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November 2019. Vol. 102, No. 10

Photo: Brian Everstine/staff

Loadmasters hitch a ride on the back of a C-130 as another comes down the line during exercise Mobility Guardian. See "Combat Heavies," p. 36.

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ON THE COVER

Photo: Heide Couch/USAF

Airmen atop the tail of a C-5M. See "Smart Sustainment," p. 30.

STAFF

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By Tobias Naegele

Playing the Numbers

The Air Force plans to radically shift funding priorities in its next budget to pay for future network connectivity to support its vision of multi-domain command and control (MDC2). For example, it might surrender some of its most heavily worn B-1 bombers, and possibly retire F-15Cs and older F-16s, in order to free up funding to build a mesh-network combat cloud.

The idea is to accept additional risk today in order to ensure less risk tomorrow. But this strategy itself is a high-risk endeavor. Historically, when the Air Force attempted similar trades, they backfired: The service ended up losing both current capability and future funding. The Air Force can ill afford such a lose-lose scenario.

Chief of Staff Gen. David L. Goldfein is committed to maintaining today's "hot lines" for F-35 fighters, B-21 bombers, KC-46 tankers, and T-7A trainers. He's also committed to building F-15EX fighters. Exactly which weapons and platforms the Air Force is prepared to give up remains a closely held secret. Every option for cuts has both risks and rewards.

Retiring B-1 bombers would further diminish the Air Force's bomber force at a time when bomber demand has been high, driven up by bombers' versatility and cost effectiveness. A single bomber today can deliver the same munitions load in a single strike as an entire aircraft carrier air wing.

The Air Force was already planning to retire both the B-1 and the B-2 well before the future B-21 is fully deployed. But "The Air Force We Need" calls for five more bomber squadrons than exist today and Air Force leaders universally acknowledge they're going to need more B-21 bombers than called for in the current plan. So, giving up capacity today will only increase the shortfall for years to come. The problem is especially stark when one looks at what allies bring to the fight. Most allies have fighters and airlift. Only a few have aerial refuelers. None have bombers.

Joint capabilities must be funded jointly.

So what else might the Air Force consider giving up? The options aren't attractive:

■ **A-10 Thunderbolts.** The Air Force has tried—and failed—repeatedly to retire the low and slow "Warthog," but its 30 mm cannon is a crowd pleaser among muddy boots soldiers and Marines, and Congress is loath to give up a weapon that protects those at greatest risk on the field of battle. Never mind that ground troops shouldn't be put into positions in which their very survival depends on a Warthog blasting an enemy at danger-close range. As long as that's a possibility, the A-10 remains a better option than the Army's Apache helicopter, and experiencing it bearing down from above holds a distinct psychological advantage over bombs delivered from B-52s circling at 30,000 feet.

■ **C-130s.** The Air Force's airlift shortage is in larger aircraft, such as C-17s; there are plenty of C-130s to go around. These are aircraft that can be retired—especially the C-130Hs. But since they are assigned to the Air National Guard, retiring them is bound to become a political issue for lawmakers from those districts. Giving them up would require putting some other mission-critical and highly useful asset into the Guard, and alone would not provide the level of savings the Air Force needs to fund its wider modernization efforts.

■ **Tankers.** Troubles with the new KC-46 Pegasus are proving as difficult to tame as its mythical namesake. Air Mobility Command boss Gen. Maryanne Miller says it will likely be three or four more years before the KC-46 can deploy. Like bombers, air refueling is a hallmark of US air superiority and one of USAF's strategic advantages. But, refueling capacity is already challenged and the planned retirement of the KC-10 may be accelerated. Meanwhile, Miller says the Air Force may have to reprogram funds to retain as many as 28 KC-135 Stratotankers to make up for the fact the KC-46 won't be available. Still unclear: If the Air Force continues to accept new airplanes at a rate of 2-3 per month, even with a flawed remote vision system, will those airplanes be left to sit idle? Or will they devour manpower and training funds while Boeing, the plane's builder, works out the kinks in design and functionality?

■ **Fighters.** USAF's fighter force is aging, and the service isn't buying enough airplanes fast enough to reverse the trend. Retiring the oldest F-15Cs and Block 30 F-16s could save some money in the short term, but doing so will accelerate the wear and tear on newer models, which will be worked harder if the number of fighters shrinks.

■ **MQ-9 Reapers and Global Hawk.** Unmanned drones are the signature aircraft of the past decade, providing persistent ISR and precision strike capability throughout the Central Command theater of operations. In many ways, Reapers and Global Hawks have altered perceptions of modern warfare. Yet they have also operated exclusively in a highly permissive environment. Is it time to start dialing back on a capability that cannot function in contested airspace? Maybe. But, doing so could undermine US capacity to fight the kinds of wars our nation has faced for the past quarter century.

Since becoming Air Force Chief of Staff three years ago, Goldfein has steadfastly advanced his vision for multi-domain warfare—essentially a hyper-speed implementation of joint warfare enabled by robust networks, artificial intelligence, and powerful data processing. The idea is to present our adversaries with such an overwhelming range of threats and risks that mounting a successful defense is essentially impossible. If that is the case, potential enemies will choose not to risk confrontation with the US or its allies.

The Air Force Chief has the right sight picture and Gen. Mark Milley, the new Chairman of the Joint Chiefs of Staff, agrees. A year ago, as Army chief, he embraced multi-domain operations, saying it is about "winning on tomorrow's battlefield by simultaneously achieving overwhelming battlefield dominance and overmatch in all five domains of warfare," and described shifting from "battles of attrition to battles of cognition, where we think, direct, and act at speeds the enemy cannot match."

The challenge is getting to that end state. Today's Air Force is too small for the missions it has. The chief is committed to building up to 386 operational squadron, but forming a distinct Space Force will only exacerbate funding problems, drawing away funding for essential needs such as jam-proof GPS III satellites and new communications constellations to help support MDC2.

Until those new capabilities are proven, however, the Air Force and the other services must be able to present a ready and effective fighting force that's able to strike deep into contested territory and has the capacity to endure in a prolonged fight with a peer rival.

The problem the Air Force is trying to solve—creating a better way to fight jointly—is really a Defense-wide problem. It cannot be achieved with Air Force structure trade-offs alone. This is where new Defense Secretary Mark T. Esper can and should, make a difference. Ultimately, MDC2 will be a force multiplier for joint force operations. Paying for it must be a joint responsibility. ✪

LETTERS

The Last Thing Wanted

I found the article "Air Force Orders Ops Pause to Address Suicide" very interesting ["World," September, p. 20]. I am a "suicide survivor." On July 1, 1994, my wife, an Air Force staff sergeant, took her life. I found the article interesting, but the understanding of suicide within the Air Force has not improved after all these years—and frankly—is flawed and naïve. Yes, the Air Force is correct, each suicide is unique. Each has a root cause, and leadership up-and-down the chain of command must identify why the airman chose to take his or her life. To give chaplains a gun lock for gun cases is ludicrous.

In the case of my wife's suicide, there was a lock on the gun case, but she cut through the gun case. The Air Force needs to address the root causes of suicide and take action to address the cause. Leaders must ask each other *why* is it OK for an airman to take his or her life. As a family member, I still ask myself that question—WHY?

As a former tech sergeant, noncomissioned officer in charge, and USAF aircrew member, I understand the stresses that come with the job and the ops tempo. Long hours and tours of duty cause undue stress on the Air Force member and their family. The Air Force leadership must focus on programs that will assist the airman with coping skills and take the time to assist an airman that is going through difficult times in his or her professional or personal life. If an airman is having some difficult times, a simple, "How is it going today?" or "Have a seat, let's talk" or "Can I help?" or "How can I help?" [could make a difference.]

There is one thing I never wanted to be, and that is a "suicide survivor."

TSgt. Mark D. Putnam,
USAF (Ret.)
Orange City, Fla.

I'm a Veterans Advocate for the Department of Veterans Service in Nevada, and have taken a suicide course, plus I am taking another next week called Safe Talk, and there are also courses on PsychArmour. [We] have a full-time person dealing with this in Nevada in the Department of Veterans Services. I agree with Lt. Gen. Richard W. Scobee's [points about] family life and finances causing a lot of stress, but the best course of action is to train supervisors and family members to look for signs. I do not believe the government is putting enough resources into mental health services. Our county is putting magnetic signs about this on the sides of their vehicles.

In the past I have run into discrimination in hiring due to being in the Guard and have been suspended from jobs due to being in the Guard. I have been fired four times due to having a service-connected disability. Even with all the programs for vets in the past 20 years, you still have the same problems out there.

Dale Hartley
McDermitt, Nev.

Ribbons and Bangles

I totally agree with Cmdr. Bradford's comments ["Letters: Chest Salad," September, p. 8], that the time has come to stop awarding medals and ribbons that mean essentially nothing, other than having served at a particular time period. I also enjoyed his pointed sense of humor describing the "Distinguished Potato Peeling Medal." Decorations should be limited to service members who encountered foreign armed opposition or who were in danger of hostile action by enemy forces. Let's stop the "fruit salad," feel-good awards. Also very important, to quote Cmdr. Bradford, "staff hero" awards must be made junior in precedence to those related to armed conflicts. The Veterans Affairs Administration allows only three awards to be noted on the VA Card: Medal of Honor, Purple Heart, and Prisoner of War.

The order of precedence of awards and decorations needs to be addressed and updated. For example, the American Defense and the National Defense medals are listed above the Armed Forces Expeditionary Medal, which is awarded to those who actually participated in a United States military operation. To get them listed in proper order will take a joint services committee review by all branches of the military. As a side bar to the reference about Herman Goering and his love of medals, there was one he was never awarded, the Knight's Cross, because it was determined he didn't earn it and therefore he didn't deserve it. United States military awards and decorations are a reflection of the person and their service to our country. They are worn with great pride by all members of the armed services. Let us keep their meaning intact.

David Ribbe
Nanuet, N.Y.

I'm wondering why members of the armed forces need to wear ribbons at all. No other profession wears awards and citations. A display wall at home is sufficient.

Jeff Rowe
Long Beach, Calif.

I was surprised to read the shot across the bow of the Air Force's awards and decorations program rendered by an Air Force outsider. No doubt that Cmdr. Bradford had good intentions, but there were some misperceptions that warrant further discussion.

The Air Force Personnel Center website lists 89 ribbons (many of which are actually medals) that airmen notionally can earn. There are also others that could have been received during time with/in other services. The object is not trying for "blackout bingo" over the course of a career, just recognition where it is due. You can learn a lot from a military member's ribbons if you're knowledgeable as to what to look for. In the case of the female airman second class (the Air Force hasn't had that rank since 1967) that Bradford met, he should have just asked the airman about her ribbons. I bet she'd have proudly shared the backstory on each and every ribbon she wore. For her, it would have been a trip down memory lane.

There's little doubt that some ribbons are the modern day equivalent of "partic-

WRITE TO US

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—The Editors

ipation trophies." The Air Force is really a microcosm of today's American society, which encourages such group recognition.

Many ribbons have little to do with job performance, as Bradford surmised. A large number are authorized based only on where you served and the function you were assigned, regardless of individual performance. Today's Air Force is a more mobile force, and short-duration deployments to overseas locations and/or combat areas can quickly add to an individual's ribbon rack.

Bradford's Distinguished Flying Cross comments demeaned those lifesavers that don't fly the plane but are "simply being on the bus [aircraft]." The "swimmers" Bradford refers to are actually Coast Guard rescue. The "hoist operators" he mentioned were probably Air Force pararescuemen. As for nurses—one DFC recipient was a World War II flight nurse, 1st Lt. Aleda E. Lutz, who flew 196 evacuation sorties accounting for 814 combat hours. Her last medevac flight ended tragically when the C-47 transport, with 15 wounded soldiers she was attending to, crashed in France with no survivors.

Col. Bill Malec,
USAF (Ret.)
O'Fallon, Ill.

Cmdr. John W. Bradford Jr.'s comment about decoration inflation brought to mind a story from my astronaut years. My commander for my second shuttle mission, Robert "Hoot" Gibson, was a decorated US Navy pilot. At a crew party at my home, my son, a Notre Dame USAF ROTC junior, commented to Hoot that he wore more ribbons on his ROTC uniform than Hoot wore on his Navy uniform. Hoot derisively replied, "You Air Force weenies get a ribbon for waking up in the morning."

Fast-forward to the third day of our DOD shuttle mission (STS-27). We experienced a minor emergency in the form of a humidity-separator malfunction. Water was accumulating on the outside of the equipment and leaking into the cabin. The threat that it could be ingested into our avionics cooling system and cause electronic failures made it an emergency that required immediate action. Hoot and Bill Shepard, another Navy officer, had in-flight maintenance duties, so USAF pilot Guy Gardner and I grabbed cameras to document their work. As that was proceeding, I looked to Guy and teasingly said, "We'll probably get a medal for this." Hoot immediately looked up and answered, "Yeah, you guys will probably get the Air Force incredible service award with oak leaf clusters, shooting stars, and flames!"

The problem was fixed and the mission successfully concluded in December 1988, in time for the formal astronaut office Christmas party. All the military astronauts came in their mess dress uniforms, of course bedecked with their decorations. In my preparations for the party, I mentioned Hoot's comment about the Air Force incredible service award to my wife and that sent her on a search of her mom's costume jewelry. She located two large and very gaudy items of that jewelry and put them on ribbons. I hung one around my neck and gave the other to Guy Gardner to wear with his uniform. We then walked into the party together and up to Hoot, who immediately saw the obnoxious glittering baubles and remarked, "Oh my God, they really did give you the Air Force incredible service award!"

On a serious note, if the requirements for modern-era combat decorations mimicked those given for World War II air operations, most of us Vietnam-era aircrews would only be wearing one Air Medal.

Col. Richard Mullane,
USAF (Ret.)
NASA astronaut (Ret.)
Albuquerque, N.M.

Oceanfront Property in Arizona

I found a couple of things in the July/August 2019 issue very interesting! First, Mr. Scott Shannon's letter seemed to come from someone who has never seen an aircraft development or acquisition before ["Letters: Wouldn't It Be Nice," p. 3]. At some point, the same letter could have been written about the original F-15, F-16, F-22, F-35, and, I suspect, every other fighter ever developed. Before we buy it, every aircraft is delivered, to paraphrase Shannon, immediately fully combat capable, is simply upgradeable, will be "fully tested (whatever that means)," the software will work perfectly, will be almost always 99-plus percent [fully mission capable], and never miss the target. Somehow, between the sales pitch and delivery the real world intervenes. I'm glad Shannon likes the F-15EX, but if he really believes all those things, I want to talk with him about a bridge in Brooklyn.

The other amusing comment was from the interview with Lt. Gen. Brian T. Kelly ["Questions & Answers: Specialty Officers Needed," p. 12]. Kelly was quoted as saying, "The development and promotion system we have today has served us really well." With all due respect to Kelly, of course, I'm sure every three- or four-star would make the same statement. Of course the system worked; it picked them. With that said, I have mixed feelings about the proposed new promotion system. Although much of it sounds good right now, I question our ability to change it after we identify the unintended consequences.

Lt. Col. Art Bierschbach,
USAF (Ret.)
Brighton, Colo.

Another 'new idea' that was a 'bad idea' only to be resurrected, as they often are ["Questions & Answers: Specialty Officers Needed," p. 12].

As I worked my way up the ranks, I was a C-130 pilot, acquisition officer, C-141 pilot, combat tactician (weapons instructor course-grad), transportation officer, senior logistician, log. group commander, systems engineer, and senior analyst in A9. After attaining the rank of O-6, I ran a systems integration office for C-17 beddown, ran the Iraqi Air Force Advisor Group, and retired as the chief of [test & evaluation] in AMC. I did these things because I could learn and adapt. That skill set me above the rest and earned me promotions (without sponsorship), not because I was a technician, but because I could *lead.*

Leaders are leaders first. Increasing the promotion rates for doers [vs. leaders] will only serve to further erode the confidence our airmen have in their leadership. A1 needs to get back to the proven truth that leaders should lead, not do.

As an aside, while I was working in A9 for an O-6 analyst, I told him quite rightly that the Air Force didn't need any analysts—just smart pilots. We just don't promote them.

Col. David Penny,
USAF (Ret.)
Seminole, Ala.

Not Knots

Retired Lt. Gen. [David A.] Deptula does a good job of summarizing the advantages of using USAF bombers for maritime search-strike missions ["Maritime Strike," September, p. 56]. However, he does not address how

the high demand and limited number of airframes impact the viability of this proposal. Nor does he address the option to develop/deploy space-based assets for beyond-the-horizon cueing of submarine, surface ship, or airborne strike platforms. This is certainly within our fiscal and technical capabilities and is a force multiplier that should be considered, unless the real object is to lobby for more bombers. Finally, as a nine-plus year B-52 "crew dog" with extensive sea surveillance experience during the Iranian hostage crisis, I take exception to the graphic titled, "Bombers' Range Advantage" that states: "Two B-52s flying at 600 knots can cover 140,000 square miles of ocean area in two hours." No one can dispute the great advantage long-range aircraft have over surface vessels for wide area search. But I don't think a B-52 can cruise at 600 knots.

Col. Marc J. Dinerstein,
USAF (Ret.)
Woodstock, Ga.

First, I want to compliment retired Lt. Gen. David. A. Deptula on putting the focus on China in the Pacific. For too long, I think many Americans have been fooled by the carefully cultivated image of China as a cuddly panda bear. As the recent China suppression efforts in Hong Kong show, it is the Communists who are in charge, not panda bears. China has aggressively seized islands in the South China Sea that are clearly not in their exclusive economic zone and intimidated other countries to do so. Joshua Wong of Hong Kong has warned Taiwan that they may be next. Second, I think Deptula did an excellent job of showing how airpower can play a powerful role with a quick-reaction time. However, I worry about our thinking in terms of numbers.

Yes, China has a Navy with about 300 ships. Certainly, a force of 15 B-1 bombers carrying 20 anti-ship missiles each could go a long way to countering this threat. But I think we should be thinking in terms of how to counter thousands of ships. If we look back to D-Day, it is worth remembering that 6,939 ships were involved: 1,213 Navy ships, 4,126 landing ships, 736 auxiliary ships, and 864 merchant vessels. A force of 15 B-1 bombers, or even a greater force of bombers, is not going to stop 6,939 ships. I think we need to examine this issue more closely. Certainly some ships would be large enough to warrant a LRASM or Harpoon but many might be smaller, and even a SDB might disable or sink them. Maybe we need to think of additional delivery systems such as developing the capability of a C-17 to deliver standoff missiles. Theoretically, it could carry nearly 100 Harpoons or 500 SDBs. A force of just 15 C-17s could be a potent weapon. This is just one idea. The important thing is to focus on the right threat numbers. Certainly, it can be pointed out that the Chinese do not have 4,000 landing ships. But the Chinese do have 5,000 large ships and countless smaller craft. Even if they are not purpose-built to be landing craft, they could get the job done. Let's recall that 850 small craft not designed to be landing ships evacuated 338,000 troops at Dunkirk.

William Thayer
San Diego

Low-Observable License Plate

Regarding "From Out of the Shadows" in the September issue [p. 63]: There was another "unofficial" announcement of the F-117A besides those mentioned in the article.

More than 20 years ago, I was riding with fellow aviation artist, Mike Machat, in the Los Angeles area. We were astonished to see an automobile sporting a license plate that read: F117A. (I don't remember if it included a hyphen.) Our jaws dropped because the license plate was an older style that was not issued after 1980. This meant that the classified designation was on display well before the Nighthawk was officially identified publicly in a blurry photograph in 1988. It was definitely not low observable. We were mystified.

That was where things stood until last year, when I mentioned the incident to a colleague who had worked with the B-2 program at Edwards AFB, Calif., back when both the B-2 and F-117A were being developed surreptitiously in adjacent facilities. She informed me that the license plate I described belonged to Denys Overholser, father of the Echo 1 computer program from which the Nighthawk was derived. She said that he had two cars and was forbidden to drive the one that bore the aircraft designation to Lockheed. She also related that the B-2 team referred to the F-117A by the term Faceted Array Reflective Technology, or FART. Mystery solved.

Hank Caruso
California, Md.

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QUESTIONS & ANSWERS

A New Way to Build Fighters

Will Roper, the Assistant Secretary of the Air Force for Acquisition, Technology and Logistics, is the point man within the Air Force for accelerating acquisition and finding ways to leverage technology to save money and build a more lethal Air Force. He served previously as the head of the Pentagon's Strategic Capabilities Office, and before that as the Chief Architect of the Missile Defense Agency. He spoke exclusively with Editorial Director John A. Tirpak about the Next-Generation Air Dominance (NGAD) system, and Roper's "Digital Century Series" concept for developing future combat aircraft. This is an excerpt from that interview.

Q. Air Combat Command needs a new air superiority capability by 2030, and the Air Force is talking with industry about possible technologies. But it seems like you want to restructure the way you design and build aircraft before you jump into NGAD.

A. I don't think the immediate set of technologies for NGAD … have shifted at all. They are a good set. I wish we could talk more broadly about them, but they make sense.

But how we build aircraft, that doesn't make sense. Approaching NGAD the way we did the F-35 would put us at great risk. It would shrink the industry base even further and incentivize companies to get out of the fighter-building business.

The idea of the 'Digital Century Series' is not about building aircraft that are different, but about building aircraft differently. The key tenet is a new 'holy trinity' of technologies that would flip the pace of building new things and the price we pay for them. That trinity is: agile software development—no surprises, there—modular, open-systems architecture—because we want to be able to change out components quickly and seamlessly—and, finally, digital engineering, which is the new element.

We're accustomed to doing things digitally in the Air Force. Flight simulators, for example, help pilots get proficient faster than just flying. It's cheaper to do it that way, as well.

Digital engineering brings that same idea into design, production, and sustainment. It brings a high level of fidelity, and not just in the design of the aircraft. It's the assembly line, where people are doing work; what work is being done; the machines that do the work; the tooling. … All digitally modeled, so you can optimize it. You can get expensive tooling out if you can find a better substitute. You can change a process from requiring an artisan with years of training to one requiring a lower skill level. The idea is to find a better way of assembling things, and raise the learning curve in the digital space, before you ever build the first aircraft.

The ambition—which I think is completely achievable—is building the first airplane as if it was the hundredth.

Q. Are there any examples that prove this works?

A. The T-7A [formerly known as the T-X] trainer is one. It gives you a leading indicator that when you apply digital engineering—and Boeing has, for that airplane—amazing things are possible. Now we want to show that we can do the same thing for advanced aircraft, and bring in the software and modularity. Everything is empowered by software—we want to have apps on airplanes that change every day if necessary—and the modularity because we want to be able to change the subsystems frequently.

Think about combining those things. You could be in production at a very low rate with a very small team if you get the hard tooling and highly skilled workforce out of the assembly line. You could build airplanes LEGO-style.

Q. So this lowers the bar for companies to compete for design work?

A. At the time of the original Century Series [the F-100 through F-117], we had over a dozen companies that could design and build airplanes. We want to get back to that, where companies design things and build them at a small rate.

With digital engineering, as technologies mature, you can modernize the design; cut new things into production without slowing down the flow. And do it between multiple vendors so that there's competition.

Q. Instead of winner-take-all, you'll have multiple companies designing aircraft for you constantly?

A. Multiple companies designing and building concurrently, with different technologies, and not designing 'X' planes but aircraft that could be produced in quantity—if the nation needs them—and flown by any pilot in the Air Force without specialized training. That's the core idea.

We hope for radically different results in terms of quality, and to keep quantities low until we need quantity in bulk.

We have to try something different, because we have so few major acquisition programs that it has shrunk the industrial base for tactical aircraft down to two or three companies that can do it. We have to change the paradigm so there's profit in design, and not ask companies to buy into a program, and hope to make

"Wings Through Time," a painting by Robert Emerson Bell, inspires USAF acquisition chief Will Roper to aim for a return to rapid introduction of new airplanes.

their investment back in production and sustainment of a large number of things.

If we don't change that, we're in danger of collapsing to a single national fighter company, and that is not where we want to be.

Q. It used to be, companies lost their shirts in design, but made profits later. That's been the model since the 1980s.

A. See, we don't want people to lose their shirt in design. We want people to get paid in design. If you want a cutting-edge Air Force, give companies profit for designing cutting-edge things.

I love design. That's where I want to be. The last thing I want is a program saying, 'hurry, hurry, let's get into production' and not think about cutting-edge because we're already in the hole. That's the model we now consider normal, and there's nothing normal about asking industry to lose money in design if you want to be cutting-edge.

Q. What would change in the usual production process, particularly on the back end?

A. With the Digital Century Series, we want to give profit in design, keep production rates low, never go to 'full rate' production, not buy hundreds or thousands of things so that we can keep upgrading and modernizing, and re-competing who builds the next aircraft every few years. If we do this well, and digital tools become common industry practice, you don't have to be a producer of thousands to be a competitor. You can be a competitor as a great design company. And if this sounds like science fiction, it's already happened in the automotive industry.

If we do it, we can start building cutting-edge aircraft every few years, and … we can build satellites this way, as well.

Q. How many would you make?

Maybe a wing's worth or two wings' worth of aircraft, not designing them to last 30 years, but with a shorter service life so we retire the airplane as the next aircraft comes online. We could grow the industrial base again. And if we do one every four or five years, then we can impose cost on our adversaries, because they'd never know what's on the next airplane we're fielding.

What would be great for a platform developer is, they could keep their design teams together and profit from doing it. No win would be a big one, and no loss would be a big loss, so you don't have to fight us in court. The loser cannot lose and be out forever. There has to always be a way to enter and keep designing. You just need to get back to designing the next one.

Q. Notionally, how many are we talking about? 50? 100?

A. That's part of why I'm going to focus a whole team on doing this, with a program executive officer to lead. It'll be a special organization with autonomy, similar to Big Safari, with a very different mission, but focused 100 percent on building digital aircraft.

I've been discussing this with industry, the platform manufacturers, the suppliers, and there's general enthusiasm. You can imagine, the idea of building things frequently has a lot of appeal. Because the intervals between major programs have grown to about 20 years. But there's a general sense of caution as well, because this is new.

The idea has appeal, too, because they … would not be in a place where they have no idea when the next fighter or bomber is going to be built.

This is different from 'X-planes' because those are about high-tech demonstrators, never meant to go into production. We're designing these with the idea that any one of them could go into production. And we'll crunch the numbers, but we envision that production of 50-60 is probably the minimum for any aircraft, because if we make too few, there's no business case for industry.

General [Mike] Holmes, [commander of Air Combat Command], sees operational advantages to this, but what I've been told is, it's more difficult to use anything less than a wing of about 72 aircraft. Doing this every five years, and maybe four, an acquisition strategy might look like: award a contract for 50, and then evaluate whether or not you want to award another option for 25, and then another option for 25. And then, at year four, move into competition for the next aircraft. And if you're not happy after 50, maybe switch to a new design earlier.

I'm envious, because I'd love to be the program manager for this.

There's a painting in the Pentagon with every airplane used by the Army Air Corps and Air Force, ["Wings Through Time" by Robert Emerson Bell]. And it shows that at the beginning, there was this big boom in development, but as you get into the Cold War, the aircraft get more sparse. And every time I pass it, I think, 'I wish I'd gotten to do acquisition during the earlier parts of the painting.' How exciting it would have been to have a new airplane coming out so frequently?

Q. How long would you keep these airplanes?

A. We don't yet know what to tell industry to design for, in terms of service life. We're going to have maverick-y maintainers and sustainers on the team. I've asked General [Arnold] Bunch, [head of Air Force Materiel Command], for help on this because we don't want these things to go through 30-year service lives. We want to balance the number of flight hours with the pace at which we can upgrade. And if we do that, we don't end up doing deep overhaul maintenance at the depots because we're taking them out of service sooner.

The good news is, we can pull some of the profit and cashflow industry currently gets from long-term sustainment contracts and plow that back into design and micro-production. So, we won't get any new money from Congress, but we can shift where it's spent. We're not going to compete with China by sustaining old things well.

Q. So you can apply this idea to unmanned aircraft as well?

A. You can apply this to anything. And although this is not a sharper point on the spear, it is a much faster spear-building process, and that's what our adversaries should fear.

I want to achieve the same revolution in aircraft and satellites and weapons that the automotive industry has achieved. Our cars [today] are increasingly digital, they run forever and they never break down. And companies can produce multiple cars in the same production lines, seamlessly, without any bump in progress or flow. We could do that.

Q. Is there enough time to apply this to NGAD? Can you risk figuring this out on such an important project?

A. We've got a set of technologies ready to go. We've got a healthy supplier base for the subsystems and they are excited to bring technologies to us, but they're not all at the same level of maturity. There's value in beginning—and demonstrating—that we can make this digital process work, getting some advanced tech on the airplanes that we don't have today, and then including the additional technology from the subsystems as it matures.

How we go forward is a warfighter decision. I will offer best advice on what's possible, and they will pick and choose what we do and when. But we've had great support from our senior leaders. I fully expect that we will begin as soon as we've figured out how you make a positive business case, balancing all the variables of design timeline, technology, maturation, sustainment, and then what it takes to make this profitable for industry. ✪

By John A. Tirpak

Time to Revisit Roles and Missions

The 1948 Key West Agreement established the roles and missions of the armed forces. With few exceptions, the decisions made then continue to stand today.

Yet changes in technology, services organization, and a reorienting of the US military to peer threats from China and Russia have Air Force leaders talking seriously about a new roles and missions debate.

A redivision of labor among the services would address space and cyber, neither of which existed as warfighting domains 71 years ago, as well as new technological realities and operating concepts, and it would color in gray areas where roles and missions among the services overlap or are under served.

