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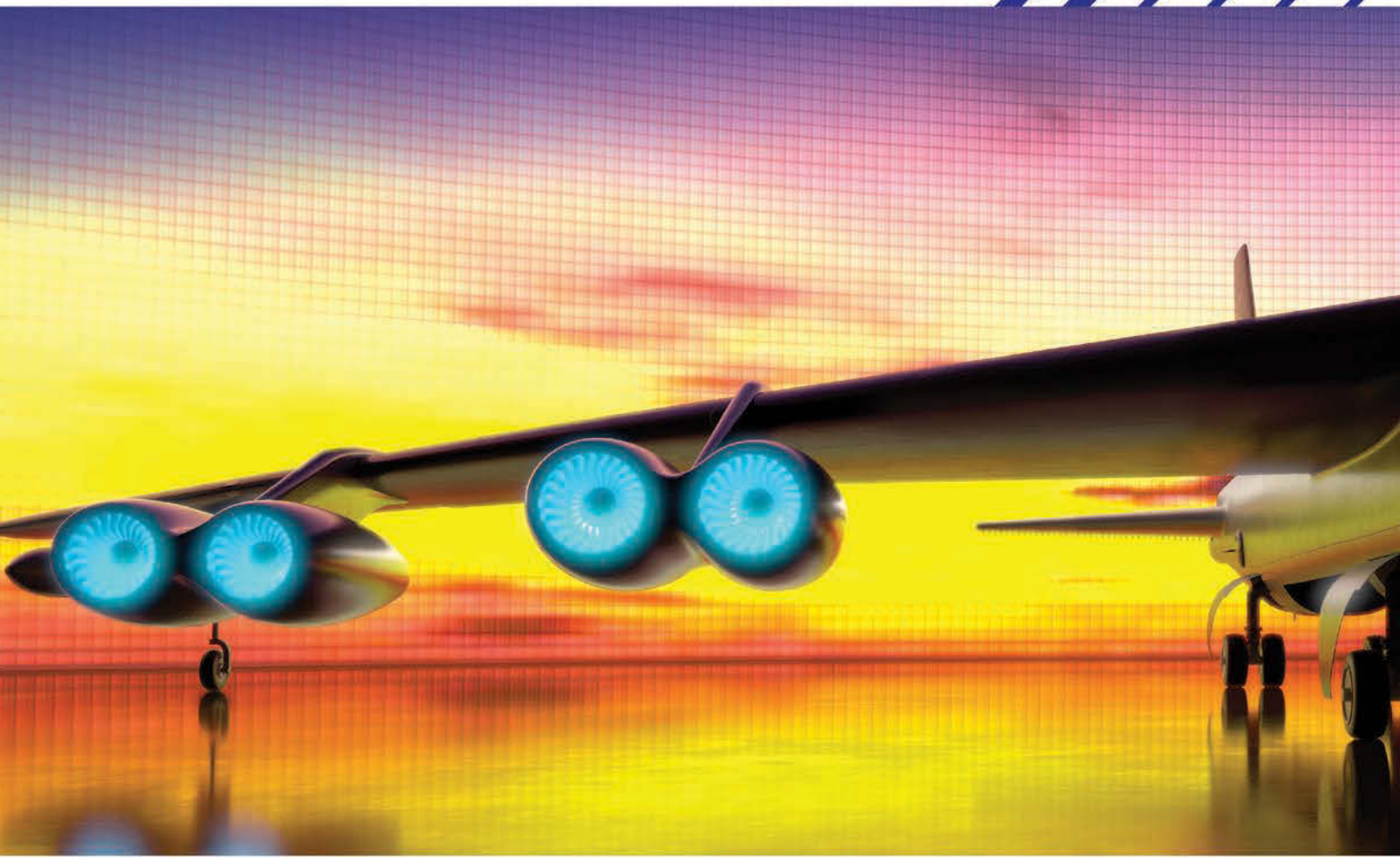

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A-10 pilot Stephen Phillis gave his life to save his wingman. Now, 30 years later, a move is afoot to upgrade his Silver Star Medal to a Medal of Honor. **See p. 55.**

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Spc Derek Mustard/ USA

An impact site from the January 2020 missile attacks at Al Asad Air Base, Iraq. See "Defending Forward Bases," p. 39.

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EDITORIAL

By Tobias Naegele

The Best Fighter in the World

Springtime in Washington. Pollen—and politics—is in the air.

In the Battle of the Budget, the Air Force and its premier acquisition program, the F-35 fighter, is under attack. House Armed Services Committee Chairman Rep. Adam Smith launched his opening salvo, calling the F-35 "a rathole" and saying he wants to "figure out how we can get a mix of fighter attack aircraft that's the most cost-effective."

It's a curious choice of words. While the projected life-cycle costs for all three versions of the F-35 over a span of nearly 40 years is $1.6 trillion, the $80 million-per-copy cost to acquire these jets is less than some last-generation aircraft—and a bargain considering the combat-multiplying effect of this vastly superior platform.

If the F-35 didn't work—if it couldn't evade radar, couldn't fly in combat, couldn't compete with the most sophisticated air defenses in the world—then it would be right to call it quits. But staying the course on F-35 is not buying into a "sunk cost fallacy," where one keeps doubling down on a losing bet in the hopes that things will turn around later. The F-35 is already a success, demonstrating combat flexibility and delivering a decisive advantage in Red Flag exercises.

The radar-evading F-35's very presence changes the nature of battle. It's a strategic investment and combat tool, not a tactical one.

Pilots have raved about the jet's performance. In its first Red Flag, F-35s scored a 20-to-1 kill ratio against a simulated enemy. In another, it flew 16 simulated offensive counter air missions, eliminating 100 surface-to-air missile sites without losing a plane. That's not just good performance—it's unmatched performance.

There are at least three arguments for the F-35 as the most cost-effective fighter the Air Force can buy:

Stealth. When adversary forces turn on S-400 and future Chinese- and Russian-made air defense systems, what will they see? An F-35 shows up on radar as the size of mosquito. It's not quite invisible, but it's too small to track effectively. Eliminate its low-observable features and sure, you save some money. You also give the enemy something they will recognize: targets.

Suddenly, "cost-effectiveness" takes on a whole new light. What price shall we put on the lives of American pilots? Is America too cheap to put our sons and daughters in the best combat aircraft money can buy?

Mission efficiency. A pair of F-35s can strike multiple targets in a contested environment with no support save, perhaps, a tanker. To get two conventional fighter jets to a similarly contested target requires 10 to 20 additional aircraft. The strike jets must be accompanied by other planes to jam enemy radar, defend the attackers, and provide situational awareness. So even if the F-35 costs twice as much per flight hour as an F-16—it's less than that, in fact—it's still the more cost-effective option. Buying F-35s eliminates the need for other aircraft and the personnel, acquisition, training, and logistics that go with them. No economic argument against the F-35 is viable without that calculus.

To opt for a lesser aircraft is specious, like the husband who argues that instead of a car, he should get a motorcycle. He knows full well that he can't ride in snow or rain nor ferry his family on the bike, so will ultimately need another vehicle. It's self-deception to think otherwise.

Unlike a motorcycle, the magic of the F-35 is that it is far more than a one-for-one replacement. It buys more value for the money.

Deterrence. The most cost-effective investments in defense are the ones that, through they're very presence, change adversaries' plans and behavior. Why has China and Russia invested so much in air defense? Why are both pursuing stealth aircraft like the F-35? It's because they know that without them, they don't stand a chance against a U.S. Air Force fully equipped with F-35s.

Stealth is a disruptive game-changer. It imposes costs on the opposition. That's part of what makes it so cost-effective itself. Failing to buy the full complement of F-35s therefore plays into their hands.

Few know better than Air Force Chief of Staff Gen. Charles Q. Brown Jr. how great a threat the U.S. faces from China and the parallel threat he faces in Washington. He commanded Pacific Air Forces in his last job before becoming Chief, so he knows the area and the arc of challenges ranging from China in the south through North Korea and Russia in the north. Brown recently asked for a review of "tactical aviation" and dialed in the Defense Department's Cost Assessment and Program Evaluation (CAPE) office to help. He believes an objective, credible study can help make his case to critics like Rep. Smith.

The study could make a big difference, but it also involves risk. Inviting CAPE to the party means bringing in long-time F-35 skeptics. And embracing the naval term "tactical aviation" to describe combat aircraft devalues the fifth-generation, manned F-35 to be the equal of less-capable older platforms and yet-to-be proven unmanned alternatives. The Navy and Marine Corps use the "tac-air" term because they see jets as supporting elements to their aircraft carriers and Marine Expeditionary Units.

In fact, however, the radar-evading F-35's very presence changes the nature of battle. That makes it a strategic investment and combat tool, not a tactical one.

Whatever we call it, this combat aviation review must be forward-looking. There is little to be gained by dwelling on the compromises wrought by making one airplane meet the competing visions of three military services. Those decisions are done. If the study focuses on combat effectiveness and efficiency, on the cost not of individual airplanes but of accomplishing the missions they must undertake, then the study will yield valuable results. If it's all about the cost of the program from its inception, it will miss the mark.

The Air Force, the F-35 Joint Program Office, and Lockheed Martin still have work to do to shave costs out of the program. It shouldn't cost $36,000 per flight hour to operate this jet and with work they can get that figure down. Likewise, there are logistics solutions to ongoing parts shortages. Solving those will be a whole lot easier than canceling a program on which we and 11 critical allies depend.

Tell your Congressman, tell your friends: Cutting back the F-35 in favor of last year's model is a move in the wrong direction. ✪

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LETTERS

SAGE Advice

In the spirit of the new fad about sustainability and recycling, might I propose a replacement for SHIELD (Strategic Homeland Integrated Ecosystems for Layered Defense) ["See Forging a Shield for the Homeland," January/February, p. 40].

It's a four-letter [word] that starts with an S: SAGE (Semi-Automatic Ground Environment). It was an acronym invented about 1957 that described a new and innovative approach to Continental Air Defense. It described the dawn of the digital age; I think back then it was a subset of Pushbutton Warfare. One thing I like about the name is its built-in OPSEC [operational security] feature. It is so vague it could mean anything!

MSgt. Michael R. Betzer,
USAF (Ret.)
Lancaster, Calif.

Special Guardians

So, since it has been decided that members of the Space Force will be addressed as "Guardians", why was it decided to name it's junior enlisted ranks as "Specialists?' Can someone please explain why the decision body did not give a nod to early Air Force ranks? These "Specialist" ranks could have been named: E1: Guardian 3rd Class; E2: Guardian 2nd Class; E3: Guardian 1st Class. Much like the early Airman 3rd, Airman 2nd, and Airman 1st Ranks of the 1950's and 1960's. Each rank, like the Navy, could be addressed as: 3rd Class, 2nd Class, etc.

Seems to me, too far easy. Apparently, no one gave it any thought.

CMSgt. Jay Wilson,
USAF (Ret.)
Gainesville, Va.

Space Force leaders say they did indeed give this issue a great deal of thought. Here's what Chief Master Sgt. of the Space Force Roger A. Towberman said at AFA's virtual Aerospace Warfare Symposium in February: "The Specialist ranks are one through four. We were very deliberate [in deciding] we're not going to call them first, second, third class. We're going to treat them more as one group, where the levels within that group are mostly in the control of the Specialists [themselves]. ... Long term, what we see happening is that I come in, and when I can prove I can do X, Y and Z, then I get promoted" to the next Specialist rank.—The Editors

The 2 Percent

That quote by Air Force Chief of Staff Gen. Charles Q. Brown Jr. [See "Verbatim," January/February, p. 16] really hurt as it implies that there has been bias against Blacks for at least 30 years. I served for 23 years (1960-1983) as an officer in USAF and of course wrote or endorsed numerous APRs [Airman performance reports], inspected barracks, discharged Airmen, and so forth. Never once did race enter into my decisions. I let the facts guide my decisions.

I can't imagine how our instructor pilots must feel, but I'm glad they did not pass along the Black pilot who couldn't handle his/her aircraft. I think our safety record attests to their diligence.

Rather than lay a guilt trip on all of us who came before, let's celebrate the fact that the United States Air Force is and always has been the best in the world. And let's get the 2 percent guys together with aspiring young Blacks to tell them what it takes.

Lt. Col. Tom Currie,
USAF (Ret.)
Westerville, Ohio

Throughout my 20-plus years as a reservist, I served as an Admission Liaison Officer (primary duty/additional duty) for over 10 years, serving to promote the office accessions programs through both the USAF Academy and USAF ROTC programs. I know for a fact that we have brand-new second lieutenants whose first assignment is

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as a minority affairs officer [with the] role to promote USAF opportunities in the minority communities. Yet, General Brown infers that there is "something in the way" preventing African Americans from becoming pilots.

As an airline pilot for a major U.S. based carrier, I know that my airline has over 6,000 qualified applications on file to fill 1,000 pilots slots in the coming year (pre-COVID) due to the large number of retirements. During a company sponsored video Q&A, the director of recruitment for my airline stated that amongst those 6,000 applicants, there are 11 percent "self-identified minorities" and 2 percent women ... and that they would hire as many as possible. He also stated that the main issue when it came to hiring minorities and women was that there were very few applicants, and very few in the "pipeline" of civilian training.

My point is simple, based on my experience in both USAF and airline flying communities—there does not seem to be a barrier to entry, but amongst young minorities and young women there seems to be a lack of interest in pursuing aviation as a career, let alone serving as an aviator in the greatest Air Force in the world. So with that, my challenge to General Brown is to either demonstrate what is the direct barrier to entry for minorities to becoming a USAF pilot, or, when it is discovered that barrier does not exist, then to ask ... why the lack of interest?

Lt. Col. Michael Wells,
USAFR (Ret.)
Highland Village, Texas

The Air Force is Black and white, not blue. And it's mostly white, and if you're white you make rank and get promoted, and you have less issues across the board—you can make mistakes and you still have a career. Not so much, as a minority.

Pilot training is easier as well—I know—I was a USAF pilot and a minority. And if you're not a fighter pilot? Forget it.

The senior leadership of USAF was educated in predominately white southern schools and they brought that systemic racism with them when joined, they became your senior leadership.

In reality it wasn't their fault, that's where they are recruited.

There are very few Harvard, Yale, Stanford, Princeton, MIT, [or] Ivy League college graduates that are USAF officers, let alone pilots.

When you attend a school that has very few minorities that you have to interact with, you bring those same traits with you to the military.

If you are a dark-skinned minority, you will be looked upon differently—ask the Chief of Staff. Better yet, ask the enlisted troops this question.

I, myself, was overwhelmed when General Brown was selected to be Chief of Staff.

All one has to do is look who they picked to be in charge of the 99th [Pursuit Squadron] Tuskegee Airman during World War II. He looked white, yet commanded minorities that were much darker than himself. That is written in stone.

For years, minorities who traveled in the '60s had "The Green Book," [listing] where they knew they could stay and eat while on the road—well, there is a Blue book, as well, for those of us who have served in USAF—what bases are good for minorities, housing, etc.

There is significant racial disparity in USAF and has been for years.

I applaud General Brown for taking this issue head-on, but unless the Majcom commanders take it seriously, this issue will fade away and go back to business as usual.

You can already see the handwriting on the wall, a blue ribbon commission on racial disparity, staffed by Active-duty minorities. You think they are going to tell the truth and put their careers on the line? Please.

Get some retired officers and senior and not-so-senior enlisted to be on the board that look like General Brown. You will get the truth then, but when you get it, what are you going to do with it?

You know what? They aren't ready for that.

Clarence J. Romero Jr.,
USAF (Ret.)
Marietta, Ga.

Let me make sure I have this right ... George Floyd, under arrest for passing counterfeit money, has his neck kneed on by a MN police officer and dies. Riots erupt over the nation all summer. During this period, the CMSAF at the time, CMSgt. Kaleth O. Wright, announces on social media that he is George Floyd. The highest ranking enlisted Airman in the USAF is George Floyd. How can the Airman sitting in the highest enlisted chair in the USAF say he's George Floyd? If CMSAF Wright is George Floyd, then who's the white "police officer" kneeling on his neck, holding him down ... General Goldfein, the CSAF? It had to be a white guy over him in the Air Force.

CMSAF Wright has the right to feel anyway he wants to feel, but I resent the assertion that the Air Force I served in holds down Black men, especially when spoken by a Black man sitting at the top of the entire enlisted force!

Incredible. Then the Air Force decides to do a racial survey to see if there's a racial problem. You're kidding me, right? You just had CMSAF Kaleth Wright tell all the Black people in the USAF that he was George Floyd, held down by white people. What results did you expect to get? Something different than what the CMSAF said? Of course not! The results said Black Airmen felt discriminated against. The report also said there isn't evidence of racism.

USAF Chief of Staff Gen. [Charles Q. Brown Jr.] says the percentage of black pilots 30 years ago was 2 percent. And, he says, it's still 2 percent today. Does that prove racism? Does that prove the system is rigged against aspiring Black youth to become pilots? You can repeat the current mantra and say, "yes," but I disagree. It's not my fault. It's not the Air Force's fault. It's not America's fault. It's the Black family's fault. But, we're not allowed to say that because that doesn't fit the narrative.

It's not the Air Force's job to increase Black pilot percentages. It's the Air Force's job to set factual pilot standards and requirements. Then, it's up to the young aspiring American to pursue his pilot goal. I didn't apply myself well in high school, so I didn't have the grades to become an AF officer and pilot. That's on me and my parents, not the Air Force.

I served in our Air Force from 1983 to 2013. The Air Force I served was not racist. There were racists in the Air Force, just like in America, but the Air Force wasn't racist. I'm sad to see the slow destruction of our Air Force, our DOD, and our nation.

CMSgt. Jerald Akers,
USAF (Ret.)
Forest, Va.

I remember joining the New York Air National Guard in 1993 and, at that time, one could not be asked if they belong to an extremist group. This was started in the Clinton administration. When I was in the Air National Guard, I did not notice extremist individuals. If anything, I saw diverse opinions, not all were the stereotyped conservative views.

TSgt. Joe Domhan,
NYANG (Ret.)
West Babylon, N.Y.

Collateral Damage

I read not the first paragraph of Michael J. Dunn's [letter] [See "Letters: Scud Hunting," January/February, p. 5] on the right of the US Army to acquire and use theater ballistic missiles as counter-fire weapons, before I concluded that this man is either woefully ignorant of a great number of battlefield realities, or frankly unpossessed of the slightest care over the risks of collateral damage plus blue-on-blue attrition. He advocates for the right of the Army to immediately launch a counter-fire mission within seconds of detection of incoming missile attacks.

Anytime a counter-battery mission is ordered, it is essential to implement a protective bubble of airspace, and ensure that all aerial assets in the line of trajectory are cleared out, both at the origin of the launch and the destination. The risk of blue-on-blue without doing this is obvious. Yet, Dunn makes zero mention of this reality. Instead, he directly asserts that tactics of over 30 years ago were used for questionable reasons, as though we had back then the same technologies as today. It's a specious argument, lacking in fairness.

The reason we sent F-15E's out into the Iraqi desert was because, back in 1990, they represented the best available weapons with which to track down and kill SCUD launchers. It was never considered, not even by Gen. Norman Schwarzkopf, a mission with realistic chance of great success, but instead a political effort to convince the Israeli government to avoid launching their own counter-Scud military missions, likely involving a degree of military ground force occupation of the launch areas, and thereby unraveling the coalition. It is therefore outrageous for Dunn to use the F-15E counter-Scud mission as an object of his derision. There was zero aerial counter options in World War II against the V-2, but does anyone dare assert that the Royal Air Force was incompetent because they could not interdict them!

Had pinpoint precision theater missiles, and GPS-aided rockets and artillery been available back then, they would have been employed consistent with their range limits. Still, the employment would have required the necessary deconfliction to ensure we did not perform the enemy's job for them, by killing our own forces in the effort, or causing a tragic civilian death incident.

Dunn's ridiculous argument provides the best argument against what he's advocating for, which is the right of ground forces to be able to launch thousand-mile ballistic missile, rocket, and artillery strikes, as counter-battery missions, within seconds of threat acquisition. Provided the same ground units are willing to completely forgo

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all aerial support missions, including counter-air, plus completely eliminate all civilian air travel within an entire continent, then his advocacy might make some sense. But, in the real battlespace he speaks of, the course of such theater weapons requires significant deconfliction, likely including civilian air traffic.

With mobile missile launch platforms, even a few minutes delay to secure such airspace clearance, would allow all but the most inept of enemy ample opportunity to vacate the place of fire employment. It is one thing for all FOB's [forward operating bases] to establish their own localized fire control zones, have them published to aviators, and communicate immediate withdrawal orders, pending a counter-battery mission. To extend that concept to an entire theater of battle is absurd. Dunn, if he's the expert he claims to be, should well comprehend all of this.

The best defense against enemy missile attack is to destroy their missile launch capability as part of the initial theater preparation mission. The interdiction and intelligence assets to find, fix, track, and destroy these enemy assets remains in the hands of the Air Force, and consistent with wise deconfliction measures, can also facilitate the responsible use of the counter-fire missions that Dunn references, but not in some matter of seconds upon launch detection, as he imagines.

Maj. Ken Stallings,
USAF (Ret.)
Douglasville, Va.

Remembering Yeager

Thanks for the great article and tribute to Chuck Yeager in the January/February issue [p. 27]. You did not mention the many flying hours in the F-100 when he commanded the 405th Wing at Clark Air Force Base, Philippines. Then-Colonel Yeager flew with our squadron (523rd Tactical Fighter Squadron), often including trips to Taiwan and gunnery sorties at Crow Valley Range. Although the wing also had B-57 Canberras and F-102 aircraft, he visited our squadron often and got on the schedule to fly the Hun whenever he was available. In those days, on the gunnery range there were friendly wagers of a nickel a hole (strafe) and a penny a foot (dive bombing). He was a very talented fighter pilot and took some money on the range, as well as losing occasionally.

He was great to work for and fly with, a fighter pilot in the truest sense.

Lt. Col. Steve Altick,
USAF (Ret.)
Yakima, Wash.

I would like to add some background about General Yeager's enormous, but probably little-known, dedication to Aerospace Education. I first met him in 1963 at the University of Nebraska when I was a graduate assistant to Dr. Frank Sorenson (one of the two or three godfathers of Aerospace Education). Chuck was the keynote speaker for the "Lincoln Aerospace Days", a week-long aerospace education program hosted by the University of Nebraska, Lincoln Public Schools, the State Department of Education, the State Department of Aeronautics, and Lincoln Air Force Base. Chuck spoke in a number of education venues that week including a seminar for Nebraska College of Engineering and the combined Military ROTC (Air Force, Army, Navy). At my request, he also dazzled the Arnold Air Society and Angel Flight in a special small group meeting one evening. In every venue, his genuine love of and dedication to his aviation domain and his sense of humor shone through.

Over the next 30 or so years, I was privileged to get to know him through our annual National Congress of Aviation and Space Education (NCASE). This conference, hosted by CAP, NASA, and FAA, attracted 1,200 to 1,500 educators each year from across the U.S. and Internationally. Chuck became a "staple" at that event, speaking from the podium, informal interviews with fellow aviation heroes such as Gabby Gabreski and Scott Crossfield, "in the halls" personal conversations with attendees, and, his favorite, spending hours at each NCASE with the CAP cadets. Some of the off-the-cuff stories he shared in each of those "conversations" were priceless and had the audience rolling with laughter while other stories were very serious and carried great historical and/or technical import. He spun his magic about aviation and space with these educators motivating them anew each year. Chuck, along with Scott, were the annual presenters at the distinguished Crown Circle of Aerospace Education Award banquet.

Mary Anne Thompson
South Yarmouth, Mass.

[John] Tirpak writes that as a flying sergeant, Chuck Yeager was flying the P-39 after winning his wings. When he deployed to Europe he came into the P-51 and started removing German fighters and according to the rest of the story, he became an ace after his short time getting back into the air after being shot down and then with the help of the French resistance—getting into combat flying again—he again became active in shooting down German fighter to include on ME 262. Then, according to the article, "He received a commission" and was promoted to captain.

Many years ago I questioned and queried AFA about a possible "flying sergeant" that had become an ace in the Mediterranean theater. I was advised that I had wrong information. I believe the same situation exists now, and I feel sure General Yeager was commissioned before he arrived in Europe.

Chief John Schmidt,
USAF (Ret.)
Tallahassee, Fla.

The call came over the radio that the wing commanding officer wanted to see the maintenance officer. We were on a fire power demonstration at Ramey Air Force Base, Puerto Rico, in the late 1960s and the weapons were not coming off the aircraft properly. I was the squadron munitions officer and acting maintenance officer at the time. I met him on the flight line and expected he would chew me out and demand results. However, he was calm and told me what they had done when he was in Vietnam. The load crews would tape the electrical lanyard to the Mer or Ter (ejector rack) and that seemed to help. He just talked with me like two people trying to fix a problem and not like a famous aviator who wanted people to be in awe of him—which I already was.

I told him we would do our best. He said if everything went well the next day, he would wag his wings upon returning from the demonstration. I told the men about the discussion and said we had to be sure the weapons came off properly as we surely did not want to disappoint our wing commanding officer. Sure enough, Col. Chuck Yeager wagged his wings when the flight returned. That was one of the highlights of my Active and Reserve career.

Col. Mac Barnes,
USAF (Ret.)
Roanoke, Va.

Fighter Fight

It seems to me that the F-15EX (which *should* be designated F-15F) would be a better fit for the ongoing Canadian fighter competition than the F-18F ["See Joining Up on the F-15EX," p. 30]. It has better range, payload, and radar antenna size, all of which will be key to any envisioned Canadian fighter operations at home in Canada or overseas on deployments. The folding wings and carrier qualified landing gear are of no use to Canada. Now that the F-15EX is going forward, Boeing should change its bid.

In addition, note that if Canadian forces deploy overseas, they will likely deploy to land bases that may also have USAF aircraft, including our own late model F-15s, and therefore there would be logistical synergies. Additionally, it should be easy to fit something like the TCS [television camera set] that was on the F-14 into the sensor stub pylons under the intakes, which would be valuable for identification during Canada's interception missions.

I have a couple of questions that some Air Force Magazine readers may know the answers to. First, since the conformal tanks had been planned from very early in the F-15 program, partly to allow unassisted cross Atlantic ferry flights, why didn't the USAF ever fit them to the C and D models? They would have been very useful for all USAF/ANG air defense missions, particularly the Icelandic deployments. I believe the Israelis fitted them on their A/B/C/D models. I have never seen an answer for this.

Second, there seems to be discrepancies in the ferry range figures given in various publications over the years. From sources going back decades, my recollection is that the various F-15 models had ferry ranges approximating 2,500 statute miles with three 600 gallon tanks, increasing to about 3,500 with the addition of the conformals. The E model supposedly gave up a tiny bit of fuel and gun ammo for an additional avionics bay. And then what explains the EX gaining 592 miles?

Third, what were the specific aerodynamic concerns about activating stations 1 and 9 on the A through E, the outboard ones? Was it flutter? All these years, in a war situation, could those stations have been used in an emergency and just accept the limitations? I know the structure could accept it, were the wiring and the fittings installed?

MSgt. Chris Dierkes
Westhampton Beach, N.Y.

Reinventing the Boom

I got into the boom tanker business at the very beginning in 1953 in the KC-97. It was the tanker version of the Boeing Stratocruiser, and the first to use the ironing board position on the fuselage belly for the boom operator. It provided direct vision of the receiver. I don't know whether it was Boeing or the Air Force who came up with the idea of locating the boom operator's position behind the cockpit, but it was nuts.

