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AIR FORCE MAGAZINE

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AIR FORCE

May 2022 Vol. 105, No. 5

Staff Sgt. Kregg York/ANG

U.S. Airmen run through morning inspections on an F-16 Fighting Falcon at Joint Base Elmendorf-Richardson, Alaska, during U.S. Northern Command Exercise ARCTIC EDGE 2022 on March 7. See "Honing the Arctic Edge," p. 32.

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The new logo for the Air & Space Forces Association. See "Editorial: The Air Force Association is No More, But AFA Lives On, p. 2.

STAFF

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By Tobias Naegele

The Air Force Association is No More, but AFA Lives On

AFA became the Air & Space Forces Association April 7, a historic shift more than two years in the making. The change was authorized last September by delegates to AFA's National Convention, approved March 5 by the Board of Directors, and finalized late that month by its Executive Committee.

Our new formal name will not obliterate our three familiar initials, however. We are still AFA, known by our familiar initials—the same ones used to describe both the Association and its activities, in particular, the annual Air, Space & Cyber Conference held each September and the winter/spring Warfare Symposium. Despite their formal names, those events are "AFA" to the Airmen, Guardians, and civilians who attend them. You can't buy that kind of brand recognition. If you have it, you don't toss it away.

Yet we are not the *same* AFA. We are something new, bigger, more ambitious. Membership is on the rise, attendance at events is booming, traffic to our websites is growing. Our message resonates: Of all the military forces available, the Army, Navy, Air Force, Space Force, and Marine Corps, only two are indispensable in every domain and any campaign: air and space.

The forces have been neglected for much of the past three decades. Dominant and victorious in the first Gulf War and tide-turning in stopping Serbian aggression against Kosovo, air and space power somehow fell out of favor after 9/11, as counterinsurgency became, if you will pardon the pun, the COIN of the realm in the Pentagon. Over the past three decades, the Air Force became the billpayer for one after another critical need. Then-Defense Secretary Robert Gates cut short production of the F-22 fighter, ruling it too "exquisite" for a world of counterinsurgency operations. A new bomber was canceled. Nuclear modernization was delayed. And all the while, the Air Force wore down its combat air power flying close air support missions in support of the Army in Afghanistan and Iraq. Now, the tide has turned.

The birth of a new Space Force in 2019 spurred a reconsideration of what we as an Association stand for.

As in the case of the Air Force, which was born out of the Army in 1947, 44 years after the first flight of the Wright Flyer in 1903, the Space Force trailed the developments and travails of American space exploration. In both cases, decades of technological, tactical, and strategic innovation built on those first improbable inventions.

America's first satellite, like the Wright Flyer, ignited a new era. Explorer 1, launched not long after Soviet Union's Sputnik, awoke Americans to the threats and risks posed by a competitive rival power. It was the beginning of America's drive to re-imagine communications, intelligence, and navigation by mastering the untapped potential of the void beyond our atmosphere. For seven decades space alternately fascinated and frustrated Americans; Apollo won the space race, but at the cost of lives and national treasure. Americans walked on the moon and brought back moon rocks, but no sooner had we reached the moon than America cast its eyes elsewhere. Skylab, the Space Shuttle, and the International Space Station each captured imaginations, but never so much as Apollo.

Indeed, most Americans barely noticed when the Space Shuttle was shut down and abandoned. America outsourced launch services to industry, yes, but also to Russia. Observers, especially China, saw the United States in retreat, and hurried to catch up.

The Air Force and America quietly went about their business. The Air Force gave us GPS and the magic of global navigation and precision timing. Private industry pioneered new launch methods, creating alternative launch partners. New satellite firms designed alternative satellite architectures, and commercial space-based sensing, communications, and more.

Space was a peaceful place and America's offerings were peaceful as well, useful in war, but not weaponized. China and Russia had other ideas. Recognizing America's advantages in space, they saw both something to emulate and targets they might need to destroy. Anti-satellite weapons, both in space and on the ground, followed, as did signal jamming and cyber cracking attacks intended to mitigate against our space advantages.

This is why we now have a Space Force. And why AFA is now the Air & Space Forces Association. AFA, of course, has always advocated for both air and space power. For many years this magazine was called Air Force Magazine and Space Digest; for a number of years, it published a separate Space Almanac. But today, with two distinct military forces in one Department of the Air Force, it is right and proper to acknowledge both entities in one name. We will do the same with this magazine very soon. In the words of Air Force Secretary Frank Kendall, these two forces are one team, engaged in one fight. AFA is fully committed to both.