Defense Secretary Mark T. Esper, speaking at AFA's Air, Space & Cyber Conference in September, said he's leading two reviews of the Pentagon this fall: one on budgets, and the other regarding force posture and operational plans. That second review will focus on whether the services are "doing the right things," Esper said. He said he's not convinced the services are "optimized" in terms of where they are located and what they do, and specifically noted that the Air Force must be prepared for the "full spectrum" of kinetic and nonkinetic threats in multiple domains.

One area ripe for discussion is base defense. Air Force leaders at the conference said their new agile deployment concept will require deploying squadrons with ground-based air defenses, which means they would take up a role traditionally performed by the Army. Under the concept, small numbers of fighters and other aircraft would move rapidly from one austere airstrip to another, the better to complicate the dilemma for an enemy trying to target them with precision weapons. The Army has neither enough air defense systems to protect all those expeditionary units, nor are the systems small and lightweight enough to be rapidly mobile using minimal airlift.

Pacific Air Forces Commander, Gen. Charles Q. Brown Jr., asked about the roles and missions debate, said, "We need to think about it." The Army's Patriot missile batteries and Terminal High-Altitude Air Defense (THAAD) systems are too unwieldy to lend themselves to USAF's goal of moving a half-dozen fighters to a location supported by a single C-130 full of technicians and equipment, Brown said. A Patriot battery can fill up to seven C-130s.

"THAADs and Patriots ... take a lot of lift," Brown said. He's talking to Air Force Research Labs about systems that would be lightweight and based on lasers or high-powered microwaves.

Lt. Gen. Thomas A. Bussiere, commander of the Alaskan North American Aerospace Defense Command Region, which is part of NORAD, said USAF "absolutely has a requirement" for ground-based air defenses both at home and abroad. The range of China's new missiles means there's "no sanctuary" anyplace.

"We have to have the tools to engage that threat," he said.

Mark Gunzinger, who led an Air Force-sponsored review of its future force structure for the Center for Strategic and Budgetary Assessments earlier this year and now works for AFA's Mitchell Institute for Aerospace Studies, said China would have an "easy job" of wiping out Air Force assets in the Pacific, concentrated as they are at a few well-known locations such as Guam and Okinawa.

The Army "does not have the resources it will need to defend our bases," Gunzinger said. Air base defense "should be an Air Force role. The Air Force should take that on."

Photo: Mike Tsukamoto/staff

Secretary of Defense Mark Esper is reviewing service roles and missions to better align with the National Defense Strategy.

ABORTED REFORMS

At the Key West meeting of 1948, the newly minted Defense Department hashed out who could have airpower, and for what ends. The Army got to keep helicopters and light aircraft for scouting and some intratheater transport, while the Air Force took over strategic and tactical functions, from bombers to close air support. The Navy was allowed to continue to have aircraft carriers and employ aircraft for almost any function, and kept its own ground force, the Marine Corps. The Navy had to give up its ambitions to conduct strategic bombing, including a "super carrier" program that would have been able to launch strategic bombers, while the Air Force got to proceed with its B-36 mega-size bomber.

Despite attempts to revisit the Key West deal through the years, it has largely remained unchanged. Congress last ordered the Pentagon to conduct a roles and missions review in 2008, when it directed the Defense Department to assign responsibilities for cyber; unmanned aircraft; intelligence, surveillance, and reconnaissance; intratheater lift; and "irregular warfare."

The Pentagon's 2009 response boiled down to an "every service for itself" approach, frequently using the phrase "each [service] has significant responsibilities" to explain the roles breakdown for each area under review.

The Air Force had sought to be the Executive Agent for unmanned aircraft in the runup to that review, arguing that its regular function of managing and deconflicting airspace above 15,000 feet made it

a logical choice to guard against aerial collisions between manned and unmanned aircraft.

Yet even though the idea was endorsed by then-Vice Chairman of the Joint Chiefs Adm. Edmund Giambastiani, at the time, then-Defense Secretary Robert Gates decided against it. Gates, who confessed abiding suspicion of the Air Force in his memoir, considered it a "turf grab," and as a consequence, all the services have pursued their own unmanned aerial vehicle programs ever since. They're supposed to be coordinated by a joint group, but it has no authority to shift resources between services or overrule a branch's plans.

SPACE FORCE BOMBERS?

The Pentagon is also working toward creating a sixth branch of the Armed Services—Space Force—that will have responsibility for conducting war in space. But space is an intrinsically multi-domain fighting arena. Ground stations that can launch rockets, high-energy lasers or microwaves at satellites are a direct threat to US space assets.

"Should Space Force have bombers to attack ground control stations? What about ground-based GPS jammers?," said retired Lt. Gen. Bruce Wright, president of the Air Force Association, and former commander of 5th Air Force and US Forces, Japan. "And what about 'Rods from God?' We've known those are coming for a long time."

Wright was referring to a concept explored in a 2005 Air Force "Transformation Flight Plan" that foresaw 20-foot tungsten poles that, dropped from orbit, could pack the equivalent force of tens of thousands of pounds of TNT. Would Space Force be in charge of ground-based defenses against such hypersonic ballistic weapons? Today, the Missile Defense Agency is responsible.

In a February report on Space Force, DOD said the new service will "synchronize" space doctrine, organization, training, materiel, leadership, education, personnel, facilities, and policies regarding the space domain. It will build "forces and capabilities," be the service with the most space expertise, and be the "advocate for spacepower." It will have the duty of "deterring aggression and defending the nation, US allies, and US interests from hostile acts in and from space, and make space capabilities available to all the other services as an enabling function."

Most of Space Force's specified duties make obvious sense. It will have responsibility for space launch, for example; detecting nuclear detonations in space; maintaining space situational awarenesss, etc. But Space Force bombers? The document says only that the new service would develop "prompt and sustained offensive and defensive space operations to achieve space superiority."

A senior Air Force official said the wording was intentionally "left vague, because those are things we are still working through."

A new roles and missions debate might not be just about the kind of operations the services undertake, but could also address how they divide geographic responsibilities. Last January, then-Air Force Secretary Heather Wilson and Chief of Staff Gen. David Goldfein penned an op-ed in which they noted that the Arctic is becoming increasingly contested as the ice melts and the sea becomes more navigable. They argued that heightened Arctic activity by China and Russia, the prospect of new resources in the region, and the Air Force's concentration of a lot of its Pacific firepower in Alaska warrants a review of what the services are doing in the region.

"The 2019 National Defense Authorization Act requires an updated Defense Department Arctic strategy outlining the roles and missions of each service in the region," they wrote. "World events and history suggest it's time to move out smartly to protect our vital national interests."

Photo: TSgt. Matthew Fredericks

Crew chiefs run though diagnostics for an F-15 at Kadena AB, Japan. PACAF is particularly vulnerable to Chinese aggression.

ARMY-CENTRIC THINKING

A new, formal roles and missions review would likely be led by Air Force Gen. John E. Hyten, Vice Chairman of the JCS, who has had an extensive career in the space business and knows as well as anyone what will be needed for a Space Force and missile defense. But Hyten will answer to Army Gen. Mark Milley, Chairman, who brings a ground-centric perspective to any new division of labor among the services.

Milley ruffled feathers with an interview he gave over the summer in which he outlined four "myths" of war. One of these, he said, is that wars can be won "from afar." Americans have an unwarranted belief in technology, Milley said, and wars can only be won with "boots on the ground." Technology merely allows the US to "shape battlefields and set the conditions for battle," Milley asserted, "but the probability of getting a decisive outcome in a war from launching missiles from afar has yet to be proven in history."

Had Milley missed Operation Allied Force, in which no NATO ground troops were deployed in combat, and yet Serbia was compelled to give up its ethnic cleansing campaign and withdraw from Kosovo by a NATO campaign conducted exclusively by air?

Milley also said rapid mobilization for war is a fantasy, and that it takes a long time to generate the forces needed to prevail in a conflict. Yet the National Defense Strategy notes that the US will likely never again have the luxury of leisurely building up forces for an assault, with supplies and equipment brought by land, air, and sea, unharassed by enemy missiles or attacks. In the early days of conflict in particular, according to the NDS, the US will need to "win from afar."

Esper said in his AFA speech that his reviews of the Pentagon are focused on tightly "aligning" the defense budget and the activities of the services with the NDS.

"Everything we do must be aimed toward achieving the goals and objectives of that strategy," Esper asserted. It will likely be the best place for Milley to start in leading a new discussion of roles and missions. ✪

One of just 20 B-2 Spirits, all of the 509th Bomb Wing based at Whiteman AFB, Mo., lines up with an F-15C over the North Sea in September. Measure for measure, the B-2's fuselage is less than six feet longer than this F-15C Eagle. But when it comes to wingspan, there's no comparison: Four Eagles can line up wingtip to wingtip and still not span as great a distance as a single Spirit.

Photo: TSgt. Matthew Plew

Three F-35A Lightnings from the 63rd Fighter Squadron at Luke AFB, Ariz., fly in formation while one takes on fuel from a KC-135 Stratotanker over Arizona in August. F-35s are the newest combat aircraft in the Air Force inventory, while the KC-135s date back to the 1960s, and are approaching an average age of 59. With the new KC-46 still years from being deployment ready, those old Stratotankers will still be around a while longer.

Photo: Amn. Brooke Moeder

Stars and Stripes are forever, but bombs? Not so much. They're the ultimate in disposable weaponry. SrA. Alan Hernandez of the 3rd Munitions Squadron builds a GBU-32 on JB Elmendorf-Richardson, Alaska, during Polar Force 20-1, an exercise designed to practice Agile Combat Employment. The polar region is increasingly contested as the polar ice cap recedes and Russia and China flex their muscles.

Photo: Justin Connaher/USAF

New Tanker Still Years from First Deployment

Photo: SrA. Alan Ricker

A KC-46A Pegasus is suspended in a hangar for a landing gear swing test on Aug. 8 at McConnell AFB, Kan. Nineteen of the new tankers have been delivered to McConnell, Altus AFB, Okla., and Pease ANGB, N.H.

By Brian W. Everstine

The troubled KC-46 tanker will not be deployable for at least three to four years—forcing the Air Force to consider delaying planned retirements of the service's older refueling aircraft. Air Mobility Command boss Gen. Maryanne Miller is pressing Boeing to solve lingering problems with the aircraft's remote vision system.

"I'm looking at the fact that we're eight months into accepting our airplanes, and Boeing has not presented a solution that has met all the parameters," Miller said Sept. 18 at AFA's 2019 Air, Space & Cyber Conference. The Air Force has identified nine parameters that must be met and two in particular are proving "very difficult," she said.

She wants answers fast. "In a couple months—that's what I'm looking for," she said. "We've got to get this airplane into the fight."

As of late September, the KC-46 Pegasus still had four Category One deficiencies, the most serious category, including a recently discovered problem with the cargo lockdown system. The Air Force has, for now, barred the aircraft from flying with passengers or cargo during the pre-initial operational testing and evaluation flights.

"I'm looking at the fact that we're eight months into accepting our airplanes, and Boeing has not presented a solution that has met all the parameters."
—Gen. Maryanne Miller, head of Air Mobility Command

But the remote vision system (RVS) remains the most serious defect, affecting the essence of the tanker's mission. The system includes two cameras and sensors that together help the boom operator guide the boom to refuel other aircraft. The most serious problem is blurry vision; the system produces an image akin to 20/50 vision. Depth perception is also a problem. Although the system uses multiple cameras, the software challenge of seamlessly stitching the images together has proved particularly challenging.

Boeing knows "it has to meet all nine" in a "pass/fail" evaluation, Miller said.

Air Force Chief of Staff Gen. David L. Goldfein said in an interview that AMC's expectations for a three- to four-year period before the KC-46 is deployable is an "honest assessment," but he said such a long delay is unacceptable.

"I'll tell you, as Chief, I hope we can cut that down," he said. "Because quite frankly, I need it now. I really can't wait three to four years. I need them in the fight

Photo: SSgt. Mary McKnight

A KC-46 heads to a rendezvous with a KC-135. Both aircraft are based out of Pease AFB, N.H. US Transportation Command has announced it needs to retain 28 KC-135s past their planned retirement date because of delays delivering a war-ready Pegasus.

now. The nation needs it in the fight now, so do our allies and partners, so do our joint teammates."

Boeing said it has the "green light" from the service to upgrade the RVS system—once the parameters are met. "Maybe we had some fault on both sides defining what the system should look like," said Mike Hafer, the company's senior manager for KC-46 business development. But "we've established very objective data now on what the RVS should be able to perform."

THE COST OF DELAY

The Air Force had expected to begin divesting its 59 KC-10s and 96 KC-135s once the overall tanker inventory reached 479, according to written testimony provided to the Senate by incoming Air Force Secretary Barbara Barrett in September. But while the service should reach that threshold in November, Goldfein said the service can't afford to retire war-ready refuelers until the KC-46 can start assuming some of their missions.

"We can't retire until we have an airplane that's combat capable," Goldfein said. He described the discourse with Boeing as "brutal, honest discussions" intended "to make sure what they deliver is fully combat capable."

US Transportation Command had already announced that it needs to retain 28 KC-135s beyond their planned retirement date because of delays to the Pegasus. Now, Miller said AMC is looking at keeping even more Stratotankers around. "I'd love to slow down the retirement because I have to keep booms in the air."

In late September, the Air Force placed another production order with Boeing for the aircraft, a $2.6 billion contract for 15 tankers, engine spares, and associated equipment. The service expects to have 179 total KC-46s delivered by 2028, leaving 300 aging KC-135s to fill the rest of the refueling role.

As of late September, 19 aircraft had been delivered to the first operational base at McConnell AFB, Kan.; the training base at Altus AFB, Okla.; and the first Air National Guard location at Pease ANGB, N.H.

Longer term, the 2018 "The Air Force We Need" plan calls for adding 14 aerial refueling squadrons. In rolling out that plan, then-Secretary of the Air Force Heather A. Wilson said refueling represented "the biggest shortfall" in mobility based on the National Defense Strategy and analysis of current threats.

The Air Force and Air National Guard are upgrading their KC-135s, meanwhile, with Rockwell Collins under contract to upgrade the avionics of KC-135Rs under the "Real-Time Information in the Cockpit" program. The airplanes will get Link 16 data communications for the first time, coupled with the glass cockpit modernization from the Block 40 and Block 45 upgrade programs. The upgrades allow pilots and boom operators to see real-time intelligence feeds, enemy threats, targeting data, and blue force locations, according to the company.

Miller said one option for expanding capacity could be private, civilian refueling aircraft, which could help out in certain situations, such as training or meeting test requirements for other aircraft.

When the Air Force awarded the KC-46 contract to Boeing, the expectation was that development would be relatively quick, since it was a modification to the established 767 airliner. And while that hasn't proven to be the case, Goldfein said the 767-base has shown capabilities.

"I've flown the KC-46, I think it's going to be a great airplane," he said. "I was excited. When you buy a commercial derivative, a 767 essentially, a lot of things come with it, because they build it for commercial." That includes a great autopilot, he said, and a solid airframe, "built for stability." That "turns out to be one of the attributes we need to be on the boom."

Just as important is its ability to support future growth. The airplane has 13 stations on it that are available for communications and other equipment to increase the airplane's situational awareness. "If you look at it not as a device, but as a node in the network, with the 13 additional stations and additional power to plug in," Goldfein said, "you've got expansion capability for multi-domain ops that I don't have in the current fleet."

So now the Air Force and Boeing must work together to ensure they are "equally confident" that the KC-46 can meet all the needed requirements, he said.

"Having been refueled, and pulled out of a lot of bad places by courageous tanker crews," Goldfein said, "I want to make sure they have exactly what they need, especially those boomers. They need to have a system they're confident in." ✪

Planning for a Bigger Bomber Force

Photo: TSgt. Jared Denton

Airmen ready a B-52H during exercise Global Thunder at Minot AFB, N.D., in November 2018. Plans to re-engine the venerable bomber will improve fuel and operational efficiency and extend its service life.

By John A. Tirpak

The Air Force will propose in its 2021 budget request to build a larger future bomber force of at least 225 aircraft—but it will give up some bomber capacity in the short term to get there.

USAF leaders at AFA's 2019 Air, Space & Cyber Conference in September hinted at the change in plans repeatedly. Acting Air Force Secretary Matthew P. Donovan, Chief of Staff Gen. David L. Goldfein, and Gen. Timothy M. Ray, head of Air Force Global Strike Command, all telegraphed the changes, which seek to add at least 50 bombers to meet the requirements of the National Defense Strategy.

Goldfein said he'd like to accelerate the rate at which new B-21 stealth bombers are bought, once the design is proven, and he also said he's in favor of buying more than the planned 100 airplanes.

The B-21, which Northrop Grumman is developing, is "at the very top of the list" of Air Force programs in terms of how well it's being managed and proceeding on schedule, Goldfein asserted. Though it is unlikely Northrop can speed up development, he said, "I'm hoping we can accelerate the numbers."

Goldfein cited external studies that peg the right B-21 inventory at more than 100 airplanes, and "I'm 100 percent in lockstep" with that thinking, he said.

China, he said, is the "priority" threat to confront, and the long distances across the Pacific place a premium on aircraft with long range and a large payload.

"Bomber aviation is in high demand." With 175 bombers now in the inventory, "we have to grow."
—Gen. David Goldfein, Air Force Chief of Staff

"Bomber aviation is in high demand," Goldfein said. With 175 bombers now in the inventory, "we have to grow."

Ray said the requirement should "grow past 225."

The US Air Force is really the only one among its allies with a true bomber capabilities. Allied air forces almost all have fighters, and some even have advanced, fifth-generation types. Many have tankers and intelligence, surveillance, and reconnaissance aircraft. But no one else brings bombers to the fight.

"My point isn't fighter versus bomber," Ray said. "My point is, there are no allied bombers. The last allied bomber retired in 1984" when Britain retired its Vulcan fleet.

Without getting into details, Donovan said that last year's Air Force white paper, "The Air Force We Need," laid out a requirement for seven additional bomber squadrons, a figure vetted by the Center for Security and Budgetary Assessments and the MITRE Corp. He said Congress has asked for specific numerical requirements for bombers and fighters by March 1, 2020.

The Air Force has never said specifically when B-21 production will commence. Vice Chief of Staff Gen. Stephen W. Wilson recently revealed that the first test flight is slated for late 2021, and Global Strike Command's 2018 "Bomber Vector"—its long-range plan

for the bomber force—projected retiring B-1s and B-2s in the early 2030s. Assuming that the first operationally configured B-21s roll off the production line in 2024, and the first 100 are delivered by 2031, that would suggest a production rate of about 14 a year, or about the same as the KC-46 tanker. Goldfein didn't say what his preferred rate of purchase would be, only that it would be greater.

The B-21 contract was awarded in 2016 and the program reportedly completed critical design review—a major program milestone—in late 2018.

Ray said he will "spend the next couple of months really pounding on the data" to determine how much he can accelerate B-21 production. But he acknowledged that it will be "several years" before there is a definitive answer. "I'm going to stay away from dates."

BYE-BYE, BONE?

The B-1 fleet has been used extensively over the past two decades and is experiencing "significant structural issues," Goldfein said. The B-1 was designed to fly low and fast, with its wings swept back, but in the fight against the Taliban in Afghanistan, it typically flies slowly, with wings swept forward, waiting to be called on to provide close air support to troops in contact. Its high payload and ability to dash to the scene of action made it the platform of choice for that mission, Goldfein said, but the loitering configuration put unexpected stress on the wing attach points and sweep mechanism.

The wear has become so bad, in fact, that at one point last summer, only six B-1s were mission capable. That has Air Force leadership weighing whether it would be "cost prohibitive" to put the B-1 fleet back in "code one" condition, Goldfein said.

Gen. Arnold W. Bunch Jr., head of Air Force Materiel Command, said USAF doesn't yet know how much service life can be squeezed out of the B-1. He said in an interview that a structural fatigue test on a representative B-1 airframe has been underway for several years; it has had to be suspended twice to allow for repairs, first for a fuselage break in 2016, and then again for a wing break in 2018.

"If you break something, you have to design a repair, do that repair, and then continue," Bunch told *Air Force Magazine*. When a "life-limiting" break occurs, the test airframe is repaired using the same kind of fix that would be performed in the fleet, to ensure the test airframe is representative of operational jets.

How long will the fatigue test go on? "We'll continue to test up until the point we know we can't fix it anymore," he said. "Or we'll get to a point where we won't fly the airplanes anymore."

Does the Air Force have enough data to make an informed decision about whether the B-1s can continue to serve?

"That's all part of the discussion we're having," Bunch said. The Air Force and contractor Boeing are analyzing the costs of repair so "we can make an informed decision on how we move forward, as an Air Force."

The B-1 and the even older B-52 are both "old airplanes" and "not very easy to work with," Ray said. But, "we're working on a plan."

Over the last year, the B-1 has been beset by problems, including the emergency escape systems. Maintenance crews have put that downtime to good use, he added, noting that at Dyess AFB, Texas, the B-1s were afflicted by 1,400 "discrepancies," or backlogged maintenance issues. Ray said that backlog had been knocked down to 400 and is headed lower still.

He said time-compliance technical orders would be completed by October, "much faster than we thought," while required depot maintenance is also not "as extensive as we thought."

Photo: SrA. Thomas Barley

Airmen conduct a hot-pit refueling on a B-2 at RAF Fairford, UK.

In the fatigue testing, "there were 12 things that we thought might impact the entire fleet. It turns out only two impacted a portion of the fleet," and he expected a return to "near-normal" operations in the fall.

One big change: Ray said the Air Force has probably come to the end of using bombers as close air support platforms. "I think it's incredibly important that we really look beyond CAS," he told reporters. "I think that debate is clearly closed."

While using B-1 and B-52 bombers as flying munitions dispensers on call to defend ground units probably "saved a lot of American kids," he said, "we've got to move [on]."

The B-1 is too important in its low-and-fast design intent to long-range power projection, Ray said. "The good news is, how we're going to operate is going to be different from what we're doing in Iraq and Afghanistan," he noted.

He sees the B-1 carrying "four, and potentially eight, large hypersonic weapons" on its internal rotary launchers, while its external hardpoints, sealed to comply with START treaty obligations, could be "opened up" to support carriage of the AGM-158 Joint Air-to-Surface Standoff Missile (JASSM) and its variant, the Long-Range Anti-Ship Missile (LRASM). The B-1 would thus become a high-speed standoff attack platform, armed with cruise missiles and other weapons.

"There's a lot more we can do," Ray said. The B-1 could be an important tool in the conventional fight against a peer competitor, Ray said. "We're taking a very close look at how we might make that adjustment here very soon."

That optimistic view seemed to clash with the idea that B-1s might be retired early. That some B-1s retire early and others remain for the long-range, stand-off attack role appears the likeliest scenario.

Goldfein said one idea is to retire some of the B-1s, "and then flow [the savings] into doing some key things" within the bomber portfolio. Besides equipping the B-1s for cruise missile attack, USAF could buy "long-range strategic weapons" to put on them. Meanwhile, plans to re-engine the B-52 with more efficient power plants "not only keeps the B-52 viable, it also decreases our tanker requirement [potentially meaning] I can buy B-21s faster," Goldfein said.

In a press conference, Ray said he's confident that the B-52s can be kept "very viable" using their original TF-33 engines, with help from original manufacturer Pratt & Whitney, until the re-engining work can be performed. He said he was more confident today that TF-33 will last until a new engine can be installed than he was a year ago.

"We have a good game plan there, so that's getting healthy," Ray said. "We have to be very smart with what we have and play the hand of cards we've been dealt to the best of our ability," he said. If they do that well, he went on, the Air Force can "build a better roadmap to get bigger." ✪

DOD Aims High With Ambitious Launch Plans for Space

Photo: Van Ha/USAF

USAF's Space and Missile Systems Center lofts an Advanced Extremely High Frequency satellite atop a United Launch Alliance Atlas V rocket on Aug. 8, 2019, from Cape Canaveral AFS, Fla.

By Rachel S. Cohen

The Pentagon is betting on a new era of satellites and launch, driven by the Air Force's transformation of its own space enterprise as well as the entrance of another major player: the Space Development Agency.

SDA and the Air Force Space and Missile Systems Center are taking their own first steps toward faster, more flexible launches that will push US space assets to new orbits, even as the debate over whether and how to stand up a new military service for space continues in Washington, D.C.

"Our reorganization is threat-driven," SMC Commander Lt. Gen. John F. Thompson said at AFA's 2019 Air, Space & Cyber Conference. "The reason that we have to operate more as an enterprise, rely on partnerships and new innovations, have a new culture … is because the threat and the concept that space is no longer a benign environment, but is a warfighting environment, and we need to be prepared for it."

The new era of launch will be defined by satellites that last not two decades, but less than one; that rely on commercial technology, not specialized military parts; and that consist of not a few dozen satellites for each purpose, but hundreds. SMC's goal is to build out vast constellations of satellites that can continue to meet mission needs even if some stop working or are attacked.

"Our goal going into the future is to get more on a three- to four-year cycle for our satellites, not just in production, but also in terms of their usable time on orbit," Thompson said. "We are not trying to build super-exquisite satellites anymore that will last 20 or 25 years on orbit."

"Our goal going into the future is to get more on a three- to four-year cycle for our satellites, not just in production, but also in terms of their usable time on orbit."
—SMC Commander Lt. Gen. John Thompson

SMC, which recently redesigned itself to handle programs based on where they are in their life cycle instead of by mission, also wants to shrink the number of ground control systems by using more multipurpose controls.

In addition to charting out space's role in war, military officials are imagining how Defense Department and Intelligence Community assets could aid the federal government's push to return humans to the moon and beyond. Heading that effort is SDA, which must ensure the work of each space acquisition group in DOD is compatible and moving toward the same goals.

The Air Force is focusing on assets that will sit from low Earth orbit to geosynchronous orbit, while SDA wants to cover GEO to cislunar orbit as the area becomes more crowded: "We're working with the Air Force so that we can ensure we get those data back down to the [National Space Defense Center] to fit in with the existing space situational awareness architecture," Acting SDA Director Derek M. Tournear told reporters.

In divvying up the future space architecture, SDA will split responsibilities for funding and launching satellites into multiple layers with the Air Force, Missile Defense Agency, and others. Those layers' missions span missile tracking, data transport, communications, and more.

The vision, which has slightly changed since DOD created SDA in March, now looks farther out into space. SDA learned from its initial outreach to industry that advances in commercial technology will allow the military to operate assets out to 1,500 kilometers. The Pentagon needs fewer satellites the higher up it goes, Tournear said.

SDA's goal is to help the US and its allies move through and communicate in space as new players look to the cosmos. Tournear suggested there could be undiscovered objects floating in farther orbits that might pose threats to those efforts and should be documented.

"As the US, our allies, and commercial companies want to go more and more to the moon, we want to ensure that we can maintain identification of threats within that region," he said. "That's a region that has not been an area that people have worried about before, and so that's an area that now we're going to start to make sure that we can detect objects that are operating in that area."

Going forward, DOD wants to leverage competitive prototyping and commercial tech to drive down the cost of putting new products on orbit. The department has military requirements for satellites of all sizes, from experimental cubesats to constellations of larger assets that mirror legacy constellations.

Compared to current satellite programs that cost hundreds of millions of dollars per unit, SDA looks to get down to tens of millions. Differing from his predecessor, Fred G. Kennedy, Tournear said the Pentagon wants to buy those assets instead of leasing them from industry.

"You're looking at satellites that are $12 [million] to $20 million apiece, roughly, to be able to do these kinds of military missions," Tournear said. "Multiply that by the hundreds of satellites we're talking about launching, factor in that you're going to launch, say, 20 or more satellites at a time on a commercial launch vehicle. You can come up with costs."

Per-satellite costs depend on how specialized the payloads are and how far out the satellite must travel. SDA understands the price of that ownership, he added. But the agency hasn't decided whether to use the National Security Space Launch program to put assets in space or to buy launches from commercial providers not selected in that ongoing competition.

SDA's upcoming demonstrations in fiscal 2021 will likely rely on commercial rockets bought separately from the satellites, or may require the satellite provider to offer launch as well. Tournear said the agency won't use the same rocket company to deliver each mission layer to orbit, with the idea that bringing in several different contractors will make them design systems that work together.

"The US launch industrial base, from large National Security Space Launch to commercial launch, all the way down to all of the many companies, the dozens of companies that are developing small launch capability, is as robust as it's ever been," Thompson added. "Our job … is to take advantage of that industrial base, and in as many cases as possible, grow it. So we're trying to work with as many of those small launch providers as possible."

With SDA's help, the Pentagon aims to produce about 50 satellites a year with five-year life spans. Each mission layer will gradually turn over as they receive about 100 new satellites every two years. SMC officials argue another key piece of resiliency is having the ability to upgrade military satellites as circumstances change in space.

The two organizations have multiple opportunities to build on each others' work for insight and speed. SDA has said it plans to piggyback on the Air Force and Defense Advanced Research Projects Agency's Blackjack program, and Tournear said at the conference that SDA will take advantage of SMC's Space Enterprise Consortium's nontraditional contract agreements with industry and academia.

"We're going to leverage any contracting mechanism out there," Tournear said. However, he noted: "I have experienced that normal, FAR-based [Federal Acquisition Regulation] contracting can go extremely fast. … We have our own contracting shop set up within SDA, so we're going to run really quickly."

He argues stakeholders within the Pentagon, Congress, and industry are now onboard with SDA's mission and its role within the Defense Department, after months of questions about whether it would overlap with other groups. The Trump administration envisions SDA will fall under Space Force, and Tournear said that transition would take place in late fiscal 2022.

"Eventually, when the vast majority of all space architectures and acquisitions go underneath the Space Force, then SDA would go under Space Force as well and be able to have broad purview," Tournear said.