My grandson is flying the KC-135, which has been in the inventory since the early 1950s. My father, Gen. Orval R. Cook, was deputy chief of staff Materiel, 1951-1954. Boeing came to him with the idea of manufacturing a jet tanker and wanted seed funding. He told them that they could manufacture a commercial aircraft that could be modified as a tanker. Thus the KC-135. It should have been the same with the KC-46.

Lt. Col. Peyton E. Cook,
USAF (Ret.)
Southern Pines, N.C.

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Protecting the Homeland

Lt. Gen. Michael A. Loh is the director of the Air National Guard. Air Force Magazine Digital Editor Jennifer-Leigh Oprihory interviewed Loh in February, touching on the Guard mobilization in the nation's capital, the ANG's COVID-19 response, and more. The conversation has been edited for length and clarity.

Q. The National Guard deployments to the nation's capital was unprecedented. What was the full extent of the Air National Guard's role?

A. The National Guard has always been on mission for the inauguration. [But] the events of Jan. 6 absolutely changed everything, as we witnessed the horrific acts of people overrunning the nation's capital. ... Within hours, the D.C. National Guard deployed, ... that included Air National Guard. ... It was a Wednesday. They were called up in the afternoon, so they had already done a day of work. They were at home, some of 'em, and also they were at their normal job, and they reported into their work centers, were outfitted with batons, shields, masks, helmets, and then put together like they had done back in June, on the front lines on the west steps of the Capitol. ... And they stood that line against that angry mob, from that time until they were relieved ... about [2 a.m.]. And ... that angry mob at the other side were out there all night, doing things like calling them traitors to their country and the like. It was a very emotional event, but also [a] very proud moment for both the Air National Guard and the Army National Guard as they held that line and, quite frankly, let Congress do their work.

Then, boy, that led to a series of "OK, we're not gonna to let this happen for the inauguration, ... we are gonna have ... a peaceful transfer of power. And, so, what do we need?" And that's when the National Guard moved over an Army Corps—over 25,000 Soldiers and Airmen—into the nation's capital for the inauguration. ... Both Chief Williams and I spent many days down there ... talking with the Soldiers and Airmen, and talking about the significance of this moment in our nation's history. ... You could see it in the face of the Airmen—they knew. I mean, it was a proud moment for them, as well as a proud moment for us. ... Simultaneously, the Air National Guard had to move those folks, and so we actually moved over a division's worth of Soldiers and Airmen and their equipment into D.C. via air. You know, the air power that we talk about a lot, [and] the logistics necessary to make that happen. ... This took a Total Force effort, so it wasn't just the Air National Guard. ... The Reserves helped us out, outfitting KC-46s with seats ... Active duty, the Reserves, and the Guard moving those forces in and out of [Joint Base] Andrews [in Maryland] quickly so that no airplanes spent the night. And so we actually airlifted over ... 13,000 Guardsmen in and out, and over 11,032 short tons of cargo. ... [Making it] the largest domestic military response since Hurricane Katrina back in 2005.

Andy Morataya/ANG

Lt. Gen. Michael A. Loh is the director of the Air National Guard at the Pentagon, Arlington, Va. He is responsible for formulating, developing, and coordinating all policies, plans, and programs affecting more than 107,000 Air National Guard Airmen and civilians.

Q. How did last summer's deployments for civil unrest inform the D.C. mission this year?

A. Because of the enormity of it, back in June, after the tragic death of George Floyd and the civil unrest and the racial disparity things that went on, we went out there to do civil disturbance operations. And so, we were training additional forces in order to do that. ... I mean, we used cyber professionals in that time frame. We used the logisticians. It wasn't just security forces. ... We were able to train ... forces in these mission sets. ... This time, obviously, there's no notice. ... They took the forces that ... had been trained previously, six months before, and were able to utilize them a little bit quicker.

Q. Let's talk about the COVID-19 vaccines. Maj. Gen. Jeff Taliaferro from the Joint Staff testified recently that about one in three U.S. troops have declined the vaccine. How is the vaccine playing among the Air National Guard?

A. I have a little over 24,000 that have taken at least the first dose, [and] ... compared to the other components and

services, that's actually higher. ... [I heard], anecdotally, ... just like General Taliaferro said, it's about a third ... have passed on taking the shot. I don't know if they actually denied it, or they just said, 'No, I'll pass.' [This is] a young, healthy population, and they're dealing with parents and grandparents that can't get the vaccine right now. There are members that go, 'Hey, I know I am not at the biggest risk, and so use it for those that are at the higher risk.' So, I can't tell you how many would have ... actually would have refused it. ... But I have heard from units, because I asked, "Why are they turning it] down?" [And they tell me,] 'Sir, most people are telling us, we aren't the population that's at risk. You need to stick that vaccine into the population that is at risk.' That's very noble.

Q. It's been quite a year—COVID-19, the summer riots, the insurrection in D.C. How have the call-ups affected morale and retention?

A. You talked about the domestic operations, but ... we actually extended deployments [for troops] overseas. When this thing kicked off, we had probably about 3,000—I think that's a normal, round number we have deployed overseas—in combat zones, and now we have the restrictions of movement, the quarantine, in each location. So imagine being on a six-month deployment, and then all of a sudden that's it and now I can't get forces to replace you. You're still on mission. ... Some extensions [went on] for two to three months. ... But the families have been resilient. .... We live by the motto, "Always Ready, Always There!" So when they saw this occur, they go, "Well, I understand why." And as soon as you can understand the why, it becomes a lot easier.

Our commanders and our family programs coordinators, you know, our spouse programs, all of those came together, and then of course, the community ... all came together to support the family members, and to over communicate with families, and then over communicate with their employers on expectation management.

The response from the homeland, you've seen it: Unprecedented. What gets lost in the civil disturbance operations of the summer, and of course, now, is all the hurricanes [and our] largest wildfire season. We had folks on the front lines for wildfires, hurricanes, floods. At one time, over one in five National Guard member[s] [were] mobilized on operations somewhere in the world ... over 20 percent.

Now, the good news is, I still had about 80 percent as that strategic reserve, so if something else happened in the world, I could still respond. But, that is a high ops tempo.

[Even so] ... my retention numbers are extremely high. ... I also haven't seen my recruiting numbers go down. People still want to join and be part of this national defense architecture that we have in the National Guard. So both of those have remained high.

And then, the morale of the organization. You know, it's one thing to go over and fight a nation's wars offshore. It's another to help your neighbor. And that's where the National Guard excels. We're in all the communities. We're in all the counties out there, parishes, and all that. And so it's that fabric—of helping your neighbor when things happen, and they can't help themselves—that makes the National Guard unique.

Q. One of the surprises from the Jan. 6 insurrection was the number of former military members who participated. That's prompted concerns about extremism in the force. What is the ANG doing to understand this issue?

A. So, let me talk about extremism ... we don't tolerate it, OK? Our policies expressly prohibit advocating any supremacist, extremist, gang activity, criminal gang ... ideology or any of that. ... And we reject participation in any of those events.

Now, do I know if it's widespread? I'm gonna go back to racial disparity. We didn't know how ... widespread it was, until we did some reports. ... We need to go figure it out. ... Short answer is? I don't know yet. [But] I do know this. We're going to do training. And I also note ... if you see something, please say something, and then we can go out and we can investigate. ... Right now, extremism in the ranks is worrisome because it's an unknown. ... I'll give you a much better answer probably a year from now.

Q. Secretary of Defense Lloyd Austin ordered a stand-down. Do you have a tentative game plan yet for the stand-downs within ANG?

A. I think the biggest thing that we need to talk about with our Airmen is this: Why do we serve? Go back to the core values of the United States Air Force. ... And then let's have an open dialogue ... and maybe have uncomfortable conversations, kinda like we did with racial disparity. ... Let's make sure we understand what prohibited activities we have, and then how can we prevent extremism in our ranks. ... The best thing we can do is roll out a training program to the local leaders that says, "Here's what it is. Here's what it's not. ... Here's protected speech, and that's what it looks like—you know, we should still have free speech—here's the things that are not gonna be tolerated in the military. But then, more importantly is, here's why you serve. You know, service before self." If we can concentrate on the why [extremism] hurts and harms us, then I think we'll be better off in the end.

Q. Acting Air Force Secretary John P. Roth and Air Force Chief of Staff Gen. C.Q. Brown Jr. recently ordered a Department of the Air Force-wide investigation into security at USAF and Space Force installations. What can you tell us about security from an ANG perspective?

A. I have 76 Air National Guard installations that I'm responsible and accountable for securing, and our defenders are out there each and every day doing [a] wonderful job. ... [Yet so far in] 2021, we've had 13 installation breaches, [which] we define as, did they make it through or try to make it through? Nine of those 13 were at installation control points. [But most of these are accidental.] Most of them come in, they don't realize that they're coming on a base, that they're supposed to stop, and they pass through. Good news is, none of them have caused any damage. I've had a couple where people have tried to jump the fence and steal stuff, [who were] caught. ... If you follow the standard operating procedures, and you're able to do some things like we have with other intrusion detection systems, like cameras and those types of things, we are actually very secure, and people will feel very secure being in our base. ... The other piece is, every Airman is a sensor. The community around our installations are sensors. So if you see something that's just not right, we have people that'll say something—that's kind of being that part of the community. .... And of course, we also practice .... intruder exercises, we practice insider threat exercises. And so by practicing ... we're able to actually keep very secure locations. ✪

Staff Sgt. Samuel Ley releases an MK-124 smoke and illumination signal on the Chukchi Sea, which spans the distance between northern Alaska and Siberia to the west. A Survival, Evasion, Resistance, and Escape (SERE) Specialist, Ley was teaching students how to use the flare to signal search and rescue crews in case of an emergency landing or crash.

Maj. Tyler Williams

A KC-135 pilot and his crew chief do their preflight checks at Al Udeid Air Base, Qatar, in February 2021. Stratotankers have been among the U.S. Air Force's busiest aircraft in the region, refueling joint and coalition aircraft, and supporting some airlift operations. Now help is finally on the way. The Air Force says the new KC-46 Pegasus tankers will begin doing some noncombat refueling in June, easing crews' relentless op-tempo.

Staff Sgt. Trevor McBride

The newest fighter in the Air Force inventory looks a lot like some of the oldest. USAF took possession of its first F-15EX March 11, and will use the first-in-class jet to complete operational testing. The service plans to buy 144 F-15EXs over the next 12 to 15 years. "With its large weapons capacity, digital backbone," said Air Force Program Manager Col. Sean Dorey, "the F-15EX will be a key element of our tactical fighter fleet and complement fifth-generation assets. In addition, it's capable of carrying hypersonic weapons, giving it a niche role in future near-pear conflicts.

Tech. Sgt. John McRell

By John A. Tirpak

End of the High-Low Mix?

Courtesy

The F-22 and F-35 were intended to succeed the F-15 and F-16 as USAF's high-low fighter mix. But program choices and the emergence of unmanned technologies, as represented here by the remotely piloted XQ-58A Valkyrie, threaten that vision.

The Air Force is launching a new tactical aviation study in an attempt to rationalize its swelling portfolio of manned and unmanned combat aircraft programs. The goal is to harmonize its efforts with those of the other services across the spectrum of joint combat, from high-end fighters that can take on peer competitors to cheaper airplanes for fighting in uncontested skies. It's also supposed to be an affordable plan, and will inform the fiscal 2023 budget request.

While details are still limited, it seems clear the Air Force is moving on from the "high-low," two-fighter mix it has maintained since the 1980s in favor of an assortment of capabilities tunable to the conflict at hand.

Chief of Staff Gen. Charles Q. Brown Jr., revealed plans for the study on Feb. 17, telling reporters he needs a decades-long roadmap for "tactical aviation" that balances near- and long-term needs.

The "high-end fight" warrants today's 5th-generation fighters and the Next-Generation Air Dominance (NGAD) fighter, he said, but "there's also a mix for a low-end fight," which could include a "fourth-and-a-half/fifth-gen-minus" fighter and an array of unmanned aircraft.

USAF must get both the capability mix right as well as the numbers, "to assure we are going to be successful in future conflicts," Brown said. Modeling and simulation will play heavily in the study, which he also said would be conducted in partnership with the Pentagon's Cost Assessment and Program Evaluation (CAPE) shop. The CAPE will put data rigor to the study, he said.

"If I just do an Air Force study, it's just an Air Force study," he said. With CAPE, it will gain credibility with the Office of the Secretary of Defense and the other services. CAPE has been critical of Air Force fighter programs in the past.

"I'm all about numbers and facts," Brown said. "That's what I expect from our Air Staff and that's what I'm holding them accountable to." He won't accept "emotion" from staffers who want to retain a system just because "that's what they grew up in."

During the Air Force Association's virtual Aerospace Warfare Symposium (vAWS) in February, he told reporters the study will also involve the Joint Staff, and that USAF's fighter mix will be harmonized with the capabilities of the other services. The Navy also flies the F-35 and is pursuing its own sixth-generation fighter.

It will also be informed by the Global Posture Review that Defense Secretary Lloyd Austin is conducting. Brown said he doesn't want the TacAir study to be done "in a vacuum," and "not listening to the other things that are happening inside the Department" would be naive, he said.

"As we really get into ... the budget for FY23, that's where ... we'll really make some key decisions," Brown predicted. The study

will be the jumping-off point for "a good conversation" with key stakeholders—Congress and combatant commanders—about "that right force mix."

The Air Force's air superiority model, unbeatable since the 1980s, called for a high-end capability—the twin-engine F-15—dominating the skies, with the less-costly, single-engine F-16 purchased in volume to be the "backbone of the force." When the F-22 arrived in the mid-2000s, it was supposed to become the next-generation high-end capability, while the single-engine F-35 was to succeed the F-16, extending the high-low mix well into the 21st century. But the F-22 program was terminated after only half the required numbers were built, and the F-35, though operational year five, has yet to reach full-rate production.

In recent years, the Air Force has invested in the NGAD, the F-35, new-build F-15EXs, several unmanned systems—the Low-Cost Attritable Aircraft System (LCAAS); the Valkyrie; Loyal Wingman; and Longshot—and potentially a light attack aircraft. For the latter, USAF has looked at a turboprop and/or a weaponized version of the new T-7A jet trainer.

"You're going to have to make some tough choices," Brown said, suggesting not all the programs will move forward.

Brown insisted the Air Force will not "take money from F-35" to fund NGAD; and will find the cash elsewhere in the fighter portfolio. Bringing down the age of USAF's fighters from today's average of 28 years is essential, he added.

The Chief isn't interested in buying new F-16s, preferring "a clean-sheet design," with new avionics, and agile software updates that would rapidly update code in response to changing threats and requirements. Open mission systems—which the 1970s-era F-16 lacks—is "where we need to go."

THE F-35 "CORNERSTONE"

House Armed Services Committee Chairman Adam Smith (D-Wash.) echoed Brown's call for a new fighter study, saying in a March 5 Brookings Institution event, "I'm going to try to … figure out how we can get a mix of fighter/attack aircraft that's the most cost-effective." A "big part of that," he said, is "finding something" that will make the services less reliant on the F-35. Regarding the Lightning II, he said, "I want to stop throwing money down that rat hole." Smith acknowledged there's "no easy way out of" the F-35, though, and doesn't anticipate a sudden halt to the program. Nor does his Senate counterpart, Sen. Jack Reed (D-R.I.), who said he's concerned about the F-35 but not looking to slash fighter programs.

As for Brown, he told reporters during AFA's virtual Aerospace Warfare Symposium on Feb. 25, the F-35 is "the cornerstone" of USAF's fighter program and praised its performance in combat deployments.

The Air Force still plans to buy 1,763 F-35s, but the timeline to do so remains sketchy. At the present rate, it will take until the 2040s to get there. Brown acknowledged the challenge, and suggested the Air Force may "need to accelerate" the buy, a reference to his own slogan for the force: "Accelerate Change—or Lose."

"I can't [decide] this myself," he said. Congress and DOD would have to go along, and industry would have to demonstrate it can surge production.

Brown suggested the calculus could change based on how the F-35 is used. Recent F-35 engine problems can be traced to "the high-use rate," given the F-35's frequent overseas deployments to the Middle East and Europe. "That extra time on the engines is causing them to fail a bit sooner," he said Feb. 17.

"I want to moderate how much we're using those aircraft," he continued. "You don't drive your Ferrari to work every day. … We want to make sure we don't use [the F-35] for a low-end fight when we want to save it for the high-end fight. … We don't want to burn up that capability now and wish we had it later."

The head of Air Combat Command said he's doubtful that the F-35 will ever get to its target operating cost, however. Gen. Mark D. Kelly told reporters at a Feb. 26 vAWS press conference, "I'm not brimming with confidence" that USAF can reach its goal of $25,000 per flying hour by 2025; the cost today is about $36,000, according to the Air Force and Lockheed Martin, the F-35's prime contractor.

While "I haven't lost confidence," Kelly said, "as I sit here today, I'm not overly confident we'll get there." Lockheed told reporters in February that the Joint Program Office rejected the company's pitch of a broad performance-based logistics (PBL) contract, which it said was the best bet to reach the $25,000-per-flight-hour target by 2025. Company officials said a slimmed down performance-based logistics deal could still get them there, though. Such a "skinny" PBL contract would not include authorities the company sought to make long-term economic orders for some parts and materials. Lockheed officials said they expect a sole-source request for proposals this summer, likely a five-year contract with options to extend.

Ken Merchant, Lockheed F-35 sustainability vice president, said the "skinny" PBL won't save "anywhere near what we had hoped for" with the original proposal, but said sustainment performance will match the earlier forecast. He's optimistic because flying hour costs have been almost halved since the program began.

A push is on to keep parts bins full, repair parts faster, and reduce the demand for spares by improving repair capacity "across the enterprise," Merchant said. Lockheed has assumed risk by committing to years-long deals with some of its own suppliers, even though F-35 sustainment is still on an "annual contracts" basis with the government, he said.

YOU SNOOZE, YOU LOSE

Kelly is worried that the U.S. is moving too slowly on NGAD. "I don't know … if our nation will have the courage and focus to field this capability before someone like the Chinese fields it and uses it against us," he said. "We just need to make sure we keep our narrative up and articulate the benefit" of air superiority. The U.S. military is optimized to function with control of the air, Kelly said; "It's less designed to operate without it."

If the Air Force wins the NGAD race, Kelly said, adversaries who challenge the U.S. will "suffer a very tough day, and a tough week, and a tough war."

Brown said NGAD will need to have longer range than current fighters to be effective in the vast Pacific theater, and to be less dependent on aerial refueling. The goal "is to provide … as much range as possible," he said.

Asked about Brown's idea of a "fifth-gen-minus" airplane for less-taxing missions, Kelly said it makes sense not to apply the best aircraft to undemanding missions. Using high-end fighters against low-end missions incurs "a significant jump in investment, as well as cost-per-flying-hour."

Lt. Gen. Duke Z. Richardson, military deputy to the Assistant Secretary of the Air Force for Acquisition, Technology and Logistics, said the Air Force and Congress must have the "courage" to adopt a rapid-refresh model for fighter technology, as put forward by Will Roper, the former assistant secretary. Richardson said buying new aircraft in quick succession—but at less cost, because they're only meant to last less than a decade—requires a shift in mindset. The Air Force and Congress have to be willing to have "another one right behind it" each time a new jet ends its service, he said. If either fails to follow through, the Air Force may surrender its long dominance of the air. ✪

VERBATIM

Staff Sgt. Trevor McBride

Bipartisanship

"Last week's airstrikes in Syria show that the Executive Branch, regardless of party, will continue to stretch its war powers. Congress has a responsibility to not only vote to authorize new military action, but to repeal old authorizations that are no longer necessary."

—**Sen. Tim Kaine** (D-Va.), March 3.

Golden Age

"The new authorities that we have received—[section] 804, rapid fielding authorities—we are embracing them with both arms, because in my mind, this is the golden age of acquisition for the Air Force, something that people like me ... have been waiting for our entire career. [They] allow us to go faster, to experiment, to fail, to try again, and to have the backing that, 'that's okay.'"

—**Brig. Gen. Anthony Genatempo,** commander, Air Force Nuclear Weapons Center, panel discussion on nuclear systems at AFA's virtual Aerospace Warfare Symposium (vAWS) [Feb. 24].

Adam Schultz/White House

Gold Medal Standard

"We must prepare together for a long-term strategic competition with China. How the United States, Europe, and Asia work together to secure the peace and defend our shared values and advance our prosperity across the Pacific will be among the most consequential efforts we undertake. Competition with China is going to be stiff. ... We can own the race for the future. But to do so, we have to be clear-eyed about the historic investments and partnerships that this will require. We have to protect—we have to protect for space, for innovation, for intellectual property, and the creative genius that thrives with the free exchange of ideas in open, democratic societies."

—**President Joe Biden** remarks at the Virtual Munich Security Conference with his fellow G-7 world leaders [Feb. 19].

AFA

Brown's Report Card

"How'm I doing? I'll let the folks in the field judge, but there's always room for improvement. I think there are some positive things, but I think we're also changing the culture of the Air Force ... And a cultural change takes a bit of time. And you'll have some naysayers, have some friction points. But I've got to be ... consistent and persistent on the focus ... to get through all five stages of 'no': hell no; no, we'll think about it; not a bad idea; we should have done it already."

—**Gen. Charles Q. Brown Jr.,** USAF Chief of Staff, at AFA's vAWS discussing his "Accelerate Change or Lose" message [Feb. 24].

Son of a Peacekeeper

"We've got to find a name for the [Ground-Based Strategic Deterrent]. GBSD just doesn't hack it. ... Because GBSD is very hard to explain to the American people ... GBSD requires me to define the term before I actually get into it, so for God's sakes, Air Force, let's get a name for the thing and start moving forward."

—**Gen. John E. Hyten,** vice chairman, Joint Chiefs of Staff, in a recorded panel discussion released at AFA's vAWS [Feb. 26].

AFA

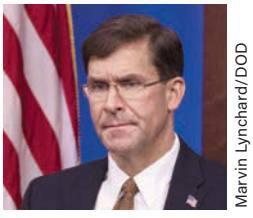
Puzzled

Mike Tsukamoto/staff; Tomekwalecki/Pixabay

"You have personnel who have to take Navy data, put it on a hard drive, fly it to an Air Force network to transmit to another Air Force place, so they can push it out to different elements in the Joint Force. ... That's unacceptable, right? We're moving data on hard drives ... because we won't allow each other's personnel access to each other's networks."

—**Lt. Gen. Michael Groen,** director of the Pentagon's Joint Artificial Intelligence Center, on the state of information sharing in today's Defense Department, during a virtual Government CIO event [March 11].

Promises, Promises



Marvin Lynchard/DOD

"We implemented our side of it in good faith, but it's fair to say the Taliban have not."

—**Mark T. Esper,** former Defense Secretary, on keeping troops in Afghanistan, in an interview with Brookings Institution [Feb. 26].

Illustration by Mike Tsukamoto/staff; NASA; Pixabay

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

A New Frontier in Space Ops

Space conflict is not the future. It is now.

Rachel S. Cohen

Space wars could be coming. After decades of peaceful expansion in space, where the United States deployed GPS for the masses and bounced secret combat messages off satellites to troops around the world, the U.S. Space Force is being more open about growing threats and risks in space, including anti-satellite missiles, signal jammers, and threats to satellite controls and radars on the ground. Each of these pose threats to the American way of life.

"The challenge is that the access to space and freedom to maneuver in space can no longer be treated as a given," said Chief of Space Operations Gen. John W. "Jay" Raymond at the Air Force Association's virtual Aerospace Warfare Symposium during a discussion with famed astrophysicist Neil deGrasse Tyson. "We have to be able to protect" U.S. civil, commercial, and military assets in space, he added.

Russia and China are the pacing threats in space, each figuring out how to work space capabilities into their own global military enterprises while developing and deploying potentially damaging spycraft and weapons in space.

"We are seeing a lot of electromagnetic spectrum activity in Syria from the Russians."
—Maj. Gen. DeAnna Burt, Space Command's Combined Force Space Component Command boss

Raymond describes Russian "nesting doll" satellites that unfold next to U.S. assets and Chinese satellites with robotic arms to grab other systems on orbit. Each is also developing electronic weapons.

"There are robust sets of jammers that can jam both communication satellites and our GPS satellites," he said. "Both China and Russia have directed-energy weapons today, ... lasers that can blind or damage our satellite systems. Both China and Russia have missiles that they can launch from the ground and kinetically destroy satellites in low Earth orbit in a matter of minutes."

China fired an anti-satellite weapon in 2007, shattering one of its own defunct weather satellites. The incident proved its technology, but also created more than 3,000 pieces of space debris that now orbits the Earth, traveling at a speed and orbit that puts other spacecraft at risk.

That move "really changed the sanctuary of space that we've all grown up with," said Space Delta 7 Commander Col. Chandler P. Atwood, also during the AFA conference.

Fourteen years later, commanders are starting to

see their forces in a different light. New squadrons are coming online with missions tailored to modern defense: advanced space threat analysis, orbital warfare, and offensive operations on the electromagnetic spectrum.

DeGrasse Tyson weighed in, stating, "Ever since Sputnik, space has been recognized as a strategic asset, or rather a strategic location. So it's not a new thing. It's actually an old thing that is finally getting recognized in the way it needs to be in terms of the umbrella of national security."

Guardians are learning to look for the fingerprints of threats they may not have noticed before. If something goes wrong on orbit, is it a typical outage, or is someone else snooping around?

"Five years ago, … we were very good at opening the [technical order],'" said Space Delta 3 boss Col. John G. Thien. "We'd see the error message come across, and it would say, 'call engineering' or 'call maintenance.' Now, we want our Guardians to actually take a look, [when] something goes wrong, … could that be a prelude to an attack?"

CYBER AND ELECTRONIC WARFARE

To distinguish between benign and malicious activity, operators will need to look to cyberspace and the electromagnetic spectrum—areas where the fight is already underway—to discern what might evolve into physical conflict. They're also pairing intelligence, surveillance, and reconnaissance techniques with daily space operations, and working more closely with other members of the Intelligence Community.

"You need an intel operator sitting right next to a space operator to provide that indications and warning … [and the] reach-back through the [Intelligence Community]," Atwood said. That enables commanders to say, "'Hey, we just saw this maneuver, we might want to do a counter-maneuver.' That's the paradigm shift that we're going through right now."

Space conflict is already playing out in real-world terrestrial operations.

Maj. Gen. DeAnna M. Burt, the commander of U.S. Space Command's Combined Force Space Component Command, said operations in Syria now look like the Air Force's Red Flag exercise—the department's premier aerial training event, in which pilots practice complex maneuvers while dealing with degraded communications and satellite interference.

"They're actively doing work in the electromagnetic spectrum, taking out [satellite communications], and GPS, and other things in the space domain," Burt said. "We are seeing a lot of electromagnetic spectrum activity in Syria from the Russians, and working to make sure we can mitigate that so it does not affect U.S. forces and the work that they need to do."

SPACECOM supports U.S. Central Command for ongoing military operations, fielding more than 500 requests for assistance from space assets in 2020. U.S. forces used military space systems to track nearly 1,300 missile launches in the Middle East in the first 11 months of 2020, Burt said.

"Multi-domain discipline in space is not for space's sake," she said. "It's in order to have those satellites to provide combat effects to our other joint brothers and sisters in the other domains."

Officials are looking for ways to keep space safe and maintain an upper hand while the Pentagon learns how to treat space as it does air, land, and sea. Troops need to be able to hold orbital threats at bay, and if they can't, they need the firepower to respond accordingly, Raymond indicated.

