from her nearly 50 years of federal service, and who also reaped rewards from her steadfast involvement with the Air Force Association and other service organizations.

The Johnigan Center for Airmen and Families serves as an education and referral center for single, married, Active-duty, Guard, Reserve, retired members, spouses, and families. Some of the programs available include: Employment Assistance, Personal and Family Life Skills Development, Relocation Assistance, Violence Prevention Integrator, and Casualty Assistance and Su

Integrator, and Casualty Assistance and Survivor Benefits.

Col. Peter Bonetti, 90th Missile Wing commander, presented Johnigan with a dedication plaque, recalling, "My second priority when I began command was to develop Airmen and their families, and it wasn't negotiable. This is required to achieve the first priority of accomplishing the mission, because who else but the Airmen are going to accomplish the mission, and this is where I realized how important [Irene] Johnigan was to F. E. Warren Air Force Base."

Johnigan was the longest serving Cowboy Chapter President with more than 40 years in the role where she focused efforts on improving the lives of the Warren Airmen and their family members through a number of initiatives. In 2019 she



Col. Peter Bonetti, left, 90th Missile Wing commander, and Irene Johnigan, a long-serving supporter of F.E. Warren and its Airmen, unveil a dedication plaque during a ceremony renaming the Airman and Family Readiness Center the Johnigan Center for Airmen and Families on June 18.

> was the 90th MW's Community Leader of the Year and in 2020, Johnigan was awarded an AFA Chairman's Citation for distinguished contributions to the Air Force Association in a specific field that has improved and elevated the effectiveness of the Association nationally.

> Her trailblazing efforts and contributions to service exemplify the Air Force's core values.

Johnigan said, "I stand before you with a great deal of humility, pride, gratitude, and appreciation. ... This honor and tribute is so incredibly overwhelming that it defies description."

The center, located at 7601 Randall Avenue, Building 207, is open Monday through Friday from 7:30 am to 4 p.m.



Senior USAF and community leaders, including (right to left) Cheyenne Mayor Patrick Collins, Brenda Lutton, and her husband Maj. Gen. Michael Lutton, 20th Air Force commander, honor Irene Johnigan at F.E. Warren Air Force Base. Updates on AFA's activities, outreach, awards, and advocacy.

AFA Board to Delegates: Give Every Member a Vote

By Tobias Naegele

AFA's Board of Directors voted to approve new bylaws in a bid to strengthen organizational leadership and open voting to every member. The vote must be ratified by delegates to AFA's convention in September for the changes to take effect.

"We voted to replace our complex and outdated Constitution with simplified Bylaws that will enable AFA to be more agile and responsive to opportunities and risks; more accountable to our members and stakeholders; and more effective in our mission to educate and advocate for American airpower and space power and to support Airmen and Guardians and their families," wrote AFA Chairman Gerald R. Murray, the 14th Chief Master Sergeant of the Air Force, in a letter to members. sense of ownership in the Association. "Today's Airmen and Guardians offer a whole new perspective developed through decades of a dynamic, high-ops-tempo environment, including combat operations," he said. "They know what works today and what doesn't, what they need now, and what they're going to need from their Association. Active duty and recently retired Airmen and Guardians are also the talent pool for current and future AFA volunteer leaders. They should have an active voice in the future of their professional association."

AFA, like the military services themselves, must modernize, Murray said, invoking former Air Force Chief of Staff Gen. Mark A. Welsh III and quoting his advice to the

Murray said the proposed bylaws are needed for two reasons: First, to vest more responsive and accountable authority in the Board of Directors, which meets frequently throughout the year, rather than in a convention that meets annually; and second, to empower every AFA volunteer leader and member, whether Active duty, Guard, Reserve, civilian, or community and industry partner, by enabling



CMSAF Gerald Murray, USAF (Ret.) addresses the Board of Directors at the National Convention during the 2019 Air, Space & Cyber Conference at National Harbor, Md.

them to elect Association directors.

The Board approved the changes June 23, and the vote to ratify will be held Sept. 18-19.

Murray said he intends to spend the summer raising awareness of the proposed changes and to fully inform all convention delegates and members about what's at stake. He urged members and delegates to educate themselves by reading up on the details and reaching out to AFA leaders to share their views on the changes and gain a fuller understanding of the issues at stake.

He said all AFA members, including Active-duty Airmen, Guardians, and civilians, deserve an opportunity and should be directly involved in their professional association.

"Under our present construct, it is the Delegates, not the Board, that make the most momentous decisions for the Association," wrote Murray, noting that delegates gather only once a year. "In the high-tech, fast-moving, and dynamic society we live in today, that's no longer good enough," he said. "Our Association must be agile and adaptable, responsive to change and challenges."

AFA President, retired Lt. Gen. Bruce "Orville" Wright, said giving every member a vote provides everyone a greater

Board from a year ago: "AFA is at an inflection point," Welsh said then, before urging Association leaders to chart a new course to remain effective and relevant in the fast-paced future.