That change promises to shape SMC's role in the military space enterprise even though the outcome is still unclear. SMC touts its successes across its recent "Summer of Launch," and its steps to reduce costs and cut time off schedules, but it has more work to do to transition to an organization focused on launch on demand, commercial partnerships, and reusable rockets.

One main concern in the burgeoning space market is protecting government and company data from foreign entities, Thompson said. Another issue is getting a better long-term feel for where the launch market might be headed and how many providers the Air Force needs as a result.

Blue Origin, the Jeff Bezos-owned commercial space company bidding for one of two NSSL contracts, argues that the competition is unclear, discriminatory against new entrants, and prompting costlier launches by narrowing to two providers. The Air Force defends its acquisition strategy for the modernized program as being open to commercial companies, but realistic about how many providers it needs to meet the launch schedule ahead to put military and intelligence assets in orbit.

"Shortening the contract [from five years] may disincentivize providers from developing all the capabilities required to launch the entire manifest, resulting in niche providers and significant risk to maintaining a certified Category C launch capability," a senior Defense Department official noted. "This scenario could force the government to buy more Delta IV Heavy launch vehicles at an extreme cost."

Barbara Barrett, the Trump administration's nominee for Air Force Secretary, said earlier this year that whether or not the market can sustain four providers in the long run, more participants can spur innovative solutions.

She told the Senate Armed Services Committee in September a top priority will be keeping the launch schedule running on time.

"We've developed not just a military and government capability, but commercial capability as well," Barrett said. "We still need to have government capability, and I'm fully supportive of continuation of that capability through the military." ✪

First Gremlins Flight Test Planned Despite Earthquake

Image: DARPA

DARPA planned to demonstrate its airborne launch and recovery of multiple unmanned aerial systems in September, but was hampered by earthquake damage to Naval Air Weapons Station China Lake, Calif.

By Rachel S. Cohen

Dynetics is preparing to fly its new drone for the first time as part of the Defense Advanced Research Projects Agency's Gremlins program, taking another step to prove out the futuristic concept of unmanned swarms.

In the future, a host aircraft could launch and recover multiple Gremlins unmanned aerial vehicles that spread out for strike, intelligence, or other missions, and send information back to the user via radios and data links. Dynetics Inc., Huntsville, Ala., is in the last phase of its competitive DARPA program and has designed a docking device that comes down from an aircraft to retrieve the small drones after they fly a mission.

Recent earthquake damage to Naval Air Weapons Station China Lake, Calif., set back the initial flight demonstration, which was slated for September, according to Tim Keeter, the Gremlins program manager at Dynetics. Instead, the test may move to the Army's Dugway Proving Ground in Utah. Keeter said it could be rescheduled to happen by the end of the year.

"It's limited range access. They've got a lot of damage that's been done," Keeter said of China Lake. "They've got a lot of things to take care of in terms of infrastructure before they can support a flight test ... like this."

A first flight will check that the unmanned aircraft works properly and will vet its aerodynamics. But rescheduling the flight test requires multiple pieces to fall into place. A C-130 must be available to launch the drone, and a range must have time to accommodate a new customer.

Dynetics will first launch and control the Gremlin from the back of the C-130 in flight, Keeter said. "We'll deploy our parachute and our airbags to have a ... gentle ground recovery, hopefully," he said.

The next step is to pair a Learjet and a C-130 to simulate the drone docking with the larger aircraft, since the Learjet acts as a testbed for the Gremlins avionics.

"That will allow us to further check our recovery system, docking system avionics, and our safety features associated with that, because that's a high-risk part of the operation, ... getting close to that manned aircraft," Keeter said. "We want to do that in February."

He believes the manned C-130 and Learjet test could happen at China Lake because it won't require some infrastructure that an unmanned flight would need. Once those aspects are proven, Dynetics will attempt to dock as many Gremlins as it can. The program's final demonstration for DARPA must show that the system can capture four drones in under 30 minutes. Dynetics has built five UAVs so far and expects the the last demo will come before summer 2020.

These tests won't include specialized payloads because the program focuses on the concept of launch and recovery instead of what a swarm could do once deployed. After the current phase of the DARPA program ends, Dynetics is eyeing a simulated mission that would look at payloads and some autonomy as Gremlins works toward becoming a program of record with the Air Force and other interested customers.

Keeter suggested that in the future, each drone could gain the ability to carry out missions without human control, alone or in tandem with other UAVs, even if they can't communicate with their users.

Figuring out how many UAVs a particular user needs to accomplish its goals is one challenge of transitioning the technology to a more permanent home. Keeter said the special operations community may need only a few at a time to act as extra sensors, while Air Combat Command could need a few dozen at once for high-intensity conflict. Dynetics has drawn up concepts for how its recovery system could fit under larger or smaller aircraft, on pylons or in rotary launchers, and Keeter pointed to the B-52 as another potential Gremlins carrier.

"The greatest utility of this capability is going to be in an [anti-access/area-denial] environment where you want to maximize the effects of distributed airborne warfare to deliver lethality ... and be able to refresh those [different technologies] in an hour," he said.

He said moving toward a program of record in fiscal 2022 is a reasonable timeline, but that those conversations aren't happening yet. The company is also eyeing the Air Force's Skyborg program and argued it could also potentially act as a host aircraft for Gremlins.

"We've had lots of conversations with them," Keeter said of the Air Force. "That whole concept of using an unmanned system to multiply the force and the capability of manned systems, that's right in line with what we mean by something that enables distributed airborne warfare. ... We fully intend to make sure that we're moving in that direction." ✪

Milley Sworn in as 20th Chairman of the Joint Chiefs of Staff

By Brian W. Everstine

Army Gen. Mark A. Milley on Sept. 30 became the 20th Chairman of the Joint Chiefs of Staff, taking over for retiring Marine Corps Gen. Joseph F. Dunford Jr.

Milley was Army Chief of Staff since 2015 and was sworn in as the nation's top uniformed officer during a rain-soaked ceremony at JB Myer-Henderson Hall, Va. During his speech, Milley pledged to continue the military's modernization, along with showing "unwavering support" and care for troops and families.

"We stand ready to keep the peace or, if necessary, win the war," he said. "We are the best-equipped, best-trained, best-led military in human history. Our adversaries should know to never underestimate our skill, our capability, and our combat power."

Dunford, who is retiring after 42 years in uniform, leaves behind a "legacy of steady leadership, solid judgment, and sincere humility," Defense Secretary Mark Esper said.

President Donald J. Trump, in a speech at the ceremony, credited Dunford for his leadership in defeating the Islamic State's physical caliphate in Iraq and Syria and for leading the forthcoming creation of a separate Space Force. ✪

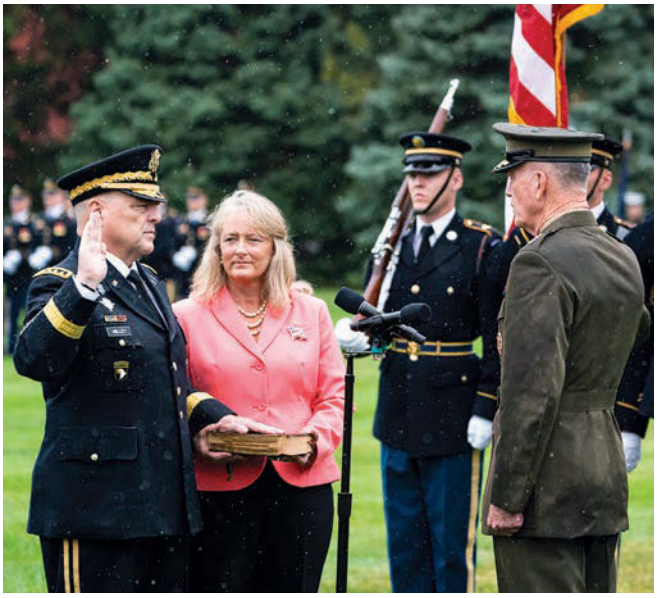


Photo: D. Myles Cullen/White House

Army Gen. Mark Milley takes the oath of office on a bible held by his wife, Hollyanne, and becomes the Chairman of the Joint Chiefs of Staff on Sept. 30.

DOD Releases Military Family Suicide Statistics

By Jennifer-Leigh Oprihory

Photo: Heide Couch/USAF

A new Pentagon report examines suicide statistics among not only Active Duty airmen, but the Total Force, including families and dependents.

Nearly 190 US military family members killed themselves in 2017, according to the Pentagon's first-ever reporting on self-inflicted deaths in military families. The numbers were released as part of the Pentagon's new Annual Suicide Report. The report only included 2017 data on military family suicide.

Suicide rates among military spouses and dependents were "comparable to or lower than" their counterparts in the equivalent US population, DOD said. But suicide rates among service members continue to be high. Total Active, Guard and Reserve suicides rose for the third year in a row, rising from 482 in 2016 to 511 in 2017, and 541 in 2018.

"Every person lost to suicide is an absolute tragedy," Defense Secretary Mark T. Esper said via Twitter Sept. 26, as the Pentagon released a report on 2018. "We mourn for the families & peers of those lost to this terrible problem."

Air Force Chief of Staff Gen. David L. Goldfein said in September that a force-wide suicide prevention stand-down held over the summer identified possible steps to better combat suicide in the ranks.

Of the family suicides, 123 were spouses—including 14 percent who were service members.

Air Force suicides in 2019 are outpacing the service's 2018 total of 80 deaths. As of Sept. 21, the Air Force reported 100 suicides by airmen.

Elizabeth P. Van Winkle, executive director of the Pentagon's Office of Force Resiliency, said, "This is the first time we have these rates for our military families," and that in future years, "we'll be able to provide more information." ✪

The Veterans Crisis Hotline is available 24 hours a day, seven days a week, for veterans, service members, and their family and friends who need help. Call 800-273-8255 and press 1, text 838255, or visit www.veteranscrisisline.net.

NRO's $1.2B Launch Deal with ULA Saves Agency 11 Months, $455M

By Rachel S. Cohen

The United Launch Alliance will receive another $1.2 billion to support launches of five National Reconnaissance Office missions, under a five-year contract increase announced Sept. 30.

The award saves $455 million on the NROL-44, NROL-82, NROL-91, NROL-68, and NROL-70 missions, according to the Air Force Space and Missile Systems Center. All five missions will head to space on ULA's Delta IV Heavy rocket. The total contract value grew from nearly $468 million to $1.6 billion with five annual options, according to the Pentagon announcement.

"To meet required launch dates, while maintaining the best value for the government, SMC and NRO divided this contract into a launch vehicle production services component (LVPS) and a LOPS (launch operations support) component," SMC said Sept. 30. "LVPS covers materials and manufacturing labor needed to produce the launch vehicles, whereas LOPS covers launch pad maintenance and range support at Vandenberg [AFB, Calif.] and Cape Canaveral [AFS, Fla.], launch vehicle propellants, satellite encapsulation, and the system engineers and technicians that support production and launch operations."

Dividing the contract not only led to cost savings, but also shrank the timeline by 11 months because ULA could negotiate prices with its suppliers and buy hardware in advance, an SMC spokesman told *Air Force Magazine.*

Vehicle production services funding for three missions was awarded in October 2018, and those contracts for the other two missions were issued in fiscal 2017. The satellites perform secretive intelligence and national security missions under the current iteration of the Evolved Expendable Launch Vehicle program, now known as National Security Space Launch.

"These are the last remnants of our sole-source contracts," Col. Robert Bongiovi, SMC's launch enterprise director, said in a release. "We look forward to embracing the competitive landscape that we have worked hard with industry to create. The competitive launch services market is strong, and we look forward to the Phase 2 acquisition that leverages this market and builds upon our legacy of mission success."

Photo: ULA

A United Launch Alliance Delta IV rocket carrying a GPS satellite lifts off from Space Launch Complex 37.

SpaceNews also reported two of the missions, NROL-44 and -82, ran behind schedule and are slated for launch in fiscal 2020. One of the remaining three will launch each year from 2022 to 2024. Overall, rocket production and launch services for the five missions cost about $2.2 billion, according to *SpaceNews.*

Got the Next Big S&T Idea?

By Brian W. Everstine

The Air Force is in the market for "disruptive" new science and technology capabilities and is offering a $14 million pot for the best ideas. The service on Sept. 26 announced "Air Force Explore" as part of its "Science and Technology 2030" strategy, which wants to draw transformational ideas from across the country "to become the Air Force we need," Maj. Gen. William T. Cooley, commander of the Air Force Research Laboratory, said in a news release. The service anticipates awarding four to seven contracts, each worth $1 million to $2 million, for suggestions focused on "global persistent awareness; resilient information sharing; rapid, effective decision-making; complexity, unpredictability, and mass; and speed and reach of disruption and lethality," according to the release. Submissions are due Nov. 11, and funds will be doled out by March 2020. Air Force Explore is a joint effort between AFRL, the Air Force Warfighter Integration Capability planning organization, and Air Force acquisition boss Will Roper.

USAF's New Justice Info System

By Jennifer-Leigh Oprihory

USAF recently launched a new, online criminal data reporting system aimed at providing "global integrated awareness" about illegal activity impacting airmen and USAF resources. The Air Force Justice Information System is touted as "the most modern" system of its kind in the Defense Department, according to an Oct. 3 Air Force Installation and Mission Support Center release. USAF security forces personnel uploaded the first case to the system in late September. "This is a monumental step in the modernization of [the] security forces criminal data reporting system" said MSgt. Elizabeth Sadler, who headed up its development. The system cost the service $5.7 million to develop and stood up in under 10 months, according to AFIMSC. The system is being rolled out in phases, with the goal to go live for the entire service—Active Duty, Guard, and Reserve—by Oct. 31. Experts at Hanscom AFB, Mass., Patrick AFB, Fla., and JB Andrews, Md., are conducting operational testing of the system.

White House to Host Interagency Space Tabletop Exercise

Photo: Trey Ward/USAF

Gen. John Raymond is pictured with military and civilian experts from 27 agencies and Australia, Canada, New Zealand, and the UK, all participants in the Schriever Wargames 2019.

By Rachel S. Cohen

Representatives from across the federal government will convene at the White House in November for a tabletop exercise aimed at improving interagency cooperation in space. The meeting this fall brings together officials at the highest echelons of government and builds on earlier tabletop iterations with the same players.

"The Schriever Wargame is played among combatant commands, services," US Space Command boss Gen. John "Jay" Raymond told reporters at a Sept. 27 breakfast hosted by AFA's Mitchell Institute for Aerospace Studies. "This is at the more strategic level and having those dialogues with the most senior leaders."

The previous White House tabletop, which took place over the summer, focused on US deterrence as it relates to space, said Raymond, who also serves as the head of Air Force Space Command. That could encompass stopping others from threatening US interests and assets in space, or using space assets to bolster deterrence in the other military domains.

"I don't think there's such a thing as space deterrence," he said. "I think there are activities that you can do in space that feed and amplify the broader deterrence. … I'm not going to go into the specifics."

The upcoming gathering will continue to flesh out a framework to determine what information the Defense Department can share within its own organization and with civilian agencies, such as the Federal Aviation Administration.

"We're currently looking at, 'Does our security classification posture impact our ability to deter?' " Raymond said during the breakfast. "You have to be able to talk about things. So we're going through the strategy … right now to figure out what that posture should be to make sure that we can adequately deter."

Photo: SrA. Christopher Quail

Left to right: Col. Joel Safranek, A1C Ceasar Ventura, and A1C Mason Gray pull off tape revealing the crew chiefs' names during a ceremony Oct. 4 at Dover AFB, Del.

Crew Chiefs Can Again Paint Names on AMC Aircraft

By Brian W. Everstine

Reversing a policy in place for the past two decades, dedicated crew chiefs can now put their names on Air Mobility Command aircraft, thanks to a push from the 736th Aircraft Maintenance Squadron at Dover AFB, Del.

As of Sept. 17, AMC is allowing dedicated and assistant dedicated crew chiefs for C-5s, C-17s, C-130s, KC-10s, and KC-135s to paint their names on their aircraft. Prior policy forbade those marks because AMC wanted airframes clear of identifying information when deployed to war zones.

When the 736th AMXS adjusted its dedicated crew chief program last year, squadron commander Maj. Kevin Scholz asked 436th Airlift Wing Commander Col. Joel Safranek why the names could not be painted on aircraft, according to a Dover release. Pilot and crew chief names are routinely painted on other USAF aircraft, such as fighters under Air Combat Command, but not airlifters.

The 736th AMXS then joined with Dover's C-5 436th Aircraft Maintenance Squadron to request AMC waive the policy. Ten months later, AMC lifted the rule.

Under the new policy, names still need to be removed from aircraft deploying to combat zones. But, if those aircraft are defined as being "transient" and not deployed for a long period of time, they are not subject to the combat deployment sanitization requirement. So, "if an aircraft is in the AOR for less than 14 days, it doesn't need to be sanitized," Scholz said in the release.

AMC said in a statement it expects the change "to increase participation in the DCC program, which facilitates pride in ownership among crew chiefs."

On Oct. 4, at a Dover DCC ceremony, crew chiefs unveiled their names painted on the aircraft.

"I was completely thrilled about this new privilege and responsibility," said TSgt. Anthony Carter, the DCC program manager with the 436th AMXS, in the release. "The sense of pride I felt when I was assigned to my first aircraft was one of the best experiences of my career and will forever be instilled into my memory. That's how I believe our airmen feel when they are assigned to an aircraft and why it was so important to have the authority to place their names on the exterior of the aircraft." ✪

Civil Air Patrol Search and Rescue Saves 117 Lives in FY 2019

By Jennifer-Leigh Oprihory

The Air Force Rescue Coordination Center credited Civil Air Patrol search and rescue efforts with saving 117 lives in fiscal 2019, according to a CAP release. While the tally fell short of the previous fiscal year's total of 158 saves, it marked CAP's third-consecutive fiscal year of triple-digit rescues, the release stated. Technology has revolutionized search and rescue by reducing the amount of time, resources, manpower, and aircraft use these kinds of missions require, according to CAP director of operations John Desmarais. ✪

NY Guard Resupplies Northernmost Military Base in Canada

By Brian W. Everstine

The New York Air National Guard's 109th Airlift Wing recently wrapped up a mission flying cargo to Canada's northernmost base, a small alert site on the northern tip of Nunavut. The C-130s and guardsmen flew seven missions from Sept. 26 to Oct. 4 to Canadian Forces Station Alert, transferring more than 100,000 pounds of cargo, according to a Guard release. The Canadian base, 490 miles south of the North Pole, has 55 people living there year round, making it the northernmost permanently inhabited place in the world. The C-130 missions were flown from Thule AB, Greenland, and crews experienced freezing fog, low visibility, and high winds, according to the release. The mission, called Operation Boxtop, takes place twice a year; this iteration also included a Royal Canadian Air Force C-17.

BMT Trainees Get OCP Uniforms

By Brian W. Everstine

Trainees in the first week of October began receiving new operational camouflage pattern uniforms as they entered Basic Military Training at JBSA-Lackland, Texas—the latest step in a multiyear process to implement the new uniform. The Air Force is issuing the uniforms to BMT personnel, as well as to those entering the Reserve Officer Training Corps, about a year after the service announced it would adopt the OCP pattern as its standard uniform. "Trainees who are here in (Airmen Battle Uniforms) will continue to wear them throughout their time here and will be replaced when they get their clothing allowance," Bernadette Cline, clothing issue supervisor, said in an Oct. 7 USAF release. The clothing is rolling out over three years, and all must wear OCPs as of April 1, 2021. Boots, socks, and T-shirts must be "coyote brown" as of June 1, 2020, with officer ranks changing to "spice brown," according to the release. Airmen already receive OCPs when they deploy. The Air Force made the switch for a better fit and feel, as well as to blend in with soldiers during joint deployments. ✪

Photo: Sarayuth Pinthong/USAF

USAF Basic Military Trainees receive the first operational camouflage pattern uniforms during initial issue, Oct. 2, at JBSA-Lackland, Texas.

Photo: SrA. Alexander Cook

An F-35 Demonstration Team pilot puts a Lightning II through aerial maneuvers at the Oregon International Air Show in McMinnville, Ore.

Pratt Gets $2.2 Billion Contract for F-35 Engines

By John A. Tirpak

The Pentagon on Sept. 30 awarded Pratt & Whitney Military Engines an almost $2.2 billion contract to supply 183 engines for all F-35 variants. The contract definitizes a previous contract covering 112 engines for Air Force F-35As, 46 engines for the Marine Corps F-35Cs, and 25 engines for Navy F-35Bs, according to a Pentagon release. The contract also definitized a previous award for long-lead parts and materials associated with 129 A-variant engines and 19 B-variant engines. Including previous contract totals, which also includes foreign sales, $3.56 billion was obligated by the Sept. 30 action. The award combined purchases of about $880 million for the Air Force, about $619.2 million for the Marine Corps, $178.8 million for the Navy, $420 million for non-US F-35 partners, and $99.4 million for foreign military sales customers. ✪

■ The War on Terrorism

Casualties:

As of Oct. 7, 82 Americans had died in Operation Freedom's Sentinel in Afghanistan, and 88 Americans had died in Operation Inherent Resolve in Iraq, Syria, and other locations.

The total includes 166 troops and four Defense Department civilians. Of these deaths, 79 were killed in action with the enemy, while 91died in noncombat incidents.

There have been 491 troops wounded in action during OFS and 80 troops in OIR.

FACES OF THE FORCE

Photo: Roland Balik/USAF

USAF **TSgt. Kenneth O'Brien** proved why he is one of the 2019 Outstanding Airmen of the Year on the way to collecting his award. In the past year, he served as a member of the president's security detail for a summit in North Korea; saved a civilian from a burning vehicle in Korea; helped rescue a group of Thai soccer players trapped in a cave; and saved the life of a Thai Navy SEAL. Then, on his flight to the US to receive the Outstanding Airman honor at AFA's Air, Space & Cyber Conference, he saved the life of a child who had lost consciousness due to an airway blockage. "Our man O'B leaps into action, clears the breathing passage, resuscitates the kid, hands him back to the parents, and then goes on about his business," wrote Lt. Gen. James Slife, head of Air Force Special Operations Command, in a Facebook post. "I can't decide if he's Superman or Mayhem (the guy on the insurance commercials)," Silfe wrote. "I don't know whether I want to be right next to him in case some bad stuff goes down, or whether I want to be as far away from him as possible because bad stuff always seems to go down around him."

US Air Force Academy alum and four-year Falcons varsity tennis starter **2nd Lt. Isaac Perez** received a 2019 Arthur Ashe Jr. Leadership and Sportsmanship Award from the NCAA on Aug. 24 during this year's US Open tournament in New York. Perez initially wanted to work in human intelligence, but will train to be an aviator starting in January as part of the Pilot Training Next initiative. While he is eager to fly any airframe after graduation, his sights are set on the F-35 Lightning II.

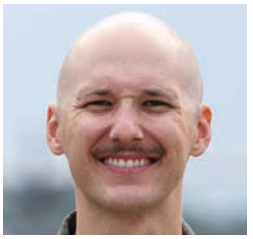


Photo: Courtesy

Growing up immersed in his father's talk of the C-130's greatness, 62nd Airlift Squadron **Capt. John Rebolledo** followed in the former C-130A crew chief's footsteps. "Once I decided I wanted to be a pilot, I knew I wanted to fly a Herk," he said. After graduating from the US Air Force Academy, completing pilot training, and overcoming airsickness, Rebolledo was assigned to fly the C-130H at Yokota AB, Japan, before transitioning to the C-130J.


Photo: A1C Jayden Ford

Photo: Courtesy

Capt. Mark King Jr., 39th Airlift Squadron assistant tactics chief, won USAF's annual Exceptional Aviator Award, which honors pilots who go above and beyond to make sure a mission succeeds, demonstrate valor, or who display a remarkable, mid-air display of courage or leadership. The C-130J pilot developed a plan that allowed his crew, in a single-pass, nighttime airdrop, to deliver 17,000 pounds of fuel to Afghan National Army partners just in time for them to escape before being overtaken by the Taliban.

When the daughter of **Capt. Steven L. Bennett,** an Air Force pilot who was killed in action during a Vietnam War mission in June 1972 and posthumously awarded a Medal of Honor, lost his dog tags, Air Force Special Operations Command came to the rescue. AFSOC command chaplain Col. Richard Anderson presented **Angela Bennett-Engele** with a set of replica dog tags in a ceremony at Hurlburt Field, Fla. "I was extremely blessed to be able to take part," Anderson said.


Photo: SSgt. Lynette Rolen

21st Operational Medical Readiness Squadron dental lab technicians **A1Cs Brittany Wright** (left) and **Tiffany Duffus** helped USAF leaders get to a struggling airman before he could take his own life. When the distressed airman called Wright, she messaged Duffus for backup, who, in turn, contacted 21st Medical Group first sergeant MSgt. Jonathan Eckley. With their help, Eckley tracked down the airman's first sergeant, who was able to intervene in time. Wright and Duffus received Air Force Awards for the actions.


Photo: SSgt. Alexandra Longfellow

Four airmen from the 4th Logistics Readiness Squadron at Seymour Johnson AFB, N.C.—**A1Cs Nathan Nguyen and Austin Herder, and SrAs. Charles Black and Robert Walsh**—responded to a two-car collision, called for help, and attended to the victims (including two who were ejected from their vehicle) until first responders arrived. "Managing the situation was probably one of the things I could credit to my Air Force training," Walsh said. "The Air Force teaches you to take hold of the situation."


Photo: SrA. Victoria Boyton

Airmen from the 352nd Special Warfare Training Squadron took part in a memorial physical training event on Aug. 9 at Keesler AFB, Miss., to honor fallen combat controller **SSgt. Andrew Harvell**, 24th Special Tactics Squadron, who was killed in action on Aug. 6, 2011. Harvell was one of 30 US troops killed in a CH-47 Chinook crash in Afghanistan's Wardak province. Photos released by the 81st Training Wing showed the Special Warfare trainees hitting the pool, working out with kettlebells, rucking, and more in his memory.


Photo: USAF

Photo: TSgt. Iram Carmona

Retired Air Force **Col. Lee Ellis,** a Vietnam War POW, shared lessons learned on resilience from his time in captivity with Air Force reservists and their families during an Aug. 17 Air Force Reserve Yellow Ribbon Reintegration Program training event in San Antonio . "Communications through our pipeline have got to stay connected," he said. "Don't ever get caught alone, and don't ever leave anyone alone." The Yellow Ribbon program works to connect reservists and their relatives with support resources before and after they deploy.

Know of someone we should recognize? Send nominees to afmag@afa.org

The Long and Short of It

Photo: SSgt. Rusty Frank

"More often than not, war is much longer, much more expensive, much bloodier, much more horrific than anyone thought at the beginning. It is important that the decision-makers assess the use of force and apply the logic we've learned over the years. War should always be the last resort."

Then-Army Chief of Staff Gen. Mark A. Milley, in a DOD publication prior to becoming Chairman of the Joint Chiefs of Staff, "Milley Dispels the Myths of War."

Photo: Amn. Chelsea Gitzen

"Shouldn't we remind ourselves from time to time that not every use of force becomes a quagmire, and that sometimes the failure to act carries its own moral consequences?"

Retired Maj. Gen. Charles J. Dunlap, Jr. (USAF), Executive Director of the Center on Law, Ethics and National Security.

Ready or Not

Photo: Greg Davis/USAF

"We have enough airplanes to fly, we just don't have enough to fly at the rate we want."

Gen. Timothy M. Ray, head of Air Force Global Strike Command, on the readiness problems with B-1 bombers.

We're Watching You

"Whether you're a bad individual or a bad nation, if there's no chance of you being caught doing something, you're pretty emboldened to do it. Attribution has become kind of the new deterrence. ... We're going to have to figure out how to attribute actions against our assets and call them out."

Lt. Gen. Joseph T. Guastella, commander of US Air Forces Central Command, on the value of ISR in space and all warfighting domains.

Illustration: Mike Tsukamoto/staff

Aliens? No. Secrets? Yes.

"Our nation has secrets, and those secrets deserve to be protected. People deserve to have our nation's secrets protected."

Chief of Staff **Gen. David L. Goldfein** in response to a question about the security concerns posed by a planned storming of Area 51.

HOLY TRINITY, BATMAN

Illustration: Mike Tsukamoto/staff

"Nothing has been as exciting to me as this confluence of agile software, open architecture, and digital engineering. Nothing. ... I've stood in the middle of 103 swarming micro-drones, which was awesome. But that's the point of the spear; it's the first thing I've seen that looks like a better spear-making machine."

Will Roper, USAF acquisition chief, on developing a new "Holy Trinity" of technology processes [*Breaking Defense,* Sept. 16].

Photo: Kremlin

THAT'S WHAT FRIENDS ARE FOR

"I don't think I'll open a huge secret here. It'll become clear anyway. We're now helping our Chinese partners to create a missile-attack warning system. ... It's a very serious thing that will drastically increase the capabilities of China."

Russian President **Vladimir Putin** remarks on a missile warning system which Moscow is helping Beijing put together. He also noted that only Russia and the US currently possess such technology [RT.com, Oct. 3].

Smart Sustainment

The Rapid Sustainment Office set out to save time and money by investing in new maintenance technologies. After just one year, the results are promising.

Maintenance crews work atop a C-5M Super Galaxy T-tail at Travis AFB, Calif. An RSO initiative has been especially effective in reducing the amount of time the airplanes are out of service due to parts failure. Photo: Heide Couch/USAF

By John A. Tirpak

Halfway through its two-year charter to quickly inject new technologies into Air Force maintenance, support, and repair, the Air Force's Rapid Sustainment Office is doing what its creator, USAF acquisition chief William Roper, had hoped.