He pointed to World War II, when the Air Force sent 1,000 bombers carrying nine bombs each to hit one ball-bearing factory. Only 100 or so of those 9,000 weapons would explode near the target, he said.

Over time, military aircraft became more precise and powerful, thanks to new weapons and technologies like GPS. But the U.S. doesn't yet have the means to defend space through force, Raymond said, so the Space Force has to work even harder to maintain a safe status quo.

"If we lost space, do we have 1,000 bombers in our Air Force today? We don't," he said. "That's why I said we can't afford to lose space, and we're not going to lose space. It's too important to us."

To keep the peace on orbit, the global community is beginning to discuss what norms of good behavior might look like for satellites, other spacecraft, and counter-space weapons. The U.S. hopes established norms and peer pressure may keep other countries from threatening civil and military assets.

It's crowded up there, Raymond said, so spacefaring nations should behave themselves.

"I would like my successors to have some rules of the road on how you operate in space," he said. "It is not safe and professional for Russia to put a threatening satellite in close proximity to a U.S. satellite."

Creating space safety guidelines won't solve all of their problems, but it will "help identify those that are running the red lights as we drive this car," he added.

Opening up in public about what space warfare is—and is not—is a first step toward convincing the American public, lawmakers, and the global community of the importance of space security. The Space Force hopes more transparency about those threats will encourage Capitol Hill to fully fund its projects for more automation, simulation, and weaponry; nudge other countries toward the same values in space; and name-and-shame adversaries to keep them in line.

For example, countries have to talk about the possibility of their satellites being destroyed if they want to get everyone on the same page about how to respond.

SpaceNews said Feb. 24 the U.S. is drafting language on its position for a United Nations report on "norms, rules, and principles of responsible behaviors" in space. Burt told the publication she wants to see a binding resolution from the U.N. that helps countries hold each other accountable.

It's harder to call someone "bad or irresponsible if I haven't fully defined what those things are on the international stage," Burt told SpaceNews.

A key part of those discussions revolves around discouraging countries from creating exponentially more orbital debris, as the cosmos become home to a growing number of commercial and military satellites, asteroid fragments, and other objects.

The Space Force tracks 27,000 objects on orbit now, while another 500,000 or so are too small to keep an eye on, Raymond said. Nearly 4,000 trackable objects are active satellites—meaning the vast majority of tracked items are space junk that could damage spacecraft in a collision.

One way to curb the spread of space debris is not to create more of it in the first place, Raymond said. That may be a challenge given that companies like SpaceX, and even the Pentagon, are planning for thousands more satellites to bolster everything from internet access to hypersonic missile tracking. Stakeholders must also consider engineering solutions to make rocket launches and satellite decommissioning cleaner, for example.

"If you and I could figure out a way to clean up all that debris that's moving so fast and over those vast distances, let me know and I'll invest with you, because we'll be well off," Raymond told deGrasse Tyson. ✪

Pentagon Editor Brian W. Everstine contributed to this article.

Airman 1st Class Colin Hollowell

With their first deployment to Ørland Air Force Station in Norway, U.S. B-1Bs Lancers can now penetrate more deeply into Arctic airspace, practice Agile Combat Employment, and train with NATO members and other regional allies. It also provides cold-weather training for some U.S. Airmen.

Closer Cooperation with Allies is *Au Courant*

Allies in Europe are gaining access to intelligence and operations on a targeted, strategic basis.

By Brian W. Everstine

U.S. Air Forces in Europe (USAFE) is bringing allies into its air operations centers (AOC), expanding training and range access, and deploying aircraft to new locations in a wide-ranging push to bring the same level of multinational cooperation found in U.S. Central Command to the European theater.

"This is all about [building] the trust and confidence we need," USAFE boss Gen. Jeffrey L. Harrigian said in an interview with Air Force Magazine. "In competition, in the operating environment that we execute today, if we get into crisis, we [would] have already got that built into how we deal with each other."

As commander of Air Forces Central Command, where he commanded earlier, Harrigian's combined air operations center at Al Udeid Air Base, Qatar, included representatives from dozens of nations. So over the past eight months he's been opening the USAFE AOC to "a handful of countries," a major step toward improving combined U.S. and partner nation operations.

"There's ... a huge appetite to expand the way we train together."
—Gen. Jeffrey Harrigian, USAFE commander

The move covers the gamut of operations and issues, whether that is "intelligence or tactics, techniques and procedures," and extends to the classified environment, Harrigian said.

Such changes have been "incremental" and access remains stratified depending on the nation-to-nation relationship. It's not one-size-fits-all for NATO members. USAFE's AOC and NATO Allied Air Command are located at Ramstein Air Base, Germany, and USAFE wants closer communication between the two.

"Underpinning all of that is really the relationships between the individuals, the people that are working in both those buildings, and that's been the approach that we've taken to facilitate the movement forward on operating more seamlessly," Harrigian said.

To improve how USAF and partner air forces fly

together, especially as more F-35s arrive on the continent, USAFE wants shared access to instrumented ranges and other improvements. The USAFE and Air Forces Africa Warfare Center at Ramstein is buying new threat emitters and making other improvements to three ranges toward that end, Harrigian said.

Airspace over the North Sea, off the coast of the United Kingdom, has turned into a highly effective "operational training environment ... facilitating some large-force training," Harrigian said. In some cases, as many as 60 jets from multiple countries have operated there simultaneously. For example, USAFE aircraft are doing live-missile shoots using AIM-9X Sidewinders there, and the command plans to fire AIM-120 Advanced Medium-Range Air-to-Air Missiles there, as well. In the past, such training was usually reserved for exercises such as Combat Archer, held in the Gulf of Mexico at the Eglin Gulf Test and Training Range off Florida's Gulf Coast.

Italy, an early F-35 adopter, has been in talks with USAFE about adding emitters and other improvements to a training range near Aviano Air Base, [Italy]. "There's certainly a huge appetite to expand the way we train together," Harrigian said.

USAFE is using exercises in the Arctic to expand its reach there, deploying B-1s to Norway for the first time in February. "As you can imagine, that is tremendous airspace up there," Harrigian said. "It affords us an opportunity to not only practice some of the foundational skills, but also get into Agile Combat Employment."

PRACTICING NEW CAPABILITIES

The command in late February wrapped up its Advanced Battle Management System (ABMS) on-ramp exercise, which brought together dozens of aircraft from U.S. military services and multiple countries to test ways to share data and operate together. Significantly, while USAFE's was the fourth ABMS on-ramp event, it was the first to include non-U.S. military participants, including the Dutch, Polish, and British air forces. It was also the first ABMS event since Congress curtailed ABMS funding in the fiscal 2021 National Defense Authorization Act.

But budget restrictions had "minimal impacts," Harrigian noted. His command pitched in with its own funds "because I thought it was important enough to contribute to this."

During the event, U.S. F-15Cs and F-15Es from RAF Lakenheath in the United Kingdom fired AGM-158 Joint Air-to-Surface Standoff Missiles over the Baltic Sea, targeting via U.S. and United Kingdom command and control systems, such as the 603rd Air Operations Center and the Deployable Ground System, U.S. Navy P-8s, USAF KC-135s from RAF Mildenhall, also in the U.K., and a USAF C-17.

Simultaneously, USAF assets at Ramstein joined Dutch F-35s in a base defense mission, in which joint and combined teams targeted unmanned aerial systems and simulated cruise missile attacks. The F-35s served as a communication link between the defense and the U.S. Army's 10th Army Air Missile Defense Command, according to the release.

The U.S. Space Force provided a Multiband Assessment of the Communication Environment from the 16th Space Control Squadron, and SpaceX's Starlink broadband system had a role in the exercise, according to Harrigian.

The 341st Missile Wing at Malmstrom Air Force Base, Mont., helped with communication; USAF's Kessel Run software factory and the Air Force Life Cycle Management Center's Detachment 12 also supported the event, which took eight months to plan and which USAFE hopes will yield "foundational improvements on some of our infrastructure ... [and] tools," Harrigian said. The goal is "to see how we holistically pulled this all together, to continue connecting different sensors."

NEW DEPLOYMENTS

USAFE is expanding its physical presence across the European continent, moving more USAF aircraft and Airmen to the east. In Romania, Air Force MQ-9 Reapers now provide 24/7 intelligence, surveillance, and reconnaissance over the Balkans—a mission Harrigian called "critically important" to both U.S. and European partners. USAFE had previously forward deployed MQ-9s to Romania from the 52nd Expeditionary Operations Group-Det. 2 at Miroslawiec Air Base, Poland, but now the MQ-9 presence is permanent.

The 25th Attack Group in Romania is larger than the Poland-based unit, which flies contractor-owned and contractor-operated MQ-9s. In Romania, the Reapers are USAF assets.

"It's a bigger presence and a couple more airplanes," said Harrigian. "It gives us greater persistence with respect to 24/7 coverage."

Also in February, the Air Force deployed B-1s from Dyess Air Force Base, Texas, to Ørland Air Base, Norway. While Lancers have integrated with Norwegian aircraft in the Arctic, this is the first time bombers will be based there. USAFE Deputy Commander Lt. Gen. Steven L. Basham called the deployment an important opportunity for crews, who will get to operate from a new, frigid location. USAF bombers usually fly out of RAF Fairford in the United Kingdom during European deployments.

"While flying out of the U.K. is great, if we don't expand our horizon and look for other opportunities to work with other allies, other partners, then we miss true training opportunities to continue to develop ourselves and—even more so, I would say—to learn from others," Basham said.

Throughout the deployment, the bombers will fly further into the Arctic, and conduct bombing training with Norwegian ground forces. It is a test more so for the crews than the aircraft. B-1s already have proven to be adept at operating in the cold. The Texas Airmen, however, don't have as much experience.

"The aircraft doesn't mind, it's our great aviators and maintainers and support personnel who might not be as familiar with the rigors of the cold," Basham said. "Our Norwegian partners are helping us along in that. But I would offer that the aircraft has performed exceptionally well, and we've been able to operate in many different environments."

For Norway, the deployment is important because Russia has exerted its pressure on the eastern edge of NATO in recent years. "This is a natural part of that, to be able to operate and defend our own territory," said Lt. Gen. Yngve Odlo, chief of the Norwegian Joint Headquarters. "For the Norwegian defense forces, it is important to more regularly exercise and train together with our close allies and the bomber task force is an important asset to be able to conduct high-intensity, combined joint operations. So to do this in the Arctic conditions is timely."

Basham added, "As more countries are drawn to the Arctic region, some with competing interests, it's imperative that we maintain free, fair access for all nations. And we will continue to work diligently with our NATO allies and partners to ensure that stability." ✪

U.S. Air Force photo by Staff Sgt. Cassandra Johnson

While the U.S. engaged in small wars in the Middle East, China and Russia modernized their strategic weapons. Now, the U.S. must modernize its bombers, including the B-52 shown here as it's fitted with AGM-86B air-launched cruise missiles, as well as it's ICBMs and ballistic missile submarine fleet—all at once—while also countering advances in hypersonic weapons, cyber, and space technology.

Pressing On With Strategic Modernization

Strategic deterrence is no longer simply about nuclear operations.

By John A. Tirpak

The United States can no longer afford to put off strategic modernization, and the Biden administration should proceed with renewing the Pentagon's planned strategic systems, senior military leaders argued in a panel discussion during AFA's virtual Aerospace Warfare Symposium.

The new administration has already said it will conduct a new Nuclear Posture Review and a Missile Defense Review, and Gen. John E. Hyten, vice chairman of the Joint Chiefs of Staff, predicted DOD will also undertake a Space Posture Review because the strategic landscape has changed so dramatically.

"Deterrence in the 21st century is wholly different than it was in the 20th century," Hyten said during the symposium. "Strategic attack can no longer just be defined as nuclear attack." Rather, attacks in space, or on earth with cyber, chemical, biological, or hypersonic weapons all could yield strategic effects.

"Without the backstop of the nuclear triad, it basically is ... impossible...to deter an adversary.
—Gen. John Hyten, Vice Chairman, Joint Chiefs of Staff

The 2018 National Defense Strategy says non-nuclear but nation-hobbling attacks may be answered "at a time, place, and [in] a domain of our choosing," Hyten said. Strategic deterrence must therefore be viewed in that context. "It's going to be a difficult problem," he said. "We've not fully thought it through." The academics who developed deterrence theory have not yet "embraced this new construct."

It's not clear yet how the Biden administration will conduct its strategic reviews, but it's clear where Hyten stands: "Without the backstop of the nuclear triad," he said, "it basically is ... impossible ... to deter an adversary."

Russia recently completed a 20-year modernization of its nuclear enterprise, with new intercontinental ballistic missiles (ICBMs), new submarines with sub-launched ballistic missiles, updated bombers equipped with new cruise missiles, and

all-new nuclear weapons, including a nuclear-tipped hypersonic missile and a nuclear torpedo.

The U.S. must modernize in response. "You have to start from the threat, and the threat is significant," he said. While the U.S. focused on counterinsurgency operations, China and Russia invested in modernizing their strategic forces. Hyten backed the President's decision to extend the New Strategic Arms Reduction Treaty, known as New START, saying, "it puts limits and a verification regime in place" and provides "good insight" into Russian nuclear capabilities and thinking, important elements to developing a U.S. deterrence strategy.

China, which has no arms control agreement with the U.S., presents a different challenge because the U.S. knows little about China's nuclear doctrine. China is building nuclear weapons "faster than anybody on the planet," including new ICBMs, cruise missiles, and nuclear-tipped hypersonic missiles "that we have no defenses for," Hyten said.

"Our nuclear modernization program ... is late to need," Hyten asserted. The nuclear triad of bombers, ICBMs, and submarine-launched ballistic missiles "is the minimum essential capability for deterrence in the great power world we live in today," he said. Losing just one piece of the triad, makes it "very, very difficult" to deter adversaries, he added. The new U.S. strategic capabilities in development are the Ground-Based Strategic Deterrent (GBSD), the ICBM succeeding the 50-year-old Minuteman III; the B-21 bomber, replacing both the B-1 and B-2; the Columbia-class missile submarine, replacing the Trident; and the Long-Range Standoff missile (LRSO), replacing the 40-year-old Air Launched Cruise Missile.

But, the portfolio needs to be expanded to include anew sea-launched cruise missile and "a low-yield nuclear weapon that will deploy in small numbers on our submarines," to counter the "thousands [of] low-yield ... and tactical nuclear weapons that Russia is building and deploying," which are not covered under New START, Hyten argued.

"We can't have interruptions in the program," Hyten insisted, "because we're starting late and ... they have to be delivered on time."

The possibility of nuclear-armed adversaries "cooperating with each other" is something the U.S. must also consider, Lt. Gen. Thomas A. Bussiere, deputy commander of U.S. Strategic Command, said on the panel.

Adversaries are relying more on their nuclear arsenals for influence and coercion, and there are a variety of limited-use options. This "requires us to rethink our approach," Bussiere said.

The "continuum of conflict" potentially leading to the use of nuclear weapons—"from competition, to crisis, to armed conflict, to limited nuclear use, to full nuclear exchange" is becoming "coupled and non-linear," he said.

Eliminating part of the triad, "would embolden our adversaries to believe they could actually employ nuclear weapons against us," he said. He noted that former Defense Secretary James Mattis was initially skeptical of the triad, but he came away from the reviews convinced of its necessity. Hyten quoted Mattis as saying, "'America can afford survival.'"

Bussiere also noted that while the idea is to keep Minuteman ready until GBSD replaces it, that may not work. The system might suddenly become unsustainable, and "it's really a choice of replacing them or losing them," he said.

In addition to the delivery vehicles, the U.S. also needs to modernize its structure to command and control the deterrent, Air Force Global Strike Command chief Gen. Timothy M. Ray said.

Biden's Strategic Guidance

The Biden administration's new strategic guidance, released in March, offers no details on specific weapons programs, but seeks instead to "head off costly arms races and re-establish [U.S.] credibility as a leader in arms control." President Joe Biden said this explains why "we moved quickly to extend the New START treaty with Russia. Where possible, we will also pursue new arms control arrangements."

The U.S., Biden said, will take steps to "reduce the role of nuclear weapons in our national strategy, while ensuring our strategic deterrent remains safe, secure, and effective," and that the nuclear assurances provided to allies "remain strong and credible." The U.S. will engage China and Russia "on a range of emerging military technological development" regarding strategic stability, he said. The goal will be to field the most advanced technology possible, while parting with "unneeded legacy platforms" to pay for it.

However, given the "strategic challenges from an increasingly assertive China and destabilizing Russia," Biden said, "we will assess the appropriate structure, capabilities, and sizing of the force." The U.S. will "ensure our armed forces are equipped to deter our adversaries."

Command and control is "the foundational piece" of a deterrent that can be wielded effectively, and communications is "more contested" than ever, so it must be "much more relevant and resilient," he said. There must also be more clarity about whether the U.S. should embrace the "no first use" doctrine, Ray said, because allies depending on the U.S. nuclear umbrella need to know what the U.S. will and won't do to protect them.

"What does 'no first use' mean to them? Because, if we can't come up with that really crisp answer, they now have to entertain their own nuclear program" because they are conventionally overmatched by adversaries.

Ray said it's possible to "put other strategic deterrent capabilities on the table that fall outside of New START," such as chemical weapons, which are "more ambiguous," but "that's a really dangerous game." Better, he said, to stick with a program that's well understood and reliable.

The nuclear modernization portfolio—including a new missile field support helicopter—"are built with a value proposition of being in the game a long time," Ray said. Modularity and open missions will keep the new systems more relevant, and easier, and less costly to update, he said.

"It would take me years to integrate a new standoff missile into the B-2," he said, but with the B-21, given its open mission systems, "it will take me months."

The panelists also noted that the Department of Energy (DOE) supplies the actual warheads for the nuclear weapons, and its infrastructure also needs funding to keep it up and running. The DOE, Hyten noted, "stopped producing plutonium pits a long time ago. ... It should be a concern to everybody in America that every adversary we face is building more plutonium pits than we are." That "includes North Korea," Hyten added. How did this happen? The DOE stopped making nuclear warheads when the U.S. stopped making nuclear delivery vehicles, Hyten observed.

"I would offer to you that the use of nuclear weapons is not necessarily unthinkable" in the minds of U.S. competitors, Bussiere said. This fact alone "requires us to rethink our ap-

proach." The U.S. is "at risk of making decisions without fully understanding the implications."

China has openly stated its intention to "double their nuclear stockpile in the next decade," and it is making delivery systems survivable, he said. The Pentagon reported last fall that China's nuclear warhead inventory is in the low 200s of weapons, while the U.S. has 3,800 active warheads and thousands more waiting to be retired.

Still, while China desires to be a major nuclear power, "they are resisting any effort to act like one" by refusing to participate in international protocols governing them, Bussiere said.

"We need to find more innovative ways to continue to deter them and set conditions favorable for us and our allies," he asserted.

The bomber, particularly, is a critical part of deterrence because of its visibility, Ray said. The forward deployment of bombers sends a strong message to adversaries, he argued, in a way not matched by ICBMs or ballistic submarines.

"Having a bomber with a cruise missile capability that can be present is something that I think is really important here. That's one more reason the LRSO—often mentioned by opponents as a piece of the strategic arsenal that can be trimmed—is essential, Ray said. Although LRSO funding that was cut back has been restored, Ray said he "can't accelerate" it the way he would like. Still, he said, the program is "healthy" and "viable."

Hyten argued that the ICBM leg, though described by critics as a sitting duck because the launch silos can be targeted with precision by an enemy, area strong deterrent.

"It's the most difficult leg to fully target," Hyten asserted. "In order to target 400 hardened silos across five states, in the middle of America, an adversary … has to commit hundreds, if not thousands of nuclear weapons." Sending thousands of missiles against the U.S. is a decision "almost impossible to make," Hyten added.

If the ICBM leg was absent, though, "you're down to a number of platforms that you could take out with 20 strategic weapons, … so you're basically an intelligence failure or a technical failure away from losing the entire structure." Minus the ICBMs, deterrence is "really challenged."

The bomber fleet can be employed as a conventional force as well as a nuclear one, underscoring the bombers' value.

Air Force Global Strike Command has a new Bomber Roadmap, Ray reported, and the ultimate goal is to get "north of" 220 bombers in the fleet. The question of "how much is enough" should be driven by the threat, Hyten insisted. "We could drop the number of nuclear weapons, but only if the threat changes," he asserted. Hyten said the U.S. must deal with "the threat that exists, not the threat we wish existed. It is a real threat. … It's only gotten worse, and … you can't just wish it away." ✪

SOCOM's Armed Overwatch Advances

By Jennifer-Leigh Oprihory

Air Force Special Operations Command (AFSOC) expects to conduct an armed overwatch flying demonstration "in the coming months," leading to a potential acquisition as early as 2022. SOCOM wants 75 aircraft for the overwatch and close-air-support mission.

"I think we can do that at relatively low risk based on what we've seen from the vendors," AFSOC boss Lt. Gen. James C. Slife said in February during a virtual "Aerospace Nation" event hosted by the Air Force Association's Mitchell Institute for Aerospace Studies.

The 2021 National Defense Authorization Act blocked U.S. Special Operations Command (SOCOM) from buying armed overwatch aircraft this fiscal year, however, Slife said Congress still gave the command enough research, development, test, and evaluation funding to move the program forward.

"That money is fully sufficient to do the demonstration program that SOCOM asked to do, and we anticipate going back for further conversation with Congress," Slife said.

Whether this will be a manned or unmanned platform remains an open question. Candidates from both camps could compete.

SOCOM wants 75 aircraft because, "that's where I think the sweet spot is—both in terms of being able to sustain a training base [and] … sustainable force-generation model, and to be able to support the number of ground teams" that the armed overwatch platform will support, Slife told reporters at the virtual Aerospace Warfare Symposium in February.

The austere environments where these units will operate may not lend themselves to such obvious candidates as the MQ-9 Reaper, which could easily fly the kinds of missions

Airman 1st Class William Rio Rosado

The MQ-9 Reaper is among the aircraft Air Force Special Operations Command will review in its quest to acquire 75 armed overwatch aircraft. Flight demonstrations could take place within month.

needed, but require longer runways and more infrastructure on the ground than SOCOM anticipates being able to provide.

"That doesn't mean that the MQ-9 couldn't be made more compatible with the mission," Slife said. "It just means we haven't seen it yet."

Slife said SOCOM is looking at "everything from existing Air Force platforms—both ISR and close air support platforms—to off-the-shelf industry platforms [and] to non-developmental platforms" developed with industry funding. He expects six or seven platforms to participate in the upcoming demonstration, depending on availability of funding.

"If it is non-developmental, and it meets the requirements that SOCOM has laid out to industry, then we're interested in looking at it," he said.

"We need to get through this demo to see what industry can produce at low risk in a short order," he said.

These aircraft could be used in the Middle East, Africa, or

elsewhere, primarily to counter violent extremist organizations and other nonstate actors

"What I would envision is a light footprint, a multi-role capability that has the ability to provide the intelligence needed to remain aware of the threat, and … a kinetic capability to take action when necessary, without drawing a lot of attention" either to the U.S. forces or the host nation that may be hosting U.S. operations, he said. "That is what the future looks like in my mind. So the armed overwatch platform must be ideally suited for that type of an operational environment."

Slife said AFSOC expects to retire the U-28 Draco aircraft now in use "as the armed overwatch platform comes online." The new aircraft should be less costly to operate, more versatile, and have "greater capacity to operate in those small, disaggregated kinds of teams."

He said he's confident that "SOCOM will be able to demonstrate to the Congress that this is a viable program, and it's required for the future operating environment." ✪

A C-130 Maintainer Seizes the Spark Tank Prize

By Amanda Miller

A crew chief and production superintendent from Davis-Monthan Air Force Base, Ariz., took home the 3D-printed trophy in the Department of the Air Force's Spark Tank innovation contest for a simple idea he predicts could "solve a lot of issues across the aircraft community."

Master Sgt. Justin Bauer pitched his idea, "Innovative Approach to C-130 Wheel Repair," at the 2021 Spark Tank finals during the Air Force Association's virtual Aerospace Warfare Symposium on Feb. 26.

AFWERX and Air Force Deputy Chief Management Officer Rich Lombardi co-produce Spark Tank; the 2021 contest received more than 300 submissions.

Bauer was one of five finalists, up against teams with ideas to prevent service-connected hearing loss, to incorporate augmented reality into briefings, to streamline workflows with a ticketing app, and to cut out the need for refueling trucks when refueling aircraft with engines running.

Bauer's idea grabbed the votes of all but one celebrity judge. The premise: C-130 aircraft wheels have to be heated up before maintainers can work on them, and not all facilities can do the heating. Bauer described the process as moving a 200-pound chunk of aluminum that's been heated to 150 degrees in and out of a big oven. Instead, Bauer realized a handheld heating element—which only costs about $100—can be applied to a wheel to warm it up.

In his five-minute Q&A with judges, Bauer confirmed the device will work overseas and can be adapted to other aircraft wheels.

In response to a question from Air Force Chief of Staff Gen. Charles Q. Brown Jr., Bauer said the biggest challenge of the project was balancing the device's heating requirements and power demands.

"It's really easy to heat up a chunk of metal, as long as you're willing to use an unlimited amount of electricity," Bauer said, "but … we really wanted to keep it under 115 volts so facilities across the globe could power the device."

Bauer got Brown's vote: "It's so much simpler; it's ready to go; and that's why I put up the C-130 wheel prep," said Brown, brandishing the paper sign judges held up to signal their votes.

Acting Secretary of the Air Force John P. Roth, another celebrity judge, pondered how to spread the idea to other countries that fly C-130 variants: "Could we shop it around with a multinational workshop of one sort or the other?"

He was on the right track.

"That's one of the most exciting things about this device, is that through small changes in the dimensions and heating abilities, we can flex this device to multiple airframes, multiple services, and multiple nationalities," Bauer said. "Through small changes in design, we can adapt the device to solve a lot of issues across the aircraft community."

AFWERX

Spark Tank winner Master Sgt. Justin Bauer from Davis-Monthan AFB, Ariz., presented the "Innovative Approach to C-130 Wheel Repair," a novel concept that helps produce more wheels, saves taxpayer money, and keep C-130's flying.

Roth cast the lone dissenting vote among celebrity judges, instead picking the idea "Inner Ear Bone Conduction Communication" by a team from the 100th Air Refueling Wing at RAF Mildenhall in the United Kingdom. Their idea is to switch to noise canceling earbuds in place of the foam plugs and bulky ear protection worn on the flight line. The bone conduction technology lets some sound through. It would protect hearing while also letting people communicate with each other without exposing the sensitive parts of their ears, the team said.

Meanwhile, fans voted online, choosing the audience favorite, "Viper Hot Refuel Kit" by a team from the 52nd Fighter Wing at Spangdahlem Air Base, Germany. The team designed a sled to serve in place of refueling trucks that may have to be transported by aircraft in advance, at a cost of $6,000 one way. The team instead put off-the-shelf petroleum oil and lubricant components into a much smaller package.

A team from the 56th Fighter Wing at Luke Air Force Base, Ariz., got a noticeable nod from celebrity judge Matt Booty, corporate vice president of Xbox Game Studios. Their idea, "NextGen Debrief—Augmented Reality Debrief Environment," would incorporate virtual reality into pilot training.

The judges wondered whether an app pitched by a team from the Air Force Academy might have more utility across the military. The idea, "Improving Commander's Support Staff Workflow with Office 365," introduces a digital means for submission and tracking of command-related workflow items. ✪

Rising Accidents in 2020 Spark Training Review: 15% Jump Included Seven Deaths, 14 Lost Aircraft

By Rachel S. Cohen

Senior Airman Maygan Straight

Among 72 Aviation accidents in 2020, one included an Afghan Air Force A-29 Super Tucano. The aircraft was lost and the pilot was left with permanent disabilities.