The new logo that grace's this month's cover combines distinct and important elements of both. The star draws its inspiration from the Hap Arnold star of the old Army Air Forces; the Delta comes from the Space Force; the Polaris a reference to the guiding star and the guiding nature of Space Force's most famous asset, GPS. These are joined together, intertwined as are air and space in any modern operation.

When the Pentagon presented its budget to Congress last month, the numbers seemed staggering to many. The biggest defense budget ever. More money for research and development than ever before. A whopping 4 percent increase in the top line. Yet this budget comes at a time when inflation is running more than 8 percent, when Vladimir Putin's Russia is demonstrating a level of brutality and cruelty that is out of place in the 21st century. This is what happens when deterrence fails—when capability is not matched with will.

The Air Force and Space Force are putting their money where they must. Revamping our nuclear forces, building the future space architecture, and developing the next generation of combat aircraft are the right priorities. But the Air Force and the United States are also suffering from 28 years of being in last place when it comes to funding—relative to the Army and the Navy. As a result, they were forced to defer modernization. Aging aircraft are being retired today because they no longer contribute effectively to the mission; new aircraft are being added at a fraction of the rate necessary to sustain the current force, let alone to bring down the average age of the aircraft needed to meet the nation's security needs.

This is not sustainable. We cannot perpetually postpone the modernization of the force with new aircraft and the systems needed to fight effectively and deter rivals from putting Americans or our allies at risk. The Air Force and Space Force have each presented unfunded priority lists. While even these fall short of the real requirements, both should be funded in full. For too long the Department of the Air Force has been tasked with far more mission than it has been allocated resources to perform.

America's defenses are built on air and space power. Failure to invest sufficiently in real combat power in air and space puts our entire nation at risk. ✪

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What are you solving for?

LETTERS

Protect the Sats

I read Maj. Gen. Lawrence Stutzriem's article "Modernizing Satellite Communication" [December 2021, p. 43] with great interest. I can't disagree with his recommendations to eventually ensure our communications remain available even in the face of our adversaries increasing threats. But I can't believe our responses to these threats would be confined to a defensive posture: no deterrence and no offense.

A confirmed attack on our space assets should be considered an attack on this nation and the attacker should suffer the consequences. For example, a kinetic attack on one of our satellites should bring the immediate destruction of the launch infrastructure that enabled the attack. A nonnuclear ICBM would be all that would be needed to destroy what is an extremely soft target in about 30 minutes, and there is probably only one site to target.

Col. Dennis Beebe,
USAF (Ret.)
Solvang, Calif.

Boomer Goes the Dynamite

In the March issue of Air Force Magazine are two articles concerning the location of the boom operator position behind the cockpit rather than the aft bottom of the fuselage ["World: GAO to Air Force: Think Twice Before Owning KC-46 Tanker Fix," p. 26, and "Letters: Tanker Tanking," p. 4]. I agree with both. My first operational assignment was as a copilot in the KC-97 at Smoky Hill Air Force Base in Salina, Kan., in 1953. The KC-97 was the first boom tanker in the Air Force. It was a modified Boeing Stratocruiser powered by four propeller engines.

This was the beginning of the jet era and the KC-97 was replaced by the KC-135. It is still in the inventory and my grandson pilots them at Fairchild Air Force Base, Wash.

At the time, 1951-1954, my father, Gen. Orval R. Cook, was deputy chief of staff, material. Boeing had asked for funds to manufacture a jet tanker. He told them to manufacture a commercial liner that could be modified. The result was the KC-135.

The solution to the boom operators position is aft bottom of the fuselage where he has eyes on the receiver. Too much time and money has been wasted. The KC-135 is old and a maintenance nightmare.

Peyton Cook
Southern Pines, N.C.

Real Life is Hard

I was both amused and annoyed by the descriptions of the hackers' gripes detailed in the Hack-A-Sat feature of the January/February issue [p. 28]. The contestants whined about "rules changing on the fly and poor communications" during the competition. Given that the purpose of the event is "to find vulnerabilities in earthbound satellite hardware," don't these "deficiencies" actually make the test more representative of the real world and, therefore, of greater potential value to the Space Force sponsors? Events in real-time don't always play nice. It seems that there could be value added (even though unintended) to this competition by learning how to overcome and prevail despite the vagaries of institutional shortcomings and the vote the other side gets.

Of course, every opportunity should be taken to ensure that future competitions

WRITE TO US

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

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AFA's Mission

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

To accomplish this, we:

- **Educate** the public on the critical need for unrivaled aerospace power and a technically superior workforce to ensure national security.
- **Advocate** for aerospace power, and promote aerospace and STEM education and professional development.
- **Support** readiness for the Total Air and Space Forces, including Active Duty, National Guard, Reserve, civilians, families and members of the Civil Air Patrol.