"Nothing is as fast as I would like," Roper said at the Air Force Association's 2019 Air, Space & Cyber Conference in September. "But I'm actually really impressed how quickly the technologies are moving, now that results have been demonstrated."

In the year since its launch, the RSO experimented with condition-based maintenance, additive manufacturing, cold spray technology, robotics, automation, and virtual reality. It's also entered a public-private partnership with Delta Air Lines to gain insight into that company's successful predictive maintenance systems.

"We're trying to show an impact on the order of half-a-billion dollars in a couple of years."
—Lt. Gen. Robert McMurry Jr., PEO, Rapid Sustainment Office

Lt. Gen. Robert D. McMurry Jr., program executive officer for the RSO and commander of the Air Force Life Cycle Management Center, said the RSO doesn't quote savings targets. But he told *Air Force Magazine* in an interview that "we're trying to show an impact on the order of half-a-billion dollars in a couple of years."

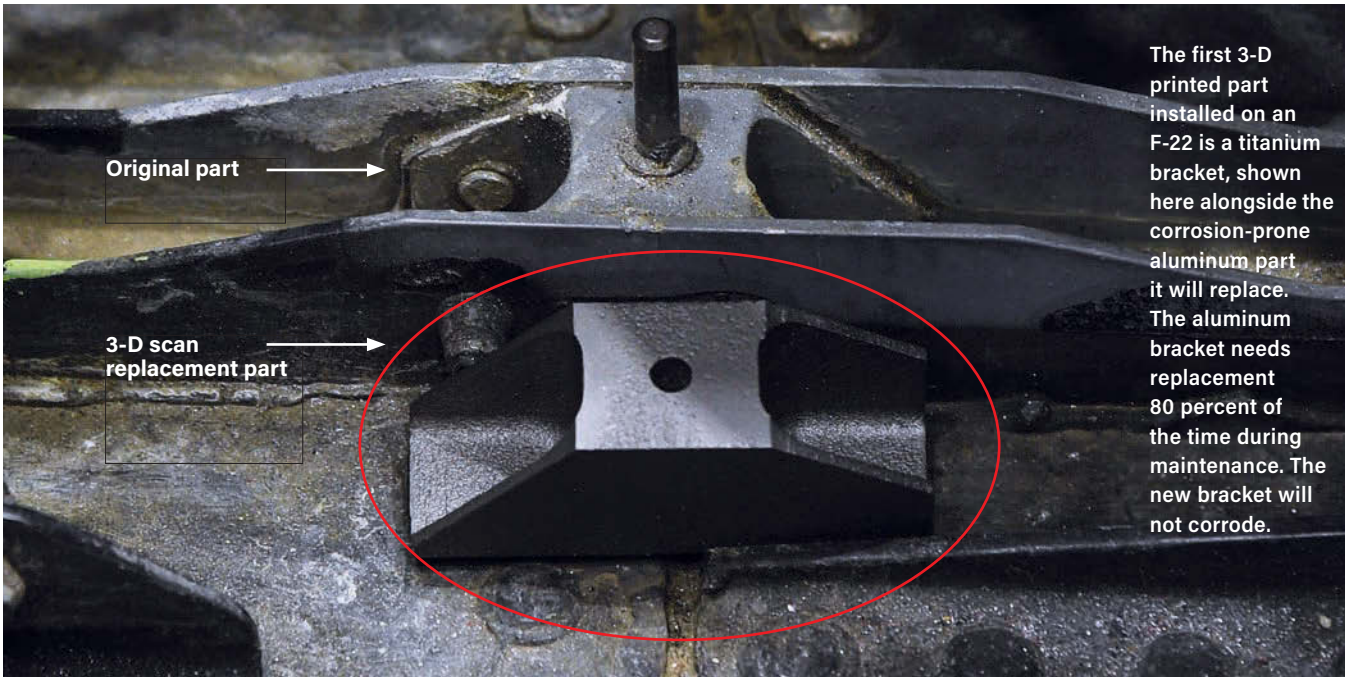
Based on existing projects in condition-based maintenance, "agile manufacturing," and automation, the RSO said it can claim $68 million in costs saved or avoided so far, "with a return on investment of 66 percent over the life cycle."

Roper conceived of the RSO idea in 2018 after noticing that the Air Force invests most heavily in weapon systems during design and development, and far less in maintainability. Given that 70 percent of the cost of a weapon system is expended to sustain its operation, he saw untapped potential for savings if sustainment costs could be reduced. He modeled the new RSO after the Air Force's Rapid Capabilities Office and the Pentagon's Strategic Capabilities Office, which Roper headed before coming to the Air Force job.

USAF acquisition chief Will Roper launched the Rapid Sustainment Office two years ago. "The algorithmic oracle that can see the future is not just money in the bank," he says. "It's readiness to the warfighter." Photo: Mike Tsukamoto/staff

Like those organizations, the RSO is meant to identify promising technologies, experiment with their use, and aim for big payoffs by reducing costs, saving time, or improving system availability.

RSO Deputy PEO Nathan Parker said the office has about 24 people today, and that will continue to grow as new project areas come online. "But it's purposely meant to be a small team that has a focused mission to solve their problem and then move on," he said. "It's not meant to be a 500-person organization. It will never grow to that."



The first 3-D printed part installed on an F-22 is a titanium bracket, shown here alongside the corrosion-prone aluminum part it will replace. The aluminum bracket needs replacement 80 percent of the time during maintenance. The new bracket will not corrode.

Photo: R. Nial Bradshaw/USAF

3-D Printing Replacement Parts

Airmen at Travis Air Force Base can now print non-standard replacement parts, saving time and money.

TSgt. Rogelio Lopez transfers print data to the Stratasys F900 3-D printer (background). The 60th Maintenance Squadron is the first field unit to have a printer certified by the Federal Aviation Administration and the Air Force Technology and Training Center to make nonstructural replacement parts for aircraft.

Using a material called Ultem 9085, the printer is capable of printing plastic parts up to 36 x 24 x 36 inches. Ultem 9085 is flame-retardant, more flexible, dense, and stronger than typical plastics.

Two finished 3-D printed latrine covers for C-5M Super Galaxy transport aircraft. If ordered through normal channels, the replacement covers would take about a year to be delivered. The 60th MXS printed two replacement covers in 73 hours. USAF is now handing off aircraft parts requests from other bases to the technicians at Travis AFB, Calif.

Photos: Louis Briscese/USAF

Source: Travis AFB, Calif.

Among the most visible successes so far: "Condition-Based Maintenance Plus," which tracks aircraft individually, by tail number, and as a fleet—seeing how the aircraft is used, when parts typically fail, and when service on subsystems really are needed.

Roper cited "40 algorithms that immediately started saving money" in C-5M Super Galaxy maintenance, explaining that the approach has been especially effective in "reducing the amount of time that planes are down due to part failure." Breakdowns can strand a plane and crew for days while waiting for parts to arrive if none are available locally.

In one case, sensor data indicated false alarms were causing maintenance crews to unnecessarily replace doors on a C-5M refrigeration system. Instead of spending $250,000 to replace the doors, they were able to replace the faulty sensors at a cost of just $1,400. Similarly, data derived from an existing sensor in the B-1 tail is now being used to predict "when fuel bladders are likely to lose balance," akin to "an oil change light coming on in a car." That means crews can take action in advance.

In other words, Roper said, the "algorithmic oracle that can see the future is not just money in the bank, it's readiness to the warfighter."

The commanding general at Air Mobility Command, Gen. Maryanne Miller, is so enamored with Condition-Based Maintenance Plus that she wears an "I Love CBM+" T-shirt every Friday, Roper said, adding that AMC is pressing to expand its use across the mobility fleet: "So they can manage it like an airline."

The KC-135 also uses CBM-plus, McMurry said, and nine other platforms are using similar analyses.

Now the fighter community is getting on board, starting with F-16s, Roper said.

Impressed by Delta maintenance programs, McMurry said, the Air Force is modeling its programs on the airline's success. "They went from 255 maintenance cancellation days in a year to 300 straight days with no maintenance cancellation," he said.

Full Aircraft Coating Removal with a 6kW Continuous Wave Fiber Laser

The Advanced Robotic Laser Coating Removal System removes paint and coatings with a laser stripping tool and state-of-the-art mobile robotics, which drastically reduces toxic waste, pollution, and processing time.

The aircraft's coating is removed through thermal decomposition. The light is invisible to the eye. Sensors enable selective removal of the topcoat and primer.

Digital modeling technology allows the robot to accurately follow the aircraft's contours. Markers on the wall are used to triangulate position.

Operators sit in a remote booth. No protective clothing is required. This system generates a 1/2 cup of hazardous waste, whereas normal plastic media blasting results in 2,000 pounds of toxic waste.

Source: Air Force Life Cycle Management Center video

Delta, and its partner Georgia Tech, have been enthusiastic supporters. "They have embraced us, they've shown us how they manage their fleet, made their tools and algorithms available to us, and given us great feedback on how we get to good—which is where we are now—and then the increasingly difficult challenge of getting from good to great," Roper said. McMurry also said the Delta/Georgia Tech team is working with Wichita State University in Kansas and Airbus to develop additional predictive algorithms.

Not every RSO effort will yield clear cash savings, McMurry noted, but that doesn't mean there isn't a return on investment. "The question is, how do you value a return to operations?" he asks. "If you save three weeks of downtime, how do you value that? Whereas ... if I manufacture a part for $4,000 that usually costs $160,000, OK, I've got a pretty good understanding of what that savings is."

Nevertheless, Parker said, the RSO was structured to pay for itself. "So every project we spend money on, we look at it through the lens of, does it save dollars? Does this technology, in addition to increasing readiness, ... have the potential to drive down costs?"

That's how Roper wanted it, McMurry said, "that the Rapid Sustainment Office should develop projects that will pay their own way." And it is.

Roper said other RSO initiatives include additive manufacturing, also known as 3-D printing—"which is just a no-brainer," he said—and using robotic lasers to remove paint.

3-D PRINTING

Additive manufacturing provides an affordable means

Cold Spray—Supersonic Particle Deposition

A new method for adding metal to worn components uses extremely high pressure to restore parts to original conditions.

Powdered metal is sprayed onto a B-1 bomber's forward equipment bay panel using a carrier gas to accelerate the metal particles through a supersonic nozzle.

The accelerated metal particles impact the panel at such a high velocity that they instantly bond to the surface.

The panel's worn surface is built up without damaging it with heat generated during a normal welding process.

Source: Ellsworth AFB, S.D., video

to generate parts that have been out of production for decades. The parts can be measured by lasers, potentially improved, and then "printed" using machines that lay down multiple layers of material until the part is formed. Parts can be created without having to hold a supplier competition, go through design, development, testing, and certification, and don't require minimum orders of dozens or hundreds when only one or two are needed.

When C-17s needed new ventilation ducts, McMurray said, additive manufacturing was the answer. "We don't have to wait on these parts, which really weren't designed to be fixed very often," he added. For now, additive techniques are limited to non-flight-critical parts, but a spokesman said experiments to print flight-critical parts—those subject to extensive dynamic stresses—are about three years away.

AFLCMC has approved 153 critical additive parts so far, either metal and polymer, for C-130 and C-5M transports, and has developed a "part tracking tool" to monitor how they perform and how much they cost or save in the long run, the RSO said.

LASER PAINT REMOVAL

The laser paint removal system installed at Hill AFB, Utah, uses a laser mounted on a robotic arm to remove paint to specified depths in days rather than weeks. Previously done with blast beads, the process of depainting an F-16 used to produce about a ton of hazardous material, and required workers to wear elaborate safety gear to protect them from toxic hexavalent chromium. The laser system essentially burns away most of the hazardous waste and sucks up what isn't burned with a vacuum, leaving only about four ounces of hazardous waste. Operators of the machine sit in a room nearby and don't have to don any protective garments or respirators.

"The challenge there," McMurry said, "is that to put more of those bays in requires more capital investment. And probably [military construction funds] as well." Roper said the technique will be expanded to every depot and the Aerospace Maintenance and Regeneration Group, which operates the "boneyard" at Davis-Monthan AFB, Ariz.

COLD SPRAY

Cold spray is another new technique. The process involves the precise, computer-controlled deposit of metal onto a worn area of an existing part. New metal is sprayed on and the speed and temperature of the process ensure it bonds permanently to the underlying metal. Parts can then be machined and made as good as new.

Photo: Amn. Ashley Thum

A South Dakota School of Mines and Technology student demonstrates the cold spray repair process on an aircraft panel. SDSM&T partnered with military and other state and federal organizations to develop the technology.

Instead of replacing an entire gearbox, McMurry said, only the worn parts need be repaired. On an F-16, a new gearbox might cost $180,000. But "with cold spray you can actually repair that for about $4,000," McMurray stated. "So, it's a pretty big deal."

SPREADING THE WORD

After proving its initiatives can pay for themselves, Roper said, the next step is to see if the Air Force can "scale them across a fleet and then across a mission." The biggest limiting factor, he said: "A lot of our logistics data is on paper."

Roper is eager to move logistics data to a digital cloud where analytics and machine learning can be applied to drive even greater savings. "It is just so compelling to think about what data analytics might do, [and how they might] give us insights we might not otherwise have on the fleet," he said.

The RSO goals are to develop an "ability to":

- Counteract obsolescence in aircraft, support, and test equipment.
- Accelerate training using virtual and augmented reality.
- Capitalize on analytical decision tools and untapped data.
- Better understand and predict aircraft, munitions, and equipment condition during operation and prior to induction into major inspection and maintenance.

Photo: SSgt. Natasha Stannard

SSgt. Zachary Dunn picks off radar-absorbent material as he readies an F-22 Raptor for repair during a Red Flag exercise in 2017. Technological advances can dramatically reduce the need for such painstaking labor.

■ Rapidly accomplish low-observable maintenance, in order to improve aircraft availability and mission capability.

■ Deploy rapidly constructed maintenance structures to support operations in austere locations. This is part of the Air Force strategy for keeping peer adversaries guessing about where USAF assets might be in time of crisis. Structures providing a dry, cool environment are critical for repairing low-observable coatings, which take longer to cure in hot climates.

■ Support a common operating picture across multiple battle spaces for enterprise logistics sustainment.

Depots are a big factor in sustainment operations, and McMurry said the focus there will be a "renewed emphasis on material availability to support the work we do." There will also be a push to "get their workforce fully staffed with certified and capable technicians" and help them "compete for talent on the human resources side, in order for them to be effective and competitive."

Depot is "always a big factor" in whether aircraft are available or not. But it's important to remember, he said, that "they're often there because we're modifying them to put in new capability," and usually it's the depot that has the "material and technicians to do that work well." The RSO will also be looking at "how do you optimize the depot workload across the three centers?"

After the two-year trial of the RSO comes to an end in October 2020, what happens then?

"We will make a recommendation back to the Secretary [of the Air Force] on the permanence of the organization next year, based on the guidelines and the charter—whether we're able to meet the mandate," Parker said.

While "we haven't been extended, ... we haven't asked to be extended either," he said. "We're basically executing the intent of the charter right now, and as we get into next year we'll make that assessment and recommendation. But all indications right now are very positive." ✪

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Combat Heavies

Mobility forces practice for peer conflict.

1. A C-17 from JB Charleston, S.C., touches down at the Selah Creek Airstrip at the Yakima Training Center in rural Washington. The C-17 carried an initial airfield assessment team.

2. Bundles are air-dropped from a United Arab Emirates C-17 during an early stage of Mobility Guardian 2019.

3. Airmen and guests on a UAE C-17 for an airdrop training flight. Dozens of international countries participated in the three-week exercise.

4. Members of the news media take pictures as bundles are air-dropped from a C-17 during the exercise.

5. Mannequins on carrying litters lie in position before being loaded on a C-5M as part of exercise Mobility Guardian. During the exercise, Air Mobility Command practiced a newly developed capability of using the Super Galaxy as a large-scale aeromedical evacuation platform.

Photos: Brian Everstine/staff; SrA. Charles Fultz (2,3); SSgt. Dana Cable; TSgt. Esteban Esquivel

By Brian W. Everstine

FAIRCHILD AFB, WASH.

In the rolling mountains and plains of the Inland Northwest, thousands of airmen and dozens of aircraft practiced mobility operations in September on an unprecedented size and scale. For three weeks, AMC airmen and aircraft joined with service members and civilians representing the other US military services and 29 international partners to fight their way through a simulation in which adversaries threatened both aircraft and bases. The objective: Learn how to be more agile in the face of adversaries seeking to disrupt USAF operations at every level.

"We are looking at—from the mobility air forces lens—what can we do to be able to adjust where we operate, to reposition where we operate, and to have a lighter, faster footprint?" explained Lt. Col. Joseph Monaco, director of Mobility Guardian 2019, the second iteration of this exercise, and the deputy division chief for AMC's training directorate.

"What can we do to be able to adjust where we operate, to reposition where we operate, and to have a lighter, faster footprint?"
—Lt. Col. Joseph Monaco, director of Mobility Guardian 2019

AMC is trying to reinvent itself as a "warfighting command" following changes made at Air Forces Central Command, US Air Forces in Europe-Air Forces Africa, and Pacific Air Forces.

As a result, AMC is now a joint and combined forces air component command, providing direct coordinating authority and providing its own operational command and control, AMC's Commander Gen. Maryanne Miller said.

"The future of warfare will be increasingly joint and coalition, trans-regional and fast, and will require us to act with greater speed and precision," Miller said. "This transformation has enabled better integration into joint operations, we're more responsive to the combatant commanders and we're able to position our mobility forces to defeat, deter, and win with more speed and agility. In line with this transformation into a warfighting headquarters,

Air Mobility Command boss Gen. Maryanne Miller (center) listens to feedback from personnel from US, joint, and international services about their participation in AMC's premiere exercise.

we are preparing for full-spectrum conflict with exercises like Mobility Guardian."

The first night of the exercise saw dozens of aircraft and hundreds of personnel fighting to seize an airfield. A constellation of bases across the western US contributed to the fight, with Fairchild serving as the main forward operating location—much like Al Udeid AB, Qatar, hosts the bulk of aircraft for current Middle East operations.

An Air Operations Center at Travis AFB, Calif., organized and controlled the infiltration, which saw five C-17s fly to Pope Field, N.C., to pick up 500 82nd Airborne troops and deliver them to an "enemy-held" strip at the Yakima Training Center in central Washington. The long, cross-country flight replicates the kind of trek forces would take from the US to a foreign battlefield.

As they approached their destination, those aircraft joined up with two more C-17s, loaded with materiel, which lifted off from Fairchild. Twenty minutes behind them were seven USAF C-130s, plus two more from Canada and one from the US Marine Corps, carrying USAF air mobility liaison officers and other personnel to help stand up airfield operations.

Also joining in: an escort of US Navy E/A-18G Growlers from NAS Whidbey Island, Wash., A-10s and F-15Es from Mountain Home Air Force Base and the Air National Guard's Gowen Field in Idaho, plus KC-135s launching out of Fairchild and KC-10s from Travis.

Simulated integrated air defense systems firing at the fleet from the Mountain Home Range Complex forced the airlifters to fly in low, maneuvering through simulated countermeasures to deliver troops and equipment to the landing zone under a cloudy midnight sky.

As the aircraft opened their doors for airdrops, an opposing ground force waited to attack. The 10-ship C-17 flight flew repeated passes in the dark, and 500 soldiers parachuted onto rough terrain—some sustaining injuries—before the soldiers fought off the opposition to seize and secure the airstrip. Embedded with the paratroopers were air mobility liaison officers responsible for coordinating between AMC and the Army and to begin airfield operations.

"As AMLOs, we are leaner, lighter. We can go in as a single person," said Maj. A. J. Baker, the operating location chief with the 621st Mobility Support Operations Squadron. "We go in as the eyes and ears."

Two C-130s followed with small contingency response airfield assessment teams—called Alpha Mikes because of the last two letters of the team's unit code—who had just four hours to assess the safety of the field and the airstrip's condition before follow-on C-17s arrived with more contingency response airmen.

Air Force Magazine accompanied the C-130s on a rehearsal flight on Sept. 12. The C-130s flew in a row, dropping low as they moved into range. The airlifters banked hard and rapidly changed altitude to avoid the simulated IADS before making their way to the drop zone. After the airdrops, the aircraft returned to Fairchild and prepared to ferry equipment to the captured airfield.

AMC's "tip of the spear" airmen said they had never trained at this scale before. USAF contingency response airmen worked with an Australian contingency response element, along with other representatives of the "Five Eyes" intelligence alliance—Australia, Canada, New Zealand, the UK, and the US.

"It's a chance to train like we fight for all of our units," said Lt. Col. Scott Taylor, the director of operations for the 821st Contingency Response Squadron. "We expect all of our units to maintain the same level of readiness, to be able to do this at any time."

Following that joint forcible-entry scenario, the exercise shifted its focus—practicing aeromedical evacuation on a grand scale. US and international partners, flying on each other's aircraft, practiced loading up as many wounded in as little time as possible onto a host of aircraft, including a C-5M Super Galaxy set up to carry almost 100 injured troops.

"We stress that [aeromedical evacuation] system in this

Photo: TSgt. Larry Reid Jr.

Soldiers with the Army's 17th Field Artillery Brigade at JB Lewis-McChord, Wash., secure a High Mobility Artillery Rocket System (HIMARS) on a C-17 as part of Mobility Guardian.

exercise, to a great degree," Miller said. "We gave them mass casualties, with no time to triage, no time to wait for an extra airplane. … That is something we never practice—this is the first time we've done this, those kind of real-world contingencies that we never get around to, that we know we're going to face."

INTERNATIONAL FLAVOR

All told, Mobility Guardian included almost 40 international partners—either flying or observing or both. Early in the exercise, Fairchild's ramp included Canadian C-130s and Royal Australian Air Force C-17s and KC-30 tankers flying alongside US airframes. Wing Commander Sarah Stalker, commander of the RAAF's 33 Squadron and leader of the RAAF detachment at the exercise, said her service's major goals were to fly in formation with US aircraft and experience using their Airbus-built KC-30 tankers to refuel aircraft they don't usually get to practice with, especially smaller aircraft that use a boom as opposed to Australian fighters, which use a drogue system.

"The major goals for us, we're looking at the interaction pieces and interoperability," she said.

Among the opportunities: linking up two tankers with Air Force Global Strike Command B-52s for simulated strike missions.

Throughout the exercise, Fairchild operated as if under threat, a scenario the Air Force hasn't faced in real life for decades, but that would be the case for overseas bases in a real war with a peer rival.

Flying operations had to overcome degraded communications, with airmen at times serving as "runners" to simulate the loss of radio communications. Base's security forces practiced warding off small drones and finding ways to be intimidating in order to protect a base cut off from bringing in reinforcements, said Col. Derek Salmi, the commander of the 92nd Air Refueling Wing at Fairchild. Salmi is also serving as the commander of the 621st Air Exercise Wing for Mobility Guardian.

AMC must be able to do "just do what we do every day," but in a highly contested environment.

"We know the enemy is going to get to us" Miller said. "They're going to get into our cyber domains, they're going to mess with our cargo loads, going to mess with our crews. And it's inevitable. A lot of the stuff we do is on the nonsecure side, on the NIPR [Nonclassified Internet Protocol Router] side of the DOD network, and we've talked about how to secure that."

During the exercise, this meant air crews needed to know the commander's intent for their missions and be confident and able enough to meet that intent without being in contact with that commander or the operations center.

"If you're on a mission and you lose connectivity back to the mother ship, back to that command and control element, do you continue, or do you not continue?" Miller said. "We give—before you launch—as part of that mission planning, … your commander's intent. You will proceed. You will do this."

In the midst of the exercise, Fairchild had to maintain current operations, such as having tankers standing alert, around-the-clock for homeland defense and strategic support. The base sent two tankers to nearby Spokane International Airport to stay on alert, with more personnel and aircraft sent to March ARB, Calif. Additional crews were deployed to Afghanistan and Incirlik AB, Turkey, as well as Operation Juniper Micron, a refueling mission operating out of Spain to support French operations in Africa.

Yet, the 92nd at Fairchild has about 2,900 personnel and 44 aircraft. At the peak of the exercise, it anticipated an additional 2,500 personnel and 43 aircraft, effectively doubling the overall force structure of the base. Clustered tents formed an "ops town" and a short line of local food trucks offered burritos, barbecued ribs, and macaroni and cheese as alternatives to field rations. The exercise's headquarters, which connects via video teleconference to the AOC at Travis, is in the basement of the base's post office.

Mobility Guardian's goal is to better prepare Air Mobility

Photo: SrA. Charles Fultz

Royal Canadian Air Force Capt. Kathleen Nguyen, a 1st Canadian Field Hospital critical care nurse, practices treating simulated patients as part of an aeromedical evacuation scenario during exercise Mobility Guardian at Fairchild AFB, Wash.

Command to fight in a world where the US may not be able to claim air dominance in combat zones or even on bases. AMC must therefore become more agile and flexible, such as adapting a location that usually only flies one mission set—tankers, in Fairchild's case—to become the main operating location for every aspect of a combined force operation.

In Europe, for example, only Ramstein AB, Germany, has a heavy airlift presence, while tankers are well-represented at RAF Mildenhall, UK. In a conflict with another top-tier military, bases will need to be able to support more than their regular operations and do so facing possible jamming, cut-off communications, and other problems.

With Mobility Guardian, "we've basically erased that map," said Lt. Col. Brett Fish, the lead planner for the Mobility Guardian office at Fairchild. "Anywhere you see US presence, we've proven flexibility and adaptability, and we can be whatever the commanders want us to be."

AMC needs to be able to surge to a new location and "be able to sustain not only the mobility air forces, but the combat air forces," Monaco said. The Air Force calls the concept "Agile Combat Employment," and Mobility Guardian was framed so the command could practice handling the fuels, munitions, and other materiel that would be needed in a fight. Because in the real world, "Who's going to be moving that stuff around? It's us," Monaco said.

AMC brought in portable fuel bladders to set up refueling operations as if they had no fuel infrastructure, something the command doesn't usually practice. "We don't get the hands-on training, so this is providing real-world readiness for our younger airmen," said MSgt. Donovan Horning, the AMC/A4 fuels plans and readiness manager.

"Adversaries are going to try to disrupt our joint force employment and force flow to posture for major combat operations," Monaco said. "How are they going to do that? They are going to deny, disrupt, degrade our intermediate staging bases and main operating bases. We know that. Especially the higher-end [adversaries] that have cruise missiles and all that type of stuff that can reach out and touch us."

Photo: TSgt. Larry Reid Jr.

Airmen with the 21st Airlift Squadron guide an Army High Mobility Artillery Rocket System onto a C-17 at Gray Army Airfield, Wash.

The world has changed. "We always just assume we're going to be able to go into a permissive, big base," Monaco said. "Those days are over." ✪

Photo: SSgt. Loren Bonser via National Archives

USAF Honor Guard at Hanscom AFB, Mass., presents arms as Sheila Widnall, the first woman ever to be a service secretary, arrives on June 27, 1997.

Proven Prowess

Women have successfully led the Air Force. Why has no other service had a female top civilian?

By Rachel S. Cohen

The Air Force is welcoming its third consecutive female Secretary at a time when the nation has yet to see a woman as Army or Navy Secretary or as Secretary of Defense.

The Senate Armed Services Committee held a Sept. 12 confirmation hearing for Barbara Barrett, President Donald J. Trump's nominee to be the next Air Force Secretary, and she is expected to be confirmed by press time. Barrett is a former Federal Aviation Administration deputy administrator and former chairman of the board of trustees for the nonprofit Aerospace Corp., and a past member of the Defense Advisory Committee on Women in the Services (DACOWITS) during George H.W. Bush's presidency.

How the Air Force came to be the likeliest spot for female senior civilian leaders in the Department of Defense may be because it places a greater emphasis on technology, and that women are more likely to have relevant backgrounds applicable to air and space than in the ground or maritime domains, some experts say. Others argue it's simply a case of good timing.

"We will see more female service Secretaries and a female Secretary of Defense in the not-too-distant future."
—Thomas Spoehr, Heritage Foundation

Sheila E. Widnall, a Clinton-era nominee from the Massachusetts Institute of Technology, was the Pentagon's first Senate-confirmed female service Secretary, becoming Air Force Secretary in 1993 and serving until 1997. Sixteen years later, President Barack Obama plucked Deborah Lee James from the private sector to serve as Secretary from 2013 to 2017. Heather Wilson, a university president and former Republican congresswoman from New Mexico, followed James from 2017 to May 2019. All three spoke by email or phone to *Air Force Magazine* for this story.

"The Air Force is providing a model to the other

Photo: A1C Chad Gorecki

Then-Secretary of the Air Force Heather Wilson speaks with airmen at Scott AFB, Ill., in 2018. Wilson became the third—and second consecutive—female SECAF when she replaced Deborah Lee James in 2017.

services that says, hey, there's an entire half of the population, and some women have a really extensive background in management and leadership and the technical aspects of the field," said Kate Kuzminski, an associate political scientist at RAND Corp. who studies military personnel. The women set an example for political leaders to "expand the scope of who they're looking at when they're filling these Secretary positions," she added.

The civilian women who have led the Air Force reflect the more technocratic nature of the Air Force as compared to the other services: Wilson ran the South Dakota School of Mines and Technology before becoming Secretary; James came from various leadership positions at government contractor SAIC in McLean, Va.; and Widnall was associate provost at MIT with a background in aerodynamics before taking on the role.

While there is no legal requirement for a service Secretary to have spent time in the military or to meet uniformed physical standards, the perception persists that civilian leaders overseeing the other services would need to have greater experience, understanding, and capability regarding the physical demands of combat.