Murray said the new bylaws are long overdue. While a decline in membership has been arrested, growth has proven difficult, and he said the Association must diversify its income streams and its Board makeup by bringing in directors who can supplement the Board's strengths with complementary skills and expertise.

"The Bylaws approved last week were crafted by a respected and experienced team of AFA leaders, aided by outside professional counsel," Murray said. "The new Bylaws ensure volunteer field leaders continue to serve on and inform our Board [and] also enable AFA to attract new outside directors who can share expertise in business, academia, fundraising, and more."

"Your Board stands strongly in favor of these changes," Murray said. "Now we look to the delegates to affirm the Board's decision to strengthen AFA, embrace all our members, strengthen our Board and governance, and build a strong future."

HEROES AND LEADERS

By John T. Correll

ALL-STAR AIRMAN

The versatile John Alison gained distinction as a fighter pilot, Lend-Lease officer, aerial ace, and founder of the air commandos.

n late 1940, Generalissimo Chiang Kai-Shek sent a delegation to the United States to acquire airplanes for the Chinese air force. Their American adviser, Claire L. Chennault, set up a demonstration of the Curtiss P-40 Warhawk at Bolling Field in Washington.

In the five-minute show, the P-40 whipped through turns and maneuvers that even Curtiss did not know it could perform. Mightily impressed, one of the Chinese officials said, "We need 100 of these."

"No," Chennault replied, "you need 100 of these," pointing to the pilot he had chosen to conduct the demonstration, Lt. John R. Alison, 28.

Alison was as an Airman of exceptional ability. He once landed a P-40 after the entire rudder had been shot away. He would eventually get to China as a member of Chennault's Flying Tigers, but not yet. The War Department had more pressing work for him.

In the spring of 1941, he went to London on behalf of the Lend Lease program to help the British get the most out of the P-40s they had obtained from the United States. Later that year, he transferred to Moscow in a similar role to assist the Russians in the assembly, maintenance, and operation of their P-40s.

The attack on Pearl Harbor drew the United States directly into the war. In July 1942, Alison was assigned to the Flying Tigers in China as deputy commander of one of Chennault's top squadrons.

The Japanese fighters, mostly Nakajima Ki-27s and Ki-43s, were rated as superior to the Flying Tiger airplanes but that depended on who was flying the P-40. In his first aerial combat, Alison shot down two enemy aircraft with a third probable but unconfirmed. In a matter of months, he was an ace with six victories in the air and one airplane destroyed on the ground.

In 1943, he was recalled to Washington. Once again, there was a special job with his name on it. The eccentric British general Orde Wingate was about to start a large irregular operation deep in the Burmese jungle to oust the Japanese occupation force.

Gen. Henry H. "Hap" Arnold sent for the two most capable lieutenant colonels in the Army Air Forces-Alison and Phillip Cochran, the model for "Flip Corkin" in "Terry and the Pirates" comic strip-to help Wingate. They were promoted to colonel and tasked to form a new kind of unit, called "air commandos" by Arnold. Cochran was the commander, Alison the vice commander.

Wingate's invasion would launch from India. Everything-Wingate's "Chindit" soldiers, their horses and mules, all supplies and reinforcements-had to be transported to Burma by air. Attack aircraft would support the Chindits in combat.

When the invasion began March 5, 1944, Cochran remained at the headquarters in India while Alison led the operational force to Burma. The first aircraft in were Waco CG-46A gliders, carrying teams that would land in a clearing, suppress any enemy forces found there, and construct airstrips in the jungle. Alison was pilot of the first glider, even though he had never flown a glider before.

The gliders got most of the men and equipment down with min-



Maj. John R. Alison, an American Volunteer Group Ace (Flying Tigers), poses in front of a Curtiss P-40 at an air base somewhere in China.

imum casualties. That night they delivered 539 men, three animals, and 65,972 pounds of stores, including bulldozers.

Within 24 hours, the invaders had widened the clearing and prepared an airstrip. The C-47 transports were close behind. The Japanese were soon under effective attack by more than 9,000 of Wingate's troops.

Three weeks into the operation, Alison was summoned again by Arnold. He departed in a damaged British C-47. Alison had not previously flown a C-47, but that made no difference.

At Arnold's direction, Alison organized several more air commando groups, deploying with one of them to the southwest Pacific where he finished the war as operations officer for 5th Air Force.

Alison and Cochran are recognized today as founders of the air commandos and honored as the originators of Air Force special operations.

In 1947, Alison left Active duty and became assistant secretary of commerce for aviation. He subsequently retired from the Air Force Reserve as a major general and went on to be elected president and chairman of the board of the Air Force Association.

He never lost his affinity for flying. Years later, when Alison was almost 90, he was offered a ride in a restored P-40. He declined. He had no interest in going unless he got the pilot's seat and flew the airplane himself. 0

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