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are optimally productive, but the useful role of uncertainties in the event should not be ignored and should be incorporated, when appropriate. Ultimately, the real metric should be the potential value to the Space Force's decision-making process, not whether the contestants' egos were appreciatively coddled. Unfortunately, the article only describes the validity of the decisions about who won prizes. Nothing is said about the actual benefits that may have been realized by the Space Force, which is unfortunate.

Hank Caruso
California, Md.

Facing Russia

If DOD is being cowed by Russia's threat to use nuclear weapons, then our own nuclear weapons are of no practical use: We will continue to back down to whomever threatens the first use of nuclear weapons just to avoid any use of such weapons ["World: Russia Tests NATO Resolve Over Ukraine," March, p. 22]. We will be blackmailed into backing down worldwide by this threat (no matter how credible).

If, however, the military advice being given to President Joe Biden is not being accepted (and this would be the second crisis in which that would appear to be the case), it is the President's responsibility to explain to us why, ask for resignations, and to demand better (or different) military advisers.

In the not-too-distant past, honorable military advisers whose advice was consistently ignored on such important issues would feel honor-bound to submit their resignations. This accomplishes two goals: The public knows whose advice is being ignored and the President is free to get (hopefully) better military advice from a new group of advisors.

As of now, we've had no resignations, so we must assume that our DOD, led by the SECDEF, is so risk-averse to using all available military options that they are compromised in the performance of their duties and should be replaced.

I spent over seven and a half years in NATO and I can guarantee that they are world-class ditherers. Without American leadership, which is currently nonexistent, NATO will not act. Beyond Polish MiG-29s, we should already have accomplished the following:

1. Stand-up NATO nuclear forces and put a portion of them on five-minute/cockpit alert. (They are not now standing nuclear alert.)

2. Move NATO ground and air forces forward into Poland, Slovakia, Rumania, and the Baltic States. (NATO forces far outnumber Russia's.)

3. Share real-time targeting of Russian forces with Ukraine.

4. Commence drone/air strikes upon all Russian forces within Ukraine, followed by a demand for all Russian forces to return to Russian territory outside of Ukraine.

Russia has exposed its military as a brutish, unprofessional hoard which does not attempt to abide by the laws of armed conflict to which it has agreed. It does not deserve any benefit of doubt as to its further intentions and appeasement doesn't work. By threatening NATO with nuclear blackmail (as it already has), Russia has exposed its real intent and that is simply to subjugate or neuter the entire continent, ridding it of U.S. influence while eliminating NATO.

By not standing up to Russia, NATO and DOD may already have ensured that when confrontation is no longer avoidable, when we have backed up as much as we can back up, it will necessarily be much bloodier and perhaps involve weapons of mass destruction. The time to act is rapidly passing us by and our

SECDEF seems unable to change this all-too-familiar European outcome from, once again, coming about.

Lt. Col. Marshall Miller,
USAF (Ret.)
Piedmont, S.D.

Questions Unasked

The editorial on "Truth and Consequences" by Tobias Naegele in the March 2022 issue [p.2] was thought-provoking on how to evaluate news stories in general. He mentioned a "foundation of disconnected truths" that contributed to a "false story"—the plane really did crash; the military really does require COVID-19 vaccination; myocarditis is a real, if rare, adverse effect of mRNA vaccines. But what concerned me were the questions not asked: was the F-35C pilot recently vaccinated and if so when, relative to the incident; did the "black box" really record the pilot's complaints of chest pains which he attributed to the vaccine; have there been other complaints, or surveys, of fighter pilots regarding symptoms and signs post vaccination, and if so when and under what conditions, etc.?

As a senior flight surgeon I recognized that the physiological stresses of flight, particularly aboard fighters vs. cargo aircraft for example, often impaired, or could have impaired, the physiological functioning and health of the crew member; this is why we would ground aircrew for illnesses and complaints that would minimally interfere—if at all—with health and function at a desk job. I should hope that the Surgeons General are investigating, with confidential surveys and other tools, the effects of the COVID-19 vaccines on aviators and keeping these data. I understand, from personal experience, that sometimes line commanders do not appreciate health and medical findings and analyses that they perceive as interfering with operational readiness.

However, the issue of the combination of mRNA vaccinations with the unique stresses of flight, and the effects on short-and long-term aviator health and functioning, needs to be addressed. It is conceivable, though not at this point proven, that combining high loads of physical stress with a vaccine that has been shown to cause myocarditis/pericarditis on rare occasions in the civilian population, especially young males, can possibly exacerbate these adverse health effects. Might this be why we've recently had several soccer (football) players who've suffered heart attacks despite being in top physical condition?