Women were considered for the SECAF job before the other services, Kuzminski argues, because a broader range of people can compete in fields based on technical merit.

"The physical differences of upper body strength really just aren't an issue in the Air Force," Wilson added.

Others dispute the notion that a Secretary's experience must reflect the physical demands of military service, saying that while a secretary must understand the institution in as many ways as possible, their knowledge must reflect not only combat but education, health care, finance, and more.

"Physical strength is nowhere on the list of qualifications for a service Secretary," Thomas W. Spoehr, a retired Army lieutenant general who now runs the Heritage Foundation's Center for National Defense, told *Air Force Magazine*. "Doubt Dwayne 'The Rock' Johnson would be a good Army Secretary."

REALISTIC REQUIREMENTS

Instead, Spoehr said, a successful service secretary should be an experienced leader and manager, someone who communicates well and gets along with Congress. He believes the Army and Navy's first female civilian bosses may not be far away.

"There is now a good number of qualified female officials who could easily serve in those roles," Spoehr said. "We will see more female service secretaries and a female Secretary of Defense in the not-too-distant future."

Eric K. Fanning, who served as deputy undersecretary of the Navy, undersecretary and acting Secretary of the Air Force, and Secretary of the Army between 2009 and 2017, noted there are women in both political parties that an administration could call on to run the land and sea services. Female members of Congress, governors, academics, industry leaders, and others have the skills to run a military department, Fanning said, adding the Army and Navy could see that day within the next several years.

Mackenzie Eaglen, an American Enterprise Institute defense fellow, said change will come from the top down. The DOD has already seen women like Michèle Flournoy, undersecretary of defense for policy from 2009 to 2012, and Ellen Lord, the Pentagon's current acquisition chief.

"A woman SECDEF would presumably be more likely to overtly target and recruit other women to lead at the Defense Department," Eaglen said. "I don't think the services that much care about what the others are doing in this regard."

Female Air Force Secretaries are the new normal. Acting SECAF Matt Donovan, speaking at a recent conference hosted by *Defense News,* noted that—as the first male civilian in charge since Fanning in 2013—he's now the odd man out.

While it's been more than a decade since the Senate last confirmed a man as SECAF, the defense community should not come to think of it as a woman's job, according to Loren DeJonge Schulman, deputy director of studies at the Center

Photo: NASA

Photo: Wayne Clark/USAF

Barbara Barrett trained as a backup crew member for a space tourism mission to the International Space Station (above). She testified at her confirmation hearing to be Secretary of the Air Force before the Senate Armed Services Committee in September (right), but had not been confirmed at press time.

for a New American Security. That label is "fundamentally unproductive," she said.

"Cogent and thoughtful discussion on how women are equally as capable as men in these roles while still bringing some unique perspectives remains challenging for the national security community," Schulman said. "There are some issues that women are simply more likely to raise or be familiar with—but are less likely to do so if they are painted as focused exclusively on women's issues."

Fanning, who now heads the Aerospace Industries Association, argues the country has moved past the idea that women run the Air Force due to tokenism. The Air Force was born to handle air warfare with new technologies and ideas outside its former home in the Army, he said, and the people chosen to lead the service are among DOD's most qualified, forward-thinking officials.

"The Air Force lends itself to thinking more broadly about its leadership than maybe the other services, the other military departments do," Fanning told *Air Force Magazine*. "This, in my mind, greatly advantages the Air Force for the future. As they can become known as the service that is more inclusive, they're going to be able to access more of the capability of this country."

Each Secretary's tenure is defined by a different focus. For example, James prioritized personnel issues, while Wilson pushed science and technology. No matter their hallmarks, James said, all have been role models.

"When you're at the top of an organization and you're different from everybody else, then those who are also different from the majority look up to you as a role model," James said. "I'd like to think that that is a good thing."

The USAF Secretaries have helped each other in ways tangible and intangible, drawing upon the experience of male and female predecessors alike. Widnall broke the so-called glass ceiling for her female successors, paving the way for their further acceptance in service leadership. Yet, despite some effort, Widnall and James never connected when the latter took office.

After Wilson succeeded her in 2017, James wrote to Wilson urging her to keep an eye on the nuclear enterprise and on combating sexual assault.

"Even though [those issues] might be seemingly going well at any given time, be careful, because they have a way of coming back again and backtracking and getting somewhat out of hand," James recalled of her advice.

Wilson said she also relied heavily on Lisa S. Disbrow, James's undersecretary who filled in as acting Secretary until Wilson was confirmed, and continued serving as the No. 2 civilian until August 2017.

"She had been an Air Force officer, really cared about the airmen, and has a black belt in Pentagon," Wilson said of Disbrow. "She taught me a lot about budget process, and how the [Office of the Secretary of Defense] staff, the Joint Staff, and the services work together."

Wilson was the senior woman—civilian or military—in the Pentagon during her tenure. The relationship between civilian and military leadership can be tricky. Secretaries have the overarching authority to set and approve policy. Service chiefs, on the other hand, are responsible to the Secretary or implementing policy, and as operational experts, provide plans and recommendations to the Secretary for approval.

Uniformed leadership is still overwhelmingly male; only a few women have led major commands and no women have led a service or served on the Joint Chiefs of Staff. Wilson believes her background as a US Air Force Academy graduate helped her standing with Air Force members.

"Two of my male predecessors … told me that I should fire at least one general officer early on 'so they take you seriously,' " Wilson said. "I never felt a need to do that. … I was confident in myself and what I knew and didn't know. I felt respected from Day One."

IDENTIFYING HURDLES

Widnall said she faced no gender-related hurdles as Secretary. James agreed, saying she felt greater pressure in majority-male environments as a younger woman than she did as a senior Air Force official. James echoed Wilson's confidence but said she went through a time when she second-guessed herself

Photo: A1C Arielle Vasquez

Then-Secretary of the Air Force Deborah Lee James talks with B-1B maintainers at Andersen AFB, Guam, in August 2016.

and shied away from contributing to discussions because she wasn't completely sure of all the facts.

"Is all of this because I'm a woman? Is it because I was young? Is it just simply because the confidence level wasn't yet there? I'm not sure," she said. "I never have been myself the victim of any sort of terrible environment due to being in a heavily male environment. I've certainly been in environments where there's been improper jokes … but never anything that I felt that I couldn't handle and stop."

While women have reached the highest positions in civilian Air Force leadership, uniformed jobs are still dominated by men. In the era of Brie Larson's "Captain Marvel" blockbuster—featuring a female fighter pilot-turned-superhero—the service is still spreading the message that women are warfighters, too.

"Think about the most protective person you know in your life, someone who would do anything to keep you safe—half the people in this room are thinking about their moms," Wilson said to House lawmakers in 2018. "We [the military] serve to protect the rest of you, and that's a very natural place for a woman to be."

Women account for about half the US population and 20 percent of the Active Duty Air Force; about 30 percent of USAF's civilian workforce are women.

"Historically, the Air Force has had the highest percentage of enlisted and officer women," the Council on Foreign Relations wrote in April 2018. "However, by 2016, the Navy had nearly caught up. In both services, approximately one in five enlisted members and officers are women."

At press time, three of 21 Air Staff members, and three of 18 members of the secretariat, were women. Air Mobility Command boss Gen. Maryanne Miller is the only woman currently leading a USAF major command.

In 2016, the Defense Department opened all combat positions to women, including several special operations specialties in the Air Force. Kuzminski argues having a female SECAF likely helped bring new Pentagon diversity policies to fruition during James's tenure.

Regardless of gender, James added, whomever is running the service has to continue to push forward diversity and furthering initiatives started in earlier administrations.

"The first couple of women that actually, eventually make it in there are going to have a tough time of it because the rest of those unit members are not going to be used to it at all—they're quite likely to be resistant and questioning—and it might feel like a very harassing environment," James said of the newly opened special operations fields.

Wilson pointed out that while the special operator and pararescue fields are unusual, they often work alongside coed teams of "remarkable special operators."

During James's tenure, the Defense Department also doubled maternity leave for women and increased paternity leave. James built on that change with others, including relaxing the height requirements that an airman needs to hit to qualify as a pilot—a shift that largely affected women. She also changed the rules so that women could wait to take the physical training test and become available for deployments one year after giving birth, rather than six months.

"The more I traveled, the more I talked to women that [it] was impacting, they were doing unhealthy things to be able to pass that PT test within six months of birth," James said. "They didn't want to leave a newborn child just six months into life."

Changing policies to better serve women and families affects military readiness. Women leave military service mid-career at about twice the rate of men, James said. That shrinks the pool of qualified women who reach senior leadership, and further stresses the all-volunteer service, which is struggling to keep pilots and other service members who want the private sector's flexibility and higher pay.

"The hardest thing is retention at the 10- to 12-year point of highly skilled people who have options," Wilson said. "The Air Force is too small for what the nation is asking of it. Reducing overseas deployments, getting more 'white space' on the calendar, and making it easier to balance service and family life is important to women and men in the service."

Finding solutions to bring women back in after an extended leave—say, to start a family—can ensure the Air Force continues benefiting from someone it has already trained. Some changes are being worked through legislation.

"If you decide you want to have two years at home with a child, whether you do the career intermission program or you leave Active Duty altogether and then you go to the Reserve, it's difficult to get the on-ramp back onto Active Duty. In fact, it's nearly impossible," Kuzminski said.

COMBATING SEXUAL ASSAULT

A female perspective in leadership is also crucial as the military continues to combat sexual assault in its ranks, although much of the process to address it is handled through the uniformed chain of command. Very little long-term research shows that any of the Defense Department's education, training, and prevention efforts have successfully reduced harassment and assault rates, Wilson said: "That is frustrating."

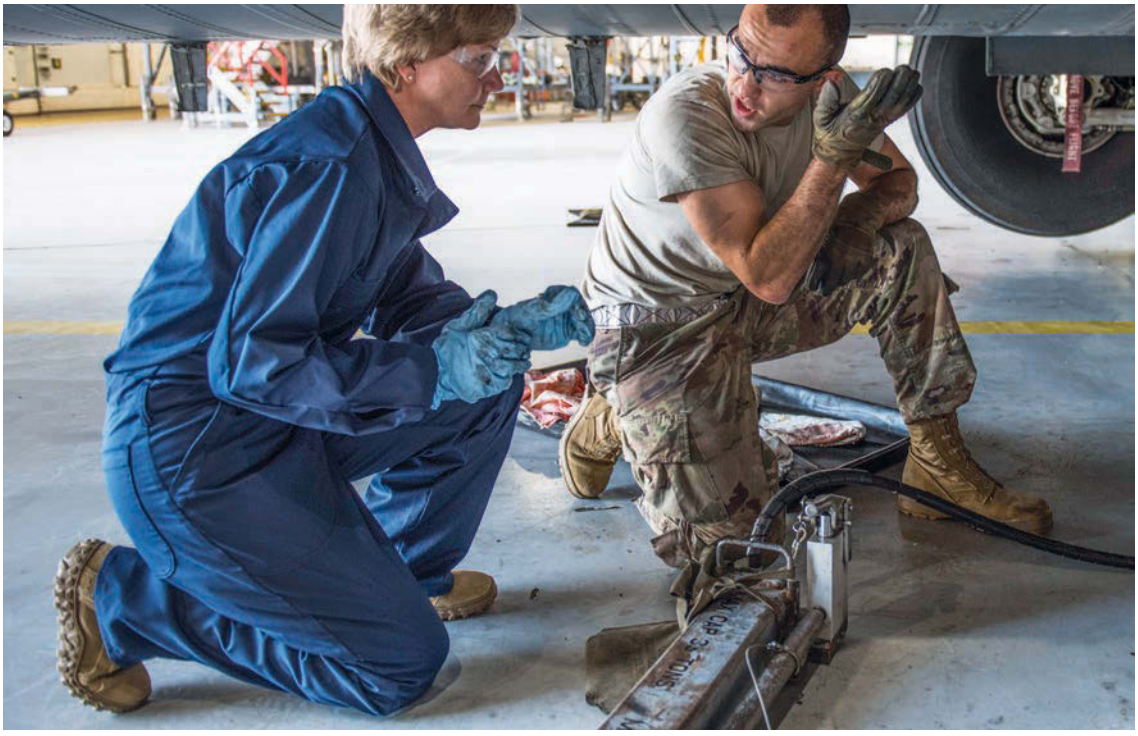


Photo: TSgt. Jodi Martinez

Gen. Maryanne Miller (left), Air Mobility Command boss, with SSgt. Brian Aviles, a C-130 maintainer. Miller is currently the only woman leading a USAF major command.

While sexual assault reports in the military are climbing overall, the Air Force reported the lowest incidence of assault in any service—4.3 percent among women and 0.5 percent among men—in the Pentagon's fiscal 2018 analysis. That rose from 2.8 percent and 0.3 percent among women and men, respectively, since the 2016 report.

A recent DOD report on sexual assault at the service academies during the 2017-2018 school year also found that about 221 USAFA cadets had experienced unwanted sexual contact, up from around 150 cadets estimated two years before. Twenty-one cadets reported an assault during their military service. The publication notes that USAFA's reporting rate has dropped since the 2011-2012 school year.

"It's got to be this leadership mantra in my opinion, to keep measuring, keep talking about it constantly, make sure the commanders at all levels know that you're watching and that you expect behaviors and you expect to keep on top of this situation," James said. "I'm not 100 percent sure that's still happening."

Despite efforts to address gender imbalance, Wilson still worries that there aren't enough women in national security positions.

"While I have a Ph.D. in international relations with a specialty in national security and international law, and women were probably as prevalent in my Ph.D. area as men, I don't see women in the Pentagon as much as they should [be] by now," she said.

The service is working to boost the numbers of women at USAFA, which can bolster female leadership down the road. Thirty percent of the academy's latest round of applicants were female, up from around 25 percent in recent years, according to the Air Force.

Wilson, who graduated in the third academy class that admitted women, was the first cadet to go on to become SECAF.

"It's a small subset of the future Air Force leaders and you have them all captive at one place at one time, and so [it is] a good time to introduce the business case for why diversity and inclusion matter. … It is the right thing, but also making the case for how it makes the Air Force itself more combat-effective," Kuzminski said.

Widnall, who praised USAFA as a proving ground for diversity, told *Air Force Magazine* the visibility of women in leadership roles offers confidence to younger generations, both enlisted and officers, that they can advance based on their skills. Seeing women run a service can also inspire girls interested in science, technology, engineering, and math (STEM) career fields to aim for military leadership as well, she said.

James believes it will be 25 to 30 years before uniformed Air Force leadership is more evenly split between men and women—if the service continues its traditional methods of growing senior officers. But it doesn't require a 50-50 split for women's input to start turning the cultural tide.

"Thirty percent tends to be considered a tipping point," James said. "Once an organization is 30 percent women, that has been deemed to be … the point whereby culture changes. That's enough women that people are used to having them around, people are used to not being shocked that they perform and perform well, and they become much more part of the team and accepted, and you almost become gender-blind."

That process has been in the works for decades. Wilson recalled the first time she saw a woman with pilot's wings while walking around USAFA.

"I saluted a young woman officer who wore wings," she said. "I actually turned around and said, 'Ma'am, excuse me, but could you tell me where you got those?' She was kind enough to stop and tell me her story. We are our stories."

Later, while serving in Congress from 1998 to 2009, Wilson met a female Air Force major general. During her time as Secretary, the service had three female four-star generals and multiple female lieutenant generals.

"It has started to not become a big deal—which is a big deal," she said.

In addition to female Army and Navy Secretaries, Wilson and James believe a female Defense Secretary is on the horizon as well. James said it could happen in the next 10 years; Wilson said it will occur during her lifetime.

What's more, Wilson bets, she'll live to see America's first female Commander in Chief. ✪

Disaster in the Philippines

Ten hours after Pearl Harbor, the Japanese caught US airplanes on the ground—again.

A B-17 at Iba Field, Philippines, in October 1941. The Japanese bases on Formosa were well within range of B-17s flying from Luzon.

Photo: Air Force Historical Research Agency

By John T. Correll

The first wave of Japanese bombers approached Clark Field undetected on Dec. 8, 1941. By the time US airmen realized they were under attack, the bombs were already falling.

Almost all of the American airplanes at Clark—45 miles north of Manila and the main operational base of the Far East Air Force in the Philippines—were lined up neatly on the ground when the strike came at 12:40 p.m. Japanese A6M Zero fighters followed the bombers, dropping down to strafe the ramp. The fighter base at Iba on the western coast of Luzon, 42 miles from Clark, was struck almost simultaneously.

By end of the first day, the strength of Far East Air Force was reduced by half, and it was eliminated as an effective fighting force. The FEAF response was scattered and ineffective. Of approximately 200 aircraft in the Japanese strike force, all but eight returned to their bases on Formosa.

Air superiority established, the land invasion began. The fighting continued for several months, but the Japanese victory was inevitable, leading to a surrender of US forces on May 6, 1942.

"How in hell could an experienced airman like you get caught with your planes on the ground?"
—Maj. Gen. Henry H. "Hap" Arnold, chief of US Army Air Forces

It was not as if US commanders in the Philippines had no warning. Ten hours had elapsed since the devastating Japanese attack on Pearl Harbor, where in addition to the naval losses, the US air forces were caught on the ground. Now, it had happened again.

When Pearl Harbor was struck at 7:55 a.m. on Dec. 7, 1941, in Hawaii, it was 2:25 a.m. on Dec. 8. Reports reached the Philippines soon afterward. In addition to warning messages received, the movement of Japanese aircraft was detected by radar and ground observers and there were several preliminary attacks.

Photo: AFA library

Maj. Gen. Lewis Brereton, commander of Far East Air Force in 1942.

Maj. Gen. Henry H. "Hap" Arnold, chief of the Army Air Forces, called FEAF commander Maj. Gen. Lewis H. Brereton to ask, "How in hell could an experienced airman like you get caught with your planes on the ground? That's what we sent you out there for, to avoid just what happened. What in the hell is going on there?"

The question has never been answered satisfactorily. Pearl Harbor generated 10 official investigations. The senior officers in Hawaii, Adm. Husband E. Kimmel and Gen. Walter C. Short, were relieved of command and forced into retirement. By contrast, there was no official investigation of events in the Philippines, and no one was held accountable.

Most historians and analysts place primary blame on Lt. Gen. Douglas MacArthur, commander of US Army Forces in the Far East (USAFFE). MacArthur and his loyalists—especially his Chief of Staff, Brig. Gen. Richard K. Sutherland—blamed Brereton. However, a close look focuses on the inexplicable actions of MacArthur and Sutherland.

Planners and strategists in Washington must also bear some fault. The war plan then in effect was unrealistic in its expectations, and MacArthur and Brereton did not have nearly enough resources to carry out its provisions.

There was no real chance of repelling the Japanese attack completely, but it might have been possible to slow the advance and disrupt the Japanese timetable in the Pacific. Any potential strategic value in doing so was lost in the addled US response.

OUTPOST IN THE PACIFIC

The United States had never known quite what to do with the Philippines, which came under its control as a result of the Spanish-American War in 1898, was granted commonwealth status in 1935, and promised independence by 1946.

There was considerable opinion that the Philippine Islands—more than 7,000 miles from the California coast and closer to Tokyo than to Hawaii—were indefensible. The Navy wanted to keep a strong naval presence but the Army, responsible for protection of the bases, regarded the Philippines as a liability.

War Plan Orange in 1928 and the follow-on Rainbow 5 plan in early 1941 visualized nothing more than defensive operations by the Army garrison and the Asiatic Fleet until reinforcements got there.

However, the Philippines had one great military asset: MacArthur, the former US Army Chief of Staff and a field marshal in the Philippine Army since his retirement in 1937. His relationship with the Philippines was special, dating back to 1900 when his father was military governor.

With the prospect of war deepening, MacArthur was recalled to Active Duty in July 1941 as commander of the newly created USAFFE. The Rainbow 5 plan was revised, setting aside the defensive strategy, shifting the emphasis to the offensive, and prescribing "air raids against Japanese forces and installations" in the event of war.

MacArthur's copy of the plan was delivered by FEAF commander Brereton, who arrived from Washington on Nov. 3. Like other US leaders in the Pacific, MacArthur had received warnings of the possibility of a Japanese attack, but he told Brereton that his own estimate was that hostile action was unlikely before the spring of 1942.

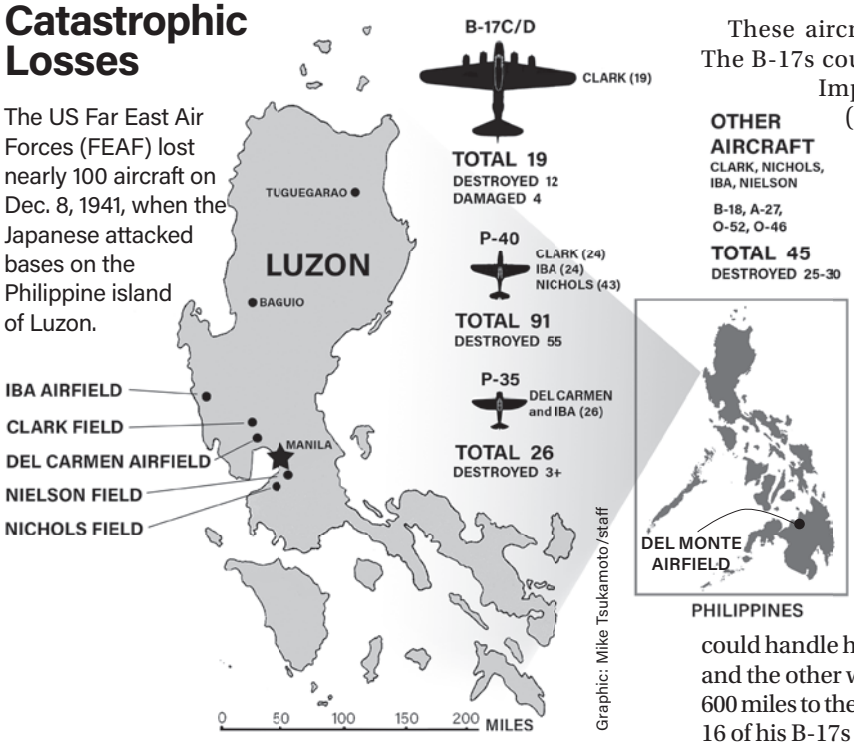
The Army ground forces consisted largely of indigenous

Photo: US Army Signal Corps Collection via National Archives

Gen. Douglas MacArthur (left) and his Chief of Staff, Maj. Gen. Richard Sutherland, in the headquarters tunnel on Corregidor, Philippines, March 1, 1942. MacArthur moved his headquarters to the island after conceding Manila to the Japanese in December 1941.

Catastrophic Losses

The US Far East Air Forces (FEAF) lost nearly 100 aircraft on Dec. 8, 1941, when the Japanese attacked bases on the Philippine island of Luzon.



Graphic: Mike Tsukamoto/staff

Philippine scouts under US command. MacArthur's critical military strength was provided by his air forces.

DEFENDERS

As recently as 1940, airpower in the Philippines had amounted to a handful of obsolete B-10 and B-18 bombers and open-cockpit P-26 "Peashooter" pursuit airplanes. The first P-40 fighters and B-17 bombers came in 1941. The Philippine Department Air Force was reorganized as FEAF, with subordinate Bomber and Interceptor commands.

The War Department projected almost 600 combat aircraft to be stationed in the Philippines, but that was a distant goal. When the Japanese struck on Dec. 8, FEAF had a total of 181 aircraft—among them 19 B-17s and 91 P-40s—on Luzon, the northernmost of the Philippine Islands.

These aircraft were of great concern to the Japanese. The B-17s could reach the southern tip of Japan, and the Imperial Army and navy air bases on Formosa (the island now called Taiwan) were well within range.

The P-40 interceptors were the only force that could interfere with Japanese air superiority in the Philippines. The P-40 could not match the A6M Zero in agility or climbing speed, but it was the front-line fighter of the Army Air Forces and fully capable in the air defense role over Luzon.

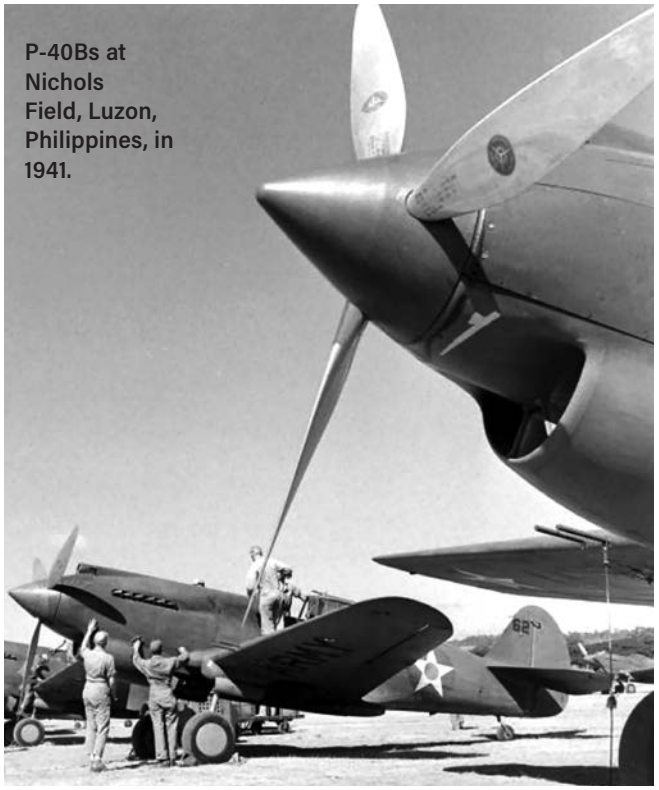
The objective of the strikes at Pearl Harbor and the Philippines was to shield Japan's drive southward to seize the oil and natural resources of Southeast Asia and the Dutch East Indies. The strategy was to clear the US forces in the Philippines out of the way. Key targets were the fighter bases. If the Japanese could knock out the P-40s, they could operate at will against the rest of the defenders.

Only two landing fields in the Philippines could handle heavy bombers in the wet season. One was Clark, and the other was Del Monte on the island of Mindanao, some 600 miles to the south. As a security measure, Brereton dispersed 16 of his B-17s to Mindanao on Dec. 5 and kept the other three at Clark. The remaining capacity for B-17s, at Del Monte, was reserved for a bomb group due to deploy from the United States.

USAFFE possessed seven radar sets, of which two—one at Iba Field and the other outside Manila—were operational on Dec. 8. Ground observers at critical locations served as additional lookouts, but it took almost an hour for their reports to reach Interceptor Command.

Most of Japan's carriers were allocated to the Pearl Harbor attack so land-based navy and army aircraft from Formosa would carry out the strike on the Philippines. The plan was to launch them as soon as confirmation of the strike on Pearl Harbor was received. The airplanes were gassed and ready, but a thick fog rolled in at midnight and delayed takeoff.

According to information obtained after the war, the delay caused anxiety among the Japanese, who anticipated that B-17



P-40Bs at Nichols Field, Luzon, Philippines, in 1941.

Photo: US Army Air Corps

strikes had been ordered and knew that their defenses were "far from complete" and "would have been ineffective against a determined enemy attack."

STRANGE INTERLUDE

The first report from Pearl Harbor reached Manila at 2:30 a.m.—five minutes after the attack—in a message from Hawaii to the US Asiatic Fleet, but the information was not relayed immediately to the Army.

USAFFE heard the news from a commercial radio station around 3 a.m. and alerted base commanders. Sutherland awakened MacArthur at 3:30 when official notice was received. At 3:40, Brig. Gen. Leonard T. Gerow, chief of the Army War Plans Division, called MacArthur from Washington, D.C., with a longer account.

At 4 a.m. Gen. George C. Marshall sent MacArthur a cablegram directing him to "carry out tasks assigned in Rainbow 5 as they pertain to Japan." The War Plans Division called again at 7:55 to check on the situation in the Philippines and to give an additional warning.

Brereton, seeking permission to strike the Japanese bases on Formosa, tried to see MacArthur at 5 a.m. but was denied access by Sutherland. With the B-17s standing by for takeoff, Brereton made another attempt to see MacArthur at 7:15 but was again turned away by Sutherland. At 8:50, Sutherland instructed Brereton to "hold off bombing of Formosa for the present."

In his memoirs, published in 1964, MacArthur said that as late as 9:30, "I was still under the impression that the Japanese had suffered a setback at Pearl Harbor" and that it was even later when "I learned, to my astonishment, that the Japanese had succeeded in their Hawaiian attack." This claim was not credible, and the memoirs treat the events of Dec. 8 in less than three pages.

At 10 a.m., Brereton checked back with Sutherland, who told him to take no direct action. Finally, at 10:14, MacArthur called Brereton directly and gave him the authority to make the decision on offensive air action.

CONFUSION

Hours earlier, as dawn approached, fighters on Luzon maintained their alert but the first blow fell far to the south. Aircraft from a lone Japanese carrier struck two US Navy locations in Mindanao at 6 a.m., destroying two PBY seaplanes but accomplishing little else.

The fog over Formosa lifted around 7 a.m., and two formations of imperial bombers headed for northern Luzon. At about 9:30, they attacked a landing strip at Tugueraro—no airplanes there that morning—and Baguio, the summer capital of the Philippines.

Meanwhile, as a precautionary measure, FEAF had ordered the B-17 and B-18s into the air and was holding them in a pattern in the vicinity of the base. FEAF pursuit squadrons attempted to intercept the Japanese bombers but were unable to do so. Observers reported that the Japanese were returning home and at 10 a.m. an all-clear signal was sent to US aircraft.

With MacArthur having cleared Brereton to bomb Formosa, the B-17s prepared to land for refueling, loading of ordnance, and crew briefing.

