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STAFF

Publisher
Larry O. Spencer
Editor in Chief
Adam J. Hebert

Managing Editor
Juliette Kelsey Chagnon
Editorial Director
John A. Tirpak
News Editor
Amy McCullough
Assistant Managing Editor
Chequita Wood
Senior Designer
Dashton Parham
Pentagon Editor
Brian W. Everstine
Senior Editor
Steve Hirsch
Digital Platforms Editor
Gideon Grudo
Production Manager
Eric Chang Lee
Photo Editor
Mike Tsukamoto

Contributors
Wilson Brissett, John T. Correll, Rachel Cox, Robert S. Dudney, Jennifer Hlad, Frederick A. Johnsen

ADVERTISING:

Arthur Bartholomew
213.596.7239
Tom Buttrick
917.421.9051
James G. Elliott Co., Inc.
airforcemagsales@afa.org

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A SpaceX rocket booster lifts a payload into space. See "Rocket Science," p. 46. Photo by SpaceX.

Nuclear Rohrshach Test

"We must modernize and rebuild our nuclear arsenal, hopefully never having to use it, but making it so strong and powerful that it will deter any acts of aggression," President Donald Trump asserted in his February 2018 State of the Union address.

"Perhaps someday in the future there will be a magical moment when the countries of the world will get together to eliminate their nuclear weapons," he continued. "Unfortunately, we are not there yet."

People see what they wish in it, but the Nuclear Posture Review prescribes exactly what's needed

Former President Barack Obama's vision, articulated in Prague in 2009, was to put nuclear disarmament first while maintaining a credible arsenal. Trump's vision reverses this and says strengthen the nuclear arsenal first.

What happened in the intervening nine years? Russia happened.

When Obama was elected, hopes ran high that Russia would evolve into a peaceful actor. As the 2010 Nuclear Posture Review put it, "Russia is not an enemy and is increasingly a partner."

The New START agreement, signed that year by Obama and then-Russian President Dmitri Medvedev, limits the US and Russia to 1,550 deployed strategic launchers through February 2021.

Things have gone downhill since then. Russia, China, Iran, and North Korea are not interested in following the US lead on nuclear reductions. They are brutally self-interested and see much to gain by improving their own nuclear forces.

In 2014, Russia invaded Ukraine and illegally seized Crimea. It steadily ramped up rhetoric and aggression toward its neighbors and the United States and repeatedly violated arms control agreements and international law. "We must look reality in the eye and see the world as it is, not as we wish it to be," Defense Secretary James Mattis wrote in his introduction to the NPR.

In response, the NPR lays out specific force-structure plans. Ohio-class nuclear missile subs will be replaced by next generation Columbia-class boomers; the Ground-Based Strategic Deterrent (GBSD) will begin replacing Minuteman III ICBMs; the next generation B-21 bomber will supplant the B-2 stealth bomber; and Long-Range Standoff (LRSO) cruise missiles will replace old Air-Launched Cruise Missiles.

The National Nuclear Security Administration (NNSA), which ensures the safety, security, and effectiveness of nuclear weapons, is accelerating some programs begun under Obama. NNSA is modernizing warheads and developing the B61-12 nuclear bomb to consolidate multiple old weapons and offer greater accuracy and reliability.

The US will also develop new, lower-yield nuclear cruise missiles for Navy use and will shorten the time needed to conduct a "live" nuclear test.

America's "test readiness posture has not changed," said USAF Brig. Gen. Michael J. Lutton, who is responsible for military application at NNSA. Little "t" testing takes place all the time, Lutton



A B61-12 test unit is dropped from an F-15E during a development flight test in 2015.

noted. Examples include flight-testing weapons and performing stockpile stewardship computer simulations.

There are no plans to conduct an actual nuclear test, as the US has had a self-imposed "Big T" testing moratorium in place since 1992.

"The United States remains committed to its efforts in support of the ultimate global elimination of nuclear, biological, and chemical weapons," the NPR reads. The US has reduced its nuclear stockpile from a peak of 31,000 weapons to 4,000 and has deployed no new nuclear capabilities in two decades.

Still, antinuclear critics are beside themselves. In a masterstroke of hyperbole, the Bulletin of the Atomic Scientists this year moved its "Doomsday Clock," which "warns the public about how close we are to destroying our world with dangerous technologies of our own making," to two minutes to midnight. This is "the closest the Clock has ever been to Doomsday."

Similarly, Sen. Diane Feinstein (D-Calif.) said the NPR "lowers the threshold for use of nuclear weapons," repeating a canard that seemingly resurfaces with every new nuclear review or strategy.

If the only options are unusable nuclear weapons, "are we then back to the doctrine of massive retaliation, from which every American administration since the 1950s has sought to escape because of the lack of credibility of the choice it posed between suicide and surrender?" asked Henry Kissinger ... in 1990.

People see what they want to see in this NPR. The review is short on hope, long on reality. It offers exactly the nuclear roadmap the US needs right now.

"I hope everyone understands that it is better to not mess with Russia," Putin bluntly stated in August 2014, in the midst of his invasion of Ukraine. "I have to remind you that Russia is a nuclear superpower."

This "environment makes further progress toward nuclear arms reductions in the near-term extremely challenging," Mattis wrote. "Ensuring our nuclear deterrent remains strong will provide the best opportunity for convincing other nuclear powers to engage in meaningful arms control initiatives."

New START expires in 2021. The US should pursue an advantageous new arms control agreement before then, but to do so it must negotiate from a position of strength.

Rare-Earth Now Rare in US

The recent issue contains an article about how the rare-earth elements have seemingly been corralled by the Chinese ["Rare-Earth Uncertainty," February, p. 52].

One of the past candidates at either the Air War College or combined schools, Col. Justin C. Davey, wrote about this very subject several years ago and it seemingly received little attention.

In that article Davey pointed out what the impacts would be, and no one including Congress appears to have paid attention to that until this new administration came to be.

In many areas now, the US is totally reliant upon foreign sources for things that used to be very common in our industries. Thanks to the socialism and attitudes of our Congress we are no longer the leader of the world but are having to compete where we never have before.

James Tribbett
Phoenix

Two items stood out: first, that the environmental damage that is possible (likely?) in storing the tailings for this type of mining is so profound it is understandable that there are very few places in the US from which we can obtain them. But if that's true, why isn't the US military removing and recycling the existing rare-earth element components? Does that mean that they are usually thrown away, potentially causing the same damage?

Second, and unsaid in the article, is that certain foreign powers have "partnered" with smaller nations in order to obtain, retrieve, and refine rare-earth elements for retrieval and storage in the US. What action has the US military taken

to get ahead of this potential problem? Or are we going to allow our lesser competitors to get ahead of us on this front?

Norman Gaines
Hartsdale, NY

Before Cyber

A great article on the state of the Air Force's cyber warrior forces and mission area today ["The Cyber Warriors," January, p. 38]. But who were the airmen before the term "cyber" came into vogue that were the foundation for this mission area? You really have to go back into the 1960s and look at evolution happening in computers, in the world, and the military. Who is the Air Force's Cyber-1, and what was the Air Force doing in the then-realm of computer security or the terms "confidentiality, data integrity, and availability," the basis of what later morphed into cyber security with the integration of other security areas. The Air Force Computer Security Office moved from the Air Force Data System Design Center at Gunter AFS, Ala., to Electronic Security Command (Air Force Intelligence Command), Kelly AFB, Texas, in the 1984-85 time frame and then on to Air Force Space Command.

This rich history is there for the writing. The Cyber-1 is Col. Roger R. Schell, who was instrumental in the Air Force efforts in development of multilevel secure operating systems at ESD [Electronic Systems Division] and later became the deputy director, NSA National Computer Security Center, author of the Orange Book, and mentor for me during my time as program manager, Air Force Computer Security Office. Cyber-2 is Lt. Col. Bill Rendelman, my predecessor as program manager. Cyber-3, Lt. Col. Larry Nobel, Roger Schell's predecessor at ESD and then action officer at the Air Staff, the unsung hero who lead the way through Washington at all the agencies, other services, and Air Staff to get our regulation coordinated, funded, and message through. The other effort that is missed is the OSI's Abacus Seven Program in the early 1980s which took automation officers/NCOs and trained them as OSI agents to combat computer crime and espionage (this was the brainchild of Lt. Col. (then-Capt.) Bob Schlansker). My office and theirs combined to form

teams to elevate bases and programs for computer security risks.

There is so much more to this history that should be told to the Air Force as the events that took place at Air Force Space Command, what went into the planning of the Air Force Security Program and its writing of the first Air Force Computer Security Regulation, the first Air Force Security Workshop (Conference), and the difficulties in getting funding, and finally getting its first program plan approved. There is a lot there. But more importantly, the tie from there and what happened after the beginning, the wake-up, then the slow progress to what it is today. When briefing, the main comebacks I always received were: "There is no smoking gun!," "You're too 1984!," "You're going against the Privacy Act!," "Our airmen have security clearances and they will never do that!," "We have guards and fences!," "That is not possible!," "You can't do that!," "Networks won't be a problem!," "Small Computers should be a supply item and not controlled!" ... and this was in 1980-83.

Lt. Col. Curtis Higuchi,
USAF (Ret.)
Colorado Springs, Colo.

All Hail February Issue

"Replacing Minuteman," [February, p. 27]: Excellent coverage of a complex subject that doesn't get discussed much, but is of critical importance.

"Life on the Line," [February, p. 40]: I was surprised at how effective this photo essay is in conveying engaging information about a subject that usually comes across as dry and clerical. The selection of photographs is outstanding. They are both colorful and descriptive in ways that I've rarely seen. They succeed at showing an amazing breadth of manufacturing capabilities and technologies that are one of the US' crown jewels. Good job!

"Rare-Earth Uncertainty," [February, p. 52]: This is a really obscure subject that I haven't seen treated this clearly and thoroughly anywhere else. The discussion of both the physics and the politics provide a welcome perspective to a hot-button topic that generally is dealt with only in short sound bites.

Hank Caruso
California, Md.

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.

—The Editors

We Are Not Alone

Thanks again for yet another great issue of *Air Force Magazine*. As I neared the end of the article by John Tirpak, ["Aperture: America First" March, p. 9], and read what our President said about NATO, I was again dismayed by the rhetoric "...we can no longer be taken advantage of or enter into a one-sided deal where the United States gets nothing in return." Does the President not remember 9/11, when for the first time in history Article 5 was invoked and for our country's sake? Does anyone remember when NATO sent AWACS aircraft to Tinker Air Force Base to fly cover over these United States while our AWACS were scattered around the globe? I certainly do! I will be the first to agree that our NATO partners should pay their fair share, but can you imagine what Europe would look like today if it were not for the strong NATO partnership that kept the Soviets at bay? Without NATO we really would be on our own in this big world, and that is simply not an acceptable strategy.

Col. Frank Alfter,
USAF (Ret)
Beavercreek, Ohio

In response to the "America First" article, p. 9, March 2018, I would think that a publication such as *Air Force Magazine* would contain editorials that were more supportive of the commander in chief, President of the United States, and with less of a negative overtone.

Ron Banks
Hurst, Texas

Secure in Our Identities

I am curious about the very narrow subject matter [in the] all-too-brief "Infographic: Intruder Alert" [March, p. 54].

Don't get me wrong, having some idea of what the 33rd Network Warfare Squadron does to secure the Air Force Network (AFNET) is very interesting. To most readers however, this information will be unactionable. What might they do with this information?

I would suggest a further exploration into the tools that are used daily by literally millions of airmen, soldiers, and seamen to secure their unclassified communication transactions. Avoiding the eye-crossing technical details of the cryptographic private and public key infrastructure (PKI) tools that are used to assure the identities of the message senders and recipients, the tools also reveal if the message was

intercepted and altered and thus, not to be trusted.

A further feature allows for the effortless encryption of sensitive information such as medical or legal documents. It is in effect a built-in notary public for the entire system.

The Department of Defense developed and released PKI to the Services nearly 20 years ago, and the true heroic efforts are those accomplished year after year, to deploy, maintain, update, and improve the infrastructure part of PKI to keep up with the technology that the bad guys are using. Although the Service PKI System Program Offices (SPOs) operate out of tightly controlled facilities, one can garner a decent idea of the system capabilities by checking out some of the Defense Information Systems Agency (DISA) websites.

While the current media frenzy over the American election system security is getting all the attention, it is easy to forget that we already have and are using the tools that can secure such systems. It seems that the only issue requiring public discussion is that PKI requires the use of assured identities. The simplest approach would require that the card stock and processes used by state motor vehicle agencies to issue driver licenses be upgraded to DOD identification standards—typically, an ID card or approved device.

Anyone willing to explore this topic from the Air Force perspective will be supremely impressed by the relatively small team comprising the USAF PKI SPO, which is also based out of JB-SA-Lackland, Texas. Lastly, an aware public might insist upon a more widespread civilian use of such tools to secure their private and business dealings. Is there an expense associated with such tools? Certainly! However, according to a recent Department of Justice report, the 2014 cost of identity theft in the United States was \$15.4 billion dollars. Surely, we can find a way to invest, so as to avoid the cost and the anguish associated with identity theft.

Capt. John Facey,
USAF (Ret.)
Sant Antonio

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Contacts

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Field Services field@afa.org
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Insurance afa.service@mercer.com
Membership membership@afa.org
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ISIS AFTER ISIS

The bomb-dropping phase to exterminate the so-called Islamic State may be over and its strongholds conquered, but ISIS is likely not going to be truly dead for years—and may never be—Gen. Paul A. Selva, Vice Chairman of the Joint Chiefs of Staff, explained in January.

Though many ISIS fighters were killed or captured, many escaped, likely to go back to their countries of origin still radicalized, Selva told defense journalists in Washington. One way to “thin the herd” is to get home countries to take back and imprison their citizens who fought for ISIS, or directed or committed domestic terrorism in places like Paris or Belgium. This approach can prevent, long-term, the “consolidation” of ISIS vets.

Coalition intelligence knows, though, that other “unaccounted for” survivors are attempting to return to their home countries, Selva said, and “what they’re going to do is hard to predict.” He’s worried that these radicalized fighters have gotten used to an environment where there are no “rules of engagement” and no restrictions on killing civilians or children.

They’re “very dangerous” he said, because the ISIS ideology pegged nonbelievers as not valuable. And their mindset is, “because you have no value, I may do with you as I please. I can take your life, I can rape you, I can subjugate you, I can do anything I want. And there’s no deprogramming involved in their return home, so that is a very, very compelling problem,” Selva explained. The kind of violence these fighters have unleashed on others is “unspeakable.”

The coalition is providing whatever information it can about returning ISIS fighters, but “the catalog” of foreign fighters is “not terribly precise.” Many have dual passports and multiple aliases, so home-country security may not even be aware of many individuals who fought for ISIS.

Unfortunately, “their ability to communicate ... to their followers worldwide is still fairly robust,” Selva said. Social media and new encryption methods “make that possible.”

Worse, the videos and websites that radicalized ISIS recruits are still out there, and “the latency of stuff on the Internet is measured in years, not months or minutes,” Selva said. Hunting it all down and deleting it is a chore, because “people are willing to reinstall it” on other social media platforms. Selva warned that “the ideology of ISIS will persist for some time after the group itself is extinguished.”

Banning this material is “something we ... as a free and open set of societies ought to be really thinking about,” he said. “How do we get at the counter-radicalization piece that will still have to go on after the physical caliphate itself is completely extinguished? Because we’re going to go about the process of rooting all this stuff out, off the Internet, and putting moderate voices out there that actually counter this ideology.”

And then, there will have to be economic opportunities made available “to the population that was the source of the foreign fighters in the first place.” Selva noted.: For example, those who “believe they’re disenfranchised all around the world,

who are easy prey for that legacy of stuff that stays out there on the Internet.”

He added, “If we fail to address” those conditions, “my concern is, in five or 10 years, we’ll have ISIS 2.0 or al Qaeda 3.0, and the process will start again somewhere else in the world.”

Selva also said that it’s not the military’s task to address those underlying economic breeding grounds for terrorism.

“I kill people and break things. I don’t build schools and teach



SSgt. Jonathan Young prepares to upload the X-51A WaveRider hypersonic flight test vehicle to a B-52 for fit testing at Edwards AFB, Calif.

children the right way to treat one another. But somebody in government needs to be paying attention to that part,” he said.

In the area of hypersonics, Selva confirmed what current and former defense leaders have been saying for months: The US has lost its lead to China.

China, Selva said, has made hypersonics a “national program,” and has made plain that it’s willing to spend “up to hundreds of billions” of dollars “to solve the problems of hypersonic flight [and] hypersonic target designation.” While the US may have paved the way, China and Russia alike have “moved out pretty smartly” to conquer this field of technology.

The US, however, has not “lost the hypersonics fight,” Selva insisted. The US has “taken a different approach,” working on “a family of hypersonic systems that work without necessarily trying to close all the technology pieces” at the outset. The focus for the US is on making such a vehicle “survivable and maneuverable, which is a flight control problem.” Getting the vehicle to be responsive to commands and updates and hunting down moving targets is something that “will happen later in the development of the technology,” he revealed.

He did not say whether the preferred US approach is in a gliding vehicle, launched to hypersonic speed by a booster or an air-breathing approach like that taken in the X-51 program, but he clearly was referring to a hypersonic missile and not a manned platform.

“Can you scale hypersonics from a small, highly maneuverable, high-G, sturdy machine to something you’d put a human

in? I'm not sure that one would invest the money to make that transition," he said, suggesting a hypersonic weapon obviates the need for a hypersonic platform.

Selva declined to name a single hypersonics lead at the Pentagon, saying only that there are three entities working the problem. He would only name two. One is the Defense Advanced Research Projects Agency, or DARPA. "The Navy has a hypersonics program," too, he said, and "the third one I won't reveal," he added.

GO FASTER!

In a January interview with *Air Force Magazine*, however, Air Force Vice Chief of Staff Gen. Stephen W. Wilson said "I can tell you we're all doing things: us (the Air Force), DARPA, SCO (the Defense Department's Strategic Capabilities Office)," and he allowed there's "discussion in with the Department" about whether somebody should be in charge of the hypersonic enterprise.

A possible candidate to be the Pentagon's director for hypersonics might be the planned new Assistant Secretary of Defense for Research and Engineering, Wilson said, but that position "doesn't exist yet."

Wilson also said the Air Force can "never" again spend 20 years introducing a new system, because adversaries are simply developing new capabilities too rapidly.

"Speed wins," Wilson asserted, explaining that he believes USAF's new starts should have a goal of delivering combat capability within five years of a go-ahead. He pointed out that in the 1950s and 1960s, big programs were brought to the field within three years, but whether the nation can return to that model, "I don't know."

DOES NORTH KOREA HAVE THE GOODS?

North Korea's military has not yet openly demonstrated all the elements needed to make a successful nuclear-armed ICBM capable of reaching the continental US. In the January meeting with defense reporters, Selva said while Kim Jong Un has shown progress in long-range rockets and developing nuclear warheads, he has not demonstrated "all the components" of a true ICBM.