Col. Glen I. Reeves,
USAF (Ret.)
Sun City, Ariz.

More Discomfort

I was disappointed by a number of the letters in the March issue, but not surprised ["Letters: Definitely Uncomfortable," p. 4]. Militaries, by their nature, are authoritarian and many of its members tend to be uncomfortable with and resistant to change. The same resistance to change also applies to societies. We saw resistance to President [Harry S.] Truman's order to take down racial barriers in our armed forces and sadly that resistance has continued not only in the armed forces but also across much of our society, despite laws regarding civil rights.

There has been similar resistance to the changes involved in opening up our society, and our armed forces to women, and now we are seeing resistance to the relaxation of rules regarding gender identities. To some extent this opposition to increased racial and gender diversity is because of the threat it poses to those who have profited by the lack of diversity. And while the letter writers may be correct regarding some short-term loss in capabilities when barriers to individuals created by discrimination are removed, they are seriously wrong in the long term because changes that embrace diversity make our armed forces, our society, and our economy stronger and far more capable.

Anyone who has doubts about the value of increased diversity need only look at what is happening in Russia and other authoritarian nations and compare the strength of their armed forces, societies, and economies to that of the United States.

Lt. Col. Price T. Bingham,
USAF (Ret.)
Melbourne, Fla.

Disjointed

To help keep myself informed of what's current in the joint force, I subscribe to all of the service's professional journals as well as the various associations such as this magazine, AUSA, and the Navy's Proceedings. It's more than disappointing to read the persistent slant in this publication not just toward certain political agendas (which isn't altogether surprising considering the lobbying nature of AFA), but the constant derision of other services, in particular the U.S. Army.

No one service alone can hope to successfully defeat any of our nation's adversaries, and yet readers of Air Force Magazine are fed a steady diet of how "decisive" the USAF is and how money needs to be moved now(!) from the U.S. Army's budget to USAF. Where is the introspection that I see in the other service's publications?

There is certainly enough blame to go around, mostly internal to USAF, about the state of the current force. Lobby and complain all you want about the budget, but once it's been set, deal with the realities. Look at ways to increase the capabilities and scope of your current equipment and personnel. Discuss ways to reduce costs such as upgrading certain parts of the fleet instead of new purchases or cut the number of personnel (broaden the skill set of aircraft maintenance personnel instead of being so incredibly specialized).

Open your eyes and see how the other services are doing things now that can actually help USAF's mission effectiveness and survivability. In short, be part of the team.

CW4 Charles Boehler,
NMARNG
Albuquerque, N.M.

Reunions

■ **Air Force Technical Applications Center** (AFTAC) Alumni Association Reunion, May 18-22, 2022, at The Radisson Resort at the Port in Melbourne, Fla. **Contacts:** Sean Ryan, Chair AFTAC (ocenablueview@yahoo.com) (321-591-9053) or Phil Godfrey, Vice Chair (afsophil@gmail.com) (321-446-8775) (www.acompletereunion.com/aftac).

■ **Laredo AFB, UPT Class 74-02**, (50th reunion) United Snakes of Laredo. Sept. 18-20 or Sept. 25-27, 2022, in Las Vegas. **Contact:** Fred Harsany (fharsany@gmail.com) or Facebook: Class 74-02 Laredo (Group).

Unit reunion notices should be sent three months ahead of the event to letters@afa.org, or mail notices to "Unit Reunions," Air Force Magazine, 1501 Langston Blvd, Arlington, VA 22209-1198. Please designate the unit holding the reunion, time, location, and a contact for more information. We reserve the right to condense notices.

VERBATIM

Joined at the Hip

Courtesy photo

"Ultimately, the success of the Space Force will be determined by how our contribution to the joint and combined team fight is valued by other members of the team. ... They need us; we need to help them understand that fact. We won't achieve that goal if we focus too much on the separateness and independence of space as independent warfighting domain."

—Secretary of the Air Force Frank Kendall speaking at the Space Symposium in Colorado Springs, Colo., on April 5.

Above and Beyond

"Warrior culture is required to make this strategy possible ... unleashing and empowering incredible Airmen and families biased toward action, unencumbered by bureaucracy, and intentionally disruptive to the status quo. We will tolerate nothing less. ... I need you bothered, like me, to work harder, move faster, and passionately enable our operational wings to make our missions and people more successful."

—Gen. Mike Minihan, commander of Air Mobility Command, speaking to Mobility Air Forces leaders outlining his "strategy to win" during a Spring Phoenix Rally, MacDill Air Force Base, Fla., March 29.

Armed Forces of Ukraine/Facebook

Need to Modernize

"I think the Ukrainians are right—you're basically a target in the air if you don't have any of that modern capability. It's