"It required some time to bring in all the bombers from patrol, but shortly after 11:30 all American aircraft in the Philippines, with the exception of one or two planes, were on the ground," the official Air Force historical account said. However, at 10:15, the main Japanese strike force—108 navy bombers and 84 Zeros—set out for Clark and Iba. At 11:20, radar picked up their approach. The warning to FEAF units, issued through Interceptor Command channels, was not passed on to the bomb group at Clark.

Confusion prevailed. The pursuit group commander directed his available fighters to cover Manila, believing that was the target for the incoming Japanese formations. The P-40s at Clark were held on the ground where pilots "awaited takeoff orders while eating sandwiches sent out to them," according to historian William Bartsch.

"All during the Clark Field attack there were 36 P-40s and 18 P-35s airborne and covering Nichols Field, Cavite, and Manila, 55 miles south of Clark Field," Brereton said. "Efforts to get this fighter force to proceed to Clark were unavailing because the one radio set available for fighter-ground communications had been hit in the initial attack."

CAUGHT ON THE GROUND

The Japanese formation approached Clark in two waves. It "was almost overhead at the time the air raid siren was sounded and the bombs began exploding a few seconds thereafter," the official Air Force history said.

The bombers, flying at high altitude, left the B-17s largely undamaged, but they were followed by the fighters in a low-level strafing attack that was devastatingly effective. "Only one B-17 at Clark was not hit," according to Brereton.

A few gun crews got their antiaircraft weapons into operation. Most of the shells turned out to be duds and those that were not could not reach the Japanese bombers at altitude. But several P-40s were able to take off and shot down three Zeros.

"We looked down and saw some 60 enemy bombers and fighters neatly parked along the airfield runways," a Japanese pilot said in postwar interrogation. "The Americans had made no attempt to disperse the planes and increase their safety."

The other Japanese formation hit Iba at about the same time. "Damage at Iba was, if anything, more severe [than at Clark]," the Air Force history said. "Of the 3rd Squadron's P-40s, apparently only two escaped destruction. Bombs crashed into barracks and

service buildings. Much of the airplane maintenance equipment was lost, and with it, the entire radar installation."

Of the 181 FEAF airplanes based on Luzon when the Japanese attacked, about 100 were destroyed, and others were significantly damaged in the bombing and strafing attacks. P-40s from Clark and the other US fighter bases shot down seven Zeros and one Mitsubishi G3M bomber.

The B-17s were "thought capable of striking the enemy's bases and cutting his lines of communication," said Army historian Louis Morton. "Hopes for the active defense of the islands rested on these aircraft. At the end of the first day of war, such hopes were dead."

The Japanese soon had command of the air over Luzon. "Except for reconnaissance missions carried out by pursuit pilots, the air force could offer little support to the hard-pressed infantry," the official history said.

FALL OF THE PHILIPPINES

The primary target for the Japanese naval bombers on Dec. 9 was the Nichols Field fighter base near Manila. Del Carmen and Nielson Fields were struck on Dec. 10, and Nichols was hit again. Tactics were similar to those employed at Clark. The bombers came first, followed by fighters in low-level strafing attacks.

With the radar at Iba destroyed, the only warning was from observers and air patrols, and that was limited. By Dec. 10, Interceptor Command had only 30 pursuit aircraft left, including eight outmoded P-35s, but not counting one or two useless P-26 Peashooters.

Most of the Asiatic Fleet withdrew from Philippine waters, leaving only submarines to contest Japanese naval superiority. The Japanese infantry began its invasion of Luzon on Dec. 10.

The remaining B-17s on Luzon fell back to Mindanao Dec. 11. As the Japanese attacks reached Del Monte Dec. 19, the B-17s were withdrawn to Darwin, Australia. Several B-17 strikes against the invaders were mounted, staging when feasible from Del Monte and Clark, but the results were negligible.

MacArthur conceded Manila and moved his headquarters to the fortress island of Corregidor Dec. 24. Brereton and the remnants of FEAF were transferred to Australia. On orders of President Franklin D. Roosevelt, MacArthur also left the Philippines March 12 to set up a new command in Australia.

The War Department announced March 25 that MacArthur had been awarded the Medal of Honor. This was done at Marshall's urging and approved by Roosevelt mainly as an effort to counter accusations that MacArthur had abandoned his post in the Philippines.

Lt. Gen. Jonathan M. Wainwright, commanding all forces in the Philippines, surrendered unconditionally on May 6. MacArthur expressed his strong disapproval.

JUDGMENT

In early 1942, Brereton moved on to a new assignment. When Maj. Gen. George C. Kenney arrived to take command of air forces in the southwest Pacific, Sutherland told him the loss of aircraft on the ground in the Philippines had been Brereton's fault. In 1945, Sutherland said that Brereton had not obeyed a direct order before the attack to move all of the B-17s to Del Monte.

In his memoirs, published in 1946, Brereton laid out his side of the story. Among other things, he said that, "Neither General MacArthur nor General Sutherland ever told me why the authority was withheld to attack Formosa."

MacArthur reacted with a 400-word statement to *The New York Times*. "General Brereton never recommended an attack on Formosa to me, and I know nothing of such a recommendation having been made," he said. "Such a proposal, if intended seriously, should have been made to me in person by him." In any case, an attack on Formosa "would have had no chance of success."

Photo: USAF

P-35s lie in pieces at Nichols Field on Dec. 10, 1941. The Japanese forces inexplicably caught virtually the entire FEAF fleet on the ground mere hours after the attack on Pearl Harbor, Hawaii.

Furthermore, "the overall strategic mission of the Philippine command was to defend the Philippines, not to initiate an outside attack," MacArthur said.

As for the B-17s, "I had given orders several days before to withdraw the heavy bombers from Clark Field to Mindanao, several hundred miles to the south, to get them out of range of enemy land-based air."

None of this is substantiated in records or documents from 1941, however. Brereton attempted several times to present his proposal "in person." There is no explanation of why MacArthur did not find time to consult with the commander of his most important forces.

The mission under War Plan Rainbow 5 was not defensive. It was to take offensive action. MacArthur had been specifically reminded to implement Rainbow 5. It can be debated whether it would have worked, but a B-17 strike was of definite concern to the Japanese.

The plan to relocate some of the B-17s to Del Monte was proposed by FEAF staff in November. Sutherland agreed, with reluctance, on the condition that the move southward would be temporary. Brereton ordered the deployment. There is no indication that MacArthur took any interest in it prior to the attack.

Hap Arnold summed it up reasonably well in his memoir *Global Mission* in 1949. "I have never been able to get the real story of what happened in the Philippines," he said. ✪

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

Mosaic Warfare

Designing a New Way of War to Restore America's Military Competitiveness.

Photo: SrA. Alexander Cook

An F-35 with USAF's Lightning II Demonstration Team performs aerobatics in September. In the mosaic concept, F-35s and other highly integrated platforms would operate in close cooperation with single-function platforms to create a complete, interconnected and changeable web of systems.

*By **Lt. Gen. David Deptula, USAF (Ret.)**, and **Heather Penney** with **Maj. Gen. Lawrence Stutzriem, USAF (Ret.)**, and **Mark Gunzinger**. This article is adapted from the Mitchell Institute paper "Restoring America's Miltary Competitiveness: Mosaic Warfare," which can be downloaded in its entirety at: http://www.mitchellaerospacepower.org/publications.*

Ever since 1991's Operation Desert Storm, adversaries have systematically watched the American way of war, cataloging the US military's advantages and methods and developing strategies and systems to erode those advantages and exploit vulnerabilities in US force design. Now America faces challenges from China and Russia, each of which have watched and learned from US strategy in Iraq and Afghanistan and have responded by developing anti-access/area-denial (A2/AD) strategies and systems designed to block the United States from intervening should they choose to aggress against their neighbors.

Mosaic is conceived, in particular, as a response to the burgeoning threat posed by China, which has carefully designed its systems warfare strategy to counter America's traditional way of war.

The National Defense Strategy in 2018 sounded the alarm over the risks posed by Chinese and Russian revisionist ambitions. Wargames that centered on major conflicts with China and Russia have resulted in loss after loss for US forces. According to senior RAND analyst David Ochmanek, "In our games, when we fight Russia and China, blue gets its ass handed to it."

To overcome, the US military must transform itself to a new force design that can withstand and prevail in a systems warfare conflict. Mosaic warfare is one answer: a way of war that leverages the power of information networks, advanced processing, and disaggregated functionality to restore America's military competitiveness in peer-to-peer conflict.

Mosaic is designed to address both the demands of the future strategic environment and the shortcomings of the current force. The term "mosaic" reflects how smaller force structure elements can be rearranged into many different configurations or force presentations. Like the small, dissimilar colored tiles that artists use to compose any number of images, a mosaic force design employs many diverse, disaggregated platforms in collaboration with current forces to craft an operational system.

Mosaic employs highly resilient networks of redundant nodes to obtain multiple kill paths and make the overall system more survivable, minimizing

the critical target value of any single node on the network. This design ensures US forces can be effective in contested environments and that the resulting force can be highly adaptable across the spectrum of military operations. Mosaic combines the attributes of highly capable, high-end systems with the volume and agility afforded by smaller, less costly, and more numerous force elements, which can be rearranged into many different configurations or presentations. When composed together into a mosaic force, these smaller elements complete operational observe–orient–decide–act cycles (John Boyd's "OODA loops") and kill chains. Just like LEGO blocks that nearly universally fit together, mosaic forces can be pieced together in a way to create packages that can effectively target an adversary's system with just-enough overmatch to succeed.

CHINA'S SYSTEM-CONFRONTATION WARFARE

Mosaic is conceived, in particular, as a response to the burgeoning threat posed by China, which has carefully designed its systems warfare strategy to counter America's traditional way of war. China's A2/AD capabilities are designed to block America's physical access to combat zones and negate its ability to maneuver. Yet these systems do not merely pose technical and operational challenges; rather, according to Elbridge A. Colby, one of the authors of the National Defense Strategy, China intends to employ them to achieve strategic-level effects, rendering the most critical elements of US operations ineffective.

The overwhelming effectiveness of the United States in Operation Desert Storm precipitated a major shift in Chinese military theory. China scholar M. Taylor Fravel notes: "China's intensive study of the United States through the 1990s, especially toward the end of the decade, was ... intended to identify weaknesses that could be exploited, in addition to areas to copy." As a result, China envisions targeting US data links, disrupting information flows, denying command and control, and kinetically targeting physical nodes of US information systems, with the goal of systematically blinding US commanders and paralyzing their operations.

As Colby suggests, the Chinese A2/AD complex is not just an integrated air defense system, but more importantly a critical piece of a larger strategy to target and defeat US forces as a system. RAND analyst Jeffrey Engstrom calls this strategy "system confrontation" and its theory of victory "system destruction warfare." In combat operations, he says, "PLA planners specifically seek to strike four types of targets, through either kinetic or nonkinetic attacks, when attempting to paralyze the enemy's operational system."

These attacks encompass:

■ **Information.** Degrading or disrupting the flow of information in the adversary's operational system by targeting networks, data links, and key nodes to leave elements of the operational system "information-isolated" and thus ineffective.

■ **High Value Assets.** Targeting the key nodes or functionalities within the adversary's operational system, including command and control, ISR, and firepower: "If the essential elements of the system fail or make mistakes, the essence of the system will ... [become] nonfunctional or useless."

■ **Operations.** Degrading or disrupting the operational architecture of the adversary's operational system seeks to disrupt how elements of an adversary's system collaborate and support each other.

Terms of Reference

Systems Warfare: A theory of warfare that does not rely on attrition or maneuver to achieve advantage and victory over the adversary. Instead, systems warfare targets critical points in an adversary's system to collapse its functionality and render it unable to prosecute attack or defend itself. A major objective of this approach is to maximize desired strategic returns per application of force (achieve best value).

Force Design: Overarching principles that guide and connect a military's theory of warfare and victory, its doctrine, operational concepts, force structure, capabilities, and other enterprise functions.

Disaggregated Element: Functionality that has been decomposed to its most basic practical combat element; for example, an observation or orientation function. These elements can range from simple functions, such as a single-sensor observation node, to more complex platforms, as needed, to be viable in the overall combat system, such as a multifunction aircraft.

Node: An element in the combat zone, whether disaggregated or multifunction, that participates in the operational architecture by receiving and sharing information.

Mosaic: A force design optimized for systems warfare. Modular and scalable, a mosaic force is highly interoperable and composed of disaggregated functions that create multiple, simultaneous kill webs against emerging target sets. A mosaic force's architecture is designed for speed, has fewer critical nodes, and remains effective while absorbing information and nodal attrition.

■ **Speed.** Distorting and extending the adversary's time sequence or operational tempo (the OODA loop) aims to induce friction, confusion, and chaos by employing deception, creating nodal failures and network and data link outages to cause "stutter" at any stage in the decision loop or kill chain.

THE TRANSFORMATION IMPERATIVE

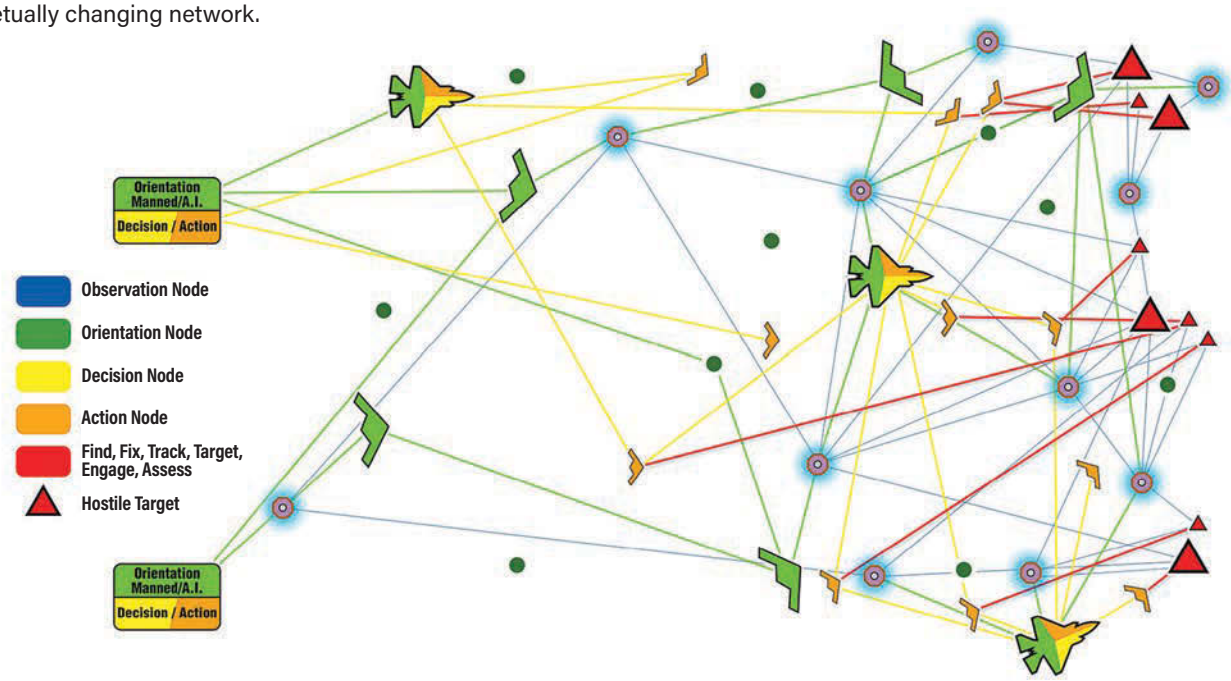
Future adversaries will learn from China's progress in maturing a systems warfare theory that targets US force design and operations, so systems warfare will not be limited to China over the long term. The Department of Defense should consider "systems confrontation" and "systems destruction warfare" as leading indicators, therefore, of how peer and near-peer adversaries could hold at risk US forces and operational architectures in the future.

America's current way of war is vulnerable to this kind of systems warfare because of decisions made in the wake of the dramatic and overwhelming victory of the air campaign in the 1991 Gulf War. Afterward, DOD chose not to invest in maturing its own systems warfare strategy. Consequently, the US military today is unprepared for this emerging threat.

Compounding the problem is the dramatic downsizing of the Air Force after the fall of the Soviet Union. Had the Air Force been allowed to procure planned numbers of B-2s and F-22s; had it been allowed to pursue the Next-Generation Bomber in 2008 as programmed; and had it been allowed to maintain the pace of purchases of F-35s as originally planned, the risk posed by these peer threats today might not be so dire. There would be sufficient force structure to provide strategic depth in response. But nearly 30 years of budget-driven cuts have left the Air Force with margins that are too thin to face a peer threat, much less one employing a systems warfare strategy.

Mosaic Warfare's 'Kill Web'

In conventional warfare, the kill chain is defined by the "OODA" loop – that is, the steps necessary to observe, orient, decide, and act on a target. But in a mosaic operational construct, the point-to-point chain is replaced by a web of sensor nodes that all collect, prioritize, process, and share data, then fuse it into a continuously updated common operating picture. Instead of tightly integrating all those functions into a single, expensive platform, as in the F-35, in mosaic warfare, these functions are disaggregated and spread among a multitude of manned and unmanned aircraft that share data and processing functions across a perpetually changing network.



Graphic: Zaur Eylanbekov/staff

All the military services are in serious need of recapitalization today, but none more so than the Air Force, which is smaller and older than it has ever been in its history. Having spent the last 17 years operating in extremely permissive environments, it now finds itself too small, its information systems too brittle, and its command and control too centralized to withstand systems warfare. US force design therefore must be mapped to how US enemies intend to fight and to fill the resulting gaps in the current US force.

The problems plaguing today's force include:

- Small inventories of capable, high-end multifunction platforms that make US operational architectures too vulnerable.
- The continued practice of buying multiple kinds of high-end weapon systems, but all in such limited numbers that their purchase is neither efficient nor able to provide the force capacity needed for great power conflict.
- Slow development and fielding for major new weapon systems.
- Difficulty scaling current force design appropriately across the spectrum of conflict.
- Critical shortages in key capabilities, such that the current force cannot withstand attrition and survivability factors threaten to outweigh the ability to create effects in future wars.

Without significant changes, neither the ways nor the means available to US forces will be sufficient to accomplish the ends outlined in the 2018 National Defense Strategy. The US military must reinvigorate the theory of systems warfare first manifested during Operation Desert Storm. Toward that end, mosaic warfare offers a new force design for optimizing US forces and operational concepts for the systems warfare of the future, rather than for the conflicts of the past.

Photo: TSgt. Nancy Goldberger/ANG

Lt. Col. Christina Darveau (right) trains 1st Lt. Crystal Na on board an E-8C JSTARS aircraft at Robins AFB, Ga. Today's JSTARS aircraft center battle management on one potentially vulnerable platform; mosaic seeks to make that capability more survivable by spreading the capability across the fleet.

MOSAIC: A FORCE DESIGN FOR SYSTEMS WARFARE

In the mosaic concept, platforms are "decomposed" into their smallest practical functions to create collaborative "nodes." These functions and nodes may be abstracted and broadly categorized by the familiar functionalities in an OODA loop: observe, orient, decide, and act.

In the past, an F-15 in an air-to-air engagement would need to first observe the airspace in its lane, identifying enemy aircraft with its radar, which is an observation node. When the radar received a return, that contact would be processed through the fire-control computer and displayed on the

Photo: SSgt. Rachel Simones

Three unmanned aerial systems at Edwards AFB, Calif. Drones could serve as observation nodes, communication links, or perform other functions, working as part of a disaggregated system of systems.

screen; together, these comprise the orientation node. The pilot can then engage other on-board sensors (additional observation nodes) to improve his orientation before deciding on an action (making the pilot the decision node). Finally, the pilot can take action, pairing a missile to the contact and firing the weapon (the action node).

Up until now, increasing the speed of operations required that all these OODA functions had to be hosted on a single weapon system to complete a kill chain. Indeed, fifth-generation aircraft have accelerated this process by pushing orientation and decision closer to action at the forward edges of combat. Advances in processing power, algorithms, and data links have made these aircraft incredibly valuable battle managers in contested and dynamic environments.

Historical case studies show that orientation must be located where there is processing capacity to filter, correlate, and fuse observations into meaning, or orientation. The closer orientation and decision nodes are to the point of action, the faster and more effective the outcomes.

Today, however, advanced data links and processing make it possible to integrate these functions even as they are disaggregated into distinct platforms. Thus, these functions can be distributed throughout the battlespace and integrated not in a single platform, but over distance through data links, to achieve effects.

Conceptualizing mosaic through an abstracted, notional operational architecture—where functionality is the focus, not specific technologies or platforms—enables the development of a more heterogeneous force and technological growth. This is a critical point: Being overly prescriptive with regard to technology risks condemning a force design to rigidity, brittleness, and/or obsolescence.

The design should support both multifunction platforms—hosting many different functionalities—and simple-function nodes hosting just one or two. When pieced together, these smaller functional elements can form operational OODA cycles that today must be managed within a single system. Leveraging advanced networks, data links, and enablers such as artificial intelligence/machine learning, a mosaic design can target adversary systems with just enough overmatch to succeed.

Built on adaptable and highly resilient networks with redundant nodes, these systems could create multiple kill paths, minimizing the critical value of any single system in the network to ensure US forces remain effective in contested environments. In other words, by disaggregating functionality, the mosaic force can survive network and nodal attrition and still be effective. Mosaic combines the attributes of highly capable, high-end systems with the volume and agility afforded by numerous smaller force elements that can be rearranged into many different configurations or presentations.

Yet the mosaic force design concept is more than just an information architecture. Mosaic offers a comprehensive model for systems warfare, encompassing requirements and acquisition processes; the creation of operational concepts, tactics, techniques, and procedures; and force presentations and force-allocation action, in addition to combat operations. For example, by disaggregating and abstracting the operational architecture into OODA nodes instead of major programs, both requirements setting and acquisition can be simpler and faster. The ad hoc connectivity of a mosaic force enables faster and more adaptive tactical innovation to generate numerous potential kill paths. And because mosaic nodes are like LEGO blocks, force presentations can be tailored and surprising.

The attributes of a mosaic force design can help increase the speed of action across the US warfighting enterprise, whether quickly responding to urgent new requirements, integrating innovative or out-of-cycle capabilities, or developing new operational plans. The guiding principles and technologies that underpin a mosaic force design will help enable the United States to prevail in long-term competitions with great power adversaries.

IMPLEMENTING MOSAIC FORCE DESIGN

Implementing a mosaic force design will challenge doctrine, tradition, parochialism, bureaucratic fiefdoms, and even the pride of victories past. Yet, to support the priorities of the 2018 National Defense Strategy, the US must adapt its approach to warfare. To migrate to a mosaic force design, the US must:

■ Maintain commitments to current force structure and programs of record. While some defense leaders may advocate for bold moves, bold does not always mean wise. Terminating current programs and divesting force structure without replacements in hand will only exacerbate current

Photo: TSgt. Michael Mason

Maintainers tow an MQ-9 into position for tests before ISR operations at Ali Al Salem AB, Kuwait. Sensor systems like these could work directly with combat weapon systems under the mosaic way of war.

vulnerabilities. The acquisition of high-end capabilities, such as the F-35 and B-21, should be accelerated, and the development of disaggregated elements must be introduced to create a future mosaic force.

■ Aggressively invest in developing and fielding mosaic enablers. Artificial intelligence underlies nascent, critical technologies, such as autonomy for maneuver, decision-making, and network routing, which together make up the connective tissue that will enable a mosaic force and operational concept. These mosaic enablers will unlock the power of current platforms even as new, simple-function platforms reach the field. Mosaic enablers are about changing how the US employs its forces, not just what is in the inventory. Mosaic enablers create the path for the current force to migrate to a more effective, resilient, and surprising mosaic force.

■ Experiment with mosaic operational concepts, architectures, and empowered command and control at the edge. Fully aligning information and command-and-control architectures with an operational concept is crucial to any force design. Continuous tactical experimentation with cutting-edge technologies, combined with rigorous operational analysis, is necessary to explore the art of the possible and how to exploit mosaic enabling technologies. These experiments would also help identify other needed technological investments and refine future doctrine and operational architectures.

■ Conduct an operations-focused cost assessment of force design alternatives. A future US force capable of deterring or, if necessary, prevailing in a high-end systems warfare conflict will require greater capacity compared to the current force. Sufficient capacity (force size) as well as the right mix of capabilities will be critical to achieving the attack density needed to defeat great power aggression and sustain a deterrent posture in other theaters. High-quality wargaming of force design alternatives augmented by operational and cost analyses could help identify the right force size and mix needed to implement the 2018 NDS.

Many trends already indicate the value and potential of mosaic operations. Early examples of systems, technologies, software, and architectures that are mosaic in nature are already being developed or fielded. Indeed, the US Defense Advanced Research Projects Agency and the services have been investing in maturing many of the mosaic enablers that they have already identified. Mosaic-type operations are not new to the US Air Force, and the service is perhaps the best candidate to take the lead role in developing a mosaic force design concept that could reshape DOD's planning, processes, force structure, and how it executes its missions.

Photo: Li Xiaopeng/China Ministry of Defense

A Chinese military unit fire a surface-to-air missiles during a live-fire test in June. Advanced anti-access/area denial (A2/AD) threats are driving the need for a new approach to warfare.

A nation's military backstops the political grand strategy of any great power. The United States must out-adapt adversaries who have, and will continue to adapt to, an obsolescing US force design. Indeed, the United States can migrate to a more effective force design even as new elements are introduced to make it more effective in character and operational concept. What cannot migrate is resistance to this new way of war—a mosaic force design—within a defense culture conditioned by an atypical era of absolute military dominance, permissive threat environments, and a lack of peer adversaries. Swift decisions are needed at the apex to align thinking and resources to the enablers of mosaic warfare. ✪

AFA ALMANAC

By Chequita Wood

The Air Force Association's 12 Founders

JOHN S. ALLARD
Bronxville, N.Y.

EDWARD P. CURTIS
Rochester, N.Y.

W. DEERING HOWE
New York

SOL A. ROSENBLATT
New York

JAMES M. STEWART
Beverly Hills, Calif.

CORNELIUS VANDERBILT WHITNEY
New York

EVERETT R. COOK,
Memphis, Tenn.

JIMMY DOOLITTLE
Los Angeles

RUFUS RAND
Sarasota, Fla.

JULIAN B. ROSENTHAL
New York

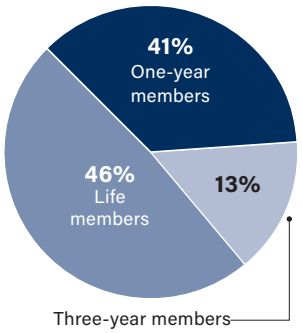
LOWELL P. WEICKER
New York

JOHN HAY WHITNEY
New York

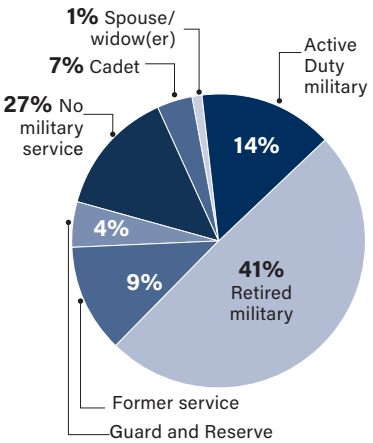
Profiles of AFA Membership

As of June 2019. Total 97,181. Numbers are rounded.

MEMBERSHIP CATEGORY

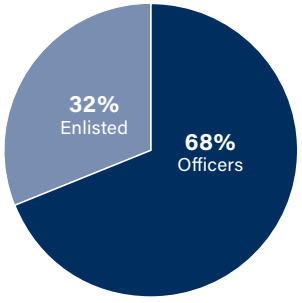


MILITARY STATUS

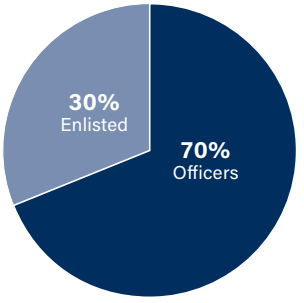


OF AFA'S SERVICE MEMBERS WHO LIST THEIR RANK:

ACTIVE DUTY



RETIRED MILITARY



AFA Membership Statistics

Year	Total	Life Members
1946	51,243	32
1947	104,750	55
1948	56,464	68
1949	43,801	70
1950	38,948	79
1951	34,393	81
1952	30,716	356
1953	30,392	431
1954	34,486	435
1955	40,812	442
1956	46,250	446
1957	51,328	453
1958	48,026	456
1959	50,538	458
1960	54,923	464
1961	60,506	466
1962	64,336	485
1963	78,034	488
1964	80,295	504
1965	82,464	514
1966	85,013	523
1967	88,995	548
1968	97,959	583
1969	104,886	604
1970	104,878	636
1971	97,639	674
1972	109,776	765
1973	114,894	804
1974	128,995	837
1975	139,168	898
1976	148,202	975
1977	155,850	1,281
1978	148,711	1,541
1979	147,136	1,869
1980	156,394	2,477
1981	170,240	3,515
1982	179,149	7,381
1983	198,563	13,763
1984	218,512	18,012
1985	228,621	23,234
1986	232,722	27,985
1987	237,279	30,099
1988	219,195	32,234
1989	204,309	34,182
1990	199,851	35,952
1991	194,312	37,561
1992	191,588	37,869
1993	181,624	38,604
1994	175,122	39,593
1995	170,881	39,286
1996	161,384	39,896
1997	157,862	41,179
1998	152,330	41,673
1999	148,534	42,237
2000	147,336	42,434
2001	143,407	42,865
2002	141,117	43,389
2003	137,035	42,730
2004	133,812	42,767
2005	131,481	43,094
2006	127,749	43,266
2007	125,076	43,256
2008	123,304	43,557
2009	120,507	43,782
2010	117,480	43,954
2011	111,479	44,182
2012	106,780	43,686
2013	102,540	43,851
2014	96,017	43,720
2015	92,829	43,936
2016	93,379	44,074
2017	90,970	44,083
2018	96,429	44,068
2019	97,181	44,035

DONALD W. STEELE SR. MEMORIAL AWARD

Air Force Association unit of the year.