A fully functional ICBM is more than just a rocket and a warhead, Selva explained. The rocket has to be maneuvered such that it can "do the roll maneuver that actually points it in the direction of the United States." Targeting and fuzing systems are also needed, and they must be packaged inside "a survivable re-entry vehicle that can withstand the stress and shock" of launch, transit, and re-entry when the unit is subjected to extreme heat and vibration.

To date, Kim has not demonstrated "the fusing and targeting technologies ... or the re-entry vehicle," Selva said. And while North Korea has conducted much of its rocket and nuclear research underground and in widely separated locations, Selva said he's unaware of any way to test re-entry technologies underground.

"I believe we would be able to observe the tests" if they'd been made, Selva said. He also noted, however, that Kim has not pursued any part of its ICBM project in "the way we would do it. So it's possible, although I think unlikely, he's found a way to do the testing another way." For that reason, the US must "place the bet that he might have" a working ICBM.

He admitted his concerns about North Korea developing a



A North Korean team elevates a missile for firing.

new class of vehicles which can very quickly raise and launch a missile. Pyongyang previously relied on Scud-type transporter-erector-launchers, or TELs, to move and launch missiles. Once they stop moving, they go through a process of raising and fueling the missile, requiring "tens of minutes to an hour," Selva said, which allowed that much warning time of a launch if they were spotted. Now, North Korea has new vehicles, mobile-erector-launchers or MELs.

These can move a missile out to a circular concrete launch pad, elevate it already fueled and launch in "a dozen minutes or so," with a commensurate reduction in warning time.

Making the task doubly challenging is the fact that North Korea has been "very disciplined" about keeping its missile activities concealed when US satellites pass overhead, he said. It also practices good camouflage techniques and keeps as much illicit activity as it can underground, Selva noted, adding "it's very hard to catch them out in the open."

Selva insisted the US does not "do preemption," but wouldn't simply wait to be attacked if it saw troubling activity. Any action would have to be taken within the context of rhetoric and provocations signaling that North Korea was getting ready to launch. But if the context signaled that intent—and the US could not necessarily see all of North Korea's missiles—it could still render them ineffective by attacking their supporting infrastructure, such as crews, fuel, command and control, etc.

In certain circumstances, all of those things would become "legitimate, proportional, discriminate military targets," Selva asserted. If "the poor sergeant" whose job it is to launch the missile is bombed in his quarters, he's "not available" to perform that task, Selva pointed out.

Though a "bolt out of the blue" attack with no warning or provocative precursors is always possible, Selva said it's unlikely, and if tensions rose, the US could adjust its "day-to-day posture" in the region to have assets in place capable of crippling North Korea's missile capability.

If North Korea succeeded in launching a missile, the US has space-based means of detecting it and ground-based means of tracking and intercepting it, Selva noted.

Photos: Chad Bellay/USAF; DPR Korea

RAVEN, JIGSAW, AND CHAINSAW

Maj. Eric Bow used to spend most of his workday copying and pasting. As the targeting effects team chief, Bow created a lot of PowerPoint slides and Excel documents, and a lot of information was conveyed by phone or email.

Now, thanks to a target development management program called Raven, all of the “junk” and duplication of effort has gone away, cutting 12 hours of work down to three or four hours.

“We were killing ourselves back in Raqqa and Mosul,” Bow said recently, as he walked *Air Force Magazine* through the process of developing a target.

Raven is one of about six Defense Innovation Unit-Experimental (DIUx) programs running now at the Combined Air Operations Center (CAOC) at Al Udeid AB, Qatar. Most were developed and reached initial operational capability within the last year, and helped increase efficiencies and effectiveness, reduced man hours, and increased savings, explained Col. Mike Drowley, US Air Forces Central Command chief of staff.

In the CENTCOM area, Drowley said there are multiple streams of information from multiple places: signals intelligence, communications intelligence, and human intelligence. When Lt. Gen. Jeffrey L. Harrigian became the commander of AFCENT, one of his imperatives was, “how do we manage all



Capt. Gary Olkowski, seen here with Jigsaw, the Pentagon's digital tanker planning tool.

this data and then how do we effectively give it to the people that need to utilize it the most,” Drowley said.

One of the first programs to roll out in March 2017 was a tanker planning tool called Jigsaw. Previously, Drowley said, it took five or six people upward of eight hours each day to plan tanker flights, using magnets on a giant whiteboard. Now it's down to one or two people for two or three hours a day, and the whiteboard has been replaced with a dual touch screen that has generated savings of 400,000 to 500,000 pounds of fuel—or \$750,000 to \$1 million—each week.

“It was literally a whiteboard with a dry-erase marker, trying to figure out what receivers are going to one tanker, and then all of a sudden, a change would come in at the two-hour point, and you'd have to completely wipe the board and start all over again,” Drowley said.

Now, the tanker planning airmen can just click on an icon and drop it on another location, and the program calculates everything—from how much fuel the tanker has left to the available airspace—Maj. Derrick Baker, air refueling coordination chief, explained.

The program eliminates the need for tedious math, reduces the potential for human error, and allows them to redo the plan in a



An F-16 Falcon is refueled by a KC-135 Stratotanker. A new program called Jigsaw allowed CAOC planners to ditch the whiteboards previously used for tanker planning.

matter of minutes, versus hours, said Baker.

At the same time, on the combat operations division floor, Marine Corps dynamic targeting chief Capt. David Wesalo is using a program called Chainsaw for dynamic targeting and communicating with coders in real time to provide feedback.

The program consolidates “a ton of programs into one,” reducing a process that took an hour or two, to a matter of minutes, he said.

Chainsaw reached initial operational capability in mid-November, just 120 days from its inception, and Wesalo said he's already given the developers about 50 suggestions. He likened the initial program to a skateboard, with the goal of using user feedback to evolve that skateboard into a Ferrari.

Drowley said the speed the programs are developed is unlike anything he's ever seen in the military, and much of it is due to an iterative, adaptive approach that doesn't focus on getting a perfect solution right out of the gate.

Airmen work with DIUx coders to identify what they need, and the first version of a program is usually about a “60 percent solution,” Drowley said. Then, users begin to use the beta version and give constant feedback about how to change or improve the program, which has allowed rapid changes to meet real needs.

“We're not looking for the home runs here, we're trying to get a bunch of singles and make progress,” he explained. “You're trying to come up with that first step, and once you have that first step, now you do rapid iterations to get to where we need to be.”

The command also sends airmen to Silicon Valley to learn about the culture and the processes, and brings coders to the CAOC to see what operations are going on and what the requirements are.

Drowley said, It's all part of a culture that we are trying to build where “we don't want airmen thinking like airmen, we want them thinking innovatively, we want them thinking differently.”

“We don't want just one way of thought,” he added.

Jennifer Hlad is a freelance journalist based in the Middle East and a former *Air Force Magazine* senior editor.

Photos: USAF; MSgt. Phil Speck/ANG



An airman readies a weapons load at an undisclosed location in Southwest Asia.

■ Air Force “Zero-Based Review” Underway

Air Force leaders have begun a “zero-based review” of the service’s programs and activities, taking a hard look to see if anything it’s doing is propelled not by need but inertia, service undersecretary Matthew P. Donovan said Jan. 18.

“We are looking for programs that are no longer needed. The idea is to get after the relevancy of what we do,” he said in a speech to an Air Force Association audience on Capitol Hill. It’s been “more than 20 years” since the service has conducted such a review, and “everything is on the table.”

Donovan told reporters he doesn’t expect “major changes” from the review, which is being led by USAF’s strategic plans and programs shop.

The review is expected to be concluded by March 15, Donovan said.

■ Afghanistan Strikes Increase Significantly in 2017

US aircraft finished 2017 flying combat missions in Afghanistan at the highest rate in years—dropping more bombs than in any other year since 2011.

US aircraft in the final two months of 2017 kicked off a new campaign against the Taliban, called Jagged Knife, targeting Taliban drug facilities inside Afghanistan. After an initial salvo involving F-22s, aircraft including B-52s, F-16s, MQ-9s, and Navy F-18s hit 11 narcotics facilities in Helmand Province.

This contributed to 2017’s total of 4,361 strikes in Afghanistan, according to numbers released by Air Forces Central Command.

Tanker sorties to fuel this new offensive also increased, reaching 5,714—the most in the past three years.

In December, US and coalition aircraft released a total of 584 weapons in the air war against ISIS, the lowest monthly total since August 2014. However, 2017 was a busy year as coalition aircraft helped US-backed fighters rout ISIS from its so-called capitals of Raqqa, Syria, and Mosul, Iraq.

There were a total of 39,577 bombs dropped as part of Operation Inherent Resolve in 2017, bolstered by 13,243 tanker sorties and 14,015 ISR sorties.



A B-52 lands at Andersen AFB, Guam, in January.

■ All Three USAF Bombers Deploy to Guam

Six B-52s and about 300 airmen from Barksdale AFB, La., deployed to Andersen AFB, Guam, in January to participate in the continuous bomber presence mission in the Pacific.

The B-52s replaced six B-1B Lancers from Ellsworth AFB, S.D. Additionally, three B-2 Spirits deployed to Guam to support the Pacific deterrence mission.

At one point in January all three bomber variants were at the base for the first time since August 2016 and for just the second time in USAF history.

■ Air Force to Establish D.C.-Based Vice Commander for Space Command

Air Force Secretary Heather Wilson has told congressional defense committees the Air Force plans to establish a three-star vice commander of Air Force Space Command who will serve in the Washington, D.C., area, USAF spokesman Maj. William Russell said.

The new position will be responsible for a variety of tasks related to coordinating with Air Force headquarters and other national security agencies. Air Force Space Command will still maintain its two-star deputy commander billet in Colorado Springs, Colo., whose responsibilities do not change.

Russell said he could not speculate on potential nominations, but this position, like all three-star positions, must be confirmed by the Senate.

The Air Force had previously created a position for a deputy chief of staff for space, and Maj. Gen. David D. Thompson was confirmed for the position last year. However, the Fiscal 2018 defense authorization bill eliminated that position.

JROTC students explore the flight deck of a KC-10 tanker during a tour of Travis AFB, Calif.



John Rood survived a bruising confirmation process to become undersecretary of defense for policy.

■ Senate Confirms New Undersecretary of Defense for Policy

The Senate on Jan. 3 confirmed John C. Rood to be undersecretary of defense for policy with a vote of 81-7, despite a rocky nomination process. During his confirmation hearing, both Republican and Democratic senators hammered Rood, a former senior vice president at Lockheed Martin, about potential conflicts of interest.

■ Airmen Receive Distinguished Flying Crosses for Afghanistan Mission

Two airmen at Cannon AFB, N.M., on Jan. 5 received Distinguished Flying Crosses for their role in a 2016 resupply mission in Afghanistan, braving enemy anti-aircraft fire to help US special operations forces on the ground.

On Jan. 5, 2016, Capt. Charlotte Raabe and SSgt. Gary Bjerke were flying as part of a six-man aircrew in an MC-130J Commando II conducting an emergency resupply airdrop to special operations forces who were under fire in an isolated area of Afghanistan. The aircraft flew through an area where it was within reach of small arms and anti-aircraft artillery.

"It did not set in that we were taking fire until the ramp and door had opened," said Bjerke, the loadmaster on the mission. Raabe was the aircraft's combat systems officer. "I distinctively remember hearing the cracks of the bullets passing behind the aircraft. The only thing I could think of was that this resupply needed to be executed successfully."

The crew air-dropped a bundle of ammunition and supplies, which landed within 50 meters of the team, according to an Air Force news release.

■ Tackling the Pilot Shortage Problem

The Air Force launched the Junior Reserve Officers' Training Corps Flight Academy scholarship program in January, which plans to teach cadets how to fly. The effort is one of many steps the service is taking to address its growing pilot shortage.

Scholarship recipients will take classes this summer, each course lasting between seven and nine weeks, according to the Air Force. If all goes according to plan, cadets will return with private pilot licenses. However, there is no requirement for cadets to become military pilots.

"We understand not all of the cadets graduating from the Flight Academy will elect to take a military track, but that's OK as those young people electing to enter commercial aviation will have a positive impact on the overall national crisis," said Brig. Gen. Michael G. Koscheski, director of the Air Force Aircrew Crisis Task Force, in a press release.



T-6 Texan II aircraft are grounded—again.

■ 19th Air Force Grounds T-6 Trainers

Maj. Gen. Patrick J. Doherty, commander of 19th Air Force, indefinitely suspended all T-6 Texan II operations on Feb. 1, after a "cluster" of unexplained physiological events (UPEs) were reported at three bases within a week.

"We're acting swiftly, making temporary—but necessary—changes to everyone's training, general awareness, checklist procedures, and possibly [modifying] aircrew flying equipment to mitigate risk to the aircrew while we tackle this issue head-on to safeguard everyone flying T-6s," Doherty said in a statement.

The suspension comes a week after USAF stood up a team dedicated to investigating similar UPEs. As recently as November 2017, two A-10 pilots at Davis-Monthan AFB, Ariz., reported physiological incidents while flying, which led the base to ground a third of its Warthog fleet for about a week.



Maj. Gen. Anthony Cotton is taking over as commander of Air University.

■ 20th Air Force Commander Promoted to Lead Air University

The Senate has confirmed Maj. Gen. Anthony J. Cotton, commander of 20th Air Force, based at F.E. Warren AFB, Wyo., for promotion to lieutenant general. He is to take command of Air University at Maxwell AFB, Ala.

Maj. Gen. Ferdinand B. Stoss assumed command of 20th Air Force from Cotton during a Jan. 26 ceremony. Stoss previously served as director of operations and communications for Air Force Global Strike Command headquarters at Barksdale AFB, La.



Vice President Mike Pence speaks during the AFWERX grand opening in Las Vegas.

■ Air Force Opens Innovation Hub in Las Vegas

The Air Force opened its new innovation hub and start-up center in Las Vegas on Jan. 11 with the goal of incubating a new approach to solving national security problems.

With an initial \$2 million budget, AFWERX includes Air Force officials, with involvement from industry and academia. It centers on a facility that includes a 25,000-square-foot fabrication lab, containing 3-D printers and carbon fiber ovens to help "bring some ideas to life in a physical form," AFWERX spokesman Bobby Mack said. The second floor is a 15,000-square-foot collaboration space, which includes areas that are restricted for classified work.

AFWERX will eventually have a permanent staff of 12 people focusing on new USAF mission areas.



Speeding up F-35 testing.

■ F-35 "Pre-IOT&E" Underway, Aimed At Expediting Testing

Six F-35 jets—two of each variant—deployed to Eielson AFB, Alaska, on Jan. 18 for cold-weather testing as part of an unusual effort to speed up initial operational test and evaluation, according to USAF officials.

The Air Force Operational Test and Evaluation Center at Kirtland AFB, N.M., in coordination with the Pentagon's Operational Test and Evaluation shop, has begun "pre-IOT&E" activities on the F-35, to "mitigate delays in program development," a center spokeswoman said.

The jets at Eielson were doing cold-weather testing in temperatures averaging minus 23-degrees Fahrenheit. AFOTEC and the Defense Department's OT&E were collecting "data regarding the F-35 air vehicle system's effectiveness, suitability, and mission capability during alert launches in cold-weather," said Maj. Gen. Matthew H. Molloy, AFOTEC commander and head of the F-35 joint operational test team.

■ The War on Terrorism

US Central Command Operations: Freedom's Sentinel and Inherent Resolve.

Casualties

As of Feb. 15, a total of 49 Americans had died in Operation Freedom's Sentinel in Afghanistan, and 52 Americans had died in Operation Inherent Resolve in Iraq and Syria.

The total includes 97 troops and four Department of Defense civilians. Of these deaths, 46 were killed in action with the enemy while 55 died in noncombat incidents.

There have been 239 troops wounded in action during OFS and 58 troops in OIR.



The first Operationally Responsive Space satellite, ORS-1, successfully launched from NASA's Wallops Flight Facility in Virginia in 2011.

SPEEDING UP **SPACE**

SHOULD USAF'S OPERATIONALLY RESPONSIVE SPACE OFFICE MORPH INTO A RAPID CAPABILITIES OFFICE FOR SPACE?

By Wilson Brissett



William LaPlante, USAF's former acquisition chief, at AFA's Air Warfare Symposium in 2015. Both he and Gen. John Raymond say speed in developing space assets is becoming evermore critical.

Air Force leaders have sounded a consistent warning in recent years: The National Security Space enterprise must accelerate the way it acquires new systems. Space has become a combat domain, they say, and adversaries are building the means to rapidly take offensive action in orbit. The US, in turn, must be ready to counter such action just as quickly. "I really see a need to go fast" in acquisition, said Gen. John W. "Jay" Raymond, commander of Air Force Space Command (AFSPC) at the 33rd Space Symposium in April 2017. Responding to this situation demands that USAF develop and launch resilient capabilities more efficiently, and space leaders believe a Rapid Capabilities Office focused on space is likely the best way to do it.

Experience with space defense programs over the past decades has been a harsh teacher, as some major programs have soared over budget and missed deployment by years. The GPS III's next generation operational ground control system, known as OCX, is one of the more infamous examples. Even when OCX Block 0 was finally delivered to the Air Force in November 2017, Space and Missile Systems Center commander Lt. Gen. John F. Thompson called it "a historically troubled program."