The Air Force is considering changes to its pilot curriculum to curb the rising number of aviation accidents across the service, Chief of Staff Gen. Charles Q. Brown Jr. said Feb. 25.

The Air Force saw 72 total aviation accidents over the course of fiscal 2020—10 more than in the previous year. Thirteen of the 72 accidents last year caused injury or death, according to Air Force Safety Center data obtained by the magazine. That data was current as of Feb. 16.

Seven people died in incidents that occurred between Oct. 1, 2019, and Sept. 30, 2020. One was permanently, partially disabled, while nine others suffered broken bones or minor injuries. Fourteen aircraft were destroyed in that time period as well.

Statistics show the Air Force is "continuing the generally decreasing trend of aviation Class A mishaps over the last 10 years," the service said. But the most destructive accidents have not tapered off nearly as much as the Air Force might like, given its push to improve maintenance and training protocols.

Air Force Magazine made several of the mishaps public for the first time. Other incidents had previously unreported details as well.

When an A-29 light attack plane crashed in Afghanistan last summer, the U.S. military reassured the public that its pilot had ejected and was rescued. But the reality was more complicated.

The unidentified Airman, an American flying an Afghan Air Force Super Tucano as part of the U.S. training mission in the country, is now permanently, partially disabled, according to Air Force Safety Center data obtained by Air Force Magazine. The A-29 was destroyed after suffering from what initially seemed to be mechanical issues.

Air Education and Training Command (AETC), the organization in charge of the training wing the pilot belonged to, declined to provide more details about the pilot's condition or what the Airman is doing now.

"Because it was an Afghan A-29, the Air Force did not have the lead for the accident investigation," said AETC spokesperson Marilyn C. Holliday. "The Air Force did complete a safety investigation, which is not releasable."

Twenty-nine Class A aviation mishaps occurred in fiscal 2020, including 23 incidents involving manned aircraft and six involving unmanned aircraft. Those numbers are slightly higher than the 26 mishaps in fiscal 2019, but nearly on par with the 10-year average of 31 accidents, the Air Force Safety Center said. The service has seen 29 mishaps a year on average over the past five years, the center added.

Class A incidents are those in which Defense Department aircraft are destroyed or total more than $2.5 million in damages, or where a person is killed or permanently, fully disabled.

For Class B accidents, the Air Force saw 39 manned aircraft mishaps and four unmanned mishaps, totaling 43 incidents. That's a jump from 36 Class B accidents in the previous year—about the same as the five-year average of 45 accidents per year, but lower than the 10-year average of 49.

"Overall, statistics tend to fluctuate from year to year, so the service looks at trends within the data to see if there are significant changes and, more importantly, to determine if there are common issues," the Safety Center said in a statement to Air Force Magazine.

F-22 fighter jets saw the most severe problems most often, with five Class A mishaps over the course of fiscal 2020. A-10s, C-17s, and F-15s tied for the most Class B mishaps. Among unmanned aircraft, the MQ-9 Reaper logged seven Class A and B crashes in that time.

The Air Force also recorded six Class A incidents involving unmanned aircraft, including one on July 24, 2020, where an unnamed drone was completely destroyed in a crash while controlled by an Air Force Special Operations Command unit in an undisclosed location. It's possible that aircraft could be a secretive RQ-170 reconnaissance drone or any others kept out of the public eye.

MQ-9 Reapers comprised the rest of the most severe incidents. One "intentional ditching" over Somalia in June 2020 led to a total aircraft loss for the 432nd Wing out of Creech Air Force Base, Nev. That same month, the New York Air National Guard saw another MQ-9 damaged when it lost thrust upon takeoff and left the runway.

Reapers were completely destroyed in August 2020 in an unknown location while flying for the 27th Special Operations Wing, and in September 2020 in Kuwait while flying for an undisclosed unit. Another MQ-9 at Holloman Air Force Base, N.M., was damaged upon takeoff on Sept. 2, 2020, as well.

Nineteen types of airframes, from the A-10 to the CV-22,

were involved in Class B mishaps over the course of the year. Their woes span engine fires, bird strikes, foreign object debris, and more.

Class B events meet at least one of these criteria: they incur damages costing between $600,000 and $2.5 million; cause a permanent, partial disability; or lead to inpatient hospitalization of at least three personnel.

An MQ-9 in Jordan was "struck by [a] vehicle" when taxiing, causing major damage to both the drone and the vehicle, according to the Air Force. The lower hatch of a U-2 spy plane's camera bay fell off the aircraft mid-flight. Multiple F-16 fighter jets were "damaged in weather" in South Korea, the same day a typhoon brought heavy rain to parts of the country, but landed without incident.

One B-1 bomber from the 7th Bomb Wing in Nevada saw an electrical malfunction in flight that sent smoke into the cockpit, then blew out a tire upon landing. On one unfortunate day for an A-10 in Georgia last April, the aircraft's gun malfunctioned, its engine was damaged, its "canopy departed," and it landed with its landing gear up—but no injuries were reported.

The Safety Center also shed more light on the XQ-58 Valkyrie crash in October 2019 that rendered the prototype "Skyborg" drone temporarily unusable. The Valkyrie experienced "several failures" while trying to land during a test in Arizona, causing "severe structural damage."

Not all entries in the list provided by the Air Force included damage costs; those that did totaled nearly $29 million. The bulk of that cost, $23.6 million, comes from a C-130J's hard landing in Germany in April 2020. It is slightly more expensive than the $21 million in damage cited in the Air Force's accident investigation for the event released Feb. 16.

The Air Force has already incurred at least five Class A mishaps so far in fiscal 2021, including the Feb. 19, T-38 crash in Alabama that killed 23-year-old 1st Lt. Scot Ames Jr. and a Japanese student pilot.

"We are a close-knit family and the loss of our teammates affects us all," said Col. Seth Graham, commander of the 14th Flying Training Wing—the same wing to which the now-disabled A-29 pilot belonged. "The strength of our bond is what will help us get through it together."

The statistics worry Brown, who told reporters during AFA's virtual Aerospace Warfare Symposium he's already spoken with major command leaders about ways to address the issue.

Air Education and Training Command is working with organizations that own those aircraft, like Air Combat Command and Air Mobility Command, on a new approach to flight training, he said.

"Some of the incidents we've had have been in what I would call basic phases of flight, probably the most important phases of flight, which are takeoff and landing," Brown said.

About 30 of the 72 Class A and B mishaps that occurred in fiscal 2020 involved takeoffs and landings, including some where the aircraft "rejected takeoff" and others with faulty landing gear or crashing on approach.

Brown dealt with the mishap issue firsthand while looking into a spate of F-22 landing problems during his recent tenure as commander of Pacific Air Forces. He suggested the evolution of aerospace technology has led the Air Force to pack more and more into initial flight school, to teach students about increasingly complex aircraft with "smart" weapons.

"We pushed, in some cases, a lot of things into our early courses, our basic courses, so when they show up at their operational unit, they're fully capable," Brown said. "I think we may have pushed … a little bit too far. We need to spend more time on the basics so they have a good foundation."

Young pilots can spend more time on the advanced aspects of flight once they reach their units, he added.

While airframes like the F-22 fighter jet and C-17 cargo plane saw some of the most mishaps related to takeoff and landing, Brown said he's not focused on one platform over another. Going up and coming down should be second nature to Airmen flying any plane, he said.

"You can mess up … in the air, but if you don't take off and land, you lose, potentially, that Airman, and that particular airplane," Brown said. "That's what we're focused on right now." ✪

Sgt. 1st Class R.J. Lannom Jr./National Guard

The National Guard will continue to guard the U.S. Capitol, supporting Capitol Police, Washington, D.C.,'s Metropolitan Police and other federal agencies.

DOD Extends National Guard Deployment to Protect Capitol

By Brian W. Everstine

Defense Secretary Lloyd J. Austin III on March 9 approved an extension of the National Guard deployment to the U.S. Capitol complex for about two months, though there is a push in Congress to end the deployment sooner.

National Guard troops have been deployed to the building to help U.S. Capitol Police with security in the aftermath of the Jan. 6 insurrection, and the police department has requested an extension of the presence as there are concerns about continued threats. The extension includes about 2,300 troops, about half the amount that had been deployed, according to a Pentagon statement.

Kirby said the deployment is to help the Capitol Police "fill some of the gaps" in that department's capabilities across the complex. He would not speculate if the deployment would be further extended, but said that as the police "look at themselves as an institution" and what they need in the long term, the Guard could help.

The deployment of the troops, from Jan. 6 to March 12, is expected to cost about $500 million, according to the Associated Press. ✪

Staff Sgt. Jack Sanders

Defense Secretary Lloyd Austin III put dozens of advisory boards on hiatus in February and ordered a review of their value and utility.

Austin Slashes Hundreds of Volunteer Advisory Positions

By Amanda Miller

Defense Secretary Lloyd J. Austin III cleared out "several hundred" volunteer seats on the Pentagon's 42-plus civilian advisory boards—every seat he has the power to appoint, according to spokespeople. He blamed the unprecedented purge on "the scale of recent changes" to board seats made in the final weeks of the Trump administration, according to Department of Defense spokesperson Susan Gough.

Austin "was concerned by the scale of recent changes to department advisory committees," Gough explained in an email to Air Force Magazine. "For example, recent nominations affected half the membership of each the Defense Policy Board and Defense Business Board." She did not specify what problems Austin thought the changes might present, nor did she detail how many last-minute appointments the Trump administration tried to make in its final days or weeks.

Instead, Gough said Austin instructed Pentagon officials to review each board so he can "get his arms around the breadth and quality of advice provided ... and make department senior leaders comfortable about why we have the advisory committees and the expertise they provide."

Rather than wait for the results of the review, two Pentagon officials, speaking anonymously, announced the conclusion of the board members' terms to the press Feb. 2. Board members had not been notified. A DOD news story posted online by the Pentagon that same day said board members were "directed ... to resign," but Gough clarified: "We did not ask for resignations, nor did we terminate the members. ... We concluded their service as we stood down the boards until further notice." A letter thanking them for their service was to have been sent by Feb. 26.

Ending all terms at once was "equitable, fair, and uniformly consistent," an official said in the Feb. 2 briefing.

A tradition that dates all the way back to the beginning of the federal government, the boards provide expertise from the civilian world. By holding public meetings, they also provide a forum for public input, according to the General Services Administration (GSA), which monitors advisory committees such as the DOD boards and others across the federal government. The boards don't have any decision-making powers.

If Austin's Jan. 30 memo announcing the review is any indication, many of those 42-plus boards might not come back.

Board members on DOD-appointed advisory boards serve one-year terms and may be reappointed for three more one-year terms, serving a maximum of four years, Gough said. Because of potential conflicts of interest, board members' activities may be restricted, and those restrictions may extend past the end of their service, according to the GSA.

Austin's move followed "frenetic" last-minute changes by the Trump administration that involved "removing people who had been on some of these boards and then replacing them, or just simply adding them in a quite unprecedented fashion," an unnamed official said Feb. 2.

Airman 1st class Zachary Willis

The arrival of the KC-46 at McConnell Air Force Base, Kan., Jan. 25, 2019, ushered in a new era of aerial refueling capability for the overall joint force.

KC-46s Could Be Available for Limited Operations in June

Brian W. Everstine

U.S. Transportation Command (TRANSCOM) is looking to integrate the KC-46 into operations as soon as June, following Air Mobility Command's (AMCs) move to free up the troubled tanker for ops to relieve stress on legacy refuelers.

TRANSCOM boss Army Gen. Stephen R. Lyons recently visited KC-46 officials at McConnell Air Force Base, Kan., and said he is "encouraged by recent [Air Force] efforts that will make the KC-46 available for limited mission requirements as soon as June," the command said in a Twitter statement.

The statement is an update from Air Mobility Command's announcement Feb. 24 that it would clear the KC-46 to be tasked by TRANSCOM this year. AMC boss Gen. Jacqueline D. Van Ovost, in announcing the step, said it would be a conditions-based process, with the aircraft only tasked with missions it has been cleared to fly in operational testing. This could include U.S.-based

refueling of certain aircraft, or overseas missions to refuel deploying fighters—such as F/A-18s—using the centerline drogue system.

"We will now commit the KC-46 to execute missions similar to the ones they've been conducting over the past few years in the Operational Test and Evaluation plan, but can now include operational taskings from U.S. Transportation Command," Van Ovost told reporters. "For example, today the KC-46 may provide aerial refueling (AR) for F-16s participating in a U.S.-based training exercise. Under this new approach, if AMC is tasked to provide AR support for an operational coronet mission to move F-18s overseas or an operational B-52 mission, the KC-46 is on the table, which frees up KC-135s and KC-10s to execute other combatant command deployments that the KC-46A is presently unable to support with its existing deficiencies."

The aging KC-135s and KC-10s are heavily tasked with overseas combat deployments, along with a constant need to support training, exercises, and testing at home. By making KC-46s available to TRANSCOM, those crews would be more available for required combat missions or be able to spend more time resting and training at home. KC-46s would not be used for combat deployments until cleared after the installation of the improved remote vision system, expected to begin in 2023.

New Bosses Take Command at TRANSCOM, SOUTHCOM

By Brian W. Everstine

President Joe Biden on March 6 nominated USAF Gen. Jacqueline D. Van Ovost—currently the U.S. military's only woman with four stars—to command U.S. Transportation Command, and Army Lt. Gen. Laura J. Richardson for a fourth star and to take over as commander of U.S. Southern Command. If confirmed, Van Ovost and Richardson would become the second and third women to lead combatant commands.

USAF

USAF Gen. Jacqueline Van Ovost

Monica King/USA

Army Lt. Gen. Laura Richardson

During a March 8 speech at the White House commemorating International Women's Day, Biden said the two generals "pushed open the doors of opportunity" for female service members, calling them "outstanding and eminently qualified warriors and patriots."

"Each of these women have led careers demonstrating incomparable skill, integrity, and duty to country," he said as Van Ovost and Richardson stood by his side. Having both of them lead combatant commands shows little girls and boys that "this is what generals in the United States armed forces look like," Biden added.

Van Ovost is currently the commander of Air Mobility Command, and if confirmed, she will become the second USAF woman to lead a combatant command, following retired Gen. Lori J. Robinson, who led U.S. Northern Command from May 2016 to May 2018.

Van Ovost is a former experimental test pilot and command pilot with more than 4,200 hours in more than 30 aircraft. A 1988 Air Force Academy graduate, she's commanded at the squadron, wing, and major command level. She also served as director of staff for Headquarters Air Force and vice director of the Joint Staff.

1st Air Force

First Air Force, including Florida Air National Guard F-15s seen here conducting a NORAD mission over the Kennedy Space Center, will now be supporting SPACECOM as well.

First Air Force Expands Mission To Support US Space Command

By Brian Everstine

First Air Force will provide Air Force support to the recently re-established U.S. Space Command, making the organization responsible for both protecting the homeland and now supporting operations in space, the department announced March 11.

The Numbered Air Force also will continue to support U.S. Northern Command and North American Aerospace Defense Command.

"In this new role, First Air Force will be better able to identify and address gaps and seams when integrating space power into the support of the homeland defense mission. This will also inform efforts to better fuse space operations into air operations centers around the globe," Air Force Chief of Staff Gen. Charles Q. Brown Jr. said in a release

Air Combat Command is working out how to organize, train, and equip First Air Force for the new mission, with initial operational capability expected by the end of calendar year 2021.

In its current role, First Air Force provides aerospace control and air defense of the continental United States and coordinates air response for natural disasters such as wildfires.

"We look forward to supporting USSPACECOM in their efforts to defend against threats to the space domain," said Lt. Gen. Kirk S. Pierce, First Air Force commander, in the release.

USAF assets already provide support for human space flight, with missions such as rescue aircraft and Airmen on alert for launches.

FACES OF THE FORCE

@NVNationalGuard/Twitter

Lt. Col. Justin Galli will be the only ANG member to take part in the Harvard Kennedy School's National Security Fellows Program in 2021. The program, open to lieutenant colonels, colonels, and some Intelligence Community civilians, aims to ready participants "for executive-level service in security and intelligence fields," the 152nd Airlift Wing wrote. Galli hopes to leverage his experience in a future posting in the nation's capital, and to also use it to enrich Nevada ANG personnel back home.

Keith Keel/USAF

505th Test and Training Group Superintendent Chief Master Sgt. Jacinta Migo on Feb. 1 became the first-ever woman who was born and raised in the South Pacific U.S. territory to rise to that rank. Migo, who was born in Pago Pago, America Samoa, enlisted in 1998, and is currently based out of Hurlburt Field, Fla. During the promotion ceremony, two of her children put her new insignia on her uniform, while a third gave her a traditional lei to commemorate the moment.

Airman 1st Class Jackson Manske

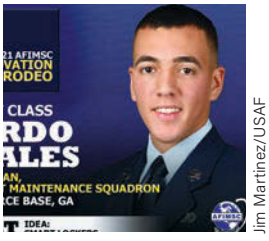
1st Lt. Saleha Jabeen on Feb. 5 became the first-ever Muslim to graduate from Air Force Basic Chaplain Course, which is hosted at Maxwell Air Force Base, Ala. The Indian native—who commissioned into the Air Force in December 2019 and received her Ecclesiastical Endorsement from the Islamic Society of North America—said the course never forced her to waver on her faith or convictions. "I am surrounded with people who respect me and are willing to receive what I bring to the table as a woman, a faith leader, and an immigrant," she said. "I am provided with numerous opportunities to learn and develop skills that best equip me to be a successful officer and a chaplain in a pluralistic environment. I get to provide spiritual care to all service members, Guardians, and families, and advise the commanders on religious and moral matters regardless of my faith, ethnicity, or gender. Like our boss says, it has never been a better time to serve as a chaplain in the U.S. Air Force Chaplain Corps."

Airman 1st Class Mariam Springs

714th Training Squadron Flight Chief Master Sgt. Kyle Harris won the 2021 Noncommissioned Officer Association's Vanguard Award at the AETC level in recognition of his quick response to a car accident in October 2020. After coming across a four-car accident on his way home from work, the Little Rock Air Force Base, Ark., Airman left his car, hurried to the scene, evacuated two people from their vehicles, called for help, and then performed first aid on a man who'd been trapped in his vehicle.

Master Sgt. Nancy Goldberger

A crew of 33 E-8C Joint STARS aviators made history Feb. 19 when the first all-African American flight crew in JSTARS history flew from Robins Air Force Base, Ga., on a training mission. The flight crew used the training to also commemorate Black History Month. For **Capt. Andrea Lewis**, the first African American female pilot in Georgia Air National Guard history, this flight was a dream come true. The flight was historic on many levels: the first all-African American E-8C Joint STARS flight crew, piloted by the first female African American pilot in Georgia Air National Guard history, with the first African American former wing commander in Georgia Air National Guard history, and the first female African American state command chief in Georgia Air National Guard history, all executing a mission from the sole location of the E-8C Joint STARS mission at Robins Air Force Base.



Jim Martinez/USAF

An idea for a smart locker mail system in base dorms won the 2021 Air Force Installation and Mission Support Center (AFIMSC) Innovation Rodeo Feb. 5. **Airman 1st Class Ricardo Morales**, a JSTARS journeyman at Robins Air Force Base, Ga., will receive funding from AFIMSC to develop his idea for potential implementation across USAF and DOD. Morales came up with the idea after realizing the service lacked package pickup and delivery options for Airmen living in base dorms.

USAFA

Second Lt. Jeff Gerlica, is the 2020 USAFA Cadet of the Year. Gerlica was the Cadet Wing's vice wing commander during summer 2019, when he led operations for 4,000 cadets. He served on advisory boards for former Academy Superintendent Lt. Gen. Jay B. Silveria and Commandant of Cadets Maj. Gen. Michele C. Edmondson, and served as an ambassador to Congress members, SECAF, and other VIPs. He was also team captain of the 2020 baseball team, and had a 3.90 fall/4.0 spring GPA.

USAF

Paula Taylor stepped down as the director of the F.E. Warren Air Force Base museum in Wyoming after a nearly 30-year career leading the institution and as an ambassador for the 90th Missile Wing. During her tenure, Taylor took care of over 2,000 artifacts and pioneered and oversaw the base's open house for a quarter of a century. "Paula's actions as the museum director went far beyond the norm. ... Her preservation expertise ... aided Air Force ICBM operations after the service reclaimed certain historical artifacts," said wing historian Kyle Brislan.

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

Spanish space surveillance operators command a virtual space operations center in Suffolk, Va., Sept. 26, 2019, during Global Sentinel 19, a multilateral exercise with Australia, Canada, France, Germany, Italy, Japan, the Republic of Korea, Spain, the United Kingdom, and the United States.

Staff Sgt. J.T. Armstrong

Building the New Space Coalition

Partnerships in space could build capabilities and save money for all in the coalition.

By Rachel S. Cohen

At the dawn of the new space age, the United States is racing to assemble a military coalition of spacefaring nations to rival that of Operation Enduring Freedom or the Western Bloc.

Its success could reshape yet another area of military power in America's image, bringing the same security dynamics to the cosmos that have evolved for decades on Earth.

Countries have operated military satellites, radars, and other space-related weapon systems for years. But with a Cold War redux underway, the United States says it needs to beef up its defenses on orbit to fend off Russian and Chinese aggression in the cosmos. American officials argue it takes a multinational team to protect international space exploration and commerce—as well as GPS and other systems that enable terrestrial ops and modern civilian life.

"There's a significant understanding of the importance of space, and U.S. leadership in space is resonating across the globe," Gen. John W. "Jay" Raymond, the Space Force's Chief of Space Operations, said Feb. 3.

"In the grand scheme of things, the U.S. is still going to be the 800-pound gorilla when it comes to military space capabilities." —Victoria Samson, Secure World Foundation

In making the case that the United States needs its new Space Force, federal officials argue that the Pentagon now sees space as it sees everything else: a domain where countries are stocking their arsenals and could eventually spark aggression with consequences to U.S. citizens.

"The complexity of operations in the largest and most challenging warfighting environment requires us to strengthen ... alliances and attract new partners," U.S. Space Command boss Gen. James H. Dickinson said in January at an Aerospace Nation event hosted by AFA's Mitchell Institute for Aerospace Studies.

Countries must be able to share information, connect their technologies, and "unite around a compelling narrative" of the U.S.-led coalition remaining the top dog in space, he said. And right now, that narrative is driven by the desire to outpace Russian and Chinese advancements and discourage aggression.

That may not always convince other countries with different histories and geopolitical realities. Whereas

U.S. Space Force's Gen. John "Jay" Raymond, Chief of Space Operations, visits the NATO Space Centre at Ramstein Air Base, Germany, which will support NATO operations, missions, and activities to increase NATO space domain awareness through the coordination of data, products, and services with allies.

Headquarters Allied Air Command/courtesy

nations can agree on the merit of limiting space debris that could damage satellites and other vehicles, it may be harder to get them on the same page when it comes to offensive and defensive weapons.

For example, in a statement to the United Nations last year, Japan reiterated its "unwavering basic position" that it wants to prevent an arms race in outer space—a common criticism of the Space Force's work.

"The U.S. and its allies do tend to share the common concern about a cluttered space environment, [and] competition that is focused on behavior as being threatening, as opposed to technologies," said Victoria Samson, Washington office director for the Secure World Foundation. "Russia, China and ... their allies still focus very much on, 'The big threat that we have to worry about is space-based interceptors,' i.e., U.S. missile defense systems."

Certain countries are moving in the same direction as the U.S. by launching their own military space organizations, like the United Kingdom's Space Command and France's Air and Space Force. Some are nurturing early investments in civil and commercial space ventures, as well.

Those new groups don't fundamentally change the nature of international military space cooperation, which the U.S. has done for decades, Samson said. But it does shift what other countries can bring to the table as they recognize the role space plays in national security.

"In the grand scheme of things, the U.S. is still going to be the 800-pound gorilla when it comes to military space capabilities," Samson said. "If I were these other countries, what I would be doing is trying to look at [is] 'OK, I don't want to reinvent the wheel. I want to figure out, what's our niche? Where's my value added, as opposed to replicating everything the U.S. does?'"

American officials are reaching out across the globe to gauge ripe opportunities for new partnerships, or for building on existing alliances. Foreigners are learning in DOD's space schoolhouses, and participating in space defense exercises. Much of those discussions are related to norms of behavior on orbit: what's acceptable, what's not, and how to react.

But not all space partnerships are created equal. Where wealthier countries may have more established national security space needs, others may only have the budget or desire to pursue civil and commercial space programs. The U.S. is learning to meet everyone where they are, said Lt. Col. Pete Atkinson, SPACECOM's international engagements chief.

Raymond often touts agreements with Norway and Japan to carry American payloads on their satellites for communications in the Arctic and object tracking over Europe and Asia, respectively. Those are slated for launch through 2024.

Another 10-nation pact allows the signatories to work together on "microsatellite military utility, military optical satellite communications and optical space data relay, and responsive launch and range operations," a Space Force spokesman said.

NATO IN SPACE

Raymond recently returned from a visit to NATO's new space center at Ramstein Air Base, Germany, which aims to more regularly incorporate space into allied ops plans. That could mean anything from enabling satellite communications for coalition flights in the Middle East to tracking prospective ballistic missiles fired into Europe.

NATO, which lacks its own space inventory but uses that of its member countries, is ramping up its space strategy after recognizing the cosmos in 2019 as the next frontier for conflict. Partnering more closely with the U.S. will be key to the alliance's success, according to Frank A. Rose, a former assistant secretary of state who is now a foreign policy researcher at the Brookings Institution.

"To date, U.S. leadership has been the key driver of NATO decision-making on outer space, and senior U.S. officials have actively engaged the alliance leadership," Rose wrote. "Senior-level engagements between U.S. political and military leaders should continue and be expanded."

He recommended creating a position for a NATO liaison officer at SPACECOM or Space Force headquarters, like those in similar jobs at U.S. Strategic Command. NATO also needs to strengthen its ties to the European Union to get access to space data that not all NATO members—or the organization itself—can see.

"The United States should also seek to incorporate NATO representatives into its outer space-related wargames where possible, especially the Schriever Wargame, the premier U.S. space wargame," Rose wrote. "At the end of the day, all of this will require clear, sustained, and consistent U.S. leadership."

In Latin America, countries are looking to collaborate on space situational awareness (or object tracking), space weather, and satellite imagery for humanitarian aid and other missions.

Last year, U.S. Southern Command, SPACECOM, and the Space Force co-hosted a summit with Brazil, Chile, Colombia, and Peru to share their strategies and look for common ground.

"The Americas have seen a surge of space activity," Lt. Col. Galen Ojala, U.S. Southern Command's director of space forces, said in a November 2020 press release.

"Various civil and defense ministries actively operate and pursue additional capabilities across industry and academia for the good of their people and regional security. On a single overflight of Earth, their satellites support urban planning, crop estimates during [the coronavirus pandemic], law enforcement, environmental monitoring, and territorial security."

Africa is also seeing a resurgence in military space plans for several countries after "domestic and international political dynamics halted or softened those quests" following the Cold War, South African researcher Samuel A. Oyewole wrote last year. The U.S. has helped partner nations across Africa learn to use satellite communications systems, and is in talks to further improve data-sharing with the Pentagon.