Year	Award Recipient(s)
1953	San Francisco Chapter
1954	Santa Monica Area Chapter (Calif.)
1955	San Fernando Valley Chapter (Calif.)
1956	Utah State AFA
1957	H. H. Arnold Chapter (N.Y.)
1958	San Diego Chapter
1959	Cleveland Chapter
1960	San Diego Chapter
1961	Chico Chapter (Calif.)
1962	Fort Worth Chapter (Texas)
1963	Colin P. Kelly Chapter (N.Y.)
1964	Utah State AFA
1965	Idaho State AFA
1966	New York State AFA
1967	Utah State AFA
1968	Utah State AFA
1969	(No presentation)
1970	Georgia State AFA
1971	Middle Georgia Chapter
1972	Utah State AFA
1973	Langley Chapter (Va.)
1974	Texas State AFA
1975	Alamo Chapter (Texas) and San Bernardino Area Chapter (Calif.)
1976	Scott Memorial Chapter (Ill.)
1977	Thomas B. McGuire Jr. Chapter (N.J.)
1978	Thomas B. McGuire Jr. Chapter (N.J.)
1979	Brig. Gen. Robert F. Travis Chapter (Calif.)
1980	Central Oklahoma (Gerrity) Chapter
1981	Alamo Chapter (Texas)
1982	Chicagoland-O'Hare Chapter (Ill.)
1983	Charles A. Lindbergh Chapter (Conn.)
1984	Scott Memorial Chapter (Ill.) and Colorado Springs/Lance Sijan P. Chapter (Colo.)
1985	Cape Canaveral Chapter (Fla.)
1986	Charles A. Lindbergh Chapter (Conn.)
1987	Carl Vinson Memorial Chapter (Ga.)
1988	Gen. David C. Jones Chapter (N.D.)
1989	Thomas B. McGuire Jr. Chapter (N.J.)
1990	Gen. E. W. Rawlings Chapter (Minn.)
1991	Paul Revere Chapter (Mass.)
1992	Central Florida Chapter and Langley Chapter (Va.)
1993	Green Valley Chapter (Ariz.)
1994	Langley Chapter (Va.)
1995	Baton Rouge Chapter (La.)
1996	Montgomery Chapter (Ala.)
1997	Central Florida Chapter
1998	Ark-La-Tex Chapter (La.)
1999	Hurlburt Chapter (Fla.)
2000	Wright Memorial Chapter (Ohio)
2001	Lance P. Sijan Chapter (Colo.)
2002	Eglin Chapter (Fla.)
2003	Hurlburt Chapter (Fla.)
2004	Carl Vinson Memorial Chapter (Ga.)
2005	Central Florida Chapter
2006	Enid Chapter (Okla.)
2007	Central Oklahoma (Gerrity) Chapter
2008	Lance P. Sijan Chapter (Colo.)
2009	Paul Revere Chapter (Mass.)
2010	C. Farinha Gold Rush Chapter (Calif.)
2011	Lance P. Sijan Chapter (Colo.)
2012	Hurlburt Chapter (Fla.)
2013	Paul Revere Chapter (Mass.)
2014	D.W. Steele Sr. Memorial Chapter (Va.)
2015	Lance P. Sijan Chapter (Colo.)
2016	Paul Revere Chapter (Mass.)
2017	Enid Chapter (Okla.)
2018	Langley Chapter (Va.)
2019	Wright Memorial Chapter (Ohio)

JOHN R. ALISON AWARD

AFA's highest honor for industrial leadership.

Year	Award Recipient(s)
1992	Norman R. Augustine, Chairman, Martin Marietta
1993	Daniel M. Tellep, Chm. and CEO, Lockheed
1994	Kent Kresa, CEO, Northrop Grumman
1995	C. Michael Armstrong, Chm. and CEO, Hughes Aircraft
1996	Harry Stonecipher, Pres. and CEO, McDonnell Douglas
1997	Dennis J. Picard, Chm. and CEO, Raytheon
1998	Philip M. Condit, Chm. and CEO, Boeing
1999	Sam B. Williams, Chm. and CEO, Williams International
2000	Simon Ramo and Dean E. Wooldridge, missile pioneers
2001	George David, Chm. and CEO, United Technologies
2002	Sydney Gillibrand, Chm., AMEC; and Jerry Morgensen, Pres. and CEO, Hensel Phelps Construction
2003	Joint Direct Attack Munition Industry Team, Boeing
2004	Thomas J. Cassidy Jr., Pres. and CEO, General Atomics Aeronautical Systems
2005	Richard Branson, Chm., Virgin Atlantic Airways and Virgin Galactic
2006	Ronald D. Sugar, Chm. and CEO, Northrop Grumman
2007	Boeing and Lockheed Martin
2008	Bell Boeing CV-22 Team, Bell Helicopter Textron, and Boeing
2009	General Atomics Aeronautical Systems Inc.
2010	Raytheon
2011	United Launch Alliance
2012	Boeing
2013	X-51A WaveRider Program, Boeing, Aerojet Rocketdyne, and Air Force Research Laboratory
2014	C-17 Globemaster III, Boeing
2015	F-22 Raptor, Lockheed Martin
2016	SpaceX
2017	Northrop Grumman
2018	Skunk Works, Lockheed Martin
2019	Draken International

AFA MEMBER OF THE YEAR AWARD

State names refer to recipient's home state at the time of the award.

Year	Award Recipient(s)
1953	Julian B. Rosenthal (N.Y.)
1954	George A. Anderl (Ill.)
1955	Arthur C. Storz (Neb.)
1956	Thos. F. Stack (Calif.)
1957	George D. Hardy (Md.)
1958	Jack B. Gross (Pa.)
1959	Carl J. Long (Pa.)
1960	O. Donald Olson (Colo.)
1961	Robert P. Stewart (Utah)
1962	(No presentation)
1963	N. W. DeBerardinis (La.) and Joe L. Shosid (Texas)
1964	Maxwell A. Kriendler (N.Y.)
1965	Milton Caniff (N.Y.)
1966	William W. Spruance (Del.)
1967	Sam E. Keith Jr. (Texas)
1968	Marjorie O. Hunt (Mich.)
1969	(No presentation)
1970	Lester C. Curl (Fla.)
1971	Paul W. Gaillard (Neb.)
1972	J. Raymond Bell (N.Y.) and Martin H. Harris (Fla.)
1973	Joe Higgins (Calif.)
1974	Howard T. Markey (D.C.)
1975	Martin M. Ostrow (Calif.)
1976	Victor R. Kregel (Texas)
1977	Edward A. Stearn (Calif.)
1978	William J. Demas (N.J.)
1979	Alexander C. Field Jr. (Ill.)
1980	David C. Noerr (Calif.)
1981	Daniel F. Callahan (Fla.)
1982	Thomas W. Anthony (Md.)
1983	Richard H. Becker (Ill.)
1984	Earl D. Clark Jr. (Kan.)
1985	George H. Chabbott (Del.) and Hugh L. Enyart (Ill.)
1985	George H. Chabbott (Del.) and Hugh L. Enyart (Ill.)
1986	John P. E. Kruse (N.J.)
1987	Jack K. Westbrook (Tenn.)
1988	Charles G. Durazo (Va.)
1989	Oliver R. Crawford (Texas)
1990	Cecil H. Hopper (Ohio)
1991	George M. Douglas (Colo.)
1992	Jack C. Price (Utah)
1993	Lt. Col. James G. Clark (D.C.)
1994	William A. Lafferty (Ariz.)
1995	William N. Webb (Okla.)
1996	Tommy G. Harrison (Fla.)
1997	James M. McCoy (Neb.)
1998	Ivan L. McKinney (La.)
1999	Jack H. Steed (Ga.)
2000	Mary Anne Thompson (Va.)
2001	Charles H. Church Jr. (Kan.)
2002	Thomas J. Kemp (Texas)
2003	W. Ron Goerges (Ohio)
2004	Doyle E. Larson (Minn.)
2005	Charles A. Nelson (S.D.)
2006	Craig E. Allen (Utah)
2007	William D. Croom Jr. (Texas)
2008	John J. Politi (Texas)
2009	David R. Cummock (Fla.)
2010	L. Boyd Anderson (Utah)
2011	Steven R. Lundgren (Alaska)
2012	S. Sanford Schlitt (Fla.)
2013	Tim Brock (Fla.)
2014	James W. Simons (N.D.)
2015	James R. Lauducci (Va.)
2016	David T. Buckwalter (Texas)
2017	James T. Hannam (Va.)
2018	Russell V. Lewey (Ala.)
2019	Susan Broderick Mallett (Ala.)

AFA CHAIRMAN'S AEROSPACE EDUCATION ACHIEVEMENT AWARD

For long-term commitment to aerospace education, making a significant impact nationwide.

Year	Award Recipient(s)
2009	ExxonMobil Foundation
2010	*USA Today*
2011	The National Science Foundation
2012	The Military Channel
2013	The Civil Air Patrol Aerospace Education Program
2014	Department of Defense STARBASE Program
2015	Northrop Grumman Foundation
2016	Harry Talbot
2017	Analytical Graphics, Inc.
2018	Project Lead the Way
2019	Air Force Junior Reserve Officer Training Corps.

GOLD LIFE MEMBER CARD

Awarded to members whose AFA record, production, and accomplishments on a national level have been outstanding over a period of years.

Name	Year	Card No.
Gill Robb Wilson	1957	1
Jimmy Doolittle	1959	2
Arthur C. Storz Sr.	1961	3
Julian B. Rosenthal	1962	4
Jack B. Gross	1964	5
George D. Hardy	1965	6
Jess Larson	1967	7
Robert W. Smart	1968	8
Martin M. Ostrow	1973	9
James H. Straubel	1980	10
Martin H. Harris	1988	11
Sam E. Keith Jr.	1990	12
Edward A. Stearn	1992	13
Dorothy L. Flanagan	1994	14
John O. Gray	1996	15
Jack C. Price	1997	16
Nathan H. Mazer	2002	17
John R. Alison	2004	18
Donald J. Harlin	2009	19
James M. McCoy	2013	20
George M. Douglas	2014	21
John A. Shaud	2016	22
Mary Anne Thompson	2018	23

H.H. ARNOLD AWARD

Named for the World War II leader of the Army Air Forces, the H.H. Arnold Award has been presented annually in recognition of the most outstanding contributions in the field of aerospace activity. Since 1986, it has been AFA's highest honor to a member of the armed forces in the field of national defense.

Year	Award Recipient(s)
1948	W. Stuart Symington, Secretary of the Air Force
1949	Maj. Gen. William H. Tunner and the men of the Berlin Airlift
1950	Airmen of the United Nations in the Far East
1951	Gen. Curtis E. LeMay and the personnel of Strategic Air Command
1952	Sen. Lyndon B. Johnson and Sen. Joseph C. O'Mahoney
1953	Gen. Hoyt S. Vandenberg, USAF (Ret.), former Air Force Chief of Staff
1954	John Foster Dulles, Secretary of State
1955	Gen. Nathan F. Twining, Chief of Staff, USAF
1956	Sen. W. Stuart Symington
1957	Edward P. Curtis, special assistant to the President
1958	Maj. Gen. Bernard A. Schriever, Cmdr., Ballistic Missile Div., ARDC
1959	Gen. Thomas S. Power, CINC, SAC
1960	Gen. Thomas D. White, Chief of Staff, USAF
1961	Lyle S. Garlock, Assistant SECAF
1962	A. C. Dickieson and John R. Pierce, Bell Telephone Laboratories
1963	The 363rd Tactical Recon. Wing and the 4080th Strategic Wing
1964	Gen. Curtis E. LeMay, Chief of Staff, USAF
1965	The 2nd Air Division, PACAF
1966	The 8th, 12th, 355th, 366th, and 388th Tactical Fighter Wings and the 432nd and 460th TRWs
1967	Gen. William W. Momyer, Cmdr., 7th Air Force, PACAF
1968	Col. Frank Borman, USAF; Capt. James Lovell, USN; and Lt. Col. William Anders, USAF, Apollo 8 crew
1969	(No presentation)
1970	Apollo 11 team (J. L. Atwood; Lt. Gen. S. C. Phillips, USAF; and astronauts Neil Armstrong and USAF Cols. Buzz Aldrin and Michael Collins)
1971	John S. Foster Jr., Dir. of Defense Research and Engineering
1972	Air units of the allied forces in Southeast Asia (Air Force, Navy, Army, Marine Corps, and the Vietnamese Air Force)
1973	Gen. John D. Ryan, USAF (Ret.), former Chief of Staff
1974	Gen. George S. Brown, USAF, Chm., Joint Chiefs of Staff
1975	James R. Schlesinger, Secretary of Defense
1976	Sen. Barry M. Goldwater
1977	Sen. Howard W. Cannon
1978	Gen. Alexander M. Haig Jr., USA, Supreme Allied Commander, Europe
1979	Sen. John C. Stennis
1980	Gen. Richard H. Ellis, USAF, CINC, SAC
1981	Gen. David C. Jones, USAF, Chm., Joint Chiefs of Staff
1982	Gen. Lew Allen Jr., USAF (Ret.), former Chief of Staff
1982	Gen. Lew Allen Jr., USAF (Ret.), former Chief of Staff
1983	Ronald W. Reagan, President of the United States
1984	The President's Commission on Strategic Forces (Scowcroft Commission)
1985	Gen. Bernard W. Rogers, USA, SACEUR
1986	Gen. Charles A. Gabriel, USAF (Ret.), former Air Force Chief of Staff
1987	Adm. William J. Crowe Jr., USN, Chm., Joint Chiefs of Staff
1988	Men and women of the Ground-Launched Cruise Missile team

1989	Gen. Larry D. Welch, Chief of Staff, USAF
1990	Gen. John T. Chain, CINC, SAC
1991	Lt. Gen. Charles A. Horner, Cmdr., CENTCOM Air Forces and 9th Air Force
1992	Gen. Colin L. Powell, USA, Chm., Joint Chiefs of Staff
1993	Gen. Merrill A. McPeak, Chief of Staff, USAF
1994	Gen. John Michael Loh, Cmdr., Air Combat Command
1995	World War II Army Air Forces veterans
1996	Gen. Ronald R. Fogleman, Chief of Staff, USAF
1997	Men and women of the United States Air Force
1998	Gen. Richard E. Hawley, Cmdr., ACC
1999	Lt. Gen. Michael C. Short, Cmdr., Allied Air Forces Southern Europe
2000	Gen. Michael E. Ryan, Chief of Staff, USAF
2001	Gen. Joseph W. Ralston, CINC, EUCOM
2002	Gen. Richard B. Myers, USAF, Chm., Joint Chiefs of Staff
2003	Lt. Gen. T. Michael Moseley, Cmdr., air component, CENTCOM, and 9th Air Force
2004	Gen. John P. Jumper, Chief of Staff, USAF
2005	Gen. Gregory S. Martin, USAF (Ret.), former Cmdr., AFMC
2006	Gen. Lance W. Lord, USAF (Ret.), former Cmdr., AFSPC
2007	Gen. Ronald E. Keys, Cmdr., ACC
2008	Gen. Bruce Carlson, Cmdr., AFMC
2009	Gen. John D. W. Corley, Cmdr., ACC
2010	Lt. Gen. David A. Deptula, USAF Deputy Chief of Staff, ISR
2011	Gen. Duncan J. McNabb, Cmdr., TRANSCOM
2012	Gen. Norton A. Schwartz, USAF (Ret.), former Chief of Staff
2013	Gen. Douglas M. Fraser, USAF (Ret.), former Cmdr., SOUTHCOM
2014	Gen. C. Robert Kehler, USAF (Ret.), former Cmdr., STRATCOM
2015	Gen. Janet C. Wolfenbarger, USAF (Ret.), former Cmdr., AFMC
2016	Gen. Mark A. Welsh III, USAF (Ret.), former Chief of Staff
2017	Lt. Gen. Christopher C. Bogdan, USAF (Ret.), former PEO, F-35 Prgm
2018	Gen. Herbert J. Carlisle, USAF (Ret.), former Cmdr., ACC
2019	Gen. Ellen M. Pawlikowski, USAF (Ret.), former Cmdr., AFMC

W. STUART SYMINGTON AWARD

AFA's highest honor to a civilian in the field of national security, the award is named for the first Secretary of the Air Force.

Year	Award Recipient(s)
1986	Caspar W. Weinberger, Secretary of Defense
1987	Edward C. Aldridge Jr., Secretary of the Air Force
1988	George P. Schultz, Secretary of State
1989	Ronald W. Reagan, former President of the United States
1990	John J. Welch, Asst. SECAF (Acquisition)
1991	George Bush, President of the United States
1992	Donald B. Rice, SECAF
1993	Sen. John McCain (R-Ariz.)
1994	Rep. Ike Skelton (D-Mo.)
1995	Sheila E. Widnall, SECAF
1996	Sen. Ted Stevens (R-Alaska)
1997	William Perry, former SECDEF
1998	Rep. Saxby Chambliss (R-Ga.) and Rep. Norman D. Dicks (D-Wash.)
1999	F. Whitten Peters, SECAF
2000	Rep. Floyd Spence (R-S.C.)
2001	Sen. Michael Enzi (R-Wyo.) and Rep. Cliff Stearns (R-Fla.)
2002	Rep. James V. Hansen (R-Utah)
2003	James G. Roche, SECAF
2004	Peter B. Teets, Undersecretary of the Air Force
2005	Rep. Duncan Hunter (R-Calif.)
2007	Michael W. Wynne, SECAF
2008	Gen. Barry R. McCaffrey, USA (Ret.)
2009	Sen. Orrin G. Hatch (R-Utah)
2010	John J. Hamre, Center for Strategic & International Studies
2011	Rep. C. W. "Bill" Young (R-Fla.)
2012	Gen. James L. Jones, USMC (Ret.)
2013	Michael B. Donley, SECAF
2014	Ashton B. Carter, former Deputy SECDEF
2015	William A. LaPlante, Asst. SECAF (Acquisition)
2016	Jamie M. Morin, Director, Cost Assessment & Prgm Evaluation
2017	Lisa S. Disbrow, Undersecretary of the Air Force
2018	Deborah Lee James, former SECAF
2019	Heather Wilson, former SECAF

AFA LIFETIME ACHIEVEMENT AWARD

The award recognizes a lifetime of work in the advancement of aerospace.

Year	Award Recipient(s)
2003	Maj. Gen. John R. Alison, USAF (Ret.); Sen. John H. Glenn Jr.; Maj. Gen. Jeanne M. Holm, USAF (Ret.); Col. Charles E. McGee, USAF (Ret.); Gen. Bernard A. Schriever, USAF (Ret.)
2004	Gen. Russell E. Dougherty, USAF (Ret.); Florene Miller Watson
2005	Sen. Daniel K. Inouye; William J. Perry; Patty Wagstaff
2007	CMSAF Paul W. Airey, USAF (Ret.)
2008	Col. George E. Day, USAF (Ret.); Gen. David C. Jones, USAF (Ret.); Harold Brown
2009	Doolittle Raiders; Tuskegee Airmen; James R. Schlesinger
2010	Col. Walter J. Boyne, USAF (Ret.); Andrew W. Marshall; Gen. Lawrence A. Skantze, USAF (Ret.); Women Airforce Service Pilots
2011	Natalie W. Crawford; Lt. Gen. Thomas P. Stafford, USAF (Ret.); Gen. Larry D. Welch, USAF (Ret.); Heavy Bombardment Crews of WWII; Commando Sabre Operation-Call Sign Misty
2012	Gen. James P. McCarthy, USAF (Ret.); Vietnam War POWs; Berlin Airlift Aircrews; Korean War Airmen; Fighter Pilots of World War II
2013	Maj. Gen. Joe H. Engle, USAF (Ret.); US Rep. Sam Johnson; The Arlington Committee of the Air Force Officers' Wives' Club—"The Arlington Ladies"
2014	Brig. Gen. James A. McDivitt, USAF (Ret.); Civil Air Patrol—World War II veterans; American Fighter Aces
2015	R. A. "Bob" Hoover; Eugene F. "Gene" Kranz; Gen. Michael V. Hayden, USAF (Ret.)
2016	Maj. Gen. Claude M. Bolton Jr., USAF (Ret.); Lt. Col. John T. Correll, USAF (Ret.); Gen. Charles A. Horner, USAF (Ret.); Lt. Gen. James M. Keck, USAF (Ret.); Gen. Richard B. Myers, USAF (Ret.)
2017	Gen. Ronald R. Fogleman, USAF (Ret.); Col. Clarence E. "Bud" Anderson, USAF (Ret.); Elinor Otto; Lafayette Escadrille Memorial Foundation
2018	Maj. Gen. Alfred K. Flowers, USAF (Ret.); Dan Friedkin; Air Force Scientific Advisory Board; Air Force Enlisted Village; Air Force Aid Society
2019	Gen. John A. Shaud, USAF (Ret.); Gen. T. Michael Moseley, USAF (Ret.); Dr. Benjamin Lambeth

DOTTIE FLANAGAN STAFF AWARD OF THE YEAR

A donation from the late Jack B. Gross, national director emeritus, enables quarterly and staff member of the year awards.

Year	Award Recipient(s)	Year	Award Recipient(s)	Year	Award Recipient(s)
1992	Doreatha Major	2001	Katie Doyle	2010	Bridget Wagner
1993	Jancy Bell	2002	Jeneathia Wright	2011	Merri Shaffer
1994	Gilbert Burgess	2003	Jim Brown	2012	Caitie Craumer
1995	David Huynh	2004	Pearlie Draughn	2013	Pamela Braithwaite
1996	Sherry Coombs	2005	Ursula Smith	2014	Bridget Dongu
1997	Katherine DuGarm	2006	Susan Rubel	2015	Nathaniel Davis
1998	Suzann Chapman	2007	Ed Cook	2016	Amanda L. Grandel
1999	Frances McKenney	2008	Michael Davis	2017	Alexandria Browning
2000	Ed Cook	2009	Chris Saik	2018	Lisa O'Loughlin

Aerospace Awards

AWARDS AND RECIPIENTS

David C. Schilling Award
Most outstanding contribution in the field of flight
MQ-9 Operators

Theodore von Karman Award
Most outstanding contribution in the field of science and engineering
Kessel Run Team

Gill Robb Wilson Award
Most outstanding contribution in the field of arts and letters
The Cold Blue

Hoyt S. Vandenberg Award
Most outstanding contribution in the field of aerospace education
Civil Air Patrol

Thomas P. Gerrity Award
Most outstanding contribution in the field of systems and logistics
Maj. Timothy Foster, Spangdahlem AB, Germany

Lieutenant General Claire Lee Chennault Award
For outstanding aerial warfare tactician(s) from ACC, PACAF, USAFE, ANG, and AFRC
Maj. Jerry Entine, Eglin AFB, Fla.

General Larry D. Welch Award-Officer
Most significant impact by an individual on the overall operations, safety, security, and effectiveness of the Air Force nuclear mission
Col. Jason Bartolomei, Hill AFB, Utah

General Larry D. Welch Award-Enlisted
Most significant impact by an individual on the overall operations, safety, security, and effectiveness of the Air Force nuclear mission
SMSgt. Thomas Podgorski, Whiteman AFB, Mo.

General Larry D. Welch Award-Civilian
Most significant impact by an individual on the overall operations, safety, security, and effectiveness of the Air Force nuclear mission
Scott Bagnell, Offutt AFB, Neb.

General George C. Kenney Award
Most significant contribution by an individual or team in the area of lessons learned
3rd Space Experimentation Squadron Weapons and Tactics Flight, Schriever AFB, Colo.

Joan Orr Spouse of the Year Award
For civilian spouses of military members for their significant contributions to the United States Air Force
Elizabeth DuBe, Kadena AB, Japan

Chief Master Sergeant of the Air Force Thomas N. Barnes Award
Most outstanding aircraft crew chief in the United States Air Force
SSgt. Brandon Deem, Kadena AB, Japan

Citations of Honor

RECIPIENTS AND ACHIEVEMENTS

Capt. Roland Neal and Capt. Phillip Huebner, Columbus AFB, Miss.
Captains Neal and Huebner enabled proof-of-concept for training 1,400 student pilots annually, leveraging virtual reality and integrating commercial solutions to address the Air Force's pilot crisis. Their careful orchestration of officer and enlisted members unlocked a pool of 275,000 potential candidates. Their synergistic efforts within the Air Force and Federal Aviation Administration enabled 480 training missions to be accomplished in support of congressionally highlighted pilot production.

706th Fighter Squadron, Nellis AFB, Nev.
The men and women of the 706th provided core subject matter expertise to Nellis' mission of operational test, tactics development, and next-generation training, fielding over $8 billion of capabilities and upgrades to the Combat Air Forces. The team also led the integration of these new capabilities into six Joint Chiefs of Staff-directed exercises, improving the capabilities of over 3,600 units throughout the Department of Defense.

Col. Frederick Coleman and Lt. Col. Keith Anderson, MacDill AFB, Fla.
Colonels Coleman and Anderson led all strategic planning at United States Central Command for Operation Inherent Resolve to defeat the Islamic State in Iraq and Syria. They represented the planning nexus between Central Command, five service components, and two subordinate headquarters. Their leadership of over 200 planners worldwide directly enabled all coalition operations to dismantle the Islamic State in Iraq and the Syrian caliphate.

18th Logistics Readiness Squadron, Kadena AB, Japan
The 18th Logistics Readiness Squadron led the first operational F-35A reception, placing fifth-generation aircraft in the priority theater designated by the 2018 National Defense Strategy. Additionally, they were an instrumental element of the pressure campaign against North Korea by supporting the National Command Authority's airborne platform during the Leader Summit. The squadron also led the Special Operations Forces deployment that saved lives of the 12-member Thai youth soccer team.

General Atomics & Affiliated Companies, San Diego
General Atomics & Affiliated Companies have a long record of advocating for STEM education and supporting and promoting aerospace education. The General Atomics Sciences Education Foundation funds nonprofit STEM organizations, such as TutorMate, and develops educational resources accessible to the local community and worldwide. General Atomics Energy Group developed a Fusion Education and Outreach Program to educate students, parents, and teachers on the STEM elements that support research and development of fusion energy. General Atomics Aeronautical Systems, Inc., and Electromagnetic Systems Group fund and support university-level STEM programs specializing in aeronautics, astronautics, robotics, and cyber-related subjects.

Professional, Civilian, Education, Management, and Environmental Awards

AWARDS AND RECIPIENTS

AFMC Management Award - Executive Division
Col. Jason Bartolomei, Hill AFB, Utah

AFMC Management Award - Middle Division*
Lt. Col. Stuart Menn, Tinker AFB, Okla.

AFMC Management Award - Junior Division*
Capt. Joseph Myers, Robins AFB, Ga.

USAFA Cadet of the Year
Cadet Gordon McCulloh, USAFA, Colorado Springs, Colo.

AFROTC Cadet of the Year
Cadet Sydney Cloutier, FL-012, Pensacola High School, Fla.

CAP Aerospace Education Cadet of the Year
Cadet Annika Walukas, Eau Claire Composite Squadron, Wis.

Paul W. Myers Award for Physicians
Maj. David Dy, Patrick AFB, Fla.

Juanita Redmond Award for Nursing
Capt. Leslie Green, JB Andrews, Md.

Stuart R. Reichart Award for Lawyers
Col. Rebecca Vernon, Hurlburt Field, Fla.

Verne Orr Award for Effective Utilization of Human Resources
1st Special Operations Group, Hurlburt Field, Fla.

Civilian Senior Manager of the Year
Connie Davis, Tinker AFB, Okla.

Civilian Program Manager of the Year*
Brian Bumgardner, Eglin AFB, Fla.

Civilian Program Specialist of the Year*
Olamarie Sheen, Ramstein AFB, Germany

Civilian Wage Employee of the Year*
Steven Fox, Tinker AFB, Okla.

Lisa Disbrow Outstanding Civilian Award
Leroy Coe, Pentagon

Gen. Edwin W. Rawlings Award – Management*
Christopher Brewster, Davis-Monthan AFB, Ariz.

Gen. Edwin W. Rawlings Award – Technician*
SSgt. Michael Bagley, Peterson AFB, Colo.

* Presented at recipient's location.

Air Reserve Component Awards

AIR NATIONAL GUARD AWARDS AND RECIPIENTS

Earl T. Ricks Award
Outstanding ANG airmanship
Lt. Col. Bryan Meek, JBSA-Lackland, Texas

CMSgt. Dick Red Award
Best ANG maintainer
TSgt. Kaisha Gurtner-Hatton, Buckley AFB, Colo.

Outstanding ANG Unit
Best ANG unit airmanship
148th Fighter Wing, Minnesota ANG

Air Force Awards

AWARDS AND RECIPIENTS

General Larry O. Spencer Innovation Award - Individual
Maj. Alexander Goldberg, Texas ANG

General Larry O. Spencer Innovation Award - Team
Kessel Run Team, Hanscom AFB, Mass.

International Affairs Excellence Award
Officer - Lt. Col. Andrew Allen; Enlisted - MSgt. Kyle Wilson;
Senior Civilian - Jean-Anne Butler; Junior Civilian - Matthew Bradesca

Crew and Team Awards

AWARDS AND RECIPIENTS

Lt. Gen. Howard W. Leaf Award
Best test team
AMCTES Strategic Airlift Test Team, JB McGuire-Dix-Lakehurst, N.J.