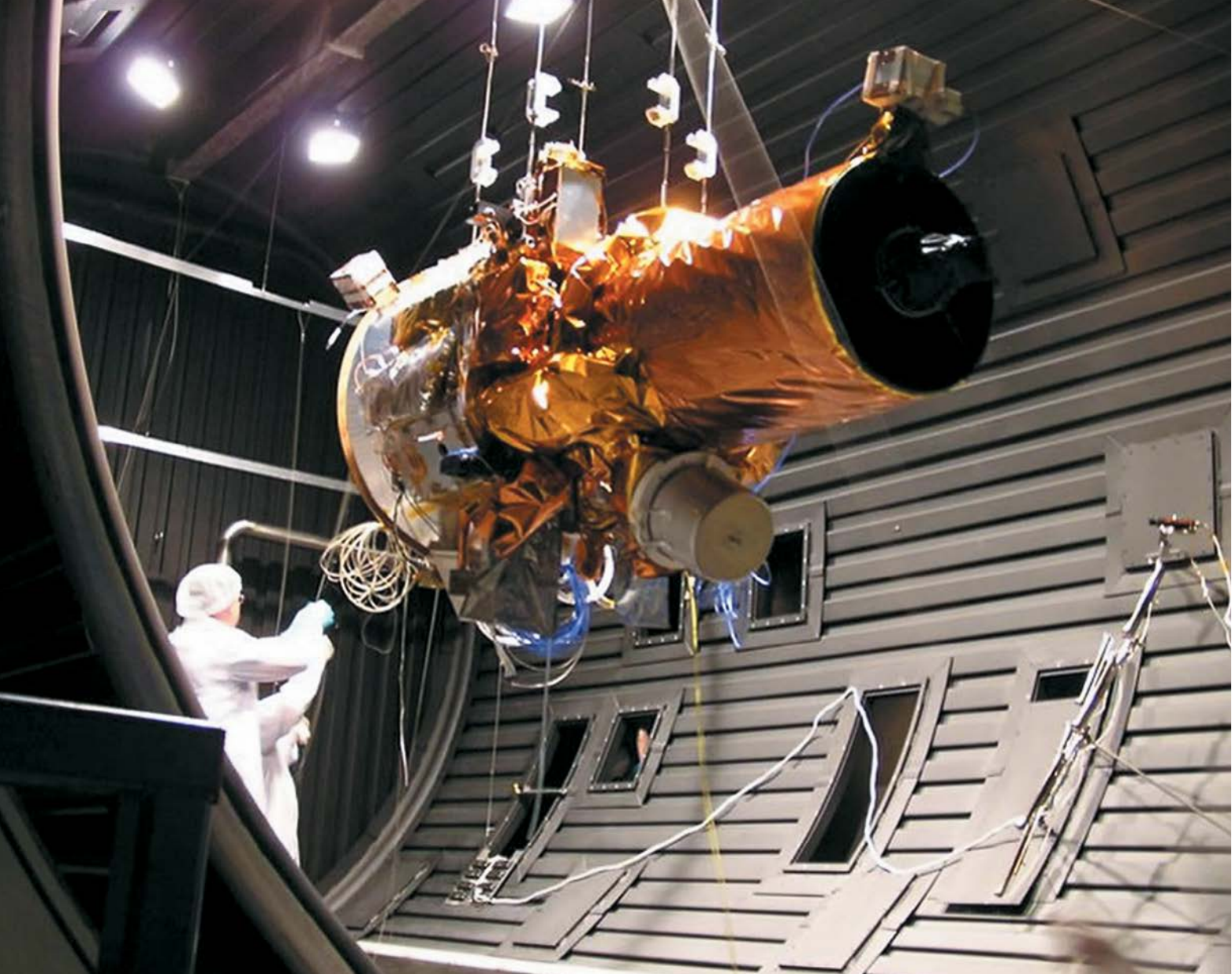
Other major space programs, such as the Space Based Infrared System and the Advanced Extremely High Frequency satellite, have struggled, but hit closer to their acquisition targets. Overall, the military space sector has actually delivered many more new systems and capabilities through its recent modernization efforts than other parts of the Air Force portfolio, such as nuclear forces. However, it hasn't been cheap, and it certainly hasn't been quick.

"Over the last 10 to 15 years, there's been a massive recapitalization of space assets," said William A. LaPlante, former assistant secretary of the Air Force for acquisition and now a senior vice president at the MITRE Corporation. He told *Air Force Magazine* even successful programs required "between one and two decades" to develop from start to finish.



Gen. John Raymond, commander of Air Force Space Command, speaks to ROTC cadets at Clemson University in August.

Photos: NASA; Scott Ash/USAF; SSgt. Ken Scar



Technicians work on TacSat-2 at the Wallops Flight Facility in Virginia in 2006.

“We can’t do that,” in a contested space environment, he said. “We have to change.”

For the US to keep pace with its adversaries, the bar must be set higher than simply avoiding acquisition nightmares like OCX. The Air Force also needs to build greater urgency into the programs that go according to plan.

“When we had unquestioned superiority, you could probably do the exquisite analysis for two or three years, development for five to 10 years, and then put up your GPS or your AEHF satellites,” said LaPlante. “We don’t have that superiority any more. The speed of technology change and potential adversaries just means we’ve got to do it differently.”

THE RCO MODEL

During his tenure in the USAF acquisition shop, which ended in November

2015, LaPlante became convinced that the service needed “a Rapid Capabilities Office ... that would be dedicated solely to space.” He had helped shepherd the Long-Range Strike Bomber program (later dubbed the B-21 Raider) into the Air Force RCO and realized the advantages of such an approach.

The RCO has been successful, LaPlante said, because “it’s an acquisition organization” unto itself. “It has all the full aspects of a program executive officer,” he said. That means that RCO Director and Program Executive Officer Randall G. Walden has access to “a full set of cost estimators, access to analytics and scientists at places like MITRE and Lincoln Labs,” as well as “expert contracting officers themselves, people who were experts in manufacturing.”

Just as important in maintaining the RCO’s efficiency is its “Washington presence,” LaPlante said.

The RCO is based at JB Anacostia-Bolling, in Washington, D.C., and quick access to Department of Defense and congressional leadership is crucial in making acquisition fast. “We could work the budget, the acquisition strategy, and requirements and get it done in a week,” LaPlante said. If an issue began to develop requiring program changes, RCO leaders could go “right to the Hill and sit down with the staffers.”

Though it sounds like something geared to quick-and-dirty projects for urgent needs, RCO is scaled to accommodate major programs, LaPlante said. “It develops real capabilities: not one-offs, but in numbers,” he said.

FROM ORS TO SPACE RCO

Even so, Air Force attempts to speed up space procurement have found success to be elusive. In 2007, the service stood up an Operationally Responsive



OCX Block 0, GPS III's next generation operational ground control system, took so long the SMC commander called it "a historically troubled program."

Space office at Kirtland AFB, N.M. ORS specialized in producing "one-offs." Reporting to the Space and Missile Systems Center, it has worked to develop experimental satellites outside of the major satellite constellation modernization programs.

"The missions and the problems they were given were sort of on the periphery of important national security space problems," said LaPlante. The ORS office's funding reflects this. In Fiscal 2017, its total budget was only \$17.9 million, said an SMC spokesman.

"There's no way that an office the size of an ORS ... would have the capabilities to do a bomber or do the equivalent of a bomber for space," LaPlante said. "The ORS office had a very, very low profile, and I think it still largely does," he added. "It really didn't get the resourcing to do this job." The ORS also "did not have the full set of capabilities the RCO had," LaPlante noted. Consequently, "that sort of put them on the back-burner."

If ORS is too small to handle major programs rapidly, then why not run major space acquisition programs through the Air Force RCO? It might actually work, LaPlante said, but the service would have to be careful not to create an overload.

"I'd be worried," LaPlante said, "that if you take an office like the RCO ... and you gave it more mission, you might actually kill what's good about it."

He thinks the best solution would be to spin off a separate RCO for the space enterprise. LaPlante said this was already evident during his time in the Pentagon, that "we needed for space a Rapid Capability Office ... that would be dedicated solely to space," instead of adding space programs to the current RCO's load.

Despite its limitations, LaPlante thinks ORS is doing good work. Recently, he was "really impressed" with an ORS-developed space situational awareness asset that was "built and deployed within two-and-a-half years. If you could do that at scale ... that would be great."

In the 2018 National Defense Authorization Act, Congress may have paved the way for the Air Force to do exactly that. The bill changes the name of the ORS office to the Space Rapid Capabilities program. The legislation also establishes ORS/SRC responsibility directly to AFSPC, at Peterson AFB, Colo., instead of SMC which is based at Los Angeles AFB, Calif.

The shift represents more than "just

a name change," Raymond said at an Air Force Association Mitchell Institute event in Washington, D.C., on Dec. 8. The move by Congress represents "a change in capabilities and capacity to get after what we need to do, and that's to go fast," Raymond said.

LaPlante agrees. "It sounds like it's going more toward the beginnings of what an RCO model is," he said. The reporting shift is most important, he noted, because "the owner of the space requirements ... is the four-star at Air Force Space Command." This move could herald others that would give SRC a set of acquisition capabilities that more closely emulate those of the RCO.

"My goal," said Raymond, "is to bring ORS capabilities more broadly across Space and Missile Systems Center and not just use them for little niche capabilities." How far and how fast the transformation goes—and how much more funding the Space Rapid Capabilities office will receive—remains to be seen, but Raymond is making it clear that, when it comes to speeding up space procurement, he means business. And for now, Congress is willing to help. ☛

BOMBERS IN 2050



USAF plans to retire the B-1 and B-2 in the 2030s as B-21s are fielded, while the B-52 remains in service until 2050.

By John A. Tirpak, Editorial Director

With the Fiscal 2019 budget request, the Air Force is beginning an overhaul of its bomber fleet, starting with a plan to extend the B-52's life span to nearly a century. If approved by Congress, the BUFF would remain operational until 2050, some 88 years after extant B-52Hs were delivered and 98 years after the YB-52's first flight.

As stealthy new B-21 aircraft become available in the late 2020s and early 2030s, the Air Force would retire its B-1s and B-2s, much earlier than previously planned. They would be phased out because the Air Force believes it must live with a bomber enterprise manpower footprint not much larger than it is now. That means the new B-21 must replace—and not be additive to—much of the existing bomber fleet.

The Air Force had previously planned to operate the B-1 and B-52 until 2040 and the B-2 to 2058.

The service is eyeing an enduring bomber fleet of roughly 175 aircraft overall, although service officials said that number could go up with more generous budgets.

In judging which older bombers to retain, USAF chose the B-52 over its younger stablemates because of the aircraft's

versatile conventional payload, comparatively lower maintenance needs, and the ability to carry the new Long-Range Standoff cruise missile, or LRSO.

The B-1, meanwhile, is labor-intensive and treaty-prohibited from carrying cruise missiles. The B-2 fleet, at only 20 aircraft, is considered too expensive per airplane to retain beyond the early 2030s.

The Fiscal 2019 budget includes the first monies necessary to begin equipping the B-52 fleet with new engines that would reduce its maintenance needs, extend its range and loiter time, and allow the aircraft to climb faster to cruising altitude. It would be retained into the 2050s. The Air Force is requesting \$64.5 million in Fiscal 2019 to get the engine replacement effort rolling.

GETTING READY FOR RAIDERS

The Air Force envisions retaining all existing bomber bases, swapping out B-1 and B-2 aircraft as B-21s become available. Very substantial military construction funds will be needed to accommodate the new aircraft, however.

The revelations were contained in USAF's "Bomber Vector." The Vector has been in development for several years and plans the phase-in of the B-21, the phase-out of older aircraft, and the timing and scope of upgrades and



Minot AFB, N.D.-based B-52Hs fly over France during a European Reassurance Initiative deployment. B-52s may serve more than 30 more years.

Photo: TSgt. Joshua Garcia



USAF's bombers—a B-1, B-2, and B-52—fly near Barksdale AFB, La.

new munitions needed for the bomber enterprise. A draft of the Bomber Vector (a planning document previously known as the Bomber Roadmap) was obtained by *Air Force Magazine*.

The Bomber Vector was to have been released last September at AFA's Air, Space & Cyber Conference. It had been briefed to members of Congress by Global Strike Command Chief Gen. Robin Rand during the summer months, and Chief of Staff Gen. David L. Goldfein announced at an AFA event in July that it would soon be released publicly. However, service leaders decided to withhold it until after release of the Nuclear Posture Review and final decisions on the Fiscal 2019 budget request.

The NPR was released in early February, validating the need for the LRSO and retaining the B-52 as its launch platform for the near future. The B-21 will also be able to carry the LRSO, and the NPR said the missile will ensure the US continues to have a means to strike any target on the globe even after adversary technological advances whittle down the B-21's stealthiness in the decades to come.

The draft version of the Vector said the B-2 would be retired "no later than 2032" and the B-1 "no later than 2036," although service officials said those dates may have shifted somewhat since.

"Included in the decision calculus to retire the B-1 and the B-2," the service said in the draft, is the need to try to maintain a "force-neutral manning structure," and to do it, it must "harvest manpower billets from the retiring plat-



Airmen load smart bombs on a B-52 at Al Udeid AB, Qatar, in 2017. B-52s have had significantly higher availability rates over the past five years than B-1 and B-2 bombers.

forms." Even so, the service sees growth in the bomber fleet from 157 aircraft today to at least 175, in order to provide the capability required by regional commanders, and "some manpower growth is inevitable."

Keeping all existing fleets and adding the B-21 to them—for a total of 257 aircraft—"is neither fiscally realistic nor desirable," USAF said in the Vector draft, adding that Global Strike Command "must pursue the optimal bomber force mix."

Simply shaving down the numbers of each type isn't effective, the paper

said, since it would require keeping all four logistical trains in place, each with its separate people, parts, and vendors. The bomber force today numbers 10,500 operations and maintenance manpower authorizations.

"Enterprise-wide reallocation of money, facilities, and other resources are necessary to facilitate B-21 fielding and ensure the Air Force has a capable and effective future bomber force," USAF said in the paper. It pegged the cost of modernizing the B-1 and B-2 to keep them capable to 2050 as \$38.5 billion, "which is enough money to

A B-1B takes off from Andersen AFB, Guam. The B-1's struggles with reliability put it on the fast track to retirement.



fund modernization upgrades for the B-52 and help fund bomber base modernization and nuclear infrastructure.”

Upgrading the B-52 to last until 2050 would cost \$22 billion, USAF said, but “this figure is offset by \$10 billion cost savings from re-engining, which pays for itself in fuel, depot and maintenance costs, and maintenance manpower in the 2040s.”

NEW/OLD MIX

After the B-1 and B-2 retirements, the Air Force would field a fleet of at least 100 B-21s and 75 B-52s.

The timing also suggests B-21 deliveries will average less than one a month during production. The Air Force has said it plans to have a “usable” asset when the first aircraft is delivered in the mid-2020s. Assuming that production of the new bomber continues until the last B-1B is retired, a production window of 2025-2036 is likely. Dividing 100 bombers over 11 years suggests a rate of about nine aircraft annually.

Former Air Force officials have hinted at such low numbers, explaining the service wasted a lot of money tooling up to produce B-2 bombers at a high rate but then built only 21 airplanes, instead of the planned 132. At less than one B-21 a month, large savings can be reaped in facilitization, manpower, and tooling—although there would likely be offset costs in learning curve and economic quantity materials purchases.

Under the Air Force’s proposal, the 1961/1962-vintage B-52s will receive

a number of upgrades and improvements to keep them relevant in a world where they are too radar-reflective to get close to well-defended enemy airspace.

The B-52 extension depends in large part on a plan to re-engine the aircraft with modern power plants. With new engines, the B-52s would never have to stand down for engine overhauls, as the time “on wing” of the new power plants would exceed the planned remaining service for the old bombers.

The B-52s would also be equipped with new standoff weapons allowing them to shoot into enemy territory from well outside the range of enemy air defenses. Among these would be the LRSO, which the Vector identified as the AGM-180/181, a possible reference to the two competing versions being developed by Lockheed Martin and Raytheon.

Goldfein, at the July event, said the new bomber force would be paired with intelligence, surveillance, and reconnaissance assets such as the RQ-4 Global Hawk to shoot targets at long range, yet with high accuracy.

The Bomber Vector draft made no mention of hypersonic missiles or any other wonder weapons that could enhance the B-52’s lethality, although it did say the venerable aircraft would be perfectly fine in operations where enemy air defenses either did not exist or had already been beaten down by other systems.

The Air Force said the decision to retire the B-1 and B-2 instead of the

much-older B-52 was based largely on the maintenance track records of the three aircraft. The B-1s and B-2s have lower mission capable rates than the B-52s.

The Vector said the B-52’s aircraft availability has averaged nearly 80 percent over the last five years, while the B-1 and B-2 averaged about 50 percent. In mission capable rates—meaning the aircraft is able to exploit its full range of capabilities, without any non-working systems—the B-52 averaged about 60 percent, while the B-1 averaged around 40 percent and the B-2 about 35 percent. The B-2’s intensive stealth-maintenance requirements drive their overall low MC rate.

The bomber’s MC rates are driven in large part by “vanishing vendor syndrome” situations where components—especially electronics—are no longer made. In the case of the B-2, the fleet is so small—only 20 airplanes—that vendors don’t want to tool up to provide parts in such low quantities. Other pieces of key gear, such as gyroscopes on the B-2, for example, “are obsolete,” the Vector reported, and maintainers are already making do by cannibalizing parts.

The B-1’s maintenance man hours per flying hour are the worst of the lot, at 74, while the B-2’s performance in this metric is 45. (That figure does not count the hours needed to maintain its low-observable features, coatings, and materials, which the Vector did not state.) The B-52’s MMH/FH rating was 62.



To make way for the B-21—shown here in an artist's concept—USAF is looking to divest the B-1 and B-2 in the early 2030s.

NOT LIKE THE OLD DAYS

Cost per flying hour was another factor weighing against the younger bombers in USAF's thinking. Both the B-1 and B-52 averaged about \$70,000 per flying hour (USAF did not call out specific numbers, and its charts were not fine-grained)—while the B-2 costs between \$110,000 and \$150,000 per flying hour to operate. Total ownership costs followed similar curves.

As advanced air defenses proliferate, for the time being, only the B-2 can penetrate them to hold targets at risk worldwide, USAF said. However, that aircraft will “see its technological advantages diminish in the not-too-distant future.” By contrast, the B-21 has been “designed to operate in this highly contested combat environment.” The B-52, despite not having the ability to penetrate, offers a lot of capability through “its high weapons carriage capacity and vast munitions diversity” to be of value either as a standoff platform or in “less challenging environments.” The LRSO will provide “a highly survivable, standoff nuclear weapon capability for the B-52 and B-21.” Some money can be saved by not fitting the B-2 with the LRSO, as had been planned.

The Bomber Vector pointed out that USAF's bomber fleet has never been so small. Today's fleet of 157 bombers (76 of which are B-52s) is only a tiny fraction of the 1960 bomber fleet of 1,526

aircraft. The Air Force said its bomber fleet is also spoken for many times over, on tap to support many missions all at the same time.

“In the last five years, Air Force Global Strike Command has gone from supporting one enduring COCOM [Combatant Commander] requirement to an average of 12 annually, a 1,100 percent increase. To meet this level of demand, AFGSC's operations and maintenance personnel and bomber airframes are managed at peak utilization rates,” USAF said. These add-on missions include nonstop bomber action in the Middle East against ISIS targets and an increasing tempo of bomber deployments to the Pacific, both as a messaging device to China and North Korea and to conduct the now-routine forward bomber presence mission, out of Guam.

The Vector said USAF's preference is that “bombers replace bombers” at existing locations, since these bases are operationally and geographically “best-suited” to the mission. Opening up new facilities or re-activating dormant ones would bring a big cost penalty. Even so, the price tag will be “several hundred million dollars per base” to properly modernize and add new “classified work spaces” at current bomber bases to protect B-21 technology and to accommodate new weapons.

In a release accompanying the unveiling of the Fiscal 2019 budget request, Air Force Secretary Heather Wilson said if Congress approves the bomber plan, “bases that have bombers now will have bombers in the future.”

To help manage the manpower transition among the four systems, the report recommended a “hybrid manpower approach” while fielding the B-21, using personnel “from retiring platforms as well as a Total Force (Guard and Reserve) and Contractor Logistics Support as necessary, to minimize manpower spikes and delays.”

In the budget-day statement, Air Force Global Strike Command boss Gen. Robin Rand noted, “at the end of Desert Storm in '91, we had 290 bombers. ... Today that force has dropped to 157 bombers at five wings and 15 Total Force bomb squadrons. That's a 46 percent decrease in our bomber force,” while it has taken on “continuous combat operations” in the Balkans, Afghanistan, Iraq, Libya and Syria, “in addition to continuous bomber rotations” in US Central Command and Pacific Command.

If the Bomber Vector is implemented as planned, in 2050 USAF will operate at least 100 batwing B-21s and 75 venerable B-52s. The B-1 and B-2, meanwhile, will have been relegated to airparks and the boneyard. ☛

Senatorial Courtesy

"It appears 'General' Rand Paul is at it again. He just called for the immediate withdrawal of all forces from Afghanistan as a way to give the US military a pay raise. Fortunately, only 'General' Paul—and the Taliban—think that's a good idea."—**Sen. Lindsey O. Graham (R-S.C.), post on his Twitter account, after Kentucky Republican Senator Paul spoke out against continued US involvement, Feb. 9.**

Jokes from a Trash Heap

"The aerospace force will continue to maintain the reliable protection of Russian airspace. Should American pilots, knowing this fact, fall into depression or succumb to any phobias, we advise the US side to exclude these flight routes near Russia's borders in the future."—**Russian Ministry of Defense, mocking US complaints of dangerous Russian fighter activity over the Black Sea, official statement released Feb. 1.**

Cognitive Dissonance

"I had been away from the national security world for a while. ... I was getting briefed to be prepared for my [Senate confirmation] hearings, and I saw the first charts on readiness. I actually thought they had inverted the numbers. I was in the service during the Cold War, and the readiness numbers are far lower than any general officer would have accepted during that time."—**Secretary of the Air Force Heather Wilson, Washington Examiner, Jan. 23.**

Unacceptable or Irreversible

"North Korea acquired nuclear weapons to assure its regime's survival. In its view, to give them up would be tantamount to suicide. An outcome that was widely considered unacceptable is now on the verge of becoming irreversible."—**Former Secretary of State Henry Kissinger, Senate Armed Services Committee, Jan. 25.**

Great Moments in Policy

"I'm not allowing [tattoo] 'sleeves' [on arms]. I'm not. My wife disagrees with me. She thinks I'm stupid. She says, 'How can you judge them [Marine Corps recruits] on their ink?' I said, 'I don't judge them; I just don't want them being Marines.' This is not an episode of 'Vikings,' where we're tattoo-

ing our faces. We're not a biker gang. We're not a rock and roll band. ... You can get 70 percent of your body covered with ink and still be a Marine. Is that enough?"—**Gen. Robert B. Neller, Commandant of the Marine Corps, on USMC tattoo policy, military.com, Feb. 2.**

Educated Beyond His Intelligence

"We've got all our freakin' night-vision goggles, all that kind of stuff, and we can't freakin' control these dudes wearing freakin' robes and chanclas [flip-flops]. It's because we've got a bunch of dumb shits over there. Think about the people who you know over there—your freakin' stupid Uncle Louie or whoever. They're dumb shits. They're not, like, high-level thinkers. They're not academic people. They're not intellectual people. They're the freakin' lowest of our low."—**Gregory Salcido, a Pico Rivera, Calif., public high school teacher, ranting to his class about US troops in Afghanistan, recorded by a student on Jan. 19. Salcido was suspended.**

Shovel Ready

"ISIS needs to understand that the Joint Force is on orders to annihilate them. So, they have two [courses of action], should they decide to come up against the United States, our allies, and partners: Surrender or die! ... If they choose not to surrender, then we will kill them with extreme prejudice, whether that be through security force assistance, dropping bombs on them, shooting them in the face, or beating them to death with our entrenching tools."—**Army Command Sgt. Maj. John Wayne Troxell, senior enlisted advisor to the Chairman of the Joint Chiefs of Staff, post on Facebook, Jan. 9.**

Foundational

"I am very concerned ... that, while we have taken a pause in terms of recapitalizing our nuclear forces, the Russians are continuing to invest in their nuclear forces, both strategic and nonstrategic, and the Chinese have continued to steadily develop and diversify their nuclear capability. Other nations—India, Pakistan—continue to expand and diversify and increase the size of their nuclear forces. ... In this more challenging world, I go back to the first principle, and that is that the basic founda-

tion of our national security is nuclear deterrence."—**Retired USAF Lt. Gen. Frank G. Klotz, former head of Global Strike Command and the National Nuclear Security Administration, defense news.com, Jan. 24.**

Sign Language

"Many Americans aren't in touch with just how close we are to war. ... The warning signs that the military has shifted to a more aggressive posture are clear. We recently sent the USS *Michigan*, a nuclear submarine, to South Korea. In October, we sent three US Navy nuclear-powered Nimitz-class aircraft carriers ... to the Western Pacific. B-52s have now joined our B-1 and B-2 bombers in Guam. ... Across the country, the Army is practicing how to activate mobilization centers. ... The Army is buying more bridging equipment. ... It's painfully clear ... that we shouldn't ignore the signals these actions send."—**Sen. Tammy Duckworth (D-Ill.), address at Georgetown University, Jan. 19.**

Too Many Damn Hornets

"Right now, we've got too many [F/A-18] Hornets. We've got too many airplanes. We need to get rid of them, because we don't have time to fix them. You have just got to get rid of them. We need more airplanes that can fly."—**Gen. Robert B. Neller, Commandant of the Marine Corps, remarks at Center for Strategic and International Studies, Jan. 25.**

What the Bundeswehr is About

"The hard currency in which the success of the [German] defense minister is measured is the readiness of the Bundeswehr [German armed forces]. That has not really improved in the last four years but rather has become worse. While foreign missions with small contingents [of German forces] went well, the Bundeswehr as a whole cannot currently be used in the collective [i.e., NATO] defense. Incidentally, the average age of all new hires will tend to go up because the Bundeswehr is no longer just about recruiting young people."—**Hans-Peter Bartels, Germany's parliamentary commissioner for the armed forces, quoted in militarytimes.com, Jan. 25.**

THE TANKER'S

After a tough 2017, the KC-46 tanker is inching closer to reality.



By Brian W. Everstine, Pentagon Editor

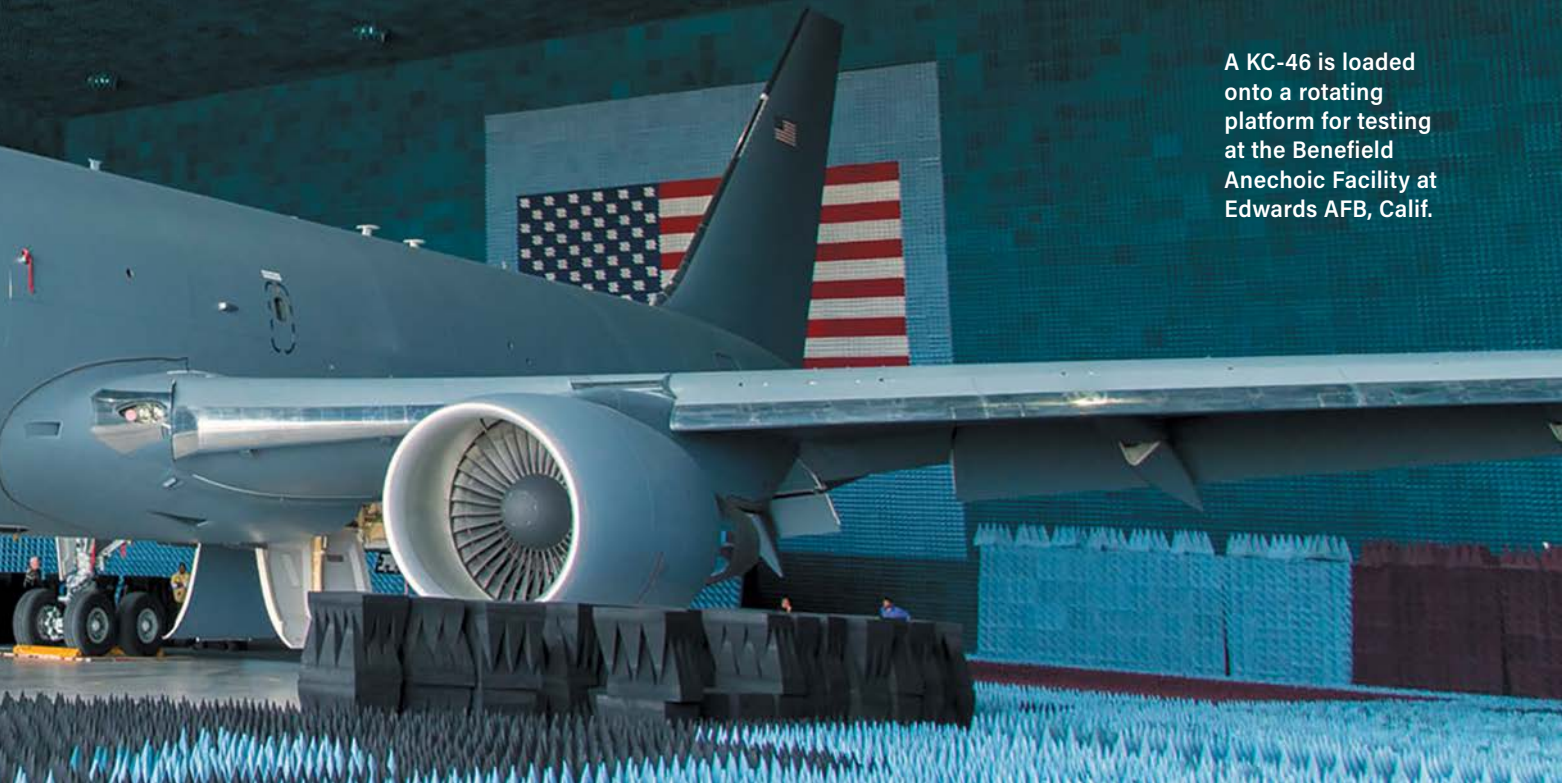
The KC-46A Pegasus tanker program ended 2017 on an upbeat note, as the first aircraft destined for operational service made its inaugural flight in early December. During the three-and-a-half-hour mission, engines, flight controls, and environmental systems were checked out. Col. John Newberry, the KC-46 system program manager, lauded the flight as “another milestone” in the program, bringing the service one step closer to fielding sorely needed new aerial refueling tankers.

The Pegasus program struggled through much of 2017, however, enduring continued delays, cost overruns, and the discovery of a serious defect.



The first Pegasus tanker destined for USAF takes off from the Boeing facility in Everett, Wash., on its first flight.

TRYING TIME



A KC-46 is loaded onto a rotating platform for testing at the Benefield Anechoic Facility at Edwards AFB, Calif.

The Air Force originally expected to accept delivery of its first operations-bound aircraft much sooner, under a deadline imposed by Boeing itself. Days before the flight, though, the company officially announced it would not meet delivery goals for 2017. This did not come as a surprise—the Air Force had already come to the same conclusion last summer.

The first hangars for Pegasus tankers are open and ready, and USAF hopes the new jets will arrive this spring.

“We will get the airplane in 2018, in my humble opinion,” Gen. Carlton D. Everhart III, commander of Air Mobility Command, said in September. “We will have a good aircraft, I believe, when we get the product. I don’t really need the aircraft right now. I need the aircraft when it’s ready.”

Last year began with a big announcement—and a big paycheck—

for Boeing. In January 2017 the company received a \$2.1 billion contract for the third low-rate initial production lot of 15 KC-46s. The award followed the first two lots, announced in August 2016, for seven and 12 aircraft, respectively, while the fourth lot is slated to be awarded this year.

The 2017 contract came as the company was transitioning “from development to production” in the program, Boeing CEO Dennis A. Muilenberg told investors in an earnings call at the time and reflected no new “technical discoveries” in flight test.

The program ramped up flying operations with the first six test aircraft, flying test missions to evaluate the KC-46’s refueling system while avionics underwent ground testing at Boeing facilities in Washington state and at USAF test facilities at Edwards AFB, Calif.

Last July, a team of Boeing, Air

Force, and Naval Air Systems Command officials took the Pegasus through electromagnetic testing at NAS Patuxent River, Md., aimed at evaluating its ability to fly and operate through electromagnetic fields under “mission conditions.” The jet sat on radiation pads at the Navy base, where it endured pulses from an electric coil above it.

At Edwards, a KC-46 was moved into the base’s Benefield Anechoic Facility, which is filled with polyurethane pyramids designed to stop the reflection of electromagnetic waves. The 772nd Test Squadron evaluated the aircraft’s “critically sensitive” radio systems to make sure that they would not be degraded in a real-world mission.

Test flights continued to ensure the new boom system’s compatibility with the Air Force, Navy, and Marine Corps



fleets. By the end of 2017, the KC-46 had completed more than 2,000 flight hours and 1,300 hundred contacts, refueling aircraft including F-16s, F/A-18s, AV-8Bs, C-17s, A-10s, and KC-10s.

In October, two KC-46s flew together and refueled each other for the first time, off-loading the maximum fuel rate of 1,200 gallons per minute. The tankers—the first and second produced in the program—transferred a total of 38,100 pounds of fuel during the flight.

In December, the Federal Aviation Administration determined that Boeing's 767-2C—the core configuration freighter that represents the basis of the KC-46 variant—is “safe and reliable.”

To receive this certification, Boeing had to have completed a series of tests, both on the ground and in the air, to prove the aircraft's avionics, auto-flight, fuel system, and environmental control systems are stable. This is one of two FAA airworthiness certifications needed; another focuses on the tanker's military systems.

The 767-2C certification is a “key building block for the KC-46 program in that it retires risk and builds confidence as we continue our test efforts,” Mike Gibbons, Boeing's KC-46 tanker vice president and program manager, said in a statement announcing the certification.

SCRAPING THE SURFACE

Amid all the apparent progress, the Air Force offered startling news in September, announcing it had identified three “deficiencies.” One of these was considered serious, in that it could affect the tanker's ability to refuel stealth aircraft.

Although no stealth aircraft, such as the F-22 fighter or B-2 bomber, has



An A-10 tanks up from a KC-46 in a 2016 test.

yet attempted to refuel from the KC-46, during some refueling test flights with other aircraft, USAF said it had observed “undetected contacts outside the receptacle.” This means the boom had touched the receiving aircraft beyond the area meant to absorb the rubbing and scraping common to air refueling. If this happened with a low-observable aircraft, the scraping could damage its special coatings, potentially ruining its stealth properties right before breaking away from the tanker to penetrate enemy airspace.

In the legacy refueling fleet—KC-135s and KC-10s—the boom operator is notified if the boom makes contact outside the refueling receptacle, Brig. Gen. Donna D. Shipton, the USAF tanker program executive officer, told reporters in September. She explained that when there is such a contact, the boom operator is required to inform the receiver aircraft pilot, who then decides whether the mission can proceed.

With the KC-46, however, the boom operator—who is positioned just behind the KC-46's cockpit, and not at the back

end of the jet where refueling is taking place—may not recognize a boom scrape when it happens, and therefore would not be able to inform the receiver pilot about a possible compromise of the receiving jet's stealthiness.

Newberry said at the time this situation could pose “significant risk to aircrew.”

Of the other two deficiencies identified, one had to do with the high-frequency radios embedded in the wings of the KC-46. To prevent potential arcing from static electricity, the KC-46 cannot broadcast during refueling operations, but USAF testers could not tell if the radios remained turned off, and whether this potentially interfered with flight controls. USAF in February said the aircraft was still acceptable for delivery even with this deficiency, but insisted that Boeing is still required to develop a long-term fix.

The last deficiency involved an “uncommanded” boom extension while the KC-46 was on the ground. In one incident, after disconnecting,



McConnell AFB, Kan., boasts this three-aircraft hangar for KC-46s.



A Pegasus undergoing tests on the electromagnetic pulse pad at NAS Patuxent River, Md., in July 2017.



The first Pegasus with an air refueling boom installed on a test flight in June 2015. Boeing is expected to deliver certified KC-46s by the end of 2018.

the boom struck a test stand. The apparent cause was a spike of pressure after fuel flow stopped, and such a situation is common in refueling operations, Shipton said.

The Air Force and Boeing are developing a software fix for this issue,

and expect it to be resolved by the end of May, Air Force spokeswoman Maj. Emily Grabowski said.

The scraping issue is deemed far more serious, however.

"We are concerned," Shipton acknowledged.

As of early January, the Air Force was still collecting flight test data to determine if the "deficiency rate and severity are within international air refueling standards," Grabowski said. After this data is collected, the service will determine if it needs to make changes to the remote vision system—the 3-D camera used by the boom operator in the refueling process—or make other changes.

Higher up in the Pentagon, the issues have caused Defense Secretary Jim Mattis to say he is unwilling to accept flawed tankers.

Mattis told reporters last December, "I reinforced that the Air Force was not going to accept tankers that weren't completely compliant with the contract."

However, Mattis called Boeing's efforts "excellent," despite missing its self-imposed delivery goals, and he noted the company is working with the Air Force to resolve the scraping issue.

Costs are beginning to climb on the KC-46, along with delays, creating an unusual situation. Under the fixed-price contract, the Air Force's costs on the program are capped at \$4.9 billion, with Boeing bearing any overages.

During an October call with investors, the company reported additional costs are coming "due to incorporating changes into initial production aircraft as we progress through late-stage testing and the certification process," Muilenberg said. The total for the third quarter of 2017 was \$329 million, bringing the company's bill for program overruns to more than \$1.9 billion after taxes. Boeing hopes to make this money back through



international KC-46 sales. Because of the fixed-price cost cap, US taxpayers are not responsible for the overages.

HANGAR TIME

Although there are no airplanes delivered yet, USAF is moving forward on its tanker plans. In mid-October, this included a ribbon cutting for an empty three-aircraft hangar at the KC-46's first operating base, McConnell Air Force Base in Kansas.

The hangar is one of 16 projects, at a cost of \$267 million, for the new aircraft. The base will eventually house 36 of the planes.

"The KC-46 will revolutionize air refueling," Col. Joshua M. Olson, the 22nd Air Refueling Wing commander said at the ceremony. "It is only appropriate that the home of air refueling take the lead with this new airframe, and that started with these 16 construction projects. They reflect years of hard work from individuals in our community who are literally laying the foundation for the future of the Air Force."

The KC-46's main training base, Altus AFB, Okla., has been training Pegasus aircrew members mainly with simulators. The base also has a new flight training facility and fuselage trainer for the aircraft.

The first KC-46 Air National Guard

An artist's concept of a KC-46 refueling a B-2 bomber. The program is working to resolve a problem in which the tanker could unknowingly damage aircraft's stealth coatings.

unit will stand up in New Hampshire, and the first Air Force Reserve Pegasus unit is planned for Seymour Johnson AFB, N.C.

In January, USAF announced JB McGuire-Dix-Lakehurst, N.J., and Travis AFB, Calif., as the preferred locations for the next two Active Duty KC-46 units. The two bases are home to the Air Force's KC-10 Extender fleet, and each will receive 24 KC-46s.

USAF plans to bring on 15 KC-46s per year at an annual cost of about \$3 billion, according to its Fiscal 2018 budget request, and this rate is expected to continue through delivery of the 179th KC-46 in about 2027. But for some senior officials this pace is not fast enough.

US Transportation Command boss Gen. Darren W. McDew, testifying to Congress last March, said the current operational tempo is so high that "if we had a thousand air refueling tankers it might be enough. If you pick a spot in the world, and you bring up any kind of issue—a simultaneous or even a competing regard anywhere else in the world—your tanker[usage] rate goes up to a place that I can't even imagine."

The Air Force's requirement is for 479 tankers. The Air Force has said it plans to phase out the KC-10s in 2019, but that schedule could change depending on how fast the Air Force receives KC-46s.

"We built 700 [tankers] in seven years in the '60s," McDew told lawmakers. If the current rate doesn't speed up, the "plan to retire the KC-10s may be revisited."

The Air Force is thus walking the fence between getting an operational capability fielded as quickly as possible, and getting the airplane in good working order from the outset, with all deficiencies corrected. Even with schedules changing and costs still rising, Pentagon officials are confident in the fleet airmen will eventually operate.

"We need the tankers, but I want the tankers done right," Mattis said. "The Air Force needs tankers done right. The American taxpayer expects tankers done right, and Boeing is committed to delivering tankers that are done right. So this is a team effort, and I'm very, very comfortable that we're on the right track. We'll get there. It'll be the best tanker in the world." ✪

T H E WRIGHT DECISION

CMSAF KALETH WRIGHT IS WORKING TO GET AIRMEN'S LIVES BACK IN BALANCE.

By Gideon Grudo, Digital Platforms Editor

Chief Master Sergeant of the Air Force Kaleth O. Wright knows the lives of enlisted airmen are out of balance, with too many demands *on* them at home station and too many demands *for* them in contingencies around the world. His charter from Chief of Staff Gen. David L. Goldfein is to help put some “white space” back on the calendars of the enlisted force. He has his work cut out for him.

After a year on the job, he's spent considerable time visiting airmen around the world, asking for their opinions, their gripes—and the things that give them satisfaction and keep them in uniform.

“I don't believe that I get 100 percent honesty back every time,” said Wright, a four-time command chief who came most recently from US Air Force in Europe and Air Forces Africa. Maybe junior airmen are “starstruck” by a visit from the top noncommissioned officer in the service, he said in a recent interview with *Air Force Magazine*.

More often than not, though, he'll get a direct answer starting with, “Hey Chief, this is what we're dealing with down here.”

The standout thing he's learned from those countless conversations is “the amount of stuff they have on their plate, along with all of these additional requirements ... and how little time they actually have.”

The feedback has driven him to whittle away at some burdensome and unpopular required online courses. Late last year, he got the requirements for annual airmen awards reduced



Only one airman at a time wears this badge of rank—and right now, it's Kaleth Wright.

CMSAF Kaleth Wright testifies before the House Appropriations Subcommittee on Military Construction and Veterans Affairs in March 2017, just after taking USAF's top enlisted position.

from 27 lines to 16. Days into 2018, he got evaluation performance reviews for airmen first class and below thrown out altogether—a long-awaited and widely lauded move.

“I feel like from the time that we started until today, we made some progress,” Wright said. “We fixed some

things,” but “I still feel like we have a lot of work to do in removing some of the barriers” keeping airmen from concentrating on the mission.

By June, he hopes to have cleared away “many of the small things” so he can chisel away at the “bigger rocks” with senior leaders.

"I don't want to go through the next three years playing whack-a-mole," he said.

The Air Force's manpower shortage is real. Too many people were let go in recent years, when service leaders were forced to choose between manpower and functional equipment. Despite the small size of the force, Air Force Secretary Heather Wilson noted last October that today's USAF is "much more active in combat" than during the Cold War.

Consequently, airmen are stretched thin, and their time is ever more valuable. Wright aims to refocus that expensive time on the mission by mitigating additional (and, some say, unnecessary) requirements.

But he also wants to expand a few demands, such as ensuring that airmen are well-trained for operating under tough battle conditions. This is particularly applicable to those headed to the Korean Peninsula and elsewhere in the Pacific.

The Air Force's challenge is to deal with "global instability and insecurity," he said, adding, "I'm concerned with the risk" being put on airmen. With rising tensions, airmen find themselves heavily tasked at home training for real-world crises. Then, when deployed in the crisis zone, they must work long hours to stay combat-sharp.

The risk is that, with little downtime, they might get burned out.

Despite the drumbeat of tensions in Korea, Wright was not losing sleep over it. In a December interview, he said, "I sit here in the briefings. I hate to call it rhetoric, right, but what we see on the news and what's actually closer to reality is totally different," he said. "Do I wake up and feel like, 'Oh man, we're really close?' Not now. Not yet."

For now, his method in reducing excessive requirements on airmen is incremental. There will be bigger moves later, but in the meantime, smaller steps can make a difference right away.

Wright's "approach to refocusing airmen on their core duties isn't one large initiative," he said, "but rather small things that add up over time." Shortening the evaluation form is an example. So are checklists.

The predeployment checklist—a mission-specific suite of training and requirements—for airmen deploying from the 1st Special Operations Wing at Hurlburt Field, Fla., was recently



Wright adjusts his new uniform hat during his appointment ceremony in February 2017 as his wife, retired MSgt. Tonya Wright, looks on.

shortened considerably. One of the boxes to be checked off was that airmen had to complete a "relatively long" computer-based training course on the Pashtun language, he noted.

"I met a commander who told me: 'This is actually not language training. You have to take it because it's on the checklist, but no one learns how to speak Pashtun from this thing.'" So, "guess what? We're not going to do it," said Wright. The wing commander was able to cut down the checklist from 14 pages to three.

That's a solid example, but Wright admits the process for similar reductions is "still very much a work in progress." Additional duties assigned force-wide are being looked at to determine whether they only apply to certain communities. Commanders are getting more flexibility to decide what duties are actually necessary for their airmen and are being allowed to cut accordingly.

The drawback is that the reductions aren't universal, and some duties taken off the shoulders of individuals are being transferred to commander support staffs, which are being reestablished gradually, as part of Goldfein's refocus on the squadron. However, "manning hasn't yet fully caught up with the intent," and so some airmen will bear a

heavier load for a time. "We're getting there," Wright insisted.

REWARDING VOLUNTEERISM

In recent years, many commanders and supervisors have strongly encouraged airmen to add a lot of off-hours volunteer work to their resumés to enhance their chances for advancement. Most have complied, fearing their promotions and careers hung on volunteerism in addition to competence at their assigned duties. It is a common critique. This belief—according to anecdotal evidence—persists despite top-level support for the "80/20" philosophy.

He asserted that "80 to 85 percent of what you'll be evaluated on for promotion or various opportunities" should be job performance, but he knows the message needs constant repetition. Pointing at the specific guidance given to the members of promotion boards, Wright said, "There is no 'additional duties, off-duty education, volunteer' formula. It's actually the exact opposite." However, he pointed out, having additional factors still account for 15 to 20 percent of a promotion evaluation is not straightforward enough for some airmen.

His specific advice? Establish career end-goals, Wright says firmly, and



Wright works out with airmen at Hurlburt Field, Fla. Daily fitness, meditation, and reading are important to USAF's top enlisted airman.

choose volunteerism and personal growth that makes you a more valuable airman. Yes, off-duty accomplishments are important for a career, but they should also be relevant.

For noncommissioned officers, he recommends getting involved with on-base and local community organizations to raise money, provide scholarships, or coordinate volunteer work. For example, airmen can get involved in setting up USAF's annual awards programs, he said, noting those presented at AFA's annual Air, Space & Cyber Conference.

Wright and other senior leaders are studying the "forced distribution" system of ranking one's subordinates relative to each other. This acknowledges that not everyone can be "outstanding" but compels supervisors to put someone at the bottom—thus damaging their advancement potential.

It's a promotion system hailed by some—Wright's predecessor, CMSAF James A. Cody was a fan. Others, such as the Deloitte Corporation, said in the *Wall Street Journal* in 2014 this sort of personnel system "crushed morale, stifled innovation, and led to unscrupulous competition" among workers.

"There is always room for improvement in any process," Wright said, explaining that forced distribution was to be scrutinized over a four-day review of enlisted evaluation in January. Data collected over the past three years of promotion cycles will be examined to see what—if any—adjustments need to be made. The review should give Wright a "more firm grasp" on the issue.

As these measures advance, Wright said airmen who want to be promot-

THE "2-10-5-7" PHILOSOPHY

Wright said he tries to hold himself to the same balance he touts for airmen: the "2-10-5-7" philosophy he swiped from USAF's Vice Chief of Staff, Gen. Stephen W. Wilson.

The numbers translate to:

2 hours in the morning to get prepared for the day—fitness, meditation, reading

10 hours of work

5 hours for the family, away from work

7 hours to sleep

ed should do their best to become "well-balanced," and that balance should include time out of uniform.

Wright said he tries to hold himself to the same balance he touts for airmen: the "2-10-5-7" philosophy he swiped from USAF's Vice Chief of Staff, Gen. Stephen W. Wilson.

The numbers translate to: two hours in the morning to get prepared for the day—fitness, meditation, reading. Then, 10 hours of work. Five hours for the family, away from work, and seven hours to sleep.

"I can somewhat get there," Wright said. "The part I struggle the most with is the five hours of 'unplugged' and the seven hours of sleep."

He admits that his wife, retired MSgt. Tonya Wright, would "wholeheartedly call BS on both of them."

She told *Air Force Magazine*, "I think he's the worst at texting his office." Wright will "get a thought and shoot it off," and his staff has no choice but to react. "They can't relax."

In his defense, she said, his schedule leaves him little time to catch up. When he does, and ideas pop up, he wants to be sure he gets them to the staff. Such ideas may come when he works—after work—from his office at home or when he grabs his laptop and sits next to her in the living room, "keeping company." It's a hybrid of family and work time many Americans—in the military or not—can relate to. Or he may work late into the night, never having been a "big sleeper," he says, while she sleeps and the television drones with the day's news or a Lakers game.

"He goes and goes and goes until he's exhausted," said Tonya. "He stays up late. I wish he would get more sleep," noting that one of the Wright's resolutions for 2018 is to do just that. "I worry he's going to crash," she said.

Wright says he does what he recommends all airmen with spouses do: Be present. That involves deliberately making time for the two of them, for example by exploring the D.C. area's restaurants and cultural offerings.

Wright tries to find time for himself during his daily commute, listening to music or podcasts. As out-of-the-workplace personal development is something Wright encourages in other airmen, he's trying to "walk the walk" himself.

The Air Force is looking at giving airmen credit for what's called "developmental special experience," which will take note of places they've been and experiences they've had that may not be obviously job related. Biographies, Wright said, can be misleading and may not tell the whole story about what an airman can do.

"You can make many false assumptions based on—well, my bio."

A BIO DOESN'T TELL THE STORY

Wright was a server at a barbecue joint in Columbus, Ga., before enlisting.

"I lacked guidance, direction, discipline, character," he said. "I had a problem with authority, I enjoyed partying and drinking like other 18- and 19-year-olds. I had trouble getting to work on time." He was not a model recruit, Wright said.

Once in the Air Force, he worked at a dental clinic at Pope AFB, N.C., and



Wright (r) speaks with A1C Jeremy Daniels, an aerospace propulsion journeyman, at Misawa AB, Japan, during his Pacific Air Forces immersion tour last summer.

his approach didn't markedly improve until a personal tragedy began a series of events that changed his outlook.

Deployed during the Gulf War, Wright got a call in March 1991 from the Red Cross informing him that his father had suffered a stroke. He had a strained relationship with his father and shrugged the news off. Hours later, though, another call came: The previous message had been a mistake, it wasn't his father but his mother that had sustained the stroke.

Wright dropped everything. He obtained leave and rushed home, calling his sister at every stop to update his progress, as email was in its infancy and social media did not yet exist.

"I made it all the way back to my last stop before getting home to Georgia," at Dover AFB, Del., Wright recalled. Calling from Dover, his sister informed him that he was too late—his mother had died.

Wright became "very, very angry," he said.

"I drank more. ... I was having such a hard time dealing with my mother's passing, I was showing up late to work—like, really late, two to three hours," he noted.

Wright had a mentor, retired MSgt. Joseph Winbush, who'd earlier taken him under his wing. He was having trouble justifying putting even more effort into an airman who was "very raw," Winbush said in an interview.

When Wright showed up hours late

yet again for work, Winbush, then a technical sergeant, pulled him in and informed him that their relationship would end if the young airman didn't pull himself together and get his life in order. To Wright, the relationship was extremely important, and he saw Winbush as a father figure.

Winbush dropped an application for the base Honor Guard in front of Wright with the implied ultimatum that he step up or lose their friendship.

Wright applied and was accepted.

"The funerals were really what turned my life around," he said. The Honor Guard march in funerals, bear rifles or the flag, and perform rituals like folding the casket flag. During one funeral, it was Wright's task to present the flag to the deceased's spouse.

"I looked this lady in the eye—which I never did—and she cried, of course, the grieving widow. And I cried. And that very second, I thought, 'Hey man, you gotta get your life together. What you're doing has meaning and you gotta do it seriously!'"

From then on, it was classes, degrees, awards, and promotions.

He credits Winbush. Without him, "I would have been out of the military," Wright insisted. Not only did Wright turn things around, he earned a Bronze Star, four Meritorious Service Medals, and is now the highest ranking enlisted airman in the United States Air Force.

Wright acknowledges that not every-

one is lucky enough to have a Winbush, and not everyone like Winbush would have the patience to stay invested in a troubled airman.

Wright said he believes firmly that airmen should be allowed to make mistakes—not crimes—and recover from them. The more senior the airman, though, the less patience USAF should have.

"Tolerance for mistakes narrows as rank grows. Senior NCOs should not make airman mistakes. ... Correcting and learning from mistakes is a measure of character," said Wright.

With mentors in short supply, Wright says it falls on supervisors to take that special interest.

He advises them to "First, listen with both ears and a shut mouth. If you create a culture of respect and trust where your airmen can own up to a mistake, you are on the right path." The next step is "you need to help them correct it and learn from it—without taking them out at the knees."

Wright still regards Winbush as a mentor, and Winbush said Wright is like family to his own children. He said the Chief's greatest flaw is getting too concerned over some things.

"He has a tendency to grab things and not let go," Winbush said. And while "determination is good," Wright's lifelong teacher concluded, the most important goal in an airman's—or in anyone's—life is "finding the balance." ★



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02.09.2018

An F-35 on the flight line at Yokota AB, Japan, during Vice President Mike Pence's visit to the Asia Pacific region. The F-35 is part of PACOM's Theater Security Package program.



5A

BEFORE FLIGHT



RED AIR FOR HIRE

THE AIR FORCE NEEDS EVERY FIGHTER
IT CAN SPARE FOR REAL-WORLD
MISSIONS. ARE PRIVATE AGGRESSORS
THE WAVE OF THE FUTURE?

By Amy McCullough, News Editor

Budget cuts in recent years have compelled the Air Force to shrink its aggressor air capability, the in-house adversaries who serve as aerial sparring partners for front-line aircrews. After the 65th Aggressor Squadron (AGRS)—which flew F-15s—shut down in 2014, only the 64th AGRS at Nellis AFB, Nev., and the 18th AGRS at Eielson AFB, Alaska—each flying F-16s—were left.

Within months, the service was forced to pull aircraft from operational units to

temporarily fill the gap left by the loss of the 65th's F-15s, but this wasn't a sustainable long-term approach: The fighters were needed for real-world missions elsewhere.

In June 2015, USAF tried something new. Four Air National Guard F-16 units squared off against Douglas A-4K Skyhawk "aggressors for hire" and realistic surface-to-air threats during the large-force employment exercise Northern Lightning at Volk Field, Wis.

The Skyhawks, provided by Draken International, provided "top-notch" training and were "five times" cheaper to fly than organic assets, said Lt. Col. Richard Wigle, a pilot at the time with

the Arizona Air National Guard's 162nd Fighter Wing, which also participated in the exercise.

After Northern Lightning, the Air Force began to think industry might be able to help it solve its Red Air problem. Air Combat Command asked Draken to provide similar training for the USAF Weapons School at Nellis.

"It was only supposed to be a couple of weeks, but we never left," said John Baum, Draken's vice president of strategic projects and security.

By September 2015, Draken was officially awarded a contract to provide adversary support to augment the Air Force's existing F-16 fleet at Nellis. Their



Aggressor F-15s and an F-16 head to the fight during Red Flag 07-3 at Nellis AFB, Nev., in August 2007. The 65th Aggressor Squadron was shut down in 2014, leaving only the 64th and 18th AGRS to perform aggressor missions. They are supplemented with civilian contractor aircraft.

contract was recently extended another year.

In the period since the original contract award, Draken has virtually taken over the role of the now-inactivated 65th AGRS, said Baum.

“Our role is to augment the 64th [AGRS] in capability and capacity to support primarily the Weapons School [and] Red Flag,” he said, though the company also supports the 422nd Training and Evaluation Squadron at Nellis. It has also supported Air Education and Training Command by mock dogfighting with F-35s from Luke AFB, Ariz., in the airspace between the two bases.



A pilot carries a flight bag with a distinctive aggressor patch during Red Flag 17-4.

Photos: MSgt. Kevin Gruenwald; SrA. Kevin Tanenbaum



Top Aces' Dornier Alpha aircraft have been modified to meet the aggressor role.

"We're essentially like ... having two squadrons on base," Baum said. "We operate like any other fighter squadron, ... we have hangar space and operate out of the 64th Aggressor Squadron as a combined unit."

Even with Draken's support, USAF still can't meet all of its requirements for adversary air, said Lt. Col. Zach Manning, 64th AGRS commander.

"During Red Flag, oftentimes blue units will augment us and will fly on the red side for some missions. That's less than ideal, and there is still a need for additional capacity," said Manning, who arrived at Nellis shortly after the 65th shut down. "We haven't slowed down at all because Draken is here."

The average 64th aggressor pilot flies two to three times a week. "The schedule can be fairly harrowing on personnel. In general we'll have a day mission and then have a night mission," said Manning.

For night missions, pilots may show up to work at 4 p.m. but won't finish debriefing until 4 a.m. or 5 a.m. "Some of the challenges I see as a commander involve making sure I give my people appropriate time off," he noted.

AN INSATIABLE DEMAND

So now the Air Force is moving for-



Capt. David Hickle, an 18th Aggressor Squadron pilot, reviews an F-16 maintenance log at Eielson AFB, Alaska.

ward with plans to contract out up to an additional 5,600 flying hours of realistic advanced adversary air at Nellis. Industry leaders said the service is leaning toward a single provider, though it is open to multiple contract awards. Ideally, Nellis would have the winning provider or providers flying on Oct. 1, so there is no gap in capability from when Draken's current contract ends on Sept. 30 and when the follow-on contract begins.

The contract—known as Nellis ADAIR II—will be worth a maximum of \$280 million for one base year, with four option years, according to documents posted on a federal website. It is part of the service's overall effort to free up aircraft and blue-suiters for operational missions while meeting the growing demand for Red Air.

In 2019, the service plans to award multiple contracts—known as the CAF ADAIR—totaling nearly 37,000 hours



Draken was originally awarded a contract to provide adversary support in 2015; the contract expires Sept. 30, 2018.

of Red Air at 11 bases, including Seymour Johnson AFB, N.C.; JB Pearl Harbor-Hickam, Hawaii; Holloman AFB, N.M.; Eglin AFB, Fla.; JB Langley-Eustis, Va.; Tyndall AFB, Fla.; Kingsley Field, Ore.; Luke AFB, Ariz.; Hill AFB, Utah; and Tucson Arpt., Ariz., according to industry officials briefed on the plan.

Over the past few years, industry has been aggressively building up its fleets of potential adversary aircraft in anticipation of the contract. Once fully implemented, USAF will have the world's largest contracted adversary air force.

In December, Draken announced it had bought 12 South African Atlas-made Cheetah supersonic fighters (converted ex-French Mirage IIIs), bringing its total fleet to 110 jets. The rest of its fleet comprised nine Aeromacchi MB-339s, 27 MiG-21s, 21 Aero Vodochody L-159s, 22 Dassault Mirage F1s, 13 A-4s, five Aero L-39s, and one Lockheed T-33.

The Cheetahs—nine C-model single-seat and three D-model two-seaters—can fly at speeds exceeding Mach 2 and have an average of 500 hours on each airframe, making them considerably younger than many of the USAF, Marine Corps, or Navy aircraft they could potentially challenge in a Red Air capacity.

A month earlier, Draken announced



F-16 maintainers replace the landing gear on an Aggressor F-16 at Nellis in 2015.

the Air National Guard had contracted it to provide adversary air support at Volk Field, Wis.; Alpena, Mich.; Gulfport, La.; Savannah, Ga.; Klamath Falls, Ore.; and Oahu, Hawaii, in addition to the roughly 4,300 annual hours it currently flies at Nellis.

If Draken provided “this bit of Red Air, I did the math, you could generate three more full classes and create another 30 F-16 pilots a year,” Baum said. “You can get five Draken sorties for the cost of one USAF F-16 sortie. It’s because we have airplanes that have been tried over

time, but physically the airplanes are less complex. ... We have third generation airplane reliability but all our jets have been upgraded from an avionics standpoint to where they have fourth gen capability.”

Textron Airborne Solutions announced in September it had acquired 63 Dassault Mirage F1 aircraft previously owned by the French air force, making it the “world’s largest private supersonic air force,” said Jeffrey Parker, chief executive officer of the Airborne Tactical Advantage Company. Textron

Photos: Top Aces; SSgt. Jerilyn Quintanilla; Draken Intl.; SSgt. Siuta Ika



A Jordanian F-5E is unloaded from a transport. TacAir has purchased more than 20 such Jordanian aircraft, intending to support US Navy and USAF adversary contracts.

bought ATAC last year in anticipation of a rapidly growing contracted Red Air market.

ATAC has flown nearly 50,000 hours of contracted adversary air since the 1990s—mostly for the US Navy—and is hoping that experience and its most recent procurement will give it an advantage in USAF's competition.

"Industry is going to be working really hard to address the full requirement for the Air Force," Parker said in an interview last fall.

"It's a massive requirement, and it requires a whole lot of airplanes," he said. "I think the calculations we ran [concluded]...140 to 150 aircraft will be required to satisfy the Air Force requirement. And aircraft are a limiting factor when standing up and responding to these requirements because there is a finite number of them available and supportable in the world."

Though the third generation Mirage fleet was built in the 1980s, Parker said the aircraft have "a lot of life left and are highly upgradable, which is key."

Tactical Air Support, Inc. (TacAir) is also looking to break into the emerging market. It announced the acquisition of 21 ex-Jordanian Northrop F-5s last year, bringing its total fleet to 26.

Though the company's fleet is much smaller than those flown by its compe-

tion, company officials say they're not going after quantity but quality. TacAir is hoping to capitalize on its experienced cadre of pilots and maintainers—as well as its fighter ethos. The company employs 52 weapons school graduates and 17 former weapons school instructors, including some with more than 2,000 hours in the F-5. The fact that the F-5 is a US-built aircraft still flown by the US Navy and Marine Corps is a bonus, officials say.

"We could go out and get the sexiest thing we could find" built by a foreign manufacturer, said Scott Gallagher, TacAir chief revenue officer, but if you "have to go to an international service provider to maintain [the fleet] that's going to be a big problem" over time, he asserted.

"That's why we're in St. Augustine [Fla.] shoulder-to-shoulder with Northrop Grumman," Gallagher said. "When we have difficulties we can go right to the [original equipment manufacturer] and say, 'We need help.'"

Top Aces says it's the only company with a true fourth generation capability. The company, a subsidiary of Discovery Air Defense, has a "guaranteed purchase agreement for 29 early block F-16s." A and B models sold to a partner country through a foreign military sale, said David L. Philman, Top Aces vice president.

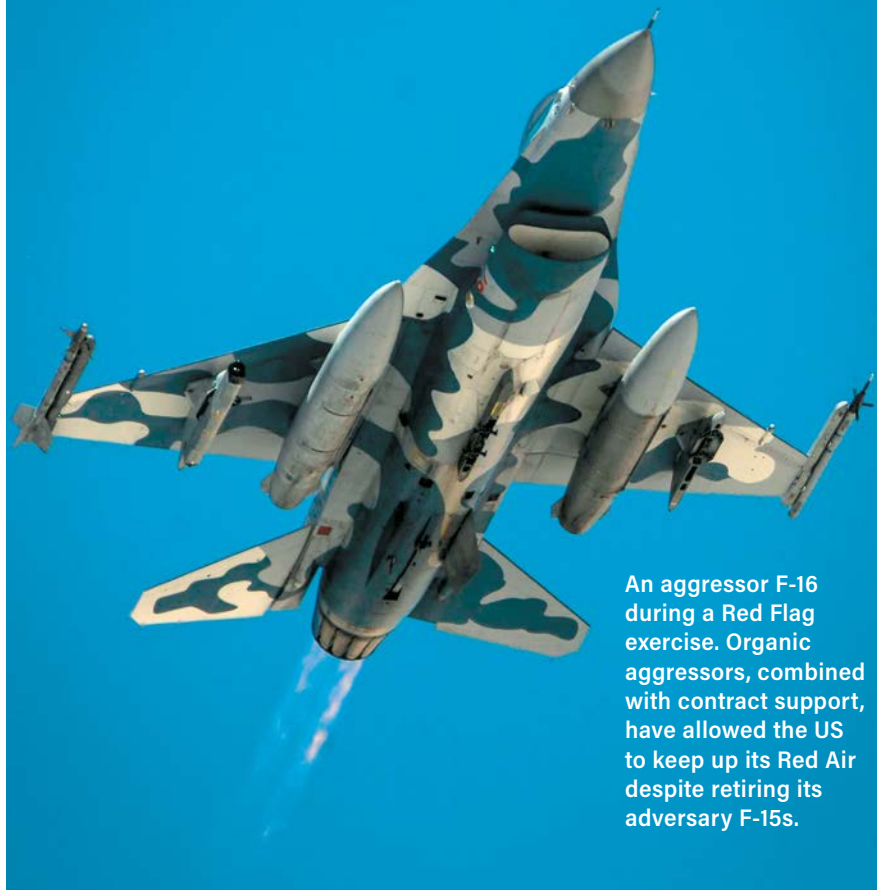
"They are essentially our airplanes. We have money down on them, and we can bring them into the country as soon as we get a contract."

Philman said the aircraft are being maintained and though they are not currently flying, they are "functional" and are considered in "flyaway condition." He said he could not release the name of the country where the aircraft currently reside, but noted that all have either undergone the Falcon Star upgrade, or the kit has been purchased.

The Falcon Star upgrade extends the service life of the jets to 10,800 hours, and Philman said they have about 3,400 hours of commercial service left before they reach that point. That translates to between 10 and 15 years of commercial viability.

"It's American built and will be flying around the world for decades to come, so it's very sustainable from a logistics standpoint," he said. "We also have a lot of maintainers and aviators that have very high experience in the F-16, so it's a way to recapture the literally millions of dollars the Air Force or Navy spends on pilots and maintainers ... with our fleet."

Most of the companies say they plan to upgrade their aircraft to specifically meet USAF requirements, which were released for Nellis phase two in January.



An aggressor F-16 during a Red Flag exercise. Organic aggressors, combined with contract support, have allowed the US to keep up its Red Air despite retiring its adversary F-15s.

WHAT USAF WANTS

The Air Force has said it's purposely avoiding specifying a specific platform for the job, but ideally it wants an aircraft capable of flying at Mach 1.5, with a service ceiling of 35,000 feet, and a 45 to 60 minute fight endurance. Aircraft must be equipped with fire-control radar capable of detecting, tracking, and simulating "ordnance employment against an opposing aircraft," and have the ability to "replicate semi-active missiles out to a range of 20 [nautical miles] and active missiles out to a range of 45 [nautical miles]," according to requirements document posted online. Aircraft also must be configured to carry training and electronic attack pods provided by the government.

Within a month of contract award, the service wants the contractor to be able to fly as many as 22 sorties a day, with each sortie averaging about 90 minutes.

"Tactical profiles may include, beyond-visual-range engagements, operational test support, dissimilar air combat maneuvers, offensive and defensive within-visual-range maneuvers, multi-ship tactics, and merges and flight," according to the document.

Contractors will provide their own

aircraft, pilots, aircraft maintenance, required support equipment, and quality assurance/quality control, while the Air Force will provide parking and hangar space.

The Air Force hasn't publically released the requirements for the larger CAF ADAIR contract, but industry sources said the draft requirements they've seen are about 50 pages long, a significant departure from those released by Nellis.

During a January industry day at Nellis, both prime and subcontractors urged the service to merge the requirements so they can upgrade their fleet in a more efficient and cost-effect way, rather than piecemealing the work to meet varying contracts.

"By nature, the Nellis ADAIR II and CAF ADAIR requirements are different—one looks to provide capabilities at one base for a single customer as early as fall of 2018 and another intends to provide various levels of capabilities at multiple bases with services starting a few years in the future. Both acquisitions are attempting to balance the [Air Force's] needs and time lines with current and future industry capabilities," said 2nd Lt. Marie Ortiz, a

spokeswoman for the 99th Air Base Wing at Nellis. "Thus, there may be differences in the requirements in Nellis ADAIR II and CAF ADAIR," though she said "the government is considering feedback received from industry to more closely align" the requirements for both contracts.

IT'S NOT A PERFECT WORLD

"In a perfect world we'd have enough resources to maintain the aggressor squadrons we used to have and bring [this training] in house," Air Combat Command boss Gen. James M. "Mike" Holmes told reporters in September. However, "in the world we're living in now, I don't want to have to trade an actual fighter squadron for an aggressor squadron because of limits on my budget. The next best thing is to see if we can contract some portion of that Red Air out. ... Why spend valuable training sorties being a training aid for somebody else if we can bring on contract Red Air and not only get dedicated people to train against but also reduce the amount of time for our guys?" added Holmes.

Since 2015, Draken has successfully done just that. On a typical day, USAF and Draken will fly side-by-side, with one of the 64th aggressors serving as the lead air-to-air commander. However, service leaders say there are still some things industry simply can't provide.

For example, USAF works closely with the Intelligence Community to accurately replicate tactics used by foreign air forces. Manning said when he showed up at Nellis from his previous assignment at Kunsan AB, South Korea, he was a qualified F-16 pilot, yet when he started aggressor training he was "blown away, because I was not prepared for the level of expertise that was needed ... in this assignment."

He said being an aggressor has "made me a better pilot," and that is something he will take with him to his next assignment.

Capt. Justin Bellamy, an aggressor pilot with the 64th AGRS, said he and his fellow USAF pilots are the subject matter experts on how US adversaries operate in the air.

"We're focused on teaching about our adversaries and then replicating what they do," he said. "Replication is only one portion of what we do. Thus far, contract Red Air has only been focused on the replication. We don't really refer to contract Red Air as an aggressor because they don't have that mission,"



Textron's MK-58 Hawker Hunter, F-21 Kfir, and L-39 Albatross cruise over the Pacific.

meaning the additional duties of teaching adversary tactics, techniques, and procedures.

For these reasons, Holmes calls contract Red Air a “temporary measure,” but he allowed that, given projected budgets, “temporary” could mean several years. The Air Force’s preference is still to have Red Air as an organic mission, he said—but industry is hoping to show the Air Force that it doesn’t have to be.

“All the folks in this initial tranche who are getting into this market need to provide quality service, because any one of us who stumbles will reflect on the rest of the market,” said TacAir’s Gallagher. He readily acknowledged that USAF will look for an alternative if the service doesn’t believe it’s getting what it needs from industry.

Though the US Navy has contracted some of its adversary air for years, the Air Force is leading the push in this emerging market, which Gallagher said he expects to be “fairly mature” in about five years.

“Between now and then we’ll learn a lot, and government will learn a lot” about potential versus performance.

“Right now there really aren’t a lot



Draken bought 12 South African air force Cheetah aircraft. The Mirage variants are young, with an average of 500 flight hours per airframe and can fly Mach 2.

of options, but the free market is a self-cleaning oven ... there will be more choices,” said Gallagher. “The government will be well served by that competition. We’ve literally built our company with that value proposition in mind.”

Draken’s Baum, a former Viper pilot, said it just makes sense to contract out at least a portion of USAF’s Red Air requirements. He noted the Air Force “literally has to bolt panels on the outside of the F-35 to let it be seen by radar” if the F-35 is to play the role of “bad guy.”

The F-35 pilots also aren’t allowed to turn on all their fifth-generation sensors, keeping them from flying the aircraft the way it was intended and the way they would fight a real battle.

“We’re not trying to come in and say the Air Force shouldn’t do any Red Air. That’s not our message at all,” he said. But, if USAF is going to “burn up hours” for adversary air, the service should “do it on our jets. They’re never going to war. Don’t do it on the brand new jets [the US] just spent billions of dollars ... procuring.”

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Note: As of Feb. 1, the Pentagon's Acquisition system officially split into two. There will be a 120-day working period within which the major changes will take place, and it will be two years before reorganization is complete.



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Key

- ASD** Assistant Secretary of Defense
- DDI** Director for Defense Intelligence
- PDUSD** Principal Deputy Undersecretary of Defense
- PTDO** Performing the Duties of
- USD** Undersecretary of Defense

An aerial view of the
Pentagon in Arlington, Va.

Photo: Sr.A. Perry Aston



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ASD, Special Operations/Low-Intensity Conflict
Owen West

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US European Command
Gen. Curtis M. Scaparrotti, USA



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 (Reports to STRATCOM)
Adm. Michael S. Rogers



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Gen. John W. Nicholson Jr., USA



US Forces-Korea
 (Reports to PACOM)
Gen. Vincent K. Brooks, USA

THE AIR FORCE MAKES MILITARY SPACE LOOK EASY. IT IS NOT.

By Gideon Grudo, Digital Platforms Editor

The Air Force's space launch enterprise has done the seemingly impossible across the last 20 years or so: made rocket science look easy.

United Launch Alliance, the joint rocket venture of Boeing and Lockheed Martin, logged its 125th successful space launch in late January, when it lofted the fourth Space-Based Infrared System (SBIRS) missile warning satellite into geosynchronous orbit. Not all 125 launches were national security launches, and other companies, notably SpaceX, also have successfully orbited satellites and other payloads. But the number of failures—once the stuff of constant headlines—has dwindled while the box score of successes continues to grow.

The string of effective launches belies the fact that getting to orbit is a tough business, and one that continues to evolve.

The latest SBIRS deployment came at a time when USAF's ability to monitor the world for strategic missile launches was critical. North Korea's string of long-range missile tests suggested it could soon make good on threats to attack the US directly. "We have a constellation of satellites that detects the IR [infrared] signature of a launch. And they can tell us where the launch is coming from and characterize what kind of rocket it is, based on the launch," said USAF Gen. Paul J. Selva, vice chairman of the Joint Chiefs of Staff, when describing SBIRS to reporters on Jan. 30.

The Jan. 19 SBIRS launch was made on a ULA Atlas V rocket. Three previous SBIRS satellites were launched on ULA rockets in 2011, 2012, and 2017.

ULA has had a majority of the Air Force's space launch business in recent years. The Challenger Space Shuttle di-

A United Launch Alliance Delta IV Heavy rocket boosts a National Reconnaissance Office satellite payload into orbit in 2010.





ROCKET SCIENCE

The GEO-4
Space Based
Infrared System
satellite is lofted
into space by an
Atlas V rocket
from Cape
Canaveral AFS,
Fla., on Jan. 19.

Photos: Patrick Corkery/U.S.A.; ULA

The SBIRS GEO-4 satellite stands ready for encapsulation at Cape Canaveral AFS, Fla.



saster in 1986 compelled the service to develop alternative ways to orbit. The “Evolved Expendable Launch Vehicle” program led to the modern day Lockheed Martin Atlas and Boeing Delta rockets. At first they competed with one another, but as the need for launch services dipped in the early 2000s, the companies joined forces to create ULA in 2006. Orbital ATK (formerly Orbital Sciences, and now a part of Northrop Grumman), founded in 1982, also lofts lighter payloads to low orbits.

Despite the downturn in space, Amazon founder Jeff Bezos started up Blue Origin in 2000, with the idea of offering lower cost, reliable launch services. Fellow entrepreneur Elon Musk, who founded PayPal and later Tesla, launched SpaceX in 2002, with similar goals. Today Blue Origin offers the Shepard and Glenn rockets, while SpaceX has had a string of successes with the Falcon 9 and, in February, the Falcon Heavy vehicle. SpaceX has demonstrated the ability to soft-land its booster rockets, which it then refurbishes for re-use, significantly reducing its costs.

The Falcon Heavy inaugural launch on Feb. 6 carried one of Musk’s Tesla roadsters into space, where it was boosted into a solar orbit that will take it out to the asteroid belt. Musk was aiming for Mars.

Musk has had a relationship with NASA as far back as 2008, but had to fight in court to win the right to compete for Air Force launch services work. SpaceX won that right in 2015 and began winning USAF launches in May 2017.

Last September, Brig. Gen. Wayne R. Monteith, commander of the 45th Space Wing, commended SpaceX for injecting a culture of speed into the launch enterprise, which allowed USAF to launch more rockets last year than Russia or China.

SpaceX “has forced us to become better at what we do,” Monteith said. “We are adopting commercial business practices, we are becoming more efficient, more effective, more affordable.”

Monteith’s remarks came just a few weeks after SpaceX’s successful launch of the secretive Air Force X-37B. Built by Boeing and managed by the Air Force’s Rapid Capabilities Office, the X-37B is a mini-spaceplane which conducts classified experimental activities in orbit. ULA handled the last X-37B launch in 2015. This was one of two national security launches SpaceX had notched on its belt before 2018;

An NRO payload awaits mounting on a booster at Vandenberg AFB, Calif., in 2010.



A SpaceX Falcon 9 reusable booster rocket lands after the launch of a classified satellite in early January.



The ULA Atlas V rocket ready to launch SBIRS GEO-4 into space on Jan. 18.





This launch of an Atlas V from Cape Canaveral in January put the SBIRS GEO-4 in orbit.

The X-37B Orbital Test Vehicle-3, one of USAF's two unmanned, reusable spaceplanes, is made safe after landing at Vandenberg AFB, Calif., in 2014. The spacecraft spent 674 days in orbit.



Photos: Jim Dowdall/Lockheed Martin; ULA (2,4,5); SpaceX; Boeing



Technicians prepare for the encapsulation of SBIRS GEO-4 at Cape Canaveral AFS, Fla., on Jan. 9.

the other was a National Reconnaissance Office payload.

Things don't always go well. Underscoring the hazards of getting to orbit, something went wrong after a Falcon 9 put a secret payload called Zuma—built by Northrop Grumman—into space on Jan. 7. SpaceX insisted it had fulfilled its part of the job, while Northrop Grumman was silent. Air Force Space and Missile Systems Center commander Lt. Gen. John Thompson said through a spokeswoman that the rocket was an “FAA-licensed, commercially procured launch service,” and that USAF had not identified “any information that would change SpaceX’s Falcon 9 certification status” due to whatever happened to Zuma.

There are other space launch startups in the wings, readying rockets and spacecraft they hope will compete for the next stage of military and civil space access. They, too, may become an indispensable part of USAF’s quest to reach orbit reliably and inexpensively, even as the service becomes evermore dependent on space capabilities. ✦



A cherry red Tesla convertible with a dummy driver dubbed Starman is now in space, launched Feb. 6 by SpaceX’s Falcon Heavy rocket.



Here, the Tesla is prepared for launch into space.



The two boosters from the SpaceX Falcon Heavy rocket gently touch down to Earth on their landing pads on Feb. 6.



Photos: Jim Dowdall/Lockheed Martin; SpaceX (2/3); ULA



An F-4 pilot takes a self-portrait with a Tu-95 Bear bomber over the North Atlantic in 1980.

INTERCEPTING THE BEAR

THE TU-95 BEAR IS STILL FLYING—AND STILL TESTING AIR DEFENSES AROUND THE PERIMETER OF NORTH AMERICA.



By John T. Correll

The Bear intercept is among the most enduring images of the Cold War. The ritual was played out thousands of times between 1961 and 1991 as US and Canadian air defense fighters scrambled to engage long-range Soviet bombers and reconnaissance aircraft on the periphery of North American airspace.

In the beginning, the fighters were usually USAF F-102s or F-106s.

Later they were F-4s and F-15s.

Sometimes the aircraft they intercepted was a Tu-16 Badger, or on occasion an M-4 Bison. By far, however, the intruder intercepted with the greatest frequency was the Tu-95 Bear. (Bear, Badger, Bison, etc., are all code names used by NATO.)

In a typical encounter, the interceptors would pull close alongside and fly formation until the Soviets left the air defense buffer zone. Both sides took pictures.

In no other Cold War setting did US and Soviet combat forces come regularly into such potentially lethal proximity. They were careful to avoid provocative actions.

In the 1980s, an F-106 from the Massachusetts Air National Guard intercepts a Tu-95 Bear bomber off the coast of Nova Scotia, Canada.



Most—but not all—of the challenges were in the far north, over the Bering Sea around Alaska or in the “GIUK gap,” the open areas between land masses of Greenland, Iceland, and the United Kingdom. Navy pilots intercepted Soviet intelligence-gathering aircraft that overflew US carriers at sea, and Air Defense Command squadrons made intercepts as far south as Florida.

In response to the increasing threat from Soviet bombers across the polar routes, the United States and Canada in 1958 formed the North American Air Defense Command, with the mission of defending the continental United States, Canada, and Alaska against air attack.

Separately, the Iceland Defense Force was organized under the auspices of NATO. It included USAF interceptors to respond to incursions of the Iceland Air Defense Interception Zone.

The first recorded intercept was Dec. 5, 1961. Two F-102s from the Alaskan Air Command’s forward operating base at Galena intercepted two Soviet bombers—Tu-16 Badgers rather than Bears—off the northwest coast in the Bering Sea.

The records are fuzzy about how many intercepts took place, but it is reasonably clear that they numbered in the thousands. Intercepts following the first one in 1961 continued regularly to the end of the Cold War, then stopped for a while.

On orders from Russian President



A DEW Line station near Point Lay, Alaska, in 1987. The line of radar stations ran more than 3,000 miles.



Staff artwork by Zaur Eylanbekov.

Vladimir Putin, the challenges resumed in August 2007 and continue today. The aircraft intercepted by US fighters is still the Tu-95 Bear, which has been in operation for more than 60 years in various models and configurations.

OVER THE TOP

In 1946, the Army Air Forces stated a “polar concept,” which put air defense priority on the “polar approaches, namely the North Atlantic and Alaska.” In 1949, the Joint Chiefs of Staff declared that all nations capable of waging war on the United States lay north of the 45th parallel—defining, in effect, the Soviet Union as the threat—and that the shortest attack route was across the

polar region.

These facts of geography took on strategic significance as the Soviets fielded bombers with enough range to reach the continental United States, beginning with the M-4 Bison in 1955 and the Tu-16 Badger in 1954. The best of them was the Tu-95 Bear, introduced in 1956. It had an unrefueled combat radius of more than 5,000 miles and long-endurance turboprop engines that gave it a top speed of 575 mph.

US air defense expanded rapidly in response. The Air Force developed the “Century series” of fighter-interceptors. The F-102 in 1956 was a stopgap solution until the superb F-106 became operational in 1959. Work began in 1957 on

the Distant Early Warning (DEW) Line of radars that eventually stretched from Alaska to Greenland. With the computerized Semi-Automatic Ground Environment (SAGE) system, air defense commanders could direct hundreds of interceptors against hundreds of targets from huge command- and-control centers.

Sovereign US airspace extends only 14 miles from the coastline, but it was obviously imprudent to allow intruders to get that close before they were challenged. Thus “air defense identification zones” were established, reaching out into international airspace for more than 200 miles. Within those zones, aircraft would be identified, tracked, and monitored—and if need be, intercepted and escorted.

Instances of visual contact between US and Soviet aircraft date back to the early 1950s, but the serious incursions began in 1958 when radar detected Soviet bombers flying in the vicinity off the coast of Alaska. F-102 interceptors were scrambled but could not catch the intruders. Sixteen similar incidents occurred before Alaskan Air Command’s first successful intercept in 1961.

However, by the time of that intercept, the air defense buildup had peaked. The bomber threat was seen as disappearing or insignificant in the context of the more dangerous ICBM threat, which had emerged in the late 1950s.

The National Security Council in 1960 predicted “a gradual transition from a largely bomber threat to one mainly composed of ICBMs.” The CIA

reported in 1961 that production of Bisons and Bears had probably ended and that the Soviets were unlikely to develop any new bombers.

A follow-on USAF interceptor, the F-108, was canceled. (See “F-108 Raper,” September 2014, p. 114.) In the 1960s, more than half of the interceptor squadrons were deactivated. Active Duty units were concentrated around the edge of the Arctic Circle while the Air National Guard, flying F-102s and F-101s rather than the more capable F-106, took over much of the Air Defense Command alert duty in the lower 48 states.

US planners had no inkling that the bomber incursions were not nearly over or that the Tu-95 Bear would still be going strong six decades later.

Over the top

Typical Soviet Cold War bomber routes



ALASKA AND ICELAND

Intercept activity was mainly in the polar region, where distances between the Western and Eastern hemispheres are compressed. At the Bering Strait, the US and the USSR were separated by only 50 miles. Alaska was directly across the Bering Sea from forward “jump” airfields in the Soviet Far East. For bombers at Murmansk on the Barents Sea, it was almost a straight shot along the rim of the Arctic Circle to Iceland.

The organization for air defense, which had evolved in pieces over time, was awkward. Alaskan Air Command was not part of Air Defense Command. It reported instead to US Alaskan Command. However, the commander of the unified Alaskan Command was also commander of the Alaskan NORAD region, so it worked out.

Almost 90 percent of the intercepts from Alaska were accomplished by fighters deployed to the Galena and King Salmon forward operating bases. According to the official tally, Alaska units flew 306 successful intercept missions and intercepted a total of 473 Soviet aircraft between December 1961 and the end of the Cold War in 1991.

In 1963, two Soviet aircraft eluded F-102s from King Salmon and pene-



A photo of the tail section of a Tu-95 Bear showing two crew members inside taken from a USAF F-4 scrambled for an intercept from Keflavik, Iceland. The USAF crew observed the Russian bombers over international waters in the North Atlantic. The USAF squadron at Keflavik intercepted more Soviet aircraft than any other unit.

trated 30 miles into American airspace over southwestern Alaska. In the ensuing furor, Air Defense Command sent F-106s on a temporary basis, but Alaska soon got F-106s of its own to replace the F-102s. Later upgrades were to the F-4E in 1970 and the F-15 in 1982.

In 1974, two Alaskan F-4s intercepted an An-24 Coke transport in distress in severe headwinds and fog and without enough fuel to get home. The Soviets landed on St. Lawrence Island and were sent safely on their way after a C-130 from Elmendorf delivered them fuel.

Alaska was not the busiest air defense sector. The majority of Cold War intercepts by far—about 3,000 of them between 1962 and 1991—were mostly around Iceland, and most were Tu-95 Bears flying out of Murmansk and from the Kola Peninsula.

Iceland had no armed forces of its own except for a coast guard. The Iceland Defense Force was a subordinate unified command of US European Command. The interceptor component of Air Forces Iceland was the USAF 57th Fighter-Interceptor Squadron at Keflavik, which intercepted more Soviet aircraft than any other unit. The squadron began with F-89 fighters in 1954, then transitioned to F-102s in 1962, F-4s in 1973, and F-15s in 1985.

The Canadians initially operated the CF-100 “Canuck” as their primary interceptor. Its cruising speed was slightly less than that of the Bear, so the

Canadians replaced it with the CF-101 Voodoo. They upgraded again in 1984 to the CF-18 Hornet.

THE MIGHTY BEAR

The Tu-95 was the Tupolev Design Bureau’s masterpiece. To achieve the range desired, it used powerful turbo-prop engines instead of fuel-guzzling turbojets. Each of the eight engines drove contrarotating propellers—two of them on each shaft, turning in opposite directions.

The result was a big airplane with more than enough range for a round-trip mission to the continental United States. It was only a little slower than a turbojet.

The Bear was notoriously noisy. The blade tips of the large-diameter propellers, churning supersonically, made so much racket that the listening devices on submerged submarines could hear the Tu-95 flying overhead. The Bear also reflected a large image on the radar return so its approach was seldom a surprise, especially when the E-3 Airborne Warning and Control System (AWACS) deployed to Alaska and Iceland in the 1980s to aid in detection and tracking.

The Tu-95 remained the mainstay of Soviet strategic aviation, even after introduction of the much faster Tu-22 Backfire and the Mach 2 Tu-160 Blackjack. The Soviets reopened the Tu-95 production line in 1981 and brought out a series of new models and variations.

Notable among these was a maritime patrol aircraft for the Soviet navy, designated the Tu-142 although it was still called the Bear. The latest air force variant is the Tu-95MS Bear H, which carries up to 10 cruise missiles.

CAT AND MOUSE

Tu-95 incursions were not actual attempts to break through the defenses to attack the United States or Canada. They were cat-and-mouse-style intelligence operations of a kind that both sides had conducted since the 1950s.

The US and the USSR routinely flew on the edges of each other’s territory to collect electronic intelligence, helping to crack codes, discover command and control procedures and preparations, and gather all sorts of valuable information. It also enabled them to test and time the response of the interceptors and determine the accuracy of the radars. They did not get maximum value from the mission unless the defenses were activated, so they had to go close enough to induce the fighters to scramble.

US overflights of the USSR ended in disaster in 1960 when the Soviets brought down a U-2 over Sverdlovsk and captured the CIA pilot. After that, the United States conducted its reconnaissance missions on the periphery, using RB-47 “ferret” aircraft at first and later the RC-135.

When in 1983 the Soviets shot down Korean Airlines Flight 007—which had



An F-22 Raptor intercepts a Russian Tu-95MS bomber in November 2007. This was the first intercept for a Raptor.

wandered far off course and twice overflew Soviet territory—they thought it was an American RC-135, which had been working in the vicinity a few hours previously.

Bear incursions and intercepts continued with increasing frequency through the 1980s. In 1985-1986 alone, the interceptor squadron at Keflavik conducted 340 intercepts. Typically, the Soviet aircraft were Tu-95s from Murmansk, discovered and reported by Norwegian radar as they passed the North Cape, then picked up and tracked by the defenses in Iceland.

As the Cold War came to an end, US President George H. W. Bush and Soviet President Mikhail Gorbachev mutually called a halt to the strategic confrontation. The era of Bear intercepts was presumed to be history.

There were scattered incidents. F-15s intercepted two Tu-95s off the shore of Iceland in 1999 but US spokesmen dismissed “two propeller bombers” as not being “a particularly big deal.”

Air defenses, allowed to deteriorate, were reinvigorated after hijacked airliners crashed into the World Trade Center and the Pentagon in 2001 but the focus was on terrorists, not the Russians.

THE PUTIN ROUND

In what was interpreted as a show of force, Putin announced Aug. 17, 2007, that Russian bombers would resume the long-distance patrol flights. “Starting today, such tours will be con-

ducted regularly and on the strategic scale,” Putin said. “Our pilots have been grounded for too long.”

The same day, Tu-95 Bears and Tu-160 Blackjacks, escorted by supporting airplanes, flew missions over the Atlantic, the Pacific, and the North Pole. The official Russian term for such flights is “combat patrol.”

Flights have continued sporadically ever since. The Canadian minister of defense said in 2014 that the Canadian air force was intercepting between 12 and 18 Russian bombers a year off the Arctic coast.

The organization for air defense has changed repeatedly. Following the terrorist attacks of 9/11, US homeland defense was grouped under the unified Northern Command, whose commander also heads NORAD. Today, however, the focus is again on Russia.

Pacific Air Forces 11th Air Force, formerly Alaskan Air Command, provides interceptor forces in Alaska under NORAD control. Air defense of Iceland is by NATO squadrons, rotating in and out of Keflavik. Air Combat Command’s 1st Air Force, with 10 Air National Guard wings, performs air defense of the continental United States.

For whatever reason, there was a surge of Bear incursions in the spring of 2017. In April, Tu-95s approached the coast of Alaska four days in a row and were met by USAF F-22s and Canadian CF-18s. In May, two Tu-95M

bombers were intercepted by F-15s off the Alaskan north slope. This time the Bears were not alone. They were accompanied by a pair of Su-35S Flankers, Russia’s best fighter aircraft.

In August 2017, Tu-95MS Bears and their Flanker escorts flew routes over the Pacific, the Sea of Japan, the Yellow Sea, and the East China Sea, generating scrambles by the Japanese and the South Koreans. Last year, F-15s, F-22s, and CF-18s began to practice and hone their identification and intercept procedures by flying against US B-2 and B-52 bombers.

“The point of this exercise is for the United States to take it [Russia] seriously as a strategic adversary,” Michael Koffman, an analyst at the Woodrow Wilson Center, explained in 2015. “Moscow’s objective is to change the perception of Russia, which is currently seen as a regional power in structural decline.”

Resumption of the combat patrols added to Putin’s political popularity at home, Koffman said. “Russia’s leaders want to be considered as the existential threat the USSR was, a country the United States negotiated and compromised with, instead of chiding, sanctioning, and ignoring.”

John T. Correll was the editor-in-chief of *Air Force Magazine* for 18 years and is now a contributor. His most recent article, “Targeting the Luftwaffe,” appeared in the March issue.

DOC'S SAGA

Getting the B-29 *Doc* flying again took decades of perseverance.



By Frederick A. Johnsen

In the skies over Oshkosh, Wis., in July of 2017, two World War II-era B-29 Superfortress bombers joined formation for the first time in six decades. It was an improbable tableau that many thought would never take place. That historic formation was as much about perseverance as it was about the changing landscape of warbird restorations.

The historical aircraft community celebrated when the then-Confederate Air Force (CAF) resurrected a B-29 Superfortress from a Mojave Desert boneyard at the Navy's China Lake Naval Weapons Center in California in 1971 and flew it to Texas to begin a long second career as a flying legend. At least three other B-29s made some flights in the 1970s and 1980s before retiring to museums, but the longevity of the CAF B-29, nicknamed *FIFI* made it the only flying Superfortress in the world.

Until *Doc* entered the skies, that is, *Doc* is another China Lake survivor, part of a gaggle of B-29s that made one-way flights to the Navy test facility in the mid-1950s to serve as ground targets to help testers measure the efficacy of new ordnance.

Doc and *FIFI* were refurbished in different locations and different decades with different sponsors. What made both of these B-29 resurrections possible was the tenacity of a patron and steward with the vision to look beyond sandblown B-29 hulks in the Mojave Desert and into the future.



Tony Mazzolini and *Doc* at the Navy's China Lake boneyard in California, as the venerable bomber is removed from the target range.

Victor Neils Agather was that spark-plug for *FIFI*. A World War II veteran who worked on developing and perfecting the B-29, Agather enjoyed postwar success as an international business leader. When the CAF was able to secure one of the desert B-29s at China Lake, advocate Agather pitched in more than \$100,000 to make it possible to ferry the bomber from China Lake to the CAF's home, which in 1971 was Harlingen, in south Texas. Agather clearly had skin in the game.

Naming the B-29 *FIFI* was a tip of the hat to Agather's wife. Her namesake bomber continues to fly.

IT WAS JUST THE BEGINNING

Tony Mazzolini was the indefatigable visionary for *Doc*. After Air Force service in the 1950s, Mazzolini's managerial acumen served him well in positions with General Electric and Continental Airlines. Mazzolini had a bit of a soft spot for the B-29 Superfortress. He remembered encountering a special Air Force radar squadron with nine B-29s nicknamed for Snow White, the Seven Dwarfs, and the wicked witch who plagued them. Each of the bombers carried the likeness of one of the characters in that story. In the last half of the 1980s he pondered the possibility of finding a second



World War II bombers *FIFI* (left) and *Doc* fly together at an air show in Oshkosh, Wis., in July 2017.



Doc, showing its age, is towed out of the desert at China Lake.

B-29 to restore to flightworthiness to complement *FIFI*. The prospect was at once intriguing and improbable.

Soon he was the tip of the spear for this quixotic notion. He had heard stories about more than 200 of the big Superfortresses making their last flights to the Aberdeen Proving Ground and China Lake Naval Weapons Center for use as test targets.

His early inquiries to the Navy at China Lake were met with replies that would discourage someone with lesser determination. No, he was told, the China Lake Superforts were all gone. Finding that hard to accept, Mazzolini kept at it until his perseverance was rewarded with the confirmation that

one China Lake B-29 remained, isolated on a distant bombing range in the desert. Mazzolini's Herculean labors were only beginning.

Mazzolini finally received permission to visit the range in 1987. As the truck carrying the inspection party rumbled over worn desert ruts, he could see a largely intact Superfortress looming in the distance. This was ample validation for Mazzolini, who almost leaped from the truck as it was still moving in on the bomber, so eager was he to inspect the aircraft.

His joy at once again beholding a Superfortress was multiplied when the identity of this airframe—Air Force serial number 44-69972—turned out

to be *Doc*, one of the named B-29s he had encountered so many years earlier at Griffiss AFB, N.Y.

The Navy was initially reluctant to sign over an essentially intact Superfortress, no matter how outdated its technologies, to Mazzolini four decades after the B-29 was built. The bomber would have to be demilitarized to render it unflyable, Mazzolini was told in early discussions. He went through the proper steps, creating a nonprofit 501(c)(3) organization to help support his endeavor to acquire the B-29. Negotiations to get the Navy to release the desert B-29 without demilitarizing it moved at a glacial pace.

Back in 1987, little did he know it would take more than 11 years before he could lay claim to the B-29 called *Doc*.

QUID PRO QUO

In the 1980s, branches of the military occasionally dipped into surplus aircraft resources to trade for historic aircraft needed by the services' museums. The Navy's quid pro quo for *Doc* seemed straightforward enough; the historical Naval aviation collection in Pensacola, Fla., needed a B-25 Mitchell twin-engine bomber in restored condition. If Mazzolini would furnish that, the Navy would release *Doc*.

By that time, B-25s were enjoying a renaissance of interest in the American warbird community, fueled in part by the massive collection of 18 of the bombers resurrected by Tallmantz Aviation for the movie "Catch-22" years earlier. The American country-



Doc and restoration volunteers in the repair bay at the Wichita, Kan., facility in 2014.

side was not littered with unwanted B-25s.

Mazzolini finally located an available Mitchell airframe in Venezuela at a price he could live with, had it dismantled and shipped to Florida, and then moved by rail to Cleveland for static restoration.

What Mazzolini charted as a six-month refurbishment program on the Mitchell stretched into a six-year effort.

First, restorers lost access to the building in Cleveland and the bomber had to be bundled up and shipped to Pennsylvania, where the Air Heritage Museum completed the restoration.

Then the Navy—initially requesting to have the Mitchell restored and configured as a representation of one of Doolittle’s Raiders—changed their mind and requested that it be finished as a naval PBJ variant. Mazzolini obliged.

Meanwhile, the lone Superfortress

in the desert, although earmarked for Mazzolini, was occasionally the object of unwanted suitors. He had to keep an eye on his prize to make sure interlopers did not get it before he could complete the deal.

By 1998 all was in order. The Mitchell bomber was restored for the Navy, and *Doc* was released intact to Mazzolini, its title transferred to enable the bomber’s extraction from the desert range to be readied for restoration. Fresh tires put *Doc* in position to roll as the bomber was gingerly towed miles from its range location to the civilian airport at Inyokern, Calif.

RESTORATION

Mazzolini and his small crew savored the idea of preparing their B-29 for its first flight in decades from Inyokern, back to a more populous aviation center where further restoration would be accomplished. After all, hadn’t three other China Lake B-29s

left the desert under their own power? The dry desert generally favored the preservation of aluminum airframe structure, even as the relentless sun made the replacement of soft parts—rubber, fabric, and plastics—mandatory.

But decades had elapsed since the last B-29 flew from China Lake. And there’s a big difference between abandoning an aircraft and storing it properly for possible reuse at a site like the Aerospace Maintenance and Regeneration Group (AMARG) at Davis-Monthan AFB, Ariz. At AMARG, experience and experiments in preservation have led to ways of minimizing intrusion of the elements into the vitals of stored aircraft. Not so on the China Lake range; no such requirement was anticipated when *Doc* was towed out to the desert.

Tony’s crew at Inyokern perceived a confluence of problems as they looked into their Superfortress on the open-

B-29 *Doc* Flies Again After 29 Years of Effort



1980

1990

1987: Tony Mazzolini discovers the B-29 *Doc* at the Naval Ordnance Test Station, China Lake, California.

1998: After delivering a restored B-25 Mitchell bomber in a trade, Mazzolini takes possession of *Doc* and moves it to an airport in Inyokern, Calif.

air ramp. Volunteers, in adequate numbers and with desirable skills, were harder to find than they would be in an aviation metropolis. And *Doc*, unprepared for long-term exposure to the elements, had aluminum corrosion requiring remediation beyond what the available crew could prudently accomplish on the windswept tarmac at Inyokern.

It was another setback—but not a showstopper. Mazzolini had asked Boeing's specialists on aging aircraft to conduct a structural inspection on the B-29. If *Doc* could not fly out from Inyokern, it could truck out. He called Boeing's Wichita plant, where *Doc* had first seen the light of day in 1945 and where Boeing had ongoing aircraft construction programs at that time.

Jeff Turner, then a Boeing vice president in Wichita, green-lighted the plan to truck *Doc* back to its home plant for repair and restoration by volunteers.

There's an elite corps of big rig truckers who specialize in relocating aircraft for museums. How do you move a B-29 Superfortress over the road? In many sections, separated with care, to enable them to be re-joined later. Another two years had elapsed; it was now 2000 and *Doc* needed to relocate.

ON THE MOVE

Tony called Ben Natrass, whose Worldwide Aircraft Recovery company has carefully dismantled and trucked dozens of aircraft, including outsized Boeing behemoths like B-29s, B-50s, and KC-97s, which bear some fundamental structural similarities to *Doc*.

Natrass knows how to study an airframe and disassemble it in ways that will make reconstituting the pieces as a whole aircraft feasible and without scarring. This is especially important for an artifact like *Doc*, intended to fly again.

"B-50s and KC-97s have a five-piece wing and the inner panels come off the sides of the fuselage," Natrass explains. Some B-29s had a five-piece wing, others a four-piece wing that carried through the fuselage, techni-



A B-29 at the Navy's China Lake, Calif., Boneyard is viewed through the nosepiece of another in 1978. Both *Doc* and *FIFI* were dumped at China Lake for use as static targets before being painstakingly restored to flying condition.

cally joined in the middle of the fuselage, but a monster to disassemble. "*Doc* had the four-piece wing," he said.

"Two outer wing panels and two inner wing panels that split in the center. There is a top fuselage cap that is removed, and the wing is lifted out the top of the fuselage. Because *Doc* was going to fly, we did not split the inner wing and we transported it as a complete 99-foot-long load," Natrass continued.

That B-29 bullet fuselage is just a foot shy of 100 feet from nose to tail gun position. Natrass had moved B-29s before, and he knew just what to do: "A production split just behind the wing breaks the fuselage into two transportable pieces," he recounted.

If that was straightforward for experienced aircraft truckers—it still wasn't easy. Cranes needed to be scheduled onsite at Inyokern. Cribbing and jiggling had to be finessed to support the precious bomber without imparting damage to its structure

during the almost 1,500-mile journey over the road to Wichita in seven truckloads.

What showed up at the Wichita gates in May 2000 is a matter of opinion. Mazzolini saw his dream B-29; others saw trailer loads of derelict bomber bones, filled with vestiges of desert sand and the desiccated remains of a few critters who sought refuge in the aircraft to no avail.

Dan Wimberly was one of the Boeing craftsmen who saw the trailers carrying Mazzolini's hopes and dreams. He remembers *Doc*'s first impression: "It was in sections and pieces on seven semi-truck flatbeds. It was rolled in ceremonial fashion ... like a war hero returning from the front line battlefield. The piles of broken wires, tubing, glass shattered or missing altogether was quite a discouraging sight!"

The broken glass, dirt, and detritus in the B-29 was a far cry from the pristine 737 fuselages he helps to craft on a daily basis. "I'm not touching it,"

2000

2000: Mazzolini contacts the Boeing plant in Wichita for help. Jeff Turner, vice president at the plant, approves, and *Doc* is disassembled, placed on seven flatbed trailers, and moved from California to Kansas.

2010

2016: After 300,000 restoration hours by hundreds of volunteers, *Doc* flies again. The B-29 bomber fired up her engines and took off from McConnell AFB, Kan., on July 17.

2020



Doc gleams on the flight line at McConnell.

Wimberly decided. A toolmaker, Wimberly had a skill set the B-29 restorers needed. He made a special tool at the request of the bomber team, and soon "I was hooked," he admitted.

Not surprisingly, the initial rush of volunteers to work on *Doc's* restoration gave way to a smaller core, Wimberly remembers, as the "not really what I had in mind" people left the effort.

Volunteers ranged from retirees who probably drove rivets on *Doc* in 1945 to current aerospace employees, to some supporters who brought more enthusiasm than experience. The team leaders managed to meld this varied crew into a workable force for restoration of the 37-ton bomber entrusted to their care.

If the overall restoration of *Doc* looked daunting back then, the Gordian knot was the corrosion discovered at Inyokern. Ultimately, the wing's lower right spar, an inverted T-section 27 feet long, had to be replaced with new metal. Nobody had manufactured a B-29 wing spar in many decades. With copies of wartime Superfortress blueprints, a new piece was crafted, but not without some learning-curve issues along the way.

WORTH THE WAIT

Wimberly remembers the outcome: "About eight years into the restoration project, we reinstalled the center wing section into the fuselage. I still remember the roar of cheers and applause from those gathered when we drove home the final wing bolt pins."

Five years into the B-29 restoration, Boeing sold off its Wichita manufacturing operations. Spirit AeroSystems became the new vendor of fuselages and structures for a number of Boeing aircraft, and now Spirit was the landlord for *Doc's* shop space. Spirit management, peopled by many of



Doc at the Oshkosh air show in 2017. *Doc* joined *FIFI* as one of the only two flying Superfortresses extant.

the former Boeing regulars including Jeff Turner, embraced *Doc's* restoration.

During the 16-year restoration, occasionally new materials and methods were better than old ones, and all of this was folded into *Doc's* dossier to facilitate the path to FAA airworthiness certification. State-of-the-art processes, including computerized design and machining, left no room for shade-tree mechanics.

Doc's rebirth as a pristine flying machine is emblematic of the evolving warbird movement around the world. Decades ago, a sole owner/operator might restore and fly a P-51 or similar project, but a bomber as big as a B-29 was too much for most individuals or groups to contemplate. But advanc-



Dan Wimberly at *Doc's* long-awaited first flight in 2016 at McConnell AFB, Kan.

es in computer capabilities have meshed with an increased sense of pride and urgency about restoring the famed aircraft of World War II, leading to evermore ambitious restorations that would have been dismissed as too audacious years ago.

And now there are two flying B-29 Superfortresses in the world. Even as they bear witness to the wartime generation who originally animated them, these mechanical marvels both tell another story of deter-

mination and optimism that is the very reason they still exist at all. ✦

Frederick A. Johnsen is a contributor to *Air Force Magazine*. His most recent article, "The Goering Interrogation," appeared in the August 2015 issue.

By Rachel Cox

MSGT. DUSTIN LAWRENCE

Home State: California

Chapter: Ramstein (Germany)

Joined AFA: 2007

AFA Office: Europe Special Assistant; Membership Committee; former President, Leadership Development Mentor, and Communications Chairman, Ramstein Chapter

Military Service: 1998-present, Active Duty

Occupation: First Sergeant

Education: B.A., General Studies, Grantham University

■ How did you first hear about AFA?

I was invited by a friend to a lunch meeting when I was stationed in New Mexico (Holloman AFB.)

■ What prompted you to join?

At first, I became an annual member because a friend was a member, but I didn't do much with it at the time. Then I was stationed at Ramstein and within six months, a meeting message was sent out. To my surprise it was for a chapter startup meeting. I was inspired to get smart on all things AFA, be an effective communications committee chairman, and help get the chapter off the ground, which led me to become a member for life. We grew the Ramstein chapter to more than 250 members in the first year, and we have grown steadily since.



Dustin Lawrence in Germany. Lawrence is focused on growing AFA's reach toward younger airmen.

■ What do you enjoy most about your AFA membership?

I enjoy AFA because I see the passion in our association's heritage. I get to meet airmen from all walks of life who have inspiring stories and who have built a true legacy, and that inspires me to help as much as I can. I also get to inspire others through our partnerships with CAP, JROTC, and local retirees.

■ What should AFA do to draw in more members?

I think we need to find ways to educate our BMT trainees about the legacy of AFA and offer membership that early. Then, if we focus on our CGOs and tier-two enlisted to educate them on the contributions AFA has made to cement our airmen's history and encourage them to take on committee roles, we may encourage Airmen for Life. Finally, we need to stay with the times, telling AFA legacy stories on social media and making membership as easy to sign up for as a Facebook or LinkedIn account.

MARC STEWART

Home State: Oklahoma

Chapter: Gerrity Chapter (Oklahoma)

Joined AFA: 1999

AFA Office: President, Gerrity Chapter; former Vice President of Awards, Montgomery Chapter

Military Service: 1999-2014, Retired

Occupation: Real Estate Investor

Education: B.S., Communications, East Carolina University; Masters, Human Relations, University of Oklahoma; Masters, Military Operational Art and Science, Air University

■ How did you first hear of AFA?

I heard about AFA in college: AFROTC, Det 600, East Carolina University! Go Pirates!

■ What compelled you to join?

My father. I was scared he would disown me if I didn't join. (Just kidding.) My father is a retired chief master sergeant and a retired Air Force civil servant with 40-plus years of service to our Air Force. He impressed upon me the importance of AFA to the Air Force, so I joined.

■ What do you enjoy most about your AFA membership?

I enjoy continuing to serve. I am no longer Active Duty, so I enjoy using the freedom to say and do what I wish as a civilian to



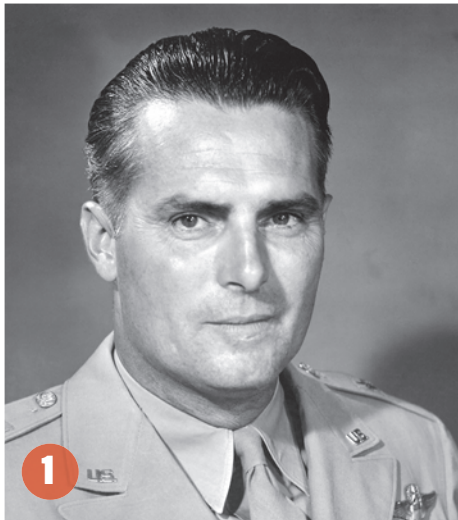
Rob Reiner (I) and Marc Stewart at the Gerrity Chapter Flyers Breakfast in May 2017. Stewart looks to increase USAF-AFA buy-in.

speak for our men and women in uniform. AFA has a great and important mission: We serve our airmen before, during, and after they serve. And that is just awesome.

■ How do we build awareness about AFA?

We exist for the Air Force, and we need 100 percent support and a buy-in relationship with the Air Force. The hurdle is that our value is measured by what we have done and accomplished. It is difficult to see the value of what we do now and what we can do in the future to shape our Air Force, especially when USAF must deal with the pressing business of defending our country with less and less. It is our job to relay our value to the Air Force. We must find a way to consistently and intimately integrate with USAF, without burdening an already overtasked force, so that I should not have to explain to any airman what AFA is or why we are here.

AFA began an Emerging Leaders Program in 2013 as an avenue to secure AFA's future. The purpose of the program is to identify, motivate, develop, and encourage emerging leaders to serve actively in AFA by providing hands-on experience and unique insights into how AFA operates and is governed. Emerging Leaders volunteer for a year. With guidance from a mentor, they participate on a national-level council, attend national leader orientations, and serve as National Convention delegates.



TRAVIS

The Rocket

At first, the California airfield went by an in-elegant name—Fairfield-Suisun. Then came the horrific aircraft accident. That is how it got the name “Travis.”

The base was rechristened in honor of Brig. Gen. Robert Falligant Travis, a true World War II combat hero who died Aug. 5, 1950, when his B-29 bomber crashed just after takeoff at Fairfield-Suisun. It marked the end of the meteoric rise of a commander.

Travis was born on Dec. 26, 1904, in Savannah, Ga., into a military family. Relatives included Lt. Col. William Barrett “Buck” Travis, commander of Texas regulars who died at the Alamo in 1836. His father, Robert J. Travis, was a decorated World War I officer and later a major general in the National Guard.

In 1928, Travis graduated from West Point and received a commission in artillery. The new second lieutenant immediately sought and received a transfer into aviation. He entered Primary Flying School at Brooks Field, Texas. In September 1929, he graduated as a pilot from the Advanced School, Kelly Field, Texas.

Tall, handsome, and athletic—and an expert poker player—Travis was a classic fast burner. Steady advancement propelled the youthful airman into command of 72nd Bombardment Squadron at Hickam Field, Hawaii, in July 1939. He was there a year before he was assigned as materiel officer of 5th Bombardment Group. In mid-1943, he



1/ Brig. Gen. Robert Travis. 2/ The wreckage from the crash that killed Travis. 3/ A C-5 takes off from Travis AFB, Calif.

ROBERT FALLIGANT TRAVIS

Born: Dec. 26, 1904, Savannah, Ga.

Died: Aug. 5, 1950, near Fairfield, Calif.

Colleges: University of Georgia (1922-24); United States Military Academy, West Point, N.Y.

Services: Army, Infantry (1928); Army Air Corps (1928-41); Army Air Forces (1941-47); United States Air Force (1947-50)

Occupation: US military officer

Main Era: World War II

Years Active: 1928-1950

Combat: European Theater

Final Grade: Brigadier General

Honors: Distinguished Service Cross; Silver Star (3); Distinguished Flying Cross (4); Purple Heart; Air Medal (4); Legion of Honor (France); Croix de Guerre with Palm (France); DFC (Britain); Croix de Guerre (Belgium)

TRAVIS AIR FORCE BASE

State: California

Nearest City: Fairfield

Area of Main Base: 9.95 sq mi/6,368 acres

Status: Open, operational

Opened as Fairfield-Suisun AAF: May 17, 1943

Renamed Fairfield-Suisun AFB: Jan. 13, 1948

Renamed Travis AFB: Oct. 20, 1950

Current Owner: Air Mobility Command

Former Owners: Air Transport Command, Military Air Transport Command, Strategic Air Command, Military Airlift Command

took over the First Bomber Command at El Paso, Texas.

With the US at war, Travis soon joined Eighth Air Force in England, heading up 41st Combat Bombardment Wing at RAF Molesworth, RAF Kimbolton, and RAF Grafton Underwood.

Travis personally led his aircrews on 35 missions over Nazi-occupied Europe in 1944. He tended to fly on missions known to all as the most dangerous. Travis was only 39 when he was promoted to brigadier general.

After the war, Travis returned to Hickam as 7th Air Force chief of staff and then as its commander. In September 1948, he was appointed commanding general of Pacific Air Command.

On June 17, 1949, Travis arrived in California to take charge of Fairfield-Suisun Air Force Base and Strategic Air Command's 9th Strategic Reconnaissance Wing, which within the year would be recast as 9th Bombardment Wing.

On the night of Aug. 5, 1950, Travis boarded a B-29 on a mission to carry an atomic bomb casing to Guam. On takeoff, the No. 2 propeller malfunctioned and the main gear failed to retract, leading to a crash. Travis died on the way to the hospital. He was one of 19 crew and ground personnel who perished.

Today, Travis Air Force Base handles more cargo and passenger traffic than any other military air terminal in the US. The base's

host unit, the 60th Air Mobility Wing, is the largest wing in Air Mobility Command, with a versatile fleet of C-5 and C-17 airlifters and KC-10 tankers.



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