Samson said the Defense Department should also do more to court India, which has launched myriad satellites and is pursuing anti-satellite weapons. Signing a space situational awareness agreement would give the U.S. as much information as possible on what the Indians are putting on orbit and could help encourage nondestructive behavior.

There are multiple avenues to working with the U.S. in space. One of the most basic is to sign an agreement to share data on decommissioned satellites and other objects orbiting the Earth. At least 26 countries have formed those pacts with the U.S. so far, in addition to about 100 intergovernmental organizations, academic institutions, and commercial companies.

It's not perfect: Even with those agreements in place, Samson said there's more to do to ensure countries are sharing information in file formats everyone can read, and to overcome classification hurdles that often stymie closer collaboration.

Another avenue is to send liaison officers to the U.S. to provide their country's perspective on daily operations. They rely mainly on unclassified information for tasks like crafting training exercises and public messages, said Maj. Gen. DeAnna M. Burt, a top commander in SPACECOM and the Space Force's operations branches at Vandenberg Air Force Base, Calif.

At the highest level are the coalition members of Operation Olympic Defender, the formal, overarching international effort to deter hostile actions in space. That includes the United Kingdom, Australia, and Canada—members of the "Five Eyes" intelligence-sharing alliance with the U.S., Canada, and New Zealand—who are allowed to operate U.S. assets.

Other countries, like France and Germany, were offered a place in Olympic Defender but have not formally signed on.

Members of Olympic Defender send exchange officers to the U.S. to work as part of the Pentagon chain of command. They handle missions such as space debris tracking and are privy to more secrets than liaison officers.

Burt said, "There are things that are U.S.-only that we have to do, but we try to limit those off of the main ops floor. The main ops floor, we operate every day at the U.S. top secret, Five Eyes level."

Burt's in charge of the Combined Force Space Component Command, the branch of SPACECOM that works with other countries during daily missions.

"Information about our constellations is passed back and forth to each other ... because we're operating together as a coalition on the ops floor," Burt said of sharing navigation and other data with the U.K., Australia, and Canada. "For the [liaison officers], that data, where I can make it unclassified and share it at the right level with that particular country, we absolutely do that.

VANDENBERG AND PETERSON

Vandenberg is the hub for most of the Pentagon's international military space cooperation, including the Combined Force Space Component Command and the Space Force's Combined Space Operations Center—a secretive command and control organization that tracks objects in space and acts as a liaison between those who operate military space assets and those who need their services.

SPACECOM wants to bring more foreign employees to its headquarters at Peterson Air Force Base, Colo., as well. Having everyone in the same room gives officials a better idea of what resources they have at their disposal—not only from the U.S. Space Force, but from across the coalition.

"One of the critical pieces of work the Space Force is doing in this year two is to develop a force design for space," Raymond said. "What I've told our team is to build that force design with coalition partners in mind from the beginning. Once we get that force design built, where there's areas to partner ... we would welcome that opportunity."

Military officials envision an interconnected web of military

Staff Sgt. J.T. Armstrong

Jamiee Maika of the Royal Australian Air Force at the Combined Space Operations Center at Vandenberg Air Force Base, Calif., Aug. 28, 2019, is part of a multinational space force partnership between the United States, Canada, Australia, and the United Kingdom.

Defense Contract Management Agency/courtesy

The AEHF-6—the final satellite of the Advanced Extremely High Frequency program—provides secure, global, and jam-resistant communications for military ground, sea, and air assets. Currently, partner satellite communications programs "piggyback" on such assets, but the multilateral space coalition has a lot of room to grow.

and commercial space systems that allows troops across the globe to talk, track moving objects, share intelligence products, and wield offensive capabilities like signal jammers, when needed.

Americans want to plug into space ops facilities in places like France and Germany, while thinking about which countries might be best suited to host U.S. assets in orbit and on the ground. Ideally, they want a fast-moving global network with backup options if certain parts fail: the GPS constellation goes down, for instance, or imagery payloads can't send pictures to Earth.

In one example, Canadian satellite communications programs piggyback on U.S. assets like the Advanced Extremely High Frequency constellation, while offering their own data through the Tactical Narrowband Satellite Communications (SATCOM) systems in geosynchronous orbit.

But the budding coalition still isn't where some officials want it to be.

"Do we let [Japan, the United Kingdom, and Australia] operate any American weapon systems in other domains? … We will let them operate, in unison with us, the F-35, which I would say is more advanced in many capabilities than almost any space system that we operate today," Vice Chairman of the Joint Chiefs of Staff Gen. John E. Hyten said at a Jan. 22 National Security Space Association event. "Space, though, is still special, so we won't."

LIMITED—BUT IMPORTANT—COOPERATION

The U.S. will never let other countries take over total responsibility for whole mission areas in space, Hyten said. But, he argues, American allies should be allowed to share more of the load.

Foreign troops are expected to take part in a broader range of U.S. space operations as those partnerships unfold. Burt said it depends where allies think they would be most useful: at SPACECOM headquarters, at missile warning units or radar sites, or perhaps embedded with Space Force Guardians around the world.

That spread also depends on how many people a nation needs at home to build its own space enterprise, versus sending them abroad to help and learn from the U.S. "Ultimately, it will be a benefit of ours, as well," Burt said.

She suggested there may be a burgeoning foreign military sales market for space, just as U.S.-made fighter jets have spread to more than a dozen countries. Using the same systems offers an easier path to interoperability than getting disparate technologies to communicate, too.

"We sell F-35s to quite a few people, right? Why wouldn't we share and sell space capabilities, working with each other on common capabilities that we as a coalition are going to need?" she said. "Those dialogues are happening."

Look to ridesharing, where U.S. payloads hitch a ride on a foreign rocket launch, as one option that could become more popular, Burt said. Multiple countries are also pursuing more universal SATCOM options, she noted, as well as a global navigation approach that ties together the U.S. GPS, Russian GLONASS, and European Galileo constellations for seamless directions.

She suggested countries may also discuss "higher-end" technologies tailored to their particular concerns and nearby threats.

Experts believe other countries could shoulder more of the burden when it comes to military space resources to monitor and communicate in the Arctic. Space-based synthetic aperture radar imagery, used to create two- and three-dimensional renderings of an area, may also be something the U.S. could outsource.

"Trying to take advantage of a geographic location, whether it's sharing data or taking on Earth observations or sharing radar capabilities—I think that'd be something that would be helpful as well," Samson said.

Balancing international investment in military space assets will be a fine line for nations to walk, she added.

Countries typically look to what the U.S. is doing when deciding what systems to build, and there is a sense of prestige associated with having domestic launch and counter-space capabilities, she said. The cost of launches and space products are dropping, leading countries that haven't traditionally pursued those programs to get in the game.

Space technology with dual civilian and military uses may be attractive to any country looking to get more bang for its

buck, rather than spend more money on multiple specialized capabilities.

Atkinson noted there's an added layer of security for countries in knowing they have the means to call out bad behavior without relying on the U.S., which could keep some investments in-house.

COVID-19'S IMPACT

The ongoing global pandemic may change the foreign calculus about how large countries can afford to grow their space programs.

"We're living in a COVID world where there's tremendous drain," Samson said. "I think it's going to be harder to make the argument for a huge investment that's basically replicating stuff you can get from a so-called trusted ally, such as the United States, when you have all these other demands on your national resources."

They could opt to share the cost of developing new systems, such as Australia's payments toward the Wideband Global SATCOM program. As space data begins to flow more freely between a growing number of allies, those nations may think twice about spending money on their own assets as well.

Even if a government opts not to build its own spacecraft from scratch, it might have just as much interest in keeping commercial products safe.

"As countries put more satellites and more of their economic and national security dependency on space, they're going to want to make sure it's protected," Samson said, noting that several leading nations talk about that resilience in the same way as the U.S.

Burt argues other countries should be concerned about Russian and Chinese aggression on orbit and weapon tests that send dangerous trash flying. Thousands of commercial satellites like SpaceX's Starlink network also promise to crowd space and could result in more collisions with national assets.

"Even if you're a country that's brand-new to the business, you do care about those things," she said. "If you're going to put a lot of money into this brand-new capability, and it could be quickly taken out by something on orbit, that's not something you want to see happen."

Some allies, like the U.K., are willing to publicly call out bad actors alongside the U.S. Others opt for more discreet, diplomatic routes to encourage compliance with international norms.

Yet the United States is opening the door to broader development of the same weapons for the sake of deterrence—and to keep its options open if war does erupt. Wargames can show where countries could move forward together.

"If we're building jammers or capabilities or [other] things, and we find that we are looking at technologies similarly to how they are … why wouldn't I say, 'There's an opportunity here for one of us to build this, and the other to invest?'" Burt said.

Conversations about whether and how to respond to aggression on orbit are still evolving, but Burt believes they've grown more promising. Participants who would have walked away from the table on divisive issues before are now hearing out the U.S., she said.

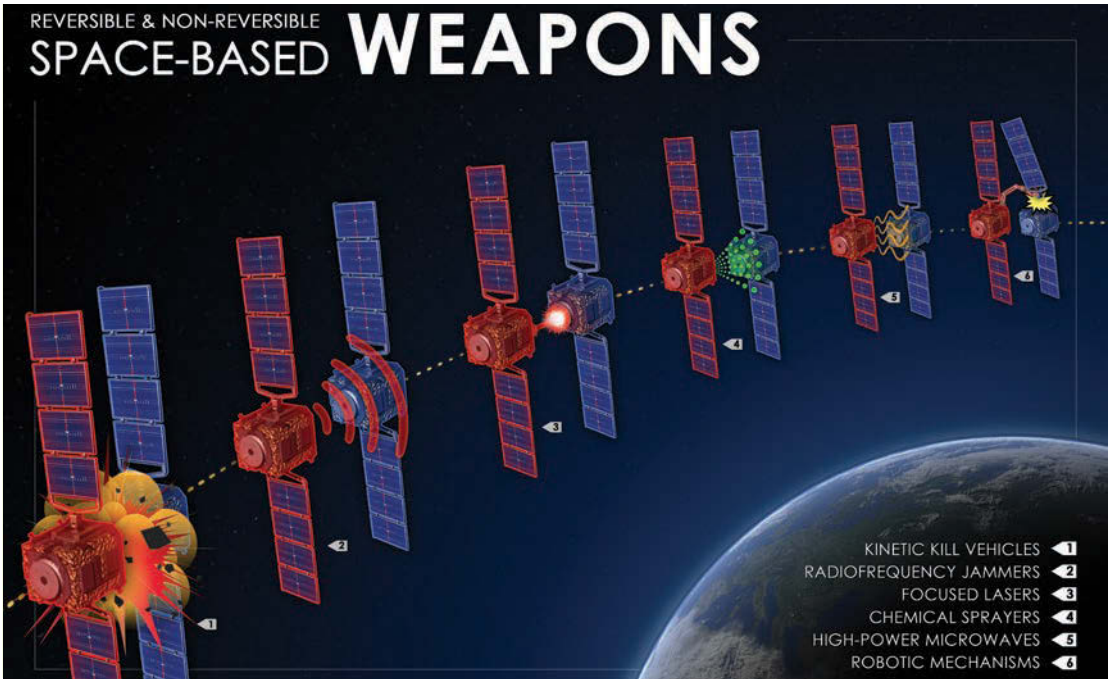
"For many countries, a human has to die for that to be determined as a hostile act," she said as an example. "If you shoot down a machine, no one died in that instance. But … we now will have second- and third-order effects of more casualties in a given engagement."

Samson cautioned that militarization of space doesn't happen in a vacuum—tensions on the defense side can spill over into civil space, where NASA is also trying to forge a multinational coalition for a new era in space exploration. Tensions may be most noticeable for countries that can't afford separate civil and military space agencies, making it harder to compartmentalize "if there's any rancor … bleeding over into the civil space cooperation," she said.

National security space matters are also being hashed out in international venues like the U.N., where fresh treaties and accords can shape the coalition's work for decades to come.

Everyone is heading into uncharted territory together, including the Pentagon. The Defense Department still has much to do to flesh out how it will organize and use American space forces, let alone work with others.

"Until the U.S. figures out its role and its mission for its Space Force and how it wants Space Command to use those forces, … it'll affect our cooperation," Samson said. "I think we need to get our house in order."



Justin Weisbarth/National Air and Space Intelligence Center

This graphic, created for the Space-Based Weapons section of the "Competing in Space" unclassified report, depicts space-based anti-satellite systems that target other space systems. Concepts for space-based anti-satellite systems vary widely and include designs to deliver a spectrum of reversible and irreversible counter-space effects.

The U.S. must take more seriously the increasing threats to its forward bases, which could have been even more catastrophic than this one visited by media in January 2020. This missile attack on Al-Asad Air Base in Iraq caused traumatic brain injuries to more than 100 Americans.

Defending Forward Bases

China and Russia have made huge strides in missile technology, while U.S. air base defense has languished. Now the United States is playing catch-up.

By Amy McCullough

The night sky lit up as ballistic missiles rained down on Erbil and Al-Asad Air Bases in Iraq. Sheltered in bunkers, Airmen found the extent of the Iranian attack hard to decipher. Staff Sgt. Brian Sermons, 22nd Expeditionary Weather Squadron aviation weather noncommissioned officer in charge at Al-Asad, heard "soul-shaking explosions." Debris pummeled the bunker walls, kicking up dirt and dust and making it difficult to breathe. When a missile struck a munitions tent, small arms rounds started to cook off, and Airmen braced themselves for what they thought was a follow-on ground attack.

"The next four hours became a blurred mix of emotions and chaos," a member of the 443rd Air Expeditionary Squadron Security Forces team at Al-Asad wrote afterward. "Bomb after bomb shook us for what felt like all night. ... My muscles tightened and I could feel my teeth grinding. Then the radio chimed in. 'You have six more missiles inbound to your area, followed shortly by two more.'"

An attack by Russia or China "would certainly be vastly more serious and consequential for air operations." —Alan Vick, senior analyst, RAND Corp.

No one died from the volley of Iranian ballistic missiles on Jan. 8, 2020, but more than 100 U.S. personnel suffered traumatic brain injuries.

It was a wake-up call: U.S. forward operating bases are vulnerable.

IT COULD HAVE BEEN WORSE

"The attack on Iraq was more symbolic, and we had early warning, so we had fewer casualties," said Alan J. Vick, a senior political scientist at RAND Corp. In the future, he said, the "Iranians could do much more" harm. An attack by Russia or China "would certainly be vastly more serious and consequential for air operations."

The U.S. must rethink how to gird against attack

Capt. Adan Cazarez/USA

The Terminal High Altitude Area Defense (THAAD) system on Andersen Air Force Base, Guam, is the only permanent THAAD system based outside the continental U.S. Here, Soldiers practice missile reload and unload of a THAAD at Andersen.

from theater ballistic missiles and land-attack cruise missiles. While traditionally an Army mission, it could be handed to someone else following a planned roles and missions review.

The last U.S. service member to die by an enemy air strike was in 1953 during the Korean War. But the nature of air base attack has changed since then, with the advent of cruise missiles, unmanned aircraft, and improved ballistic missiles. Today's air base defenses have never been seriously tested by an enemy capable of launching large salvos of guided weapons.

Carl D. Rehberg, a nonresident senior fellow at the Center for Strategic and Budgetary Assessments (CSBA), said air base defense today is "very poor across the board."

U.S. Air Forces in Europe-Air Forces Africa boss Gen. Jeffrey L. Harrigian is looking to change that with award of a nearly $1 billion air base air defense contract.

The Air Force asked contractors to respond to two hypothetical attack scenarios:

Within the first hour, 15 Chinese Dà Jiang Innovations (DJI) unmanned aerial systems attack the base, with the potential to threaten from any direction. No more than three DJIs successfully penetrate the perimeter, though not concurrently.

In the second hour, five AS-34A cruise missiles attack various sections of the base with at least 30 seconds between each arrival.

Contractors were told to assume the air base defense system will be controlled from a main operating base inside of Germany and operated by five-skill-level Airmen. Proposals were due Jan. 22 and were to include an "operations view of a base defense network." Solutions could include commercial-off-the-shelf technology and equipment that can be "modified or available within the next three years," according to the request for proposals. Contractors were asked to provide a cost and manpower estimate in their proposals.

The government wants a mix of sensors, kinetic, and nonkinetic systems, capable of finding, fixing, tracking, targeting, engaging, and assessing a range of threats, from small unmanned systems to hypersonic missiles.

Harrigian said USAFE, headquartered at Ramstein Air Base in Germany, has aggressively moved out on this effort over the last year, and recently started testing new ways to use existing sensors and cameras for improved situational awareness at the base.

"We kind of take it from the long-range to the short-range to help our domain awareness, and then we built in some algorithms that are now starting to help with the decision matrix, that would give you options depending on what the type of threat was," he told Air Force Magazine.

The data gleaned from such demonstrations will help USAFE officials "understand pattern of life," so they can better detect changes that might present a threat, he added.

The USAFE Air Base Air Defense effort is envisioned in three phases. Phase one looks to develop the Ramstein Air Defense Systems Integration Lab (RADSIL) at Ramstein, which will serve as the interim command and control center for air base defense operations in the European and African theaters.

There, officials are studying the data collected from sensors, as well as the environment, to include everything "from airplanes to the potential threats of small UAS," Harrigian said. "We're actually out there flying small UAS to ensure we can detect them." That information is fed into the lab, helping to fine-tune the algorithms that help make decisions, he added.

Phase Two will transition to a permanent air base air defense capability at Ramstein, and Phase Three includes installing air defenses at bases across Europe, Africa, and possibly other theaters, according to the request for proposals.

Pacific Air Forces boss Gen. Kenneth S. Wilsbach noted the Army already has fielded larger systems, such as PATRIOT missile batteries or the Terminal High Altitude Area Defense System (THAAD), which first deployed to Guam in 2013 to face down the North Korean ballistic missile threat. And though the command is considering adding an Aegis Ashore system to Guam as well, overall it's looking for something more agile that can be deployed to remote locations across the Indo-Pacific.

"The systems that we're going to use for base defense have to be pretty lean and pretty light, because we start running out of ships and aircraft to get those systems moving around," Wilsbach said. They must also be agile, said Wilsbach, noting that's one of the key tenants of the Agile Combat Employment

concept, which calls for moving assets and small teams of multi-capable Airmen around to various remote locations to keep to make it more difficult for the enemy to target.

"I've had conversations with multiple defense contractors, and they all have designs that they're pitching to us to be able to go forward with some purchases here in the future," Wilsbach said.

BALLISTIC THREATS

Despite a new emphasis on great power competition, Rehberg said, "the posture has not changed at all since the China threat evolved."

THAAD is designed to intercept ballistic missiles during their final stage of flight. Yet the Army has just seven THAAD batteries, with a total of 42 launchers and more than 500 interceptors, according to, "Air and Missile Defense at a Crossroads: New Concepts and Technologies to Defend America's Overseas Bases," a CSBA report co-authored by Rehberg and Mark Gunzinger, now the director of future aerospace concepts and capabilities assessments at the Air Force Association's Mitchell Institute for Aerospace Studies.

The Army's PATRIOTS—actually an acronym that's short for Phased Array Tracking to Intercept of Target—are located in Japan, Korea, and elsewhere. As of 2018, the Army had 15 Patriot battalions operating 50 batteries with 480 launchers and more than 1,200 interceptors, according to the CSBA report.

"PATRIOTS are an effective element of the air and missile defense architectures of the United States and many of its allies," the report states. But it notes, too, "they are expensive, and their combined capacity would be insufficient to protect air bases and other military infrastructure that U.S. and allied forces would depend on during a major conflict with great power."

CHINA'S RISING THREAT

Gunzinger, , who led multiple assessments on U.S. military capability requirements for both DOD and the Air Force and also was a member of the National Security Council staff, said: "We were asleep as China built up its military, its offensive capabilities." He recalled sitting in meeting after meeting as decisions were made to delay funding high-end capabilities because the National Defense Strategy at the time was focused on irregular warfare.

"China and Russia didn't defer to the future," he said. "China built multiple cruise missile systems, improved its family of ballistic missiles, increased their range, their payload capacity, the different kinds of payloads they carry, their accuracy, and on and on."

Commercial satellite images have shown mock targets representing Kadena Air Base, Japan, and possibly other U.S. and Taiwanese bases and ports, which the People's Liberation Army Rocket Force apparently use to "practice attacks," the CSBA report says. In September 2020, a Chinese military propaganda video depicted an H-6K bomber flying alongside fighter aircraft and attacking the flight line at Andersen Air Force Base, Guam. Pacific Air Forces called the video an attempt to intimidate.

China has about 1,200 short-range ballistic missiles, mostly focused on Taiwan, according to the CSBA report. It has 200 to 300 medium-range ballistic missiles that can reach the first island chain in the Western Pacific and an unknown number of intermediate-range ballistic missiles that can reach the second island chain, the report says.

But the growing cruise missile threat is what worries Gunzinger most. He said the Defense Department's last Missile Defense Review intentionally left Ballistic out of the title. "That was purposeful," he said. That change acknowledges "that it's now cruise missiles and long-range cruise missiles that can be launched from 1,000 kilometers or further at an air base or installation from China—and Russia, for that matter."

Cruise missiles fly at low altitudes in the terminal phase of flight, making them harder to detect and "pretty survivable," Gunzinger said. They are also smaller and more affordable than ballistic missiles and can be launched from aircraft that can get them closer to the fight. Ballistic missiles are larger and follow a predictable flight path, making them easier to track and target.

China also is developing unmanned aerial vehicles for both

John Cochran/USAF

Soldiers enter the portable control center of AFRL's Tactical High Power Operational Responder (THOR) on Feb. 11, at Kirtland Air Force Base, N.M. THOR is a prototype directed-energy weapon used to disable the electronics in drones, and specifically engineered to counter multiple targets.

reconnaissance and strike. Massed UAVs pose a particular hazard, and the CSBA report argues the United States "has failed to develop the means to counter salvos of large numbers of cruise missiles and UAVs." But the Air Force has made progress in recent years with directed-energy weapons, and the Pentagon appears ready to start buying the technology.

A "couple of pulses" from a high-power microwave weapon can make a swarm of UAVs drop from the sky, Gunzinger said, a vastly less costly defense than firing a barrage of bullets. "From a cost-per-effect perspective, … there's no comparison," he added. "We're talking pennies worth of electricity to create an effect on a target. Lasers, maybe it costs more than a couple bucks worth of electricity, versus spending thousands of dollars, sometimes more than thousands, per round for a kinetic interceptor."

Kremlin

A Kh-47M2 Kinzhal hypersonic air-launched ballistic missile with a range of 2,000 kilometers is carried on a MiG-31 during the Victory Day Parade in Moscow, May 9, 2018. Hypersonic speeds will make the deadly missiles extremely difficult to locate, track, and counter.

The Department of the Air Force's 2021 budget request calls for $21 million for directed-energy (DE) prototyping, though that is less than half the $44 million requested in 2020 and the $48 million in 2019, according to budget documents. From fiscal 2019 to 2025, the department plans to spend a total of $152.2 million for the DE prototyping program, which "bridges the gap between lab-based technology demonstration under a controlled environment, and demonstration of a system in realistic environments with the intent of establishing successful acquisition, and operation or operational capability implementation," according to budget documents.

Air Force Chief Scientist Richard J. Joseph said the service is testing one Air Force Research Laboratory-developed microwave drone killer, called the Tactical High-Power Operational Responder (THOR) in Africa. Richard said he's seen the system in action and it's "really quite impressive." The Air Force has not yet committed to purchase it, though the Army announced in late February it too would invest in the technology prototyping.

"The Army's directed energy capabilities will need to provide a layered defense with multiple ways to defeat incoming threats," said Lt. Gen. L. Neil Thurgood, the director of hypersonics, directed energy space and rapid acquisition, who observed the technology at Kirtland Air Force Base, N.M., on Feb. 11 and met with developers. "High-energy lasers kill one target at a time, and high-powered microwaves can kill groups or swarms, which is why we are pursuing a combination of both technologies for our Indirect Fire Protection Capability rapid prototyping effort."

USAF is evaluating multiple alternatives, including a 12-month field assessment with unnamed combatant commands of Raytheon's High-Energy Laser Weapons System (HELWS), Raytheon's high-power microwave (PHASER), as well as THOR.

"The overseas field assessments are allowing us to understand directed energy as a capability against drones. This gives us a better picture of the military utility, reliability and sustainability, training requirements, and implementation with existing base defense," said Michael Jirjis, Air Force Strategic Development Planning and Experimentation Office director, in a release.

Those tests should wrap up in April, and the results will shape where the Air Force goes with high-energy lasers and high-power microwaves moving forward, Jirjis said at the time.

RUSSIAN SALVO THREAT

Russia's arsenal of long-range conventional ballistic missiles is smaller than China's, but it has fielded multiple, short-range ballistic missile variants capable of reaching bases in Europe.

Russia had 11 combat brigades of Iskander-M road-mobile, short-range ballistic missiles systems as of 2019, systems first used against Georgia in 2008. The system has been permanently deployed to Kaliningrad since 2018, putting it within reach of NATO forces in Poland and the Baltics, as well as NATO ally Sweden, according to the Center for Strategic and International Studies.

The newer Kh-47M2 Kinzhal hypersonic air-launched ballistic missile, which Russian President Vladimir Putin first showed off in March 2018, is similar to the Iskander but is launched by a supersonic MiG-31BM jet, giving it a range of 2,000 kilometers.

"Russian crews from a MiG-31 squadron have already flown some 250 training sorties in support of this mission," states the CSBA report. "It is envisioned that the Kinzhal will be deployed with [hypersonic glide vehicles] that maneuver after separation from their boosters and fly depressed trajectories that make them difficult to intercept."

The introduction of hypersonics to the battlefield is a game-changer. Flying at Mach 5 or faster, they compress the kill chain, making it extremely difficult for a defender to locate, track, and counter.

Like China, Russia also is building multiple smaller UAV variants for targeting support.

The Air Force is actively moving out to better protect its installations overseas. Though the U.S. may be behind right now when it comes to air base defense, it is not far behind.

"We may lag in some … technology areas—in terms of building operational capabilities—but our technologies are every bit as good, if not better, than our competitors," Gunzinger said. "We will catch up, and we will do it soon." ✪

Pentagon Editor Brian W. Everstine contributed to this story.

Who Should be Responsible for Air Base Defense?

'Festering' dispute between USAF and Army demands resolution, experts say. A roles and missions review could bring one.

By Amy McCullough

The fiscal 2021 National Defense Authorization Act gave the Secretaries of the Air Force and Army until June 21 to come up with a joint strategy for defending America's overseas air bases from missiles and for the best way to preposition material.

Defending air bases is the Army's job, but it's never really been a priority for the service, according to multiple defense experts. Congress wants to change that, and an upcoming Defense Department-wide roles and missions review ordered by Defense Secretary Lloyd J. Austin III also is likely to tackle the issue.

What's not clear is if the Air Force will completely take over the task, if the Army will be forced to step up, or if the final solution will be more of a compromise.

"It's a well-known problem. It's been festering for years," said Mark Gunzinger, director of future concepts and capability assessments at AFA's Mitchell Institute for Aerospace Studies. "The Army hasn't stepped up. The Air Force continues to insist it's the Army's job, rightfully so, but someone needs to do it, and they need to start doing it now."

China and Russia didn't sit idly by as the United States focused primarily on counter-insurgency operations for the last two decades. They've been bolstering their ballistic and cruise missile capabilities, developing new variants of small, unmanned aerial systems for reconnaissance and strike operations, and training with these new systems against simulated U.S. bases.

Boeing and GDLS/courtesy

The Land Systems Initial Maneuver Short-Range Air Defense system (IM-SHORAD) Launcher, mounted here on a Stryker armored vehicle, is one of the Army's solutions to replace the aging Avenger short-range air defense system.

In addition to the Army's PAC-3 and Terminal High Altitude Area Defense System, the service is looking to field a new Initial Maneuver Short-Range Air Defense system, known as IM-SHORAD, to replace its aging Avenger system. Mounted on a Stryker armored vehicle, it has better armor and is more survivable than the legacy HUMVEE-mounted system. It also has its own radar and various weapons that are effective against air threats, but the system is mostly focused on protecting Army units from close in air threats.

Gunzinger said SHORAD and other air and missile defense capabilities are among the Army's top five priorities, "but it does not appear as if the Army has made defending air bases one of its top five priorities."

Carl Rehberg, a senior fellow at the Center for Strategic and Budgetary Analysis, said the Navy does the best job at integrated air and missile defense. It is solely responsible for protecting its ships, and doesn't have to work with another service to get the job done. As a result, there is a very clear layered defense aimed at existing threats.

"So they are the leads. ... Then we get to Army bases and air bases, especially in the theaters, and we basically fall off kind of a cliff, if you will, as far as defense," Rehberg said. "A lot of that has to do with the roles and missions issue, and who perceives the threat and where, which is part of the issue DOD is trying to grapple with. But, we really haven't made a whole lot of progress so far."

Rehberg offered several options for solving the issue once and for all.

1. The Defense Secretary could direct the Army to fund the system, and the Army could submit a budget requesting funds for new technologies to defend air bases.

2. Following the roles and missions review, the Air Force could agree to accept a portion of the mission, and the Defense Department directive detailing the roles and functions of the military services could officially be changed. The Defense Secretary would have to sign off on such a change, and Congress would need to fund the new mission.

3. The Air Force can just decide the mission is too important to wait until the issue is officially resolved and adopts its own strategy for defending air bases. However, Rehberg noted that also would require additional funds from Congress.

"There is no silver bullet against the kinds of threats that Russia and China represent," Rehberg said. "Part of the solution is kinetic, part of the solution is nonkinetic (lasers, high-powered microwaves, and electronic warfare)," but camouflage and dispersing critical airfield functions across a wider area also are just as important, he emphasized.

That's largely what the Air Force's Agile Combat Employment concept is all about—moving forces and assets around the theater so the target is more difficult to track and attack.

Gunzinger argues that air base defense is "so critical to our ability to generate combat power forward, to generate combat power inside of China and Russia's [anti-access, area-denial] complex coverage, that if the Air Force needs to do it— it ought to do it. But if the Air Force takes on the mission, the Congress ought to appropriate the additional resources to include people as well as dollars for them to do it. They can't just take it out of hide." ✪

Catching Up on Hypersonics

As flight-tests begin, the military must overcome shortages of talent, test capacity, and supply.

Photo illustration by Mike Tsukamoto/staff; Lockheed Martin; USAF

Lockheed Martin's hypersonic Air-launched Rapid Response Weapon (ARRW) is intended to travel 500 miles in just 10 minutes once fired from a B-52 bomber. That's 3,000 mph, versus about 500 mph for a conventional weapon.

By John A. Tirpak

Flight-testing U.S. hypersonic missiles is about to take off—perhaps as often as once every six weeks over the next four years—but the Pentagon still has a long way to go to create the "ecosystem" of skilled people, test facilities, and industrial capacity needed to build such weapons at scale.

The urgency is great, because China and Russia have already fielded their first hypersonic weapons, and it's expected it will take the U.S. several years to catch up. For that reason, the U.S. is on a crash program to field weaponized prototypes in the next two or three years, followed a few years later by more elaborate and mature systems built in larger numbers. However, that won't happen without building the infrastructure to produce the still-experimental vehicles.

"There are two major drivers to our hypersonic investment strategy," said Michael E. White, the assistant director for hypersonics in the office of the Undersecretary of Defense for Research and Engineering. One is that "the adversary has aggressively pursued their hypersonics capabilities and they're fielding them today." The other is that those missiles challenge the U.S. in nearly every fighting domain, and to get back in the game, the U.S. has to be able to match them, he said.

"I will never be satisfied until we're flying routinely. ... And we're not flying routinely, yet."
—Michael White, assistant director for hypersonics, DOD

On a battlefield of the near future, White observed, "the adversary is launching long-range weapons that travel 500 miles in 10 minutes, and our weapons take an hour to fly 500 miles." The U.S. "can't allow" that asymmetry to continue, he asserted.

The Pentagon and Congress are serious and in agreement about the need to make hypersonics happen, White said.

Budgetwise, "I think we're in a really good spot," he said. "We went back and looked at the 2016 budget, and in that budget, we were spending about $340 million. And now we're spending about $3.5 billion, so we've increased, in four years ... by a factor of 10." Congress has been "very supportive," he said.

China displayed DF-21 "carrier killer" and DF-26 "Guam killer" missiles in a 2019 military parade, and Pentagon officials later judged these were operational,

and not just mock-ups. Russia announced operational capability with the Avangard—a maneuvering, nuclear hypersonic glide vehicle carried on an intercontinental ballistic missile—and the Kinzhal, an air-launched tactical hypersonic missile with a range of 1,200 miles. Officials said both China and Russia are working on improved versions of those weapons, while developing numerous variants and other hypersonic munitions.

"They recognized the significance of hypersonics and made the decision to transition into system development before we did, quite frankly," White said.

TAKING THE LEAD

The U.S. has developed a portfolio for air, land, and sea launch platforms to "challenge, and if necessary, defeat" other adversary high-end capabilities, according to White. Once the forces that "hold our traditional forces at bay" have been beaten back by hypersonic weapons, "it really opens the floodgates to what we can bring ... with our conventional forces." Hypersonics has become the key enabler, he noted.

"The things that hold you at risk, you'd like to defeat with a weapon you know will get through ... and do it quickly."

But the industrial base to build hypersonic vehicles in numbers doesn't exist yet.

"If, tomorrow ... you said, 'I want to start building a thousand hypersonic missiles a year,' we wouldn't have the capacity to do that," White said. He's developed roadmaps that spell out "what ... we need to do to ensure that, as we get into the mid-2020s," the industrial base will be churning out hypersonic rounds.

White set up a "war room" last year to create the enabling infrastructure and intellectual horsepower to master hypersonics, and "the results ... are expected over the next couple of months," he said. "Program by program, we've identified key needs," and the work done will point industry toward the investments necessary.

Hypersonic missiles will be expensive for the foreseeable future, White said, and "you don't get to a point where everything becomes a hypersonic weapon." They will instead be pathfinders.

"Hypersonics ... will be the 'break down the door' weapon," said Mark J. Lewis, Executive Director of the National Defense Industrial Association's Emerging Technologies Institute. Lewis was the Director of Defense Research and Engineering for Modernization, and White's boss at the Pentagon, until mid-January.

There are "some reasons for concern" about the developing hypersonics ecosystem, Lewis said. First, "we don't have the test facilities that we need." The various hypersonic programs are "kind of climbing over one another to get to get access to wind tunnels," he observed.

Propulsion testing is especially problematic. For a combined-cycle engine—one that uses conventional, turbine-like propulsion to get to high velocity, and then transitions to a scramjet for hypersonic speed—"we really don't have anything that will let us do that adequately on the ground," Lewis said. For any wind tunnel work in the U.S., "you have very limited choices. ... So that's an area that needs investment."

Availability of flight-test ranges is another problem. Again, programs are competing for range time, not only with each other but with "all the other things we want to do flight-testing on," Lewis said.

"We've got some amazing [test] infrastructure, but it's very old," said Maj. Gen. Christopher P. Azzano, commander of the Air Force's Test Center at Edwards Air Force Base, Calif. "We've put sustainment money into it over the last few years, but it needs more."

Azzano said that last year, at the direction of former Air Force Secretary Barbara M. Barrett, "we ... prepared a number of different investment portfolios to try to improve our capacity," both in tunnels and test ranges. But "right now, there are just too many pressures on the Air Force budget to address all of them."

He acknowledged that the air test ranges are "under some strain," given the number of competing efforts, and some programs "think they're ready to go, and they're not." To be a good steward of the range space, though, Edwards is compelled to schedule range time at 100 percent. Anything less is "a wasted opportunity," Azzano observed.

The Test Center is experimenting with a concept called SkyRange, which uses unmanned aircraft to clear the test space and relay telemetry, he said, in an effort to do more with the range space already available. But hypersonics testing, with "long fly-outs" will be a challenge, Azzano admitted.

Giancarlo Casem/USAF

The first test flights of the ARRW, designated AGM-183, were scheduled for March 2021. Captive-carry tests were completed last summer and fall.

NASA

Hypersonics leaders want the pace of flight-testing to match the twice-monthly flights of the X-15 from 1959 to 1968, which rapidly generated volumes of data about the hypersonic environment, materials, and propulsion. Here, an NB-52 mother ship makes a low pass over a just-landed X-15.

White's "war room" should deliver a plan on how to address the paucity of tunnels. Though the results may be classified, the answer will include partnering with NASA and academic institutions.

Computational fluid dynamics—simulation—is part of the "three-legged stool" supporting hypersonics development, along with flight-tests and tunnels, White said, but of the three, flight-testing is the most important. "It's hard to represent everything in a wind tunnel that you're going to get in flight."

For high mach numbers coupled with intense heat, there's only one tunnel—a NASA asset—that can create the environment. But "we've made additional investment" in the Arnold Engineering Center at Tullahoma, Tenn., and "we're evaluating additional investments in partnership with NASA," White noted. Tunnel investments amount to about $500 million next year.

Besides the shortage of tunnels and ranges, Lewis is worried that the U.S. has gotten "rusty" on developmental flight-test. It's "both a science and an art. It takes practice. I worry about our lack of practice, and so we need to get back into that."

To "deliver on the time scales required, I think we need to be testing on the ground and in flight at a pretty high pace," he said. Stepping up the tempo of testing will also make all the steps involved—range safety, telemetry, checklists, etc.—more routine and reduce errors that can stop a program in its tracks. He said the X-15 hypersonic rocket plane program in the 1950s and '60s was a good model to follow: It flew, on average, every two weeks for nine years, generating a "phenomenal" knowledge base. Without constant testing, "we're not building the expertise we need."

MORE TESTING

Lewis thinks it's also important that "you … take intelligent risk," on "the ultimate goal of the program." When the biggest risks lie elsewhere, "you set yourself up for failure. And we've seen some of that." For example, he said, "if you're going to test something that flies at hypersonic speeds, for cryin' out loud, you don't want the biggest risk to be the rocket motor that gets you up to hypersonic speeds." He also believes flight-testing has gotten too cumbersome. "It's amazing how many people can say 'no' to a flight-test." Too many competing programs are fighting over range access, he said, and "if you miss your flight window … your next window is going to be two months later. And silliness like that."

White said, "We're going to fly a lot more than we ever did. … We've got between 40 and 50 flight-tests planned for the next four years," and the Pentagon's Test Resource Management Center is "investing in ways that will allow us to increase the flexibility and availability of flight-test ranges."

However, he doesn't want to substitute speed for "engineering rigor" in planning and executing tests. Typically, he said, in the interest of speed, "little things … bite you," and when tests fail, it's usually not because of some problem with a hypersonic design, but "failing the systems engineering rigor test … over the last decade or so."

He said he's "pulled together a team to do a best systems engineering practices for flight-testing," and the lessons learned will be passed along to the entire flight-test community.

"I will never be satisfied until we're flying routinely," White said. "And we're not flying routinely, yet." Key contractors have "heard me give them the systems engineering rigor speech more than once," he added.

While details are classified, two hypersonic missiles that were to make their first air-launched, free flight late last year didn't do so. Sources said the snafus were due to amateurish mistakes rather than a failure of the hypersonics technologies.

Contractors are stepping up their investments in hypersonic development, test, and production capabilities, Lewis noted. This includes not only major primes, like Lockheed Martin, Northrop Grumman, and Raytheon Technologies, but "even if you drop a tier," there are lots of companies elbowing for position. "Look at companies like Leidos," which was until recently mainly a consultancy and services outfit. "They purchased Dynetics," which does high-speed aerodynamic hardware, "so they're all-in on hypersonics."

But the U.S. shouldn't depend solely on the primes and top sub-primes, Lewis said.

"I worry about the diversity of the industrial base," he asserted. "We've got a lot concentrated in a few companies," and if they are all working on a large number of projects, "it's hard to see how they could put their 'A' team on everything."

Consequently, the Pentagon has worked hard to encourage and help finance some small businesses that can contribute to the knowledge base. While these smaller companies may not be able to manufacture thousands of weapons, they may have innovative solutions on materials and thermal management; two areas critical to the success of the hypersonics push.

"The current glide bodies leverage high-temperature carbon composite materials that take a long time to build," White

explained. "If we can leverage innovation in the small companies that allow us to do ... development ... and the buildup process much more rapidly," it will have "dramatic impact on the ability to reach our capacity goals."

Thermal management is essential because of the extreme temperatures on the nose and leading edges.

"We have to have a vehicle skin ... that can handle excessive temperatures and stay intact, and not only [that] but maintain its geometric integrity," so that complex shapes and inlets will function as designed across a flight of hundreds to thousands of miles.

Australian Department of Defense

Australia is a natural partner country for hypersonic testing and research cooperation. Here, a rocket launches from the Woomera Test Range, Australia, May 2016. The desert range could be a coveted hypersonic weapons testing location.

MAKING THE GRADE

White noted that one feared problem—that a layer of plasma around hypersonic missiles would block communications—has not materialized. Plasma layers also seem not to "affect subsystems."

Lewis would give the materials ecosystem a "B," when "a couple of years ago, it was a 'C,'" he said. "Especially in high-temperature materials, ... we really took our foot off the gas pedal" in the 2000s and 2010s. The research done was "not nearly enough for a robust ecosystem." Over the last few years, "we've really stepped up in the high-temperature materials, not only in the basic research level, but in development, manufacturing." He added, "I think we're doing well, but we should always be doing better."

To ensure there's enough talent to go around, the Pentagon has helped create an Applied Hypersonics University Consortium. Under the Joint Hypersonic Transition Office (JHTO), its goal is to attract and grow experts in rocket and air-breathing propulsion, materials, heat management, and systems engineering to meet the demand that will come as hypersonics balloons into a major sector of the aerospace industry. The university lead is Texas A&M, "and they've got something like 50 universities now," Lewis noted. The participants aren't just the "traditional" aerospace schools, either, but some who are making their entrée into aerospace materials and "people working in controls and system design," he noted.

The availability of talent is not a crisis, Lewis said. Although industry leaders express concern to him about the hypersonic workforce, they haven't told him they're having trouble hiring.

The 10-person JHTO was set up in April 2020, and has a $100 million annual budget. It moves money around among hypersonics-enabling projects to get "more bang for the buck" and "make sure we're focusing on the things that will get us ... the capabilities we really need," its director, Gillian Bussey, said in a November 2020 speech at the Technology and Training Corporation.

Among her tasks, Bussey said, is to help bridge the so-called "valley of death" that stands between promising research and programs of record. University professors were finding that "when their work starts to get somewhere that's relevant" to the Pentagon's hypersonics enterprise, "the funding kind of stops" because the research category shifts from the basic research to the applied research accounts, and "it's a lot harder for them to get funding." She's working to alleviate that problem.

The JHTO also facilitates knowledge- and resource-sharing among the services. "We're reducing waste," she asserted. "We're coordinating and collaborating," getting experts from NASA, the services, and academia working together to solve problems.

Lewis said he's been struck at the sharing of knowledge among the services. Usually, "they only pay lip service to coordinating, but ... I saw absolutely no limits on knowledge sharing. ... It's a really good news story." The Army and Navy especially are "joined at the hip" in solving their surface-launched problems, he said.

The JHTO is reaching out to other countries as well—notably Australia—and seeks to "tap into nontraditional performers ... to help them advance, to help us," Bussey said.

Besides a long history of "very substantial" contributions to the field of hypersonics, Australia has a "national enthusiasm" for it, Lewis said. Australia also has the Woomera Range Complex, "where you can test early and often and crash on a desert floor and pick it up and look at what happened." Australia also flies the F/A-18. "That means, anything the U.S. Air Force does with Australia automatically builds in a path for connectivity to the U.S. Navy. So they can ... help us with connectivity between our services."

Further out—perhaps in the early 2030s—White sees reusable hypersonic systems. They could be used for penetrating intelligence, surveillance, and reconnaissance work—a successor to the SR-71 of the 1960s to 1990s—or possibly as the first stage of a two-stage-to-orbit craft. Will those systems be manned? White's unsure, but "the Air Force has got point on putting together a strategy to get us a reusable, long-range hypersonic capability."

Lewis said he's concerned that after all the effort to create the hypersonics ecosystem, a new administration offers an opportunity for opponents of the technology to derail the effort, and put the U.S. at a serious future disadvantage.

"You still have folks coming out of the woodwork, mischaracterizing how hypersonics would be used, mischaracterizing their capabilities," and drawing the wrong conclusions. "That worries me," Lewis said.

"The debate is over. Every time we war-gamed the peer competitor scenarios, the difference between having hypersonic capability and not was the difference between winning and losing. It was that simple." ✪

The Air Force plans to retire 17 B-1B bombers in 2021, even though its bomber force as a whole is already too small to meet requirements for a major conflict with China in the Indo-Pacific, nuclear deterrence, and other missions.

Senior Airman River Bruce

Building the Future Force

The next National Defense Strategy must mitigate against looming strategic risks.

By Mark Gunzinger and Lukas Autenried

The Department of Defense (DOD) develops a new National Defense Strategy (NDS) every four years to align the U.S. military's force structure, operational concepts, programs, and budgets with the president's national security priorities. Secretary of Defense Lloyd Austin plans a comprehensive review of the present NDS, published in January 2018, and has indicated that while the strategy's focus on great power competition and conflict remains sound, updates may be warranted. Austin suggested during his confirmation hearings the next NDS must address "the continued erosion of U.S. military advantage vis-à-vis China and Russia, in key strategic areas" due to trends such as China's accelerating military modernization, its increasingly belligerent activities in the Indo-Pacific, and its growing ability to project power against the U.S. homeland.

The U.S. Air Force has too few bombers for conflict with one peer, let alone two.

Three issues threaten to further erode the U.S. military's advantages in the future, increasing the risk of failure in the event of great power conflict. Two of these stem from the 2018 National Defense Strategy, which directed how the services should size and shape their forces, while the third results from DOD's inadequate means for calculating the relative benefits of investment trade-offs. Left unaddressed, these issues threaten to increase gaps in U.S. forces and capabilities and to reduce the nation's ability to defeat peer aggression, deter nuclear attacks, and defend the U.S. homeland.

The 2018 NDS requires the U.S. military services to be able to defeat an attempted Chinese or Russian invasion of a U.S. ally before that invasion becomes a *fait accompli*, as occurred when Russia seized the Crimea from Ukraine in 2014. Similar threat scenarios include the potential for China to invade and occupy Taiwan or for Russia to invade a NATO member in the Baltics. In the face of a peer aggressor that achieves its objectives within days or weeks, the United States and its allies would face a choice: accept the new status quo or mount a major counteroffensive to evict those occupying forces, an effort so massive and escalatory that it could threaten a nuclear response.

The 2018 NDS aimed to deny China or Russia the chance to achieve a *fait accompli* in the first place by requiring that U.S. military forces be able to immediately engage invading forces, even in the face of anti-access/area-denial defenses. U.S. forces in theater would be the first responders and would be rapidly backed up by blunt forces able to operate both in theater and from long range with the intent to degrade, delay, and deny a peer adversary from achieving its campaign objectives. Critically, the 2018 NDS assumes that China or Russia would seek an off-ramp from conflict if their *fait accompli* strategy failed. This assumption minimizes the potential that China or Russia could instead choose to continue offensive and defensive operations. Failing to size the U.S. military for this longer conflict creates risk it would suffer from significant—and possibly decisive—capacity shortfalls.

Today, DOD is acquiring 5th-generation fighters, precision-guided munitions, and other advanced weapons at suboptimal rates. Persistent shortfalls in logistics capacity threaten the military's ability to sustain combat operations. In a prolonged conflict, therefore, force attrition and the expenditure of weapons that cannot be quickly replenished, the U.S. armed forces might not be able to generate sufficient combat power to meet theater commander requirements.

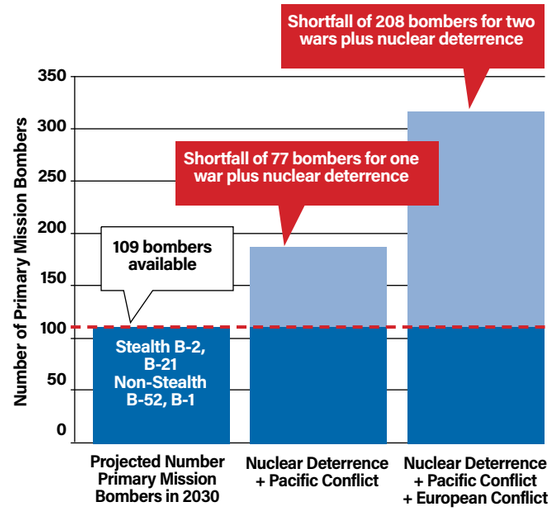
RISK: PLANNING FOR A SHORT WAR

The National Defense Strategy includes a force planning construct to guide the services in sizing and shaping their forces. This force planning construct describes the type, number, and frequency of major conflict scenarios, along with other assumptions, to help the services define requirements. From the end of the Cold War until 2018, DOD required the capacity to fight two conflicts nearly simultaneously in order to deter an opportunistic aggressor from taking advantage when the U.S. military was already engaged in combat in another theater.

Breaking from this long-standing requirement, however, the 2018 NDS adopted a single-war construct that required the U.S. military to conduct a war with either China or Russia, deter nuclear attacks, defend the homeland, and deter a second lessor aggressor or rogue state, such as North Korea or Iran, from launching an opportunistic attack. The recognition that China and Russia pose a much greater challenge than any rival since the end of the Cold War—coupled with a desire to contain the

Under Equipped

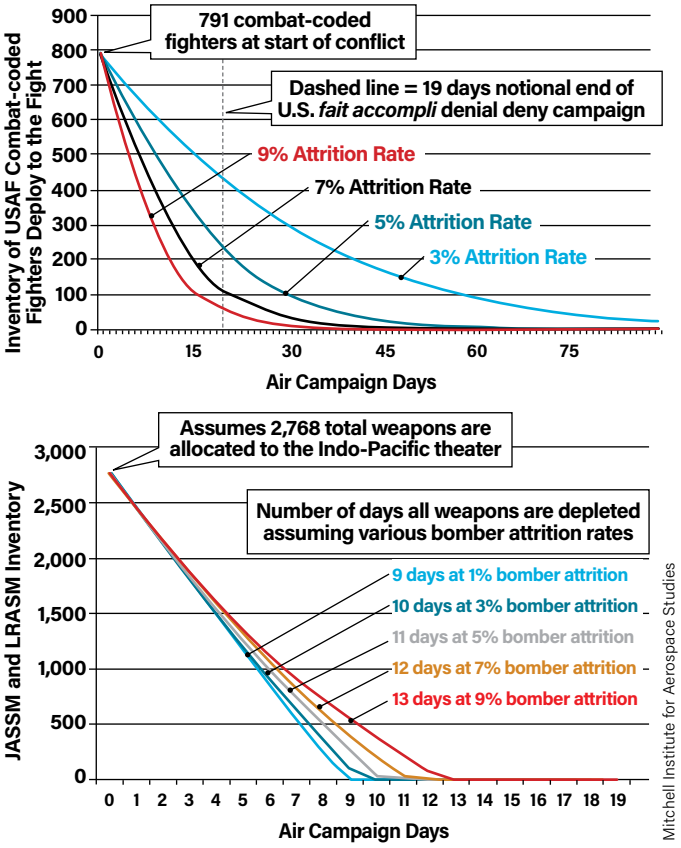
The Mitchell Institute projects the Air Force could have 109 primary mission bombers available in 2030, far less than needed to fight one war—and less than half as many as needed to fight two simultaneous wars and also deter nuclear aggression.



Mitchell Institute for Aerospace Studies

Attrition in Peer Conflicts

The U.S. Air Force has enjoyed virtually uncontested air power over the past three decades, enduring few aircraft losses in combat. But in a future peer conflict, losses could mount rapidly, potentially wiping out critical combat capability in a matter of days.



Mitchell Institute for Aerospace Studies

cost of rebuilding U.S. military combat capacity cut over the past 30 years—likely informed this decision.

Sizing the U.S. military to defeat a single peer aggressor has significant and risky consequences. The risk that a second adversary—including a peer competitor—could launch an opportunistic military operation that threatens America's vital interests is greater if adversaries know the U.S. military's capacity is challenged. China and Russia's strengthening defense ties, and their continued sharing of advanced military technologies, should further increase concerns over U.S. gaps in a number of critical capabilities. For example, the U.S. Air Force today has too few bombers for conflict with one peer, let alone two. Based on independent analysis, the Air Force lacks at least 77 bombers for a single war plus the nuclear deterrence mission, and more than double that shortfall for two peer conflicts. The Air Force's stated requirement would increase its current bomber force by five operational squadrons.

A third problem with the 2018 NDS is the U.S. military's lack of new joint warfighting concepts to defeat peer aggression. Operating concepts explain *how* the U.S. military plans to conduct future operations in all domains and link DOD's strategic goals with the forces and capabilities needed to achieve them. These concepts are critical to determining future requirements and provide a foundation for assessing force structure and capability trade-offs across the services. Such trade-offs are necessary when seeking to maximize combat potential for each dollar invested, especially now, at a time when defense budgets face reductions.

The Joint Staff is charged with leading development of a new Joint Warfighting concept for all-domain operations to deter or defeat great power aggression. The Joint Staff's consensus-driven doctrine development process is unlikely to challenge bureaucratic service equities, however, making it difficult to determine the necessary trade-offs that are part of optimizing combat lethality across the joint force. Here's how Vice Chairman of the Joint Chiefs of Staff Gen. John E. Hyten described the concept last fall, illustrating this struggle with trade-offs: "An army capability can have on its own platform, the ability to defend itself or the ability to strike deep into an adversary area of operations," he told the Hudson Institute. "A naval force can defend itself or strike deep. An air force can defend itself or strike deep. Marines can defend [themselves] or strike deep. Everybody. And … the key piece to do that altogether is an integrated version of command and control."

In other words, the operating concept envisioned for future all-domain warfare could validate redundant programs for all the services. This would surrender a necessary process for comparing competing solutions, waste investment resources, and leave the services without the funds to invest in capabilities needed to support other theater commander needs. If the Army, for example, goes ahead with plans to acquire ground-launched precision strike missiles with ranges of 1,000 miles or more—an unprecedented distance for the Army—these weapons, costing tens of millions of dollars each, will compete for funding with less expensive munitions that could be delivered by existing bombers and fighters. Mitchell Institute analysis indicates using bombers to attack hundreds of targets over long ranges would be a far less expensive solution than using multimillion dollar surface-launched missiles to attack the same targets. Meanwhile, other Army missions, such as theater base defense, would continue to be underfunded, exacerbating a risk that leaves U.S. air and other bases vulnerable to attack from ballistic missiles, cruise missiles, and drone swarms.

RISK: PLANNING FOR ONE WAR

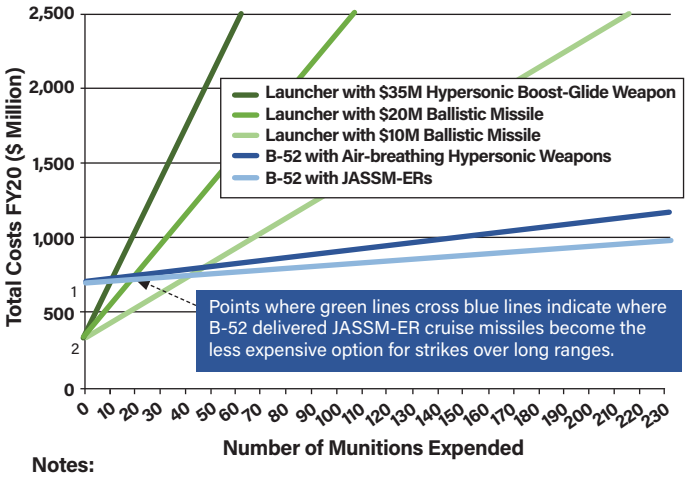
The 2022 National Defense Strategy should reduce the risk that a peer adversary might choose to engage in a long-duration conflict with the United States. Adopting a theory of victory that assumes U.S. forces may have to conduct follow-on operations, such as a punishment campaign, after denying a *fait accompli* invasion would be a strong hedge against such risks. The threat of extensive punishment operations would raise the costs of continued aggression and could deter adversaries from risking continuing hostilities.

A follow-on punishment operation against China should be part of the pacing challenge for sizing and shaping the U.S. military. Russia, by contrast, lacks the military capacity to sustain a long-term, high-intensity conflict against NATO. Because of the nature of the Indo-Pacific region and potential conflict with China, sizing the force for a *fait accompli* denial operation and a follow-on punishment campaign does not require large-scale investment in additional land forces, because large-scale land-based combat operations would be minimal. Rather, air, sea, space, and cyber offensive systems, depending on the U.S. commander's concept of operations, would be the central elements of such a campaign. These would include:

- 5th-generation stealth combat aircraft to counter advanced air and missile threats.
- Long-range ISR and strike platforms capable of penetrating contested environments to strike high-value targets, including Chinese bomber and fighter bases.
- Long-range air-launched and ship-launched anti-ship weapons to cripple PLA Navy aircraft carriers and other surface

Bomber Efficiency

Bombers and existing standoff weapons are less costly to acquire, operate, and support than building new long-range, ground-launched weapons. How total costs compare for B-52s vs. new ground-launched missiles:



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Notes:

1. Starting costs for bomber based on 30-year operations and sustainment cost of B-52.
2. Starting cost for missile battery based on acquisition, operation, and sustainment cost of new missile launchers.

Table does not include cost of C2ISR for ground battery or logistics support for deployed batteries.

combatants.

■ A next-generation counterair family-of-systems to support allied operations and deny China or Russia control of the air, especially over critical areas such as the Strait of Taiwan.

■ Multi-mission unmanned capabilities, including unmanned surface vehicles, unmanned aerial vehicles (UAV), and low-cost expendable UAVs capable of teaming with manned systems that increase DOD's capacity to project combat mass into contested areas.

■ Electromagnetic warfare capabilities to suppress advanced area-denial threats, including Chinese or Russian integrated air defense systems.

■ Offensive cyber capabilities.

■ Space domain awareness and offensive space capabilities.

■ Sufficient stores of precision-guided munitions prepositioned at forward locations in theater to sustain high tempo combat operations.

RISK: LACK OF JOINT FIGHTING CONCEPTS

The 2022 NDS should include a force planning construct that sizes and shapes the U.S. military to defeat a peer adversary, plus a second act of aggression in a different theater. This hedges against the risk that China, Russia, or a rogue state might seek to take advantage when U.S. forces are engaged in another theater.

To avoid excessive redundancy, the 2022 National Defense Strategy should differentiate between the peer conflict scenarios that each service must use to size and shape its forces. These pacing scenarios should be determined by assessing the forces U.S. commanders will require to deter and defeat future Chinese or Russian aggression.

The geography of the Indo-Pacific theater means U.S. forces needed to defeat a Chinese invasion of Taiwan or aggression in the South China Sea or East China Sea would be predominately Air Force, Space Force, Navy, and Marine Corps assets. Similarly, forces required to defeat a Russian invasion of one or more NATO states in Europe would predominately be provided by the Air Force, Space Force, and Army. Assessing the optimal force mixes for each would help reduce the cost of maintaining a two-war military. In the final analysis, it is DOD as a whole—and not each individual service—that must be capable of defeating a second aggressor.

REVISE THE THEORY OF VICTORY

To complement its new force planning concept, DOD should create all-domain operating concepts for peer conflict to help inform its future requirements and provide a foundation for assessing force structure and capability trade-offs using a cost-per-effect approach. DOD's senior civilian and military leaders should not rely on processes that seek consensus across the services or combine multiple concepts developed by each service in a stovepiped fashion. In place of the Joint Staff's current doctrine development process, the Secretary of Defense should direct a rigorous, yet targeted, examination of the services' current roles and responsibilities, then reallocate them as needed to reduce excessive redundancy in forces and capabilities. Resolving enduring debates over service roles and responsibilities for missions including long-range strikes and U.S. theater missile defense would help DOD drive new operating concepts and maximize future combat power. The Secretary of Defense and OSD staff must be deeply involved in developing and approving warfighting concepts used for DOD force planning.

DOD should also develop distinct all-domain warfighting concepts for potential future conflicts with China and Russia, not a single, overarching concept for both. Separate concepts would help account for vastly different characteristics and geographic features of the Indo-Pacific and European theaters, including physical dimensions, geographic chokepoints, the relative strengths and weaknesses of each potential adversary, and the capabilities of America's regional allies and partners. These concepts should focus on all-domain warfare, rather than "joint" operations, in order to stress the priority to integrate operations across all domains, as opposed to maximizing the contribution of organizations to combatant commanders.

LOOKING AHEAD

The 2018 National Defense Strategy rightfully shifted DOD planning and resource priorities toward preparing for great power competition and conflict, beginning the overdue process of rebalancing the U.S. military for an unprecedented array of challenges. The next NDS must build on that, reinforcing the need to ensure an unmatched advantage over China and Russia in next-generation capabilities.

In an era of flat or declining defense budgets, trade-offs will be necessary to responsibly manage the nation's defense investment portfolio. Those trade-offs must be guided by a National Defense Strategy and complementary all-domain warfighting concepts that reduce the risk of strategic failures and that measure competing solutions by means of sophisticated measures of cost per effect.

In the end, however, no number of trade-offs or cuts to current forces and readiness will create the savings needed to rebuild a military that has been subject to decades of force structure drawdowns and delayed or deferred modernization. Building America's future force will require ending the harmful cycle of opting for smaller but more capable forces, which has been a thinly veiled rationale for reducing defense spending for decades. It will take years of steady defense spending to ensure the U.S. military's transformation to a future force able to compete with China and Russia, deter peer aggression, and win America's wars. ✪

Airman 1st Class Hayden Legg

The Hybrid Optical-based Inertial Tracker (or HOBiT) and day visor provides a central interface for everything from oxygen supply to communications, flight instruments, and targeting. Tracking oxygen supply will help researchers better understand hypoxia-like events. 1st Lt. Anton King demonstrated the HOBiT at Moody Air Force Base, Ga.

The Forensics of Flight Emergencies

How military researchers are working to understand—and prevent—hypoxia-like events in Air Force aircraft fleets.

By Jennifer-Leigh Oprihory

After a U.S. Air Force F-35A pilot crashed their Joint Strike Fighter at Eglin Air Force Base, Fla., last May, an Accident Investigation Board determined that the "work of breathing," or the physical effort required on the part of a pilot's muscles for them to breathe mid-flight, contributed to the accident.

While investigators determined excessive landing speed was the main cause of the crash, issues related to breathing are a persistent problem that remains hard to pinpoint and explain. The Air Force cataloged 54 unexplained physiological episodes (UPEs) in fiscal 2020, not including that event, including five other F-35A incidents. The others were spread among A-10C, F-15C/D, F-16C/D, and F-22A aircraft.

The Air Force Physiological Episodes Action Team (AF PEAT) defines a physiological event as "any anomaly in the interaction among the aircrew, equipment, and environment that causes adverse physical or cognitive symptoms." USAF said these can include "cognitive impairment," inability to focus, slow reaction time, feeling dizzy or lightheaded, difficulty concentrating, and tingling or numbness in the extremities.

"The objective is to drive physiological episodes to zero."
—Col. Mark Schmidt, director, Air Force Physiological Episodes Action Team

U.S. Navy researchers recently concluded that UPEs in its fleets are caused by "a complex relationship between aircrew, their flight gear, and their aircraft," USNI reported last June. But, when it comes to USAF fleets, the case is far from closed.

AF PEAT Director Col. Mark Schmidt told Air Force Magazine in December his objective is "to drive physiological episodes to zero."

"Increased awareness of, and focus on, maintenance practices for both aircrew breathing systems and aircrew personal flight equipment" are helping reduce UPEs, he said. "Through a larger network that is both joint and within the Air Force, we will continue to develop and refine more comprehensive solutions."

VETTING EPISODES

The search for answers begins by narrowing down the field of study.

"Things like G-induced loss of consciousness (G-LOC), trapped gas, and spatial disorientation are excluded," the Air Force Safety Center explained in a statement. So are types of hypoxia that aren't linked to altitude, such as hypemic hypoxia—when the blood can't carry enough oxygen—stagnant hypoxia—when circulation is impeded—and hisotoxic hypoxia, when blood cells can't absorb oxygen even if it's available.

That leaves hypoxic hypoxia, which happens when the body cannot effectively transfer enough oxygen from the air through the lungs. The Safety Center said it searches for evidence of other possible explanations, such as "hyperventilation, air-sickness, … dehydration, contamination," and high or low blood sugar. If none of those can be blamed, the incident is categorized as unexplained—a UPE.

UNDERSTANDING UPES

AF PEAT is working with the Air Force Research Laboratory's 711th Human Performance Wing, the Naval Air Medical Research Unit-Dayton (NAMRU-D), and the Air Force Life Cycle Management Center to try to identify possible causes of UPEs.

On-Board Oxygen Generation Systems (OBOGS) were the subject of initial research dating back to at least 2014. The systems produce enriched breathing oxygen during flight by concentrating oxygen from engine bleed air or environmental control system air. This eliminates the need to carry liquid oxygen in the aircraft. While the OBOGS are just part of the aircrew breathing system, the systems are seen as a probable cause of hypoxia-like events.

While the 711th HPW's OBOGS lab has focused on the T-6A Texan II trainer since 2018, AF PEAT Medical Lead Col. William E. Nelson said that its findings are broadly applicable to other aircraft, as well. Researchers believe they can rule out contaminated air and are now focusing on fluctuating in-flight oxygen levels, a phenomenon known as ROHC, or rapidly oscillating hyperoxic conditions.

Although OBOGS generate more than the "minimum amount of oxygen that a pilot needs to perform effectively," AFRL 711th Human Performance Wing product line lead James Christensen explained, its production "can vary quite a bit, depending on flight conditions."

That variation may at times be too difficult for the body to manage.

In a 2018 interview with Air Force Magazine, AF PEAT's then-lead, Brig. Gen. Edward L. "Hertz" Vaughan, described the issue this way: "The problem with the aircraft is that it oscillates so quickly that the body gets out of sync."

Wing researchers are now trying to study "from a physical perspective" how the body adapts to these changes and how that may impact an aviator's ability to get his or her job done, Christensen said.

If they can establish a safe limit for the extent of oxygen-output variation, he said, they may be able to curb risky fluctuations.

Nelson said USAF and Navy researchers created an "accurate mockup of the F-35 Aircrew Breathing System—including the seat component and the angle that it's set at … along with the types of replica air equipment that's on a pilot's chest when they're breathing—so they can capture that data."

Nelson said the Air Force is attempting to learn more about the F-35 because it's new and many more aircraft are still to be built. "We're trying … to get ahead of the curve so that if there are

Physiological Events By the Numbers

Hypoxia-like events are anomalies, occurring without a clear pattern, making it harder to understand the phenomena and to assign specific causes to each incident. Episodes occur in every fighter platform, but with different frequencies. Here are two ways to look at the record:

Incidents by Fiscal Year and Platform*

Viewing the data by platform and year identifies incidents, but doesn't adjust for the size of fleets or experience of pilots.

	F-22A	F-15C/D	F-16C/D	A-10C	F-35A	T-6A	ANNUAL TOTAL
2009	2	0	8	3	—	3	16
2010	2	3	4	1	—	5	15
2011	10	1	6	0	—	2	19
2012	15	2	10	2	1	6	36
2013	5	3	7	2	1	1	19
2014	2	2	11	3	1	2	21
2015	2	12	13	4	1	4	36
2016	5	20	12	2	2	3	44
2017	1	5	15	6	9	7	43
2018	4	7	17	5	4	89	126
2019	4	10	8	2	3	41	68
2020*	1	3	6	3	5	36	54
Fleet Total	**53**	**68**	**117**	**33**	**27**	**199**	**497**

Incident Rates per Fiscal Year and Platform

(Events per 100,000 flight hours)

Translating totals into rates helps identify the frequency of issues per platform, highlighting the challenges posed by the F-35A and T-6A. The former may relate to relative experience in the platform, while the latter may be tied to the inexperience of student pilots.

	F-22A	F-15C/D	F-16C/D	A-10C	F-35A	T-6A
2009	9.53	0.00	3.11	3.24	—	1.89
2010	8.11	5.08	1.63	1.03	—	2.76
2011	65.41	2.76	2.67	0.00	—	1.05
2012	56.59	4.72	4.83	1.97	—	3.38
2013	19.14	7.67	3.68	2.12	—	0.60
2014	6.68	4.92	5.62	3.59	37.54	1.19
2015	6.25	29.28	6.16	4.59	13.39	2.48
2016	16.19	49.46	5.77	2.49	17.63	1.74
2017	2.96	12.54	7.89	7.25	67.64	3.98
2018	10.41	17.91	8.62	6.52	23.84	55.83
2019	14.57	24.17	4.17	2.56	15.43	23.77
2020*	3.68	8.24	3.70	4.07	22.50	23.83

* Note: This data is through Sept. 30, 2020, and is subject to change when final reports are submitted.
Source: AF Safety Center

Airman 1st Class Jessica Williams

Pilots learn to feel the effects of high altitude and changing oxygen flow in a hyperbaric oxygen chamber. The 14th Operations Support Squadron conducts that training at Columbus Air Force Base, Miss.

going to be more events, we've got the basic science in order to answer any questions that might come up in the future," he said.

The Air Force Life Cycle Management Center has established a second lab, the Life Support Systems Scientific Test, Analysis, and Qualification Laboratory—not just for fighters and trainers, but for all aircraft—to help figure out whether issues with aircraft life support systems are causing hypoxia-like events.

"Testing will be across compressed oxygen systems, liquid oxygen systems, OBOGS" and Molecular Sieve Oxygen Generating Systems, wrote Andrew Klein, chief engineer with AFLCMC's Human Systems Division. "Testing will be performed on both the system components, as well as the systems as a whole, to include the pilot-worn equipment, system tubing and piping, and all oxygen delivery, oxygen generation, and backup/emergency equipment."

The new lab will backup both AFLCMC's efforts to acquire new life support equipment and to keep "currently fielded capabilities" up and running, he said.

The 711th HPW OBOGS lab previously lent its equipment and expertise to the AFLCMC as needed to help determine if life support equipment from various aircraft might've contributed to unexplained hypoxia-like events.

"Ideally every piece of equipment would be removed after an incident (if deemed appropriate by the maintenance squadron), inspected, and tested thoroughly as part of the root-cause investigation," Klein said.

The new lab will focus on testing equipment and failed hardware, while the 711th will research causes of UPEs and developing new technology, Klein said.

So far, the new lab has tested and studied an improved quick don oxygen mask for C-17 and C-130 aircrew, and will soon work on the qualification process for the T-7A Life Support system.

To help reduce physiological episodes in the F-22 fleet, the Air Force installed an automatic backup oxygen system in the Raptor, modified the schedule that dictated how much oxygen is delivered at various altitudes, and redesigned a valve in upper pressure garments Raptor pilots don to reduce the labor to breathe in certain flight conditions. The Air Force's work with physiological episodes in the Raptor fleet helped spark "a realization that things besides hypoxia" could cause similar symptoms.

Pressure changes in F-15 C/D aircraft drove the Air Force to add a cockpit pressure warning system to alert pilots if an "insidious loss of pressure" occurs, Nelson said. To help prepare F-15 aircrew, they are put in a pressure chamber during training to learn to detect "rapid decompression," but maintainers have also worked to inspect and repair seals between the canopy and the aircraft to further reduce the risk of incidents, according to Nelson.

Lastly, Nelson noted, "our aerospace physiologists have been aggressively enhancing the education program of the aircrew" to understand what causes physiologic symptoms and how to react if they experience them, he said, including breathing techniques and emergency procedures.

And while UPE mitigation efforts in the U.S. military's F-35 fleets are owned by the F-35 Joint Program Office (JPO), Nelson said some of these initiatives have included modifying the Joint Strike Fighter's "OBOGS system to provide a more consistent oxygen concentration," ongoing work to improve the aircraft's oxygen regulator (known as a "spa"), and adding a carbon monoxide filter to the jets to prevent the exhaust from one jet from contaminating the air in another when they're parked "one behind another" on aircraft carriers.

IN-FLIGHT INSIGHTS

After physiological episodes in the T-6 fleet became a hot topic, researchers wanted to equip pilots with commercial medical sensors to monitor physiology mid-flight, but Christensen said they soon found the devices did not perform well "in a pressurized, maneuvering aircraft."

Eventually, flightworthy sensors were found, but pairing them with other sensors proved difficult. Components made by different manufacturers had their own unique data formats, some were wired while others were not, and synthesizing data was difficult. If data from different in-flight sensors could be integrated, Christensen said, researchers could theoretically cross-check results to understand what was happening and alert aircrew accordingly.

In 2019, AFRL launched the Integrated Cockpit Sensing Program initiative, and the program released its first request for proposals at an industry day hosted that December.

"We're less than six months into execution at this point, but ... certainly very excited," he said in November 2020.

Ball Aerospace is the prime contractor for the program, and "subcontract partners" include (but aren't limited to) Rockwell Collins, Lockheed Martin, Human Systems Integration, Inc. Within the Defense Department, the program also collaborates with Air Combat Command and Air Education and Training Command, as well as NAVAIR, NAMRU-D, AFLCMC, the T-6 Program Office, and the F-35 JPO.

"We're partnered with the DOD Rapid Prototyping Program, which is supporting us to produce an early system prototype by the end of this fiscal year," Christensen said. The prototype will be subjected to testing in a centrifuge and altitude chamber by the end of September.

About a dozen components are being tested for integration, including two developed by the wing specifically for combating hypoxia-like events in the T-6.

"The vision is not that ... every pilot's gonna be wearing tons of sensors, you know, forevermore," Christensen said. "The goal is to have the data ... to improve the flying environment."

The team is also working with Nellis Air Force Base's 422nd Test and Evaluation Squadron to obtain approval for prototype testing in the A-10, F-15, F-16, F-22, and F-35 fleets, he added. ✪

Illustration Mike Tsukamoto/staff; Photos: USAF; National Archives

Two A-10s attacked an elite formation of the Iraqi Republican Guard. Both were shot down. One pilot survived, the other sacrificed his life to make sure of it.

Above and Beyond

Three minutes and 45 seconds is an eternity when hundreds of angry people are trying to kill you.

By Brian W. Everstine

Two A-10 pilots, flying together for the 30th time in Desert Storm on Feb. 15, 1991, attacked a massive formation of Iraqi armor in the deserts of Kuwait.

One pilot, a young first lieutenant named Robert Sweet, survived and became a prisoner of war (POW). The mission commander of the flight, an experienced captain, who lingered above the site of the shoot down for three minutes and 45 seconds—intentionally drawing fire, attempting to help the search and rescue of his wingman, was ultimately shot down himself.

That pilot, Capt. Stephen R. Phillis, received the Silver Star posthumously for his actions that day.

Now, more than 30 years after the incident, a former U.S. Air Force Academy boxing buddy of Phillis, after years of research, is pressing for Phillis to receive a military award more befitting his sacrifice.

"You have a hard time explaining what heroics in an airplane looks like," said Jim Demarest, a brigadier general in the Florida Air National Guard and himself a veteran of Desert Storm. "Steve's heroics check all the boxes."

Courtesy

Capt. Stephen Phillis was killed in action when his A-10 was shot down during Desert Storm.

INTO 'BAD GUY LAND'

On Feb. 15, two A-10s assigned to the 353rd Tactical Fighter Squadron, call sign Enfield Flight 3-7, had one tasking for the day. The attack jets were to take off from King Fahd International Airport in Saudi Arabia, hit a refueling tanker, and head toward targets in the northern tip of Kuwait.

Then Sweet, the new guy in the squadron, was combat-paired with Phillis, who was the most experienced in the squadron and had been the weapons officer. Sweet had flown the most sorties of the squadron, one more than Phillis, by the time Feb. 15 rolled around.

"He was a little nervous," Sweet said of his wingman that day. "He was ... smarter than I was in a lot of ways."

After the A-10s hit the tanker, they were retasked to work with F-16s farther north into Iraq near Basra where there were some "pretty lucrative targets" near an oil field. The A-10s turned north, checked in, and heard multiple "breaks"—F-16s avoiding surface-to-air missiles (SAM) fired by Iraqis. The A-10s knew if the area was dangerous, they shouldn't hang out, and targets could be left to "the night guys"—bombers or other aircraft tasked to hit the targets after nightfall, Sweet said.

Phillis made the call to turn back and return to the first target. They moved back toward the Iraq-Kuwait border, which was "still bad guy land" at this time of the war.

The A-10s flew above a massive formation of the advanced 2nd Al Medina Armored Division—the elite formation of the Iraqi Republican Guard later made famous in the Battle of Medina Ridge, one of the largest tank battles in U.S. history.

Tens of thousands of Iraqi soldiers, columns of T-72 tanks and other armor, anti-aircraft artillery (AAA) batteries, and advanced Russian-made SA-13 surface-to-air missile systems were spread out over six miles in the sand below. U.S. bombing runs had damaged much of the Iraqi armored units, but the Medina was "pristine," Sweet said.

The sun began to dip low in the sky as the A-10s arrived and planned a couple of passes. Sweet, as he came off a pass, was shot at by a surface-to-air missile. Phillis radioed at his wingman "Chaff, flare! Chaff, flare!"

Sweet deployed flares. He saw this one, "and if you see it, you normally beat 'em, and I did."

Courtesy

1st Lt. Robert Sweet (left, with an unknown Airman) was a prisoner of war for 19 days during Operation Desert Storm. He did not know his wingman, Capt. Stephen Phillis, was also shot down—while trying to save him—until he gained his freedom.

If something on the ground shoots at you, it becomes a new target, and the A-10s turned to target the SAM position. Phillis did a gun pass over the SAM site, then radioed Sweet to turn in and do his own pass on the target.

As he was rolling, stick right at about a 60-degree bank, he was hit by another SAM from behind. The explosion blew his A-10 wing level at about 13,000 feet before it began to dive.

"I am hit, and I am heading south," Sweet said on the radio.

The explosion blew off part of the A-10's right wing, the aileron, the outboard flap, and took out the A-10s hydraulics. "Everything went into rapid mode," he said. As the Thunderbolt II went into a steep spiral, Sweet radioed, "I'm out," and punched out of the aircraft.

Phillis relayed the situation to the airborne warning and control system (AWACS) saying, "We got two SAM launches. My wingman is bag at this time. I have him in sight."

Dangling below a bright white and orange parachute, over an elite Iraqi armored division, Sweet saw .50 caliber guns and AAA fire in his direction.

"There was a rush, a little jolt, and I was hanging in the chute and it was all quiet," Sweet told People Magazine in 1991 about the ejection. "All that panic, throwing switches and bells going off, and then it was just dead quiet in the chute. Just a little breeze. Peaceful, almost. I threw off my mask, then looked down. I could see all the tanks and I was trying to steer away from them, but I knew I was going to hit close. That's when I said, "Oh, man, this is not looking good.'"

Above, Phillis switched into Sandy, or the A-10 search and rescue (SAR) mode. He radioed that he saw a good chute and marked the ejection site coordinates. He radioed the nearby E-3 Sentry AWACS that his wingman was down and asked for more aircraft to come and help the SAR effort.

These steps are the typical duty of a wingman in a downed aircraft situation—but Phillis stayed. Radio traffic showed confusion as incoming aircraft were not clear where to head.

Phillis flew an orbit over the armored division to draw fire away from Sweet as he parachuted down. He radioed incoming A-10s, trying to direct them to his position since the aircraft did not have radar.

The incoming A-10s could not spot him, so Phillis fired flares from his A-10—drawing the attention of both the Iraqis and the incoming help.

After repeated attempts to help the incoming aircraft locate him, Phillis realized the increased danger of the situation. An Iraqi SA-13 hit Phillis's A-10, lighting it on fire. He radioed to the incoming A-10s to leave, then radioed his own fate.

"Enfield 3-7 is bag as well," Phillis radioed to the AWACS with a calm tone.

With the aircraft on fire and disintegrating, Phillis turns south in an attempt to get away from the Iraqis and Sweet's ejection site. His A-10 ultimately crashed, cartwheeling through the Kuwaiti sand, and was totally destroyed.

As Sweet approached the ground, hundreds of Iraqi soldiers rushed to him. He injured his leg on landing, about 50 yards from a T-72 tank. "I stuck up my hands, but when they kept shooting, and I didn't know whether they were aiming at me, I bowed my head and covered my face with my arms," Sweet told People.

Sweet was beaten—"They were pissed off because I had just been dropping bombs on them"—and he was captured, a prisoner of war. He was ultimately moved to a prison at a Baathist Party security compound—the famous Baghdad Biltmore—that was targeted by F-117s on Feb. 23. He was then moved to a civilian prison. When other POWs arrived, Sweet learned that his wingman was shot down as well.

After the incident, U.S. forces only picked up one locator beacon. Knowing that both A-10s were shot down, the ultimate fates of Phillis and Sweet were not known until March 6, when the POWs were released, and a Red Cross plane flew them out of Baghdad. It wasn't until Sweet got off the plane—and Phillis did not—that his fate was known.

After U.S. forces liberated Kuwait and fought the Iraqi forces back, they located the wreckage of Phillis' A-10 and discovered his remains inside, along with evidence that the ejection seat was not fired.

'WHAT DOES A PILOT HAVE TO DO?'

For Demarest, himself a USAF pilot and U.S. Air Force Academy graduate, the story of Phillis's bravery should not end there. Phillis received a Silver Star posthumously for his actions, and since his A-10 was a combat loss, there was not an extensive investigation. No Accident Investigation Board

Thirty years after heroics as an A-10 pilot in Desert Storm earned him a Silver Star Medal, some are saying Capt. Stephen Phillis deserves an upgrade to the Medal of Honor.

Tech. Sgt. H.H. Deffner via National Archives

determined details of the incident.

Beginning about 1997, Demarest embarked on a mission to determine exactly what happened and to ensure that Phillis is recognized at a level he deserves. More than 20 years of research, interviews, records requests, and even a 65,000-word manuscript for a possible book, have resulted.

"I want the world to know Steve's story," Demarest said. His "forensic" review focused on the radio calls of the day, piecing together a timeline that was not extensively considered around the time of the crash.

"No one took the time to analyze what happened," he said. "The three minutes and 45 seconds represent true heroics here."

Those three minutes and 45 seconds show that Phillis acted "above and beyond the call of duty." A seasoned flight leader would note the successful ejection, the good chute, and the approximate location of the landing. Phillis, however, stayed—he put himself in grave danger repeatedly to protect Sweet as he parachuted to the ground. He made himself visible, including to the Iraqis, in an attempt to bring in search and rescue help, flying a dark green A-10 against a blue sky, orbiting "10,000 feet over 10,000 angry dudes."

"He earned his right to leave," Demarest said of Phillis. "But he stays three minutes and 45 seconds. To a pilot, it is an eternity."

After Phillis was hit, radioing he was bagged as calmly as if in a casual phone conversation, he then tried to follow Rule No. 1 of combat search and rescue by not becoming part of the search, leaving the dangerous area on his way down to try to let SAR concentrate on Sweet.

When Desert Storm ended, there was a large, public push to bring troops home quickly. Investigations and awards were not as important, Demarest contends. And in a combat situation, the push to account for what happened is not as urgent. "As soon as you confirm a KIA or a plane [crashes], the investigation stops. It's not part of the process. That's not a dig, it's just a fact," Demarest said.

Now, however, Demarest said the time is right for another look at Phillis's case. The Air Force just went through a large relook at its valor awards during the Global War on Terrorism, including upgrading the Air Force Cross for Master Sgt. John Chapman to the Medal of Honor—the only Airman to receive such an award for combat in Iraq and Afghanistan. Several other Silver Stars and Bronze Stars with Valor Device have also been upgraded.

"There's an appetite," he said. "I'm cautiously optimistic."

The Air Force has, since the Vietnam War, been "stingy" on its awards, especially during Desert Storm, Demarest said. There was a sense that USAF in the Vietnam era inflated its awards, so, since then, the Air Force has been more conservative.

Demarest now is leading a push for Phillis to receive the Medal of Honor posthumously for his actions that day. He's reaching out to political connections and officials in and out of the Air Force, sharing his findings and trying to make a case.

There are similar stories in USAF history. For example, the story of Lt. Col. Leo K. Thorsness. His wingman was shot down during a surface-to-air missile suppression mission in North Vietnam in 1967. Thorsness circled the descending parachutes, keeping them in sight to relay the position for search and rescue. During this, a nearby MiG-17 flew by and Thorsness shot it down and then left to find a tanker. When he was told there were more MiGs nearby threatening search and rescue helicopters, Thorsness returned to damage one and drive the others away, before landing at a forward operating base.

There's the story of Col. William A. Jones III. In 1968 in North Vietnam, Jones was flying an A-1H Skyraider as an on-scene commander in an attempted rescue of a downed pilot. Jones was repeatedly hit by anti-aircraft fire, but continued the search. In another pass, Jones was hit by multiple rounds of automatic weapons fire, igniting a rocket in the cockpit and causing a fire in the fuselage. He jettisoned the canopy, as fire began to spread across his body. Despite this, he flew the crippled plane back to base to pass along information for the rescue before receiving medical assistance.

Phillis staying to help Sweet "is the definition of 'gallantry beyond the call of duty' given the intense anti-aircraft fire, the enemy's awareness of his position, his lack of supporting aircraft, and his inability to safely escape because of his low altitude and the A-10's lack of speed," Demarest wrote in a document pressing the case. "Captain Stephen Richard Phillis' conduct in the face of mortal danger with complete disregard for his personal safety was aimed at saving another. Is this not exactly what the Medal of Honor should recognize? What does a fighter pilot have to do to earn the Medal of Honor?"

Sweet agrees. Phillis "gave his life for his country," and "he deserves the highest honor this country can give him," Sweet said. ✪

USAF

Soon after then-Lt. Gen. Charles Brown Jr. (center) became Combined Force Air Component Commander for Operation Inherent Resolve in 2015, he pressed to expand airstrikes from close air support missions to attack deeper into Islamic State territory, focusing on banks, command and control nodes, and oil transportation targets. He also sought to push authority to approve strikes down to the colonel level, enabling faster response.

Gradualism to a Fault

The air war against ISIS started slowly. Then strategic air power changed how the war was waged.

By Benjamin S. Lambeth

At the end of 2011, against the unanimous urging of his main security subordinates not to do it, President Barack Obama summarily withdrew the last remaining U.S. occupation troops from Iraq to honor a long-standing campaign pledge. Those troops had provided an effective stabilizing presence in the country after nine years of slow recovery from the near-devastating insurgency that followed the three-week U.S. invasion in 2003 to topple Saddam Hussein.

Rather than disentangling the United States from the region, however, Obama soon found himself stuck with a new war—and not just in Iraq, but also in neighboring Syria. This time the fight was against the self-proclaimed Islamic State in Iraq and Syria (ISIS), an abhorrent jihadist movement that arose in ungoverned spaces that opened up in 2012 as a result of the ongoing Syrian civil war.

Operation Inherent Resolve (OIR) was slow to get started, and also was slow to show significant progress. The Obama administration did not respond to ISIS' manifold abuses of hapless civilians until Aug. 8, 2014, and even that belated response was limited to airstrikes by U.S. Navy F/A-18s against a few ISIS positions in the northernmost portion of Iraq, near Erbil, where the American consulate and a substantial U.S. diplomatic presence were located.

Targeting ISIS' control, infrastructure, and governing hierarchy enabled the Air Force to move from supporting ground forces to disrupting the activities of a would-be state.

The U.S.-led air offensive continued for more than a year, primarily focused on tactical close air support, but repeated terrorist outrages perpetrated or inspired by ISIS worldwide finally forced the administration to expand its roster of approved targets in 2015 to include ISIS command centers and oil-bearing trucks, which brought in black-market revenue for the would-be caliphate. As two U.S. Air Force intelligence officers, Majors Michael Kreuzer and Denis Dallaire, later recalled, "while previous operations were primarily in support of coalition ground units fighting ISIS forces," U.S. Central Command (CENTCOM) now allowed "deliberate strikes aimed at infrastructure, logistics, and governance nodes deep within ISIS-held territory."

This effort sought to target "the control, infrastructure, and governing hierarchy of a state," which is essentially what ISIS was on a fast track to becoming. More important, the shift "enabled the Air Force to move from a role as a supporting entity for ground forces to one focused on discovering and disrupting critical ISIS support networks necessary to organize, train, recruit, and execute the group's strategy."

The main mover behind this change was CENTCOM's second successive Combined Force Air Component Commander (CFACC) for OIR, then-Lt. Gen.

Staff Sgt. Clayton Cupit

Air assets were used to go after ISIS' revenue. A pilot of a B-1B bomber, like this one shown flying with a French-manufactured Qatari Mirage 2000, recalled an attack on a bank in Mosul, cracking its safe and sending a "plume of burning currency nearly 100 feet into the air."

Charles Q. Brown Jr., who assumed that position in June 2015—10 months after the air war began. Today, Brown is the Air Force Chief of Staff.

As the chief of his Combat Plans Division, Col. (now Brig. Gen.-select) Jason M. Rueschhoff, would later recall, "General Brown was the impetus behind this moving of the fight deeper, focusing on strikes beyond the Army's fire support coordination line (FSCL) and understanding the reality of what the ground forces needed in the near-term—[on-call close air support, or CAS for short]—as opposed to what they would need in the longer term, which was deep air interdiction against the most lucrative ISIS targets."

Not long after, the administration deployed U.S. Special Operations Forces (SOF) teams to support the indigenous Iraqi Security Forces and anti-regime Syrian Defense Forces, who had been fighting ISIS on the ground. It also authorized more strikes on identified ISIS leaders and on ISIS-controlled oil production facilities, which provided the jihadist movement's main financial lifeline. In November 2015, U.S. and coalition aircraft dropped 3,227 bombs on ISIS targets, a new high. It followed with 3,139 in December, perhaps half delivered by B-1 bombers that could loiter over the battlefield for 10 to 14 hours with the help of multiple in-flight refuelings.

One B-1 aircraft commander recalled "some dramatic changes as we began targeting ISIS revenue." One target "was a bank in Mosul containing millions in currency that was being used by ISIS to pay its fighters," this pilot and Weapons School graduate said. "We did our best to quickly devise an optimized delivery solution in the jet using two GBU-31(V)3 Joint Direct Attack Munitions. The resulting impacts not only cracked the safe but also sent a plume of burning currency nearly 100 feet into the air."

Despite such examples of aircrew flexibility at the tactical level, CENTCOM's broader effort had yet to attain the magnitude of a bona fide campaign. While Obama sought to characterize the intermittent bombing as "a systematic campaign of airstrikes," the action still lacked a well-defined strategy aimed at seeking achievable goals on a realistic timetable. On the contrary, its mission statement remained vague: to "degrade and ultimately destroy" ISIS.

Obama's halting counteroffensive took more than a year to reach a point where the rules of engagement (ROE) relaxed sufficiently for planners in Air Force Central Command (AFCENT) to consider a finite number of possible civilian casualties per target attack if those casualties were deemed proportionate to the assessed importance of the target. Until then, AFCENT was "tied up in obsessive platinum-standard target vetting" dictated by White House-mandated ROE that were, according to Washington Institute analyst Michael Knights, "without a doubt the most obsessively restrictive of any air campaign ever fought by a U.S. coalition."

Indeed, throughout OIR's first year, final authority to approve any strike that might result in significant civilian casualties remained at the four-star level in CENTCOM's headquarters at MacDill Air Force Base, Fla. Not until September 2015 was CENTCOM finally allowed to delegate greater target engagement authority down to the forward-deployed Combined Joint Task Force (CJTF) commander for OIR in Kuwait, U.S. Army Lt. Gen. Sean B. MacFarland, who, in turn, pushed it down to his subordinate one-stars who oversaw the task force's two Combined Joint Operations Centers, or "strike cells," in Baghdad and Erbil.

It took another year before the next CJTF-OIR commander, U.S. Army then-Lt. Gen. Stephen J. Townsend, delegated targeting authority to his colonels in the two Army-dominated strike cells. With that, the number of officers in the kill chain who could approve strikes finally was great enough to ensure round-the-clock approvals from the strike cells.

REPRIORITIZING AIR POWER

From the time he assumed command of the air war in June 2015, Brown worked aggressively to streamline the target approval process, seeking better inputs from the Intelligence Community, and adding more important targets, such as ISIS cash reserves and oil-related facilities, to the daily list generated by the Combined Air Operations Center (CAOC). Up to that point, most of the mission lines flown in AFCENT's daily Air Tasking Order had been devoted to providing dedicated combat air patrol (CAP) orbits intended to be on call at a moment's notice for indigenous friendly ground troops, irrespective of what might have actually been required in the covered area.

Such daily CAPs came to be regarded as a given by CENTCOM's land component, Brown's chief of combat plans said. Yet with limited air assets available, they were in direct competition with other requirements, such as deeper strikes against the enemy's key nodes. Eventually, he said, "as target sets began to emerge through discovery and development, a prioritization took place in the CAOC on how we allocated air to provide close air support, when needed, and interdiction."

The chief planner continued: "Although the concept wasn't

new, the thought was to look at the problem differently than had been done with counterinsurgency air support operations in Iraq and Afghanistan. In the end, we began pulling strike assets off of traditional 24/7 CAS CAPs, either moving the CAPs to locations where expected ground contact would occur or else moving them where they could still respond quickly, but now to multiple areas across Iraq and Syria. We could then cover more area … while still retaining our deeper strike capability."

Brown's approach was almost an exact replica of then-Lt. Gen. Charles A. Horner's novel concept of "push CAS" used in 1991's Operation Desert Storm, despite initial opposition from CENTCOM's Army corps commanders. That concept assured those subordinate land commanders that they would have all the CAS they needed if required, but without needlessly tying up coalition strike aircraft for on-call CAS throughout the theater.

Brown later recalled that not long after he arrived at Al Udeid [Air Base, Qatar] as OIR's second successive CFACC, "CJTF-OIR developed a battlefield geometry that designated portions of western Iraq and eastern Syria as battlespace assigned to the CFACC. This was helpful in pushing for deliberate targets beyond the land component's FSCL and CAS mentality. The challenge was within the CJTF's intelligence, surveillance and reconnaissance (ISR) allocation process, in which ISR and other capabilities were apportioned against various 'named' subordinate operations across the CJOA [combined joint operating area]." Though not used for OIR to that point, Brown said, the process had been used earlier for Operations Enduring Freedom and Iraqi Freedom. "I pushed for a comparative and transparent analysis of organic CFACC-provided theater ISR allocation and apportionment across the CJOA, clearly illustrating the limited ISR allocation and apportionment to deliberate target development," Brown recalled later. "This resulted in a more fulsome discussion of the balance of ISR between the close CAS fight and deliberate targeting efforts."

When U.S. Air Force F-15E Strike Eagles put eight precision munitions into a bank containing millions of dollars worth of ISIS cash reserves on Jan. 18, 2016, it was a telling testament that AFCENT's performance had finally begun to show signs of perceptible gains in strategic effectiveness. By the spring of 2016, airstrikes had reduced ISIS' oil production by some 30 percent, having destroyed more than 400 oil tanker trucks. Revenue from black-market oil sales had been reduced by as much as half. On Dec. 8, 2016, coalition fighters destroyed 186 ISIS oil tanker trucks that had been concentrated in the open near Palmyra, Syria, inflicting an estimated loss of more than $2 million in illicit revenue.

Brown freely acknowledged that, as a result of more than a decade of near-exclusive concentration on providing on-call CAS to beleaguered friendly ground troops, the professional staffers in the CAOC had all but forgotten the complex art of assessing which fixed targets were of greatest importance to the enemy. This required an almost overnight shift in emphasis from so-called dynamic, or real-time, targeting of emerging objects of fleeting import, like ISIS vehicles, to deliberate targeting of larger fixed and known enemy assets, such as headquarters buildings and oil storage facilities, whose elimination might promise more enduring strategic results.

For their part, the expert targeteers in AFCENT's rear-area headquarters at Shaw AFB, S.C., had continued to conduct painstaking deliberate target analyses and to prepare meticulously documented financial and oil-related target folders as far back during the campaign as early 2015. Such deliberate target-attack options relied on a systematic accumulation of overhead imagery, electronic intercepts, and informers' tips that all pointed to sites for immense holdings of ISIS cash reserves in bank vaults, private residences, and elsewhere. Requested strikes against those choice targets, however, had invariably been disapproved by the Obama White House out of concern over potential civilian fatalities.

Tellingly, Brown remarked in July 2016 that his "biggest accomplishment" since becoming CFACC had been reintroducing more sophisticated targeting capability. "In the last 15 years or so, we've done a lot of close air support for troops in contact and armed overwatch, and in the deliberate targeting process, we lost a little muscle memory from what we had in the past," Brown recalled. "So I think this is something that's going to help us in CENTCOM's area of operations and in other contingencies later on that we, as a nation or as the coalition team, may face in the future." CENTCOM also fielded a modest number of additional U.S. SOF teams to work with indigenous friendly ground forces. As a result, the intensity of aerial weapon deliveries against ISIS grew steadily, from fewer than 200 a

Staff Sgt. R. Alex Durbin

Coalition fighters like this F-15E destroyed 186 ISIS oil tanker trucks on Dec. 8, 2016, depriving ISIS of an estimated $2 million in revenue. The attack was only possible once air resources were shifted from almost exclusive focus on close air support missions.

USAF courtesy

High-value targets such as ISIS weapons bunkers became the focus of air attacks in 2016, after then-Lt. Gen. Charles Brown Jr. convinced higher-ups to ease restrictions on strategic bombing.

month in August 2014 to more than 3,000 a month by mid-July 2016. These changes helped shift ISIS to the defensive for the first time since its emergence as a would-be caliphate more than two years before.

By November 2016, as the move by the Iraqi Security Forces to retake Mosul began gathering headway, a stack of 43 coalition aircraft orbiting overhead and on call as needed to provide both direct attack and CAS included B-52s, AV-8Bs, F-15Es, and F-22s, all holding on station and ready to engage any emerging targets as they were called out by Joint Terminal Attack Controllers (JTACs) on the ground. Those JTACs, in turn, were aided by more than a dozen remotely piloted aircraft, including armed Predators and Reapers, which provided real-time, streaming target video imagery. That aerial armada offered a glimpse at the magnitude to which AFCENT's air effort had finally grown.

From a bigger-picture perspective, however, the air war was still only marking time. True, the number of strikes against ISIS targets was up by 65 percent over a year before, and ISIS' recruitment of new jihadists was thought to have decreased from around 1,500 a month at the height of the movement's appeal to only 200 a month by early 2016. Nevertheless, the rate of daily airstrikes into Raqqa—ISIS' avowed capital in Syria—remained limited even at a time when, after 21 months of bombing, some 12,000 attacks had been conducted in all against ISIS positions at an assessed total cost of $7 billion.

SIGNS OF DECAY

Gradually, clear signs emerged that ISIS' leadership was struggling. ISIS began publicly conceding to their rank and file that the movement was encountering declining fortunes on the battlefield and could well be soon facing an imminent collapse of their vaunted caliphate. Steadily shrinking terrain holdings in Iraq and Syria and the forceful ejection of ISIS from Fallujah by mid-2016, along with the progressive increase in the number of ISIS-inspired terrorist acts abroad, all joined to indicate ISIS' faltering grip on its home turf. By that point in the air war, the bombing effort's steady gains were a direct result of the increased number of munitions dropped on ISIS targets each month and of the expanded list of target categories now approved for attack.

This came at a price. By the end of July 2016, the overall assessed cost of OIR had reached $8.7 billion, with coalition aircraft having conducted nearly 15,000 attacks on more than 26,000 individual target aimpoints. Yet the Iraqi Security Forces remained no closer than before to recapturing Mosul and depriving ISIS of its controlling presence in northern Iraq, because so many of the targets that had been struck were of little strategic import.

Air Force Chief of Staff Gen. David L. Goldfein declared at the end of August 2016 that OIR was now "absolutely going in the right direction." Yet Marine Corps Gen. James Mattis was no less on target when he offered the more sobering observation, at roughly the same time, that the administration's effort against ISIS remained "unguided by a sustained policy or sound strategy."

Following the unexpected election of Donald J. Trump to the presidency on Nov. 8, 2016, Trump appointed Mattis his Defense Secretary, and having promised in the campaign to ramp up the war on ISIS, Trump gave Mattis room to maneuver. The limits that had been placed on warfighters were reduced and in December 2018, Trump declared ISIS defeated.

In the end, OIR turned out to have been another American and coalition success story made possible largely by air power, once freed from the shackles imposed by Washington leaders who misread the enemy as a reborn Iraqi insurgency and consequently insisted on ROE meant for a different kind of war. It was that indispensible force element that finally allowed indigenous anti-ISIS troops who conducted the brunt of hard fighting on the ground with the help of embedded U.S. SOF teams and JTACs, to free Mosul and Raqqa in fairly close succession and ultimately to strangle the jihadist movement in its cradle.

Throughout it all, the combat performance of the aircrews who conducted the effort at the execution level was invariably able and effective, reflecting the high standards of operator competence and professionalism displayed in Operation Desert Storm and subsequent U.S.-led air offensives.

Yet the campaign was needlessly prolonged by two years or more thanks to its ill-conceived launch and its anemic first year. As a result, America and its coalition partners took as long to put away a fairly tractable low-technology enemy in the relatively bounded spaces of Iraq and Syria as it took the United States, in a total war for ultimate stakes, to defeat the vastly more powerful Imperial Japan and Nazi Germany in two major theaters on opposite sides of the globe in World War II. ✪

Benjamin S. Lambeth *is a nonresident senior fellow with the Center for Strategic and Budgetary Assessments and previously spent 37 years as a senior research associate at the RAND Corporation. This article is adapted from his new book, "Airpower in the War against ISIS" (Naval Institute Press, 2021).*

Mitchell Institute's Aviation and Air Power Book Series

By Jennifer Hlad

AFA's Mitchell Institute for Aerospace Studies has partnered with the University Press of Kentucky for an aviation and air power series of books that can serve as a go-to reference and resource for anyone interested in military aviation and air power history.

Series editor Brian Laslie—also the deputy command historian at North American Aerospace Defense Command and U.S. Northern Command, as well as an adjunct professor at the U.S. Air Force Academy and the Citadel—said he hopes the series will help "bridge the gap between the academics and the practitioners" and deliver these ideas and scholarship to a larger audience.

One of the first books published in the series is "Lectures of the Air Corps Tactical School and American Strategic Bombing in World War II." Phil Haun, who edited the book, "went back into the archives" and put historic lectures and other documents together in a single volume, Laslie said.

Douglas Birkey, executive director of Mitchell, said the book represents the "intellectual baseline that has guided the Air Force" through its history.

"There is no Sun Tzu or Clausewitz or any equivalent single point for the Air Force," Birkey explained, referencing the military strategists who wrote "The Art of War" and "On War," respectively.

"These lectures, and this intellectual period," are the "bedrock" or "main touchstone" for the Air Force, he said, noting that "prior to this book coming out, it was darn near impossible to get these things, because they were buried down in the archives at Maxwell" Air Force Base, Ala. "This really made it available. And you can't do a complete historical assessment of, really, World War II or other key periods without looking at these things."

The book also includes the air plan for World War II as an appendix, Laslie said: "Everything that we used in World War II … were the foundational documents for our strategy, Phil put into this book."

Another title published in spring 2019 is "Biplanes at War, U.S. Marine Corps Aviation in the Small Wars Era, 1915-1934," by Wray R. Johnson. Laslie said he wanted to make sure Air Force, Army, Navy, and Marine Corps aviation were represented in the series, and this book is "the development of Marine Corps aviation in the interwar period," or "how did the Marine Corps decide what to do with the airplane."

The Marine Corps was involved in several operations during that time period—in Haiti, in the Dominican Republic, in Nicaragua, and elsewhere, Laslie said—and they "developed this idea of supporting guys on the ground, guys who were in close contact with the irregular opponents, so I think what Wray does brilliantly in this book is, [show] the Marine Corps' legacy of how they developed their own use of air power."

"Educating Air Forces: Global Perspectives on Airpower Learning," edited by Randall Wakelam, David Varey and Emanuele Sica, which was published in December, is an edited volume "chock full" of fantastic contributors, Laslie said.

Mitchell Institute

The Mitchell Institute, along with the University Press of Kentucky, collaborate to provide a book series that serves as a historical guide for aviation and air power enthusiasts.

"It's a veritable who's who of air power authors," and focuses on how air forces teach their Airmen and educate their air forces, Laslie said. It includes chapters on the U.S., Germany, Australia, Canada, and the United Kingdom.

"Allies in Air Power: A History of Multinational Air Operations," edited by Steven Paget, comprises chapters from a variety of writers—including Bert Frandsen, Benjamin Lambeth, and Richard Hallion—that examines how air power nations work together, Laslie said.

"If there is an international conflict, it's highly doubtful that any one nation is going to be out there operating alone. And this has kind of become the model of operations. If you go back and look at Desert Storm, and the conflict in the Balkans, and on into, you know, Iraq part two and Afghanistan, I think most people would probably tend to think of those as American operations, but they're not, right? … They're combined operations. So, how do we all work together, or how do air forces of various nations work together?" Laslie said, adding, "The bottom line is, it's instrumental that we work together."

The next book in the series, "Fallen Tigers: The Fate of America's Missing Airmen in China during World War II," by Daniel Jackson, will be published in May. Laslie expects the book to be "really, really popular," in part because of the aerial combat dogfighting, but also because Jackson has "done just next-level stuff" on the Flying Tigers in WWII.

The book includes "the harrowing stories of what these guys went through after they were shot down, attempting to evade capture, and it's equally as much about the Chinese allies who helped our air crews out," Laslie said.

Jackson is "such a colorful and engaging writer," said Jackie Wilson, marketing manager for the University Press of Kentucky. "We're really excited about this release." ✪

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By John T. Correll

RESCUE IN THE CROSSFIRE

Bernard Fisher landed his A-1E on the embattled runway to bring out Jump Myers.

The US special forces camp in the A Shau Valley was a constant problem for North Vietnam. It was two miles from Laos, enabling the garrison to impede traffic on the Ho Chi Minh Trail on the other side of the border. It also lay astride the infiltration route toward Hue and Da Nang.

In 1966, the North Vietnamese Army decided to put the camp out of business and brought a fresh regiment down the Trail to join the NVA division already operating in the area.

The camp was of rough construction, with a barracks, a fort, and an airstrip of pierced steel planking just outside the barbed wire perimeter. High hills rose up on both sides of the valley. Everything, including food and ammunition, came by air. The only real defense was air support. Strength of the camp was 17 US Green Berets and 368 South Vietnamese irregulars and Chinese Nung mercenaries.

National Museum of the USAF

U.S. Air Force Majors Bernard F. Fisher (left) and D.W. "Jump" Myers posed in Vietnam after Fisher rescued Myers from the A Shau Valley Special Forces camp in March 1966.

The attack was begun on March 9, 1966, by a force of 2,000 NVA regulars. Clouds and low-lying fog concealed 20 antiaircraft guns firing from the hills. An Air Force AC-47 gunship flew up the valley at treetop level, strafing the attackers, but it was shot down on the second pass and crashed.

Two A-1E attack aircraft from Pleiku were diverted from other targets and sent to the aid of the fort. The two-seat, single-engine A-1E was propeller-driven but still effective in ground attack.

Leading the A-1E flight was Maj. Bernard F. Fisher, 39, an F-104 fighter pilot until assigned to the Air Commandos in Vietnam. Fisher, a devout Mormon, did not drink, smoke, or use strong language but he was held in high esteem in a squadron of men who did all three.

For the next several hours, Fisher and his wingman collected arriving aircraft, including bombers and transports, above the clouds and led them down the valley. They also suppressed ground fire and broke up the NVA forces massing to attack the fort. Fisher was awarded the Silver Star for the day's work, but there was more to come.

The attack intensified during the night and the defenders reported they could not hold out much longer without help. Half a dozen A-1 pilots, including Fisher and an old friend, Maj. Dafford W. "Jump" Myers, responded. The cloud ceiling was at 800 feet, providing cover for enemy gunners on the hills. "It was like flying inside Yankee Stadium with the people in the bleachers firing at you with machine guns," one pilot said.

Meyer's A-1 was hit hard and went down. The fuel tank exploded on contact with the ground and the aircraft skidded along the runway and blew up. The airstrip was cratered, smoke everywhere, and littered with debris. There were torn shards of pierced steel planking that could rip airplane tires to shreds. Miraculously, Myers was not seriously injured. The next available rescue helicopter was at least 20 minutes away.

There was never any doubt: Fisher would go in to get Myers. He touched down at the far end of the field, veered through the smoke and hazards, and detoured across a grassy area toward the burning A-1. Myers bolted out of the ditch where he had taken cover and ran alongside the airplane with bullets skipping at his heels.

Fisher stopped, helped Myers aboard, released the brakes, and poured on the power, gaining speed to lift off and climb out of the valley. Defenders in the fort cheered as Fisher's A-1 roared down the strip and rose into the air.

The camp fell to the NVA that afternoon, but air strikes subdued the attack enough for rescue helicopters to pick up survivors. The Green Berets took 100 percent casualties, five killed, 12 wounded. Only 172 of the South Vietnamese and Chinese mercenaries got out. Without air power, there would have been no survivors. The NVA paid for its victory with 800 troops lost.

Fisher was awarded the Medal of Honor, the first airman in the Vietnam War to receive it. He remained in the Air Force, retiring as a colonel in 1974. After retirement, he went back home to Idaho and became a farmer, raising seed corn, sugar beets, wheat, and alfalfa. ✪

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