Lt. Gen. William H. Tunner Award
Best airlift crew
Crew of MOOSE 69, JB Charleston, S.C.

Brig. Gen. Ross G. Hoyt Award
Best air refueling crew
Crew of PYTHON 61, McConnell AFB, Kan.

Gen. John P. Jumper Award
Best remotely piloted aircraft crew in USAF
Pilot: Capt. Ryan Perhala; Sensor Operator: SMSgt. Joshua Sjoholm;
Mission Intelligence Coordinator: SrA. Darius Rivera

Gen. Curtis E. LeMay Award
Best bomber aircrew
Crew of HAWK 91, Dyess AFB, Texas

Gen. Thomas S. Power Award
Best missile combat crew
Lt. Austin Van Hoesen and Lt. Jedediah Simpson, F.E. Warren AFB, Wyo.

Gen. Jerome F. O'Malley
Best reconnaissance crew
Crew of FIXX 74, 55th Wing, Offutt AFB, Neb.

Gen. Mark A. Welsh III One Air Force Award
For the team that best demonstrates improved effectiveness through integrated solutions
Cyber Blue Book Team, Kirtland AFB, N.M.

Airborne Battle Management Crew Award
128th ACCS Combat Crew 8, Robins AFB, Ga.

Best Space Operations Crew
Deployed Space Electronics Warfare Crew, Patrick AFB, Fla.

BAVA Humanitarian Mission of the Year Award
Most outstanding humanitarian mission
36th Airlift Squadron, Yokota AB, Japan

AIR FORCE RESERVE COMMAND AWARDS AND RECIPIENTS

President's Award for AFRC
Best AFRC flying unit or individual of the year
Capt. Charles Phelps, Whiteman AFB, Mo.

AFRC Unit Award
Best AFRC wing of the year
926th Wing, Nellis AFB, Nev.

Citizen Airman and Employer of the Year Award for AFRC - Officer
Maj. Sonja Demuth, Peterson AFB, Colo.
Karen Anderson, Lockheed Martin Space, Denver

Citizen Airman and Employer of the Year Award for AFRC - Enlisted
MSgt. Peter Thompson, Beale AFB, Calif.
Robert Burton, Deuel Vocational Institution, Tracy, Calif.

Outstanding State Organization

Virginia

President Ken Spencer

Outstanding Chapters by Size

Small Chapter
Mel Harmon Chapter, Colo.
President Michael Sumida

Large Chapter
Paul Revere Chapter, Mass.
President Donald Vasquez

Medium Chapter
Roanoke Chapter, Va.
President Robin L. Thompson

Extra Large Chapter
Seidel Chapter, Texas
President Paul Hendricks

CyberPatriot Mentor of the Year

Paul Johnson
Del Norte High School
San Diego

CyberPatriot Coach of the Year

Thomas W. Johnson
Cheyenne Central High School
Cheyenne, Wyo.

Aerospace Education Excellence Award

Presented for excellence in aerospace education programming. To qualify, a chapter must have received the Aerospace Education Achievement Award this year.

Small Chapter
Mel Harmon Chapter, Colo.
President Michael Sumida

Large Chapter
Tennessee Valley Chapter, Ala.
President Fredrick J. Driesbach

Medium Chapter
Lincoln Chapter, Neb.
President Richard T. Holdcroft

Extra Large Chapter
Ak-Sar-Ben Chapter, Neb.
President Chris Canada

Aerospace Education Achievement Award

Presented to chapters for outstanding achievement in aerospace education programming.

Ak-Sar-Ben Chapter, Neb.
President Chris Canada

Albuquerque Chapter, N.M.
President Frederick J. Harsany

Gen. Charles A. Gabriel Chapter, Va.
President Mike Winters

Lance P. Sijan Chapter, Colo.
President Charles Apodaca

Langley Chapter, Va.
President Mark "Buster" Douglas

Lincoln Chapter, Neb.
President Richard T. Holdcroft

Martin H. Harris Chapter, Fla.
President Todd Freece

Mel Harmon Chapter, Colo.
President Michael Sumida

Montgomery Chapter, Ala.
President Dale B. Barton

Mount Clemens Chapter, Mich.
President Randy Whitmire

Paul Revere Chapter, Mass.
President Donald Vazquez

Richmond Chapter, Va.
President Harper S. Alford

Roanoke Chapter, Va.
President Robin L. Thompson

Tennessee Valley Chapter, Ala.
President Frederick J. Driesbach

Wright Memorial Chapter, Ohio
President Kent Shin

Unit Exceptional Service Awards

Airmen and Family Programs
Tyndall Chapter, Fla.
President Brett Roundtree

Community Relations
Hurlburt Chapter, Fla.
President James Connors

Best Single Program
Gen. Charles A. Gabriel Chapter, Va.
President Mike Winters

Overall Programming
Paul Revere Chapter, Mass.
President Donald Vazquez

Communications
Mel Harmon Chapter, Colo.
President Michael Sumida

Veterans Affairs
Ak-Sar-Ben Chapter, Neb.
President Chris Canada

Community Partners
MiG Alley Chapter, South Korea
President Austin Hood

Distinguished Sustained Aerospace Education Award

David T. "Buck" Buckwalter

Jack Gross Award

Presented to the chapter in each size category with the highest number of new members as a percentage of chapter size at the beginning of the membership year. A minimum of 10 is required.

Small Chapter
MiG Alley Chapter, South Korea
President Austin Hood

Medium Chapter
Lincoln Chapter, Neb.
President Richard T. Holdcroft

Large Chapter
Central Maryland Chapter, Md.
President Janell R. Kersh

Extra Large Chapter
Martin H. Harris Chapter, Fla.
President Todd Freece

Chapter Size Larger Than 1,100
Langley Chapter, Va.
President Mark R. "Buster" Douglas

Arthur C. Storz Sr. Membership Award

Presented to the AFA chapter producing the highest number of new members during the 12-month period ending June 30, 2019, as a percentage of total chapter membership as of July 1, 2019. This award is based on both the quantity of new members as well as sustained new member recruitment. A chapter must be chartered for at least three years to qualify.

MiG Alley Chapter, South Korea
President Austin Hood

Community Partner Membership Awards

GOLD AWARD

Presented to chapters whose Community Partners represent at least six percent of overall chapter membership, with a minimum number of Community Partners. The minimum number is determined by chapter size.

Cheyenne Cowboy Chapter, Wyo.
Col. H. M. Bud West Chapter, Fla.
Enid Chapter, Okla.
Fairbanks Midnight Sun Chapter, Alaska
Fort Wayne Chapter, Ind.
Lincoln Chapter, Neb.
Mel Harmon Chapter, Colo.
Meridian Chapter, Miss.
MiG Alley Chapter, South Korea
Montgomery Chapter, Ala.
Northeast Texas Chapter, Texas
Swamp Fox Chapter, S.C.
Tennessee Valley Chapter, Ala.

Special Recognition Awards

STATE GROWTH

These states have realized a growth in total membership from June 2018 to June 2019.

Connecticut
Florida
Georgia
Idaho
Indiana
Iowa
Massachusetts
New Hampshire
North Carolina
Ohio
Oregon
Rhode Island
West Virginia
Wyoming

REGION GROWTH

These regions have realized a growth in total membership from June 2018 to June 2019.

Central East Region
Florida Region
Great Lakes Region
New England Region
Overseas
Southeast Region

CHAPTER GROWTH

These chapters have realized a growth in total membership from June 2018 to June 2019.

Abilene Chapter, Texas
Altoona Chapter, Pa.
Brig. Gen. Harrison R. Thyng Chapter, N.H.
Baltimore Chapter, Md.
Bill Harris Chapter, Ore.
Bob Newman Cape Fear Chapter, N.C.
Cape Canaveral Chapter, Fla.
Capt. Eddie Rickenbacker Memorial Chapter, Ohio
Central Indiana Chapter, Ind.
Central Maryland Chapter, Md.
Central Oklahoma Chapter, Okla.
Gen. Charles A. Gabriel Chapter, Va.
Cheyenne Cowboy Chapter, Wyo.
Chuck Yeager Chapter, W.Va.
Columbia Gorge Chapter, Ore.
Columbia Palmetto Chapter, N.C.
Delaware Galaxy Chapter, Del.
Denton Chapter, Texas
Dobbins Chapter, Ga.
Donald W. Steele Sr. Memorial Chapter, Va.
Eglin Chapter, Fla.
Falcon Chapter, Fla.
Flying Yankee/General Kenney Chapter, Conn.
Fort Dodge Chapter, Iowa
Fort Wayne Chapter, Ind.
Fort Worth Chapter, Texas
Frank P. Lahm Chapter, Ohio
Gen. Joseph W. Ralston Chapter, Ohio
Gold Coast Chapter, Fla.
Grissom Memorial Chapter, Ind.
Hangar One Chapter, N.J.
Highpoint Chapter, N.J.
Hurlburt Chapter, Fla.
L.D. Bell-Niagara Frontier Chapter, N.Y.
Langley Chapter, Va.
Liberty Bell Chapter, Pa.
Lincoln Chapter, Neb.
Lindbergh/Sikorsky Chapter, Conn.
Lloyd R. Leavitt Jr. Chapter, Mich.
Martin H. Harris Chapter, Fla.
Metro Rhode Island Chapter, R.I.
Miami-Homestead Chapter, Fla.
MiG Alley Chapter, South Korea
Minuteman Chapter, Mass.
Mount Clemens Chapter, Mich.
Nation's Capital Chapter, D.C.
Northeast Texas Chapter, Texas
Northwest Iowa Chapter, Iowa
Otis Chapter, Mass.
P-47 Memorial Chapter, Ind.
Paul Revere Chapter, Mass.
Pioneer Valley Chapter, Mass.
Pope Chapter, N.C.
Prescott/Goldwater Chapter, Ariz.
Pride of the Adirondacks Chapter, N.Y.
Red River Valley Chapter, N.D.
Rushmore Chapter, S.D.
Sal Capriglione Chapter, N.J.
Salt Lake City Chapter, Utah
Shooting Star Chapter, N.J.
Snake River Valley Chapter, Idaho
South Alabama Chapter, Ala.
South Georgia Chapter, Ga.
Spirit of St. Louis Chapter, Mo.
Steel Valley Chapter, Ohio
Strom Thurmond Chapter, S.C.
Tarheel Chapter, N.C.
Thomas B. McGuire Jr. Chapter, N.J.
Thomas W. Anthony Chapter, Md.
Tokyo Chapter, Japan
Total Force Chapter, Pa.
Tyndall Chapter, Fla.
Waterman-Twining Chapter, Fla.
Wright Memorial Chapter, Ohio

ACHIEVEMENT AWARD

Presented in the field to chapters whose Community Partners represent at least three percent of overall chapter membership, with a minimum number of Community Partners. The minimum number is determined by chapter size.

David D. Terry Jr. Chapter, Ark.
Gen. David C. Jones Chapter, N.D.
Golden Triangle Chapter, Miss.
Hurlburt Chapter, Fla.
Palm Springs Chapter, Calif.
Miami-Homestead Chapter, Fla.
Ute-Rocky Mountain Chapter, Utah

Individual Awards by Region

Central East

Medal of Merit
Nerfertiti Barnes
David "DJ" Baylor
Mitch Berger
Christof Cordes
Janell Kersh
Donna Malone
Hannah Richmond
Patrick Rocke
Richard "Rich" Shook

Exceptional Service Award
John "Jack" Diamond
Cristina Lussier
John "JR" Robinson

Far West

Medal of Merit
Sareta Gladson
Alison Osterberg

Florida

Medal of Merit
John "Tim" Brock
Edward "Ed" Hood
Marian McBryde
Gilberto Perez
Ryan Price

Exceptional Service Award
Christina English
Colleen Smith

Great Lakes

Medal of Merit
Pat Deem
Gene McManaway
Mark Roland
Kent Shin

Exceptional Service Award
Craig Spanburg
Randy Whitmire

Midwest

Medal of Merit
Lang Anderson
Todd Hunter
Mark Musick

New England

Medal of Merit
Ashley Breen
Nick Cloe
Chris Forkey
Shelly Lipman
Todd Myers
Timothy Riley
Donald "Bud" Vazquez

Exceptional Service Award
David Mark DeNofrio
Matt Mleziva
Jamie Navarro

North Central

Medal of Merit
Jeff Johnson

Northeast

Medal of Merit
Kathryn Sheets

Exceptional Service Award
Raymond Donnelly

Northwest

Medal of Merit
Robert Branscomb
Andrew Hockman
Fran McGregor-Hollums
Gabrielle "Gabbe" Kearney

Exceptional Service Award
William "Loyd" Patton

Overseas

Medal of Merit
Robert Montalvo
Jeremy Nickel

Rocky Mountain

Medal of Merit
David Geuting

Exceptional Service Award
Margaret Eichman

South Central

Medal of Merit
Patrick Albrecht
Joshua Anderson
Leif Dunn
Eric Jackson
Langford Knight
Paul Lips
Joe Panza
Ed Worley
Anthony "Todd" Taylor

Exceptional Service Award
Paula Penson
Andy Potter

Southeast

Medal of Merit
Rachel Sax

Southwest

Medal of Merit
Carl Armstrong
William Goodall
Caroline Jok
Jim Nye
William Polakowski
Vicki Jo Ryder
Susan Sullivan

Exceptional Service Award
George Castle
Gene Fenstermacher
Harold Thomas

Texoma

Medal of Merit
John Campbell
Terry Cox
Jennifer Deinhart
Joel Hatch
Thomas Peterson
Janelle Stafford
Scott Wilson

Exceptional Service Award
Jeffrey James
Deborah Landry
Mitzi Morrison
Molly Mae Potter
Marc Stewart

Current AFA Leadership

Gerald R. Murray
AFA Chairman of the Board

VICE CHAIRMAN FOR FIELD OPERATIONS

F. Gavin MacAloon	2016-

VICE CHAIRMAN FOR AEROSPACE EDUCATION

James T. Hannam	2018-

NATIONAL SECRETARY

Richard W. Hartle	2017-

NATIONAL TREASURER

Steven R. Lundgren	2016-

*For a full list of past leadership, go to www.airforcemag.com and type "AFA Almanac" in the search feature.

Chairman's Citation

SHARON BRANCH
JOSEPH BURKE
KELLY JONES
DUSTIN LAWRENCE
RUSS LEWEY
MICHAEL LIQUORI
THOMAS MORAN
THOMAS VELTRI

Bruce A. Wright
AFA President

AFA's Regions, States, and Chapters

CENTRAL EAST REGION — 11,485
Peter Jones

Delaware — 371
- Brig. Gen. Bill Spruance . . . 100
- Delaware Galaxy . . . 271

District of Columbia — 1,728
- Nation's Capital . . . 1,728

Maryland — 2,056
- Baltimore* . . . 738
- Central Maryland . . . 474
- Thomas W. Anthony . . . 844

Virginia — 7,119
- Donald W. Steele Sr. Memorial . . . 3,325
- Gen. Charles A. Gabriel . . . 1,588
- Langley . . . 1,332
- Northern Shenandoah Valley . . . 249
- Richmond . . . 553
- Roanoke . . . 321
- Tidewater . . . 301

West Virginia — 211
- Chuck Yeager . . . 211

FAR WEST REGION — 7,582
Wayne R. Kauffman

California — 6,880
- Bob Hope . . . 449
- Brig. Gen. Robert F. Travis . . . 435
- C. Farinha Gold Rush . . . 833
- David J. Price/Beale . . . 233
- Fresno* . . . 402
- Gen. B. A. Schriever Los Angeles . . . 639
- General Doolittle Los Angeles Area* . . . 794
- Golden Gate* . . . 422
- High Desert . . . 113
- Orange County/Gen. Curtis E. LeMay . . . 482
- Palm Springs . . . 287
- Robert H. Goddard . . . 309
- San Diego . . . 705
- Stan Hryn Monterey Bay . . . 130
- Tennessee Ernie Ford . . . 386
- William J. "Pete" Knight . . . 261

Hawaii — 702
- Hawaii* . . . 702

FLORIDA REGION — 7,535
Sharon Branch

Florida — 7,535
- Brig. Gen. James R. McCarthy . . . 251
- Cape Canaveral . . . 825
- Col. H. M. "Bud" West . . . 193
- Eglin . . . 982
- Falcon . . . 459
- Florida Highlands . . . 264
- Florida West Coast . . . 262
- Gold Coast . . . 529
- Hurlburt . . . 689
- Martin H. Harris . . . 1,017
- Miami-Homestead . . . 325
- Red Tail Memorial . . . 407
- Tyndall . . . 283
- Waterman-Twining . . . 1,049

GREAT LAKES REGION — 6,203
Tom Koogler

Indiana — 1,094
- Central Indiana . . . 351
- Fort Wayne . . . 168
- Grissom Memorial . . . 187
- Lawrence D. Bell Museum . . . 161
- P-47 Memorial Chapter . . . 115
- Southern Indiana . . . 112

Kentucky — 611
- Gen. Russell E. Dougherty . . . 372
- Lexington . . . 239

Michigan — 1,270
- Battle Creek . . . 4
- Lake Superior Northland . . . 104
- Lloyd R. Leavitt Jr. . . . 281
- Mount Clemens . . . 881

Ohio — 3,228
- Capt. Eddie Rickenbacker Memorial* . . . 437
- Frank P. Lahm . . . 346
- Gen. Joseph W. Ralston . . . 442
- North Coast* . . . 173
- Steel Valley . . . 106
- Wright Memorial* . . . 1,724

MIDWEST REGION — 5,402
Chris Canada

Illinois — 1,958
- Chicagoland-O'Hare . . . 912
- Scott Memorial . . . 1,046

Iowa — 455
- Fort Dodge . . . 27
- Gen. Charles A. Horner . . . 169
- Northeast Iowa . . . 211
- Richard D. Kisling . . . 48

Kansas — 502
- Lt. Erwin R. Bleckley . . . 332
- Maj. Gen. Edward R. Fry . . . 170

Missouri — 1,383
- Harry S. Truman . . . 483
- Spirit of St. Louis . . . 517
- Whiteman . . . 383

Nebraska — 1,104
- Ak-Sar-Ben . . . 885
- Lincoln . . . 219

NEW ENGLAND REGION — 2,779
Kevin M. Grady

Connecticut — 563
- Flying Yankees/Gen. George C. Kenney . . . 325
- Lindbergh/Sikorsky . . . 238

Massachusetts — 1,279
- Minuteman . . . 228
- Otis . . . 193
- Paul Revere . . . 632
- Pioneer Valley . . . 226

New Hampshire — 593
- Brig. Gen. Harrison R. Thyng . . . 593

Rhode Island — 186
- Metro Rhode Island . . . 149
- Newport Blue & Gold . . . 37

Vermont — 158
- Green Mountain . . . 158

NORTH CENTRAL REGION — 2,421
Larry Saggstetter

Minnesota — 793
- Gen. E. W. Rawlings . . . 663
- Richard I. Bong . . . 130

Montana — 270
- Big Sky . . . 196
- Bozeman . . . 74

North Dakota — 287
- Gen. David C. Jones . . . 134
- Happy Hooligan . . . 79
- Red River Valley . . . 74

South Dakota — 361
- Dacotah . . . 186
- Rushmore . . . 175

Wisconsin — 710
- Billy Mitchell . . . 710

NORTHEAST REGION — 5,039
Bill Fosina

New Jersey — 1,144
- Brig. Gen. Frederick W. Castle . . . 198
- Hangar One . . . 149
- Highpoint . . . 62
- Mercer County . . . 85
- Sal Capriglione . . . 213
- Shooting Star . . . 174
- Thomas B. McGuire Jr. . . . 263

New York — 1,900
- Albany-Hudson Valley* . . . 295
- Finger Lakes . . . 248
- Gen. Carl A. Spaatz . . . 129
- Genesee Valley . . . 161
- Iron Gate . . . 208
- L. D. Bell-Niagara Frontier . . . 269
- Long Island . . . 465
- Pride of the Adirondacks . . . 125

Pennsylvania — 1,995
- Altoona . . . 136
- Joe Walker-Mon Valley . . . 194
- Lehigh Valley . . . 141
- Liberty Bell . . . 483
- Lt. Col. B. D. "Buzz" Wagner . . . 90
- Mifflin County* . . . 79
- Olmsted . . . 222
- Pocono Northeast . . . 159
- Total Force . . . 279
- York-Lancaster . . . 212

NORTHWEST REGION — 3,884
William Striegel

Alaska — 492
- Edward J. Monaghan . . . 360
- Fairbanks Midnight Sun . . . 132

Idaho — 413
- Snake River Valley . . . 413

Oregon — 735
- Bill Harris . . . 187
- Columbia Gorge* . . . 548

Washington — 2,244
- Greater Seattle . . . 740
- Inland Empire . . . 605
- McChord Field . . . 899

ROCKY MOUNTAIN REGION — 4,669
Don Kidd

Colorado — 3,387
- Gen. Robert E. Huyser . . . 112
- Lance P. Sijan . . . 1,836
- Mel Harmon . . . 136
- Mile High . . . 1,303

Utah — 992
- Northern Utah . . . 334
- Salt Lake City . . . 387
- Ute-Rocky Mountain . . . 271

Wyoming — 290
- Cheyenne Cowboy . . . 290

SOUTH CENTRAL REGION — 5,649
Russell V. Lewey

Alabama — 1,845
- Birmingham . . . 285
- Montgomery . . . 859
- South Alabama . . . 167
- Tennessee Valley . . . 534

Arkansas — 782
- David D. Terry Jr. . . . 465
- Lewis E. Lyle . . . 317

Louisiana — 828
- Ark-La-Tex . . . 448
- Maj. Gen. Oris B. Johnson . . . 380

Mississippi — 754
- Golden Triangle . . . 236
- John C. Stennis . . . 356
- Meridian . . . 162

Tennessee — 1,440
- Everett R. Cook . . . 301
- Gen. Bruce K. Holloway . . . 636
- H. H. Arnold Memorial . . . 109
- Maj. Gen. Dan F. Callahan . . . 394

SOUTHEAST REGION — 6,338
Jackie Trotter

Georgia — 2,674
- Carl Vinson Memorial . . . 811
- Dobbins . . . 1,340
- Savannah . . . 334
- South Georgia . . . 189

North Carolina — 2,110
- Blue Ridge . . . 392
- Cape Fear . . . 235
- Kitty Hawk . . . 52
- Pope . . . 538
- Scott Berkeley . . . 267
- Tarheel . . . 626

South Carolina — 1,604
- Charleston . . . 505
- Columbia Palmetto . . . 359
- Strom Thurmond . . . 372
- Swamp Fox . . . 368

SOUTHWEST REGION — 5,525
Roberta Oates

Arizona — 3,000
- Cochise . . . 122
- Frank Luke . . . 1,529
- Prescott/Goldwater . . . 399
- Tucson . . . 950

Nevada — 1,403
- Thunderbird . . . 1,403

New Mexico — 1,122
- Albuquerque . . . 783
- White Sands . . . 237
- Llano Estacado . . . 102

TEXOMA REGION — 10,265
Kelly Jones

Oklahoma — 1,535
- Altus . . . 117
- Central Oklahoma (Gerrity) . . . 1,002
- Enid . . . 130
- Tulsa . . . 286

Texas — 8,730
- Abilene . . . 321
- Aggieland . . . 155
- Alamo . . . 3,185
- Austin . . . 972
- Concho . . . 182
- Del Rio . . . 122
- Denton . . . 468
- Fort Worth . . . 1,205
- Gen. Charles L. Donnelly Jr. . . . 174
- Northeast Texas . . . 400
- San Jacinto . . . 826
- Seidel . . . 720

OVERSEAS CHAPTERS

US Air Forces in Europe
- Charlemagne: Geilenkirchen, Germany
- Dolomiti: Aviano AB, Italy
- Ramstein: Ramstein AB, Germany
- Spangdahlem: Spangdahlem AB, Germany
- United Kingdom: RAF Lakenheath, UK

Pacific Air Forces
- Keystone: Kadena AB, Japan
- MiG Alley: Osan AB, South Korea
- Tokyo: Tokyo, Japan

*These chapters were chartered before Dec. 31, 1948, and are considered original charter chapters. Ohio's North Coast Chapter was formerly the Cleveland Chapter; Oregon's Columbia Gorge Chapter was formerly the Portland Chapter.

These figures indicate the number of affiliated members as of June 2019. Listed below the name of each region is the region president.

1/Frank Luke Jr. 2/An F-35 at Luke AFB, Ariz. 3/Luke with his Spad S.XII, Sept. 19, 1918, ten days before his death.

Photos: AFA library (1-3); SrA. Ridge Shan/USAF

LUKE

Bare-Knuckler

The name "Frank Luke" has been bestowed on not one, but two air bases. No other American airman can claim that distinction.

Ford Island AS, Hawaii, became Luke Field in 1919. In 1941 the Army shifted the name to a new base (today's Luke Air Force Base) in Arizona.

Luke's home state pushed to acquire the name. It's easy to see why; Luke was a huge war hero, and that wasn't the half of it.

Arizona was still a territory when Frank Luke, Jr., was born in Phoenix in 1897. He did well in school, but he was outstanding in sports. His specialty was bare-knuckle prize fighting.

Luke was a self-confident, brash, and impulsive young man. When the US entered World War I in April 1917, he saw his chance for fame and quickly joined the Army's Aviation Section.

Flight training in Texas and California revealed Luke to be a superior pilot. By March 1918, Second Lieutenant Luke had his wings and commission and had left for France, itching for combat.

Luke was assigned to the 27th Aero Squadron, part of the Army's 1st Pursuit Group. The 27th had just shifted to the powerful French Spad XIII, and Luke took full advantage of that weapon.

He secured his place in history almost overnight. Over a mere 18 days (Sept. 12 through Sept. 29, 1918), Luke shot down 18 German aircraft—four fixed-wing types and 14 observation balloons.

The latter were among the war's most dangerous air targets, all ringed with anti-aircraft cannons, machine guns, and small arms of ground troops. Balloons themselves were hard to set afire.

On Sept. 18, Luke scored five victories in 10 minutes—a phenomenal achievement for the 21-year-old warrior.

Luke was a fearless aviator, often hunting alone and against long odds. That he lacked discipline is not in doubt; he infuriated his commander. He was redeemed by his bare-knuckle combat style.

Young Luke, at the end of his 18-day spree, was America's most famous combat pilot and its top ace. He was far ahead of even Capt. Edward V. Rickenbacker, one of his few friends.

Luke's quest for glory ended Sept. 29, 1918. Taking off alone from Verdun, he sneaked in undetected behind a German balloon unit. In under 10 minutes, he had scored three victories.

Then, Luke was himself raked by German anti-aircraft fire. He managed to land near Murvaux and flee, but he soon collapsed and succumbed to wounds sustained during his flight.

Luke was the first US aviator to receive the Medal of Honor, awarded posthumously. Luke's 18 kills left him second to Rickenbacker's eventual 26.

Rickenbacker himself called Luke "the most daring aviator and greatest fighter pilot of the entire war."

Today, Luke Air Force Base rates as a major element of Air Education and Training Command. The host 56th Fighter Wing produces trained pilots for the F-16 and F-35 fighters. An integral part of Luke's fighter training is the Barry M. Goldwater Air Force Range, which comprises 1.9 million acres of the Sonoran Desert between Yuma and Tucson. At the Connecticut-sized range, pilots practice air-to-air maneuvers and attacks on ground targets. ✪

FRANK LUKE

Born: May 9, 1897, Phoenix, Arizona Territory
Died: Sept. 29, 1918 (KIA) near Murvaux, France
Nickname: Arizona Balloon Buster
Education: Phoenix Union High School
Occupation: US military officer
Services: US Army—Signal Corps, Air Service
Main Era: World War I
Years of Service: 1917-18
Combat: Western Front, Europe 1918
Final Grade: Second lieutenant (posthumously promoted to First Lieutenant)
Honors: Medal of Honor, Distinguished Service Cross (2), Croce al Merito di Guerra (all awarded posthumously)
Famous Friend: Eddie Rickenbacker

LUKE AIR FORCE BASE

State: Arizona
Nearest City: Glendale
Area: Main base 6.6 sq mi / 4,198 acres; Barry M. Goldwater Air Force Range 2,969 sq m / 1.9 million acres
Status: Open, operational
Opened as Litchfield Park Air Base: Feb. 15, 1941
Renamed Luke Field: June 6, 1941
Reactivated as Luke Air Force Base: Jan. 1, 1951
Inactivated: Oct. 31, 1946
Current owner: Air Education and Training Command
Former owners: West Coast Air Corps Training Center; Air Corps Flying Training Command; AAF Flying Training Command; AAF Training Command; Air Training Command; Tactical Air Command; Air Combat Command

THE DC-3 CLASSIC
MEN'S WATCH

MULTI-FUNCTION CHRONOGRAPH WITH 2 SUB DIALS AND STOP WATCH FUNCTION

IMAGE OF DC-3 PLANE ON WATCH FACE

GENUINE LEATHER STRAP

PREMIUM GRADE STAINLESS STEEL CASE BACK ETCHED WITH DC-3 AND IMAGE OF THE PLANE

GREAT GIFT

FOR THOSE OF YOU WHO JUST MIGHT CHANGE THE WORLD

The DC-3 airliner will go down in history as the plane that gave passengers their first transcontinental flights, and changing the face of travel forever. Now you can wear a custom collector's watch that is destined to become as popular as the aircraft that inspired it—*"THE DC-3 CLASSIC" Men's Watch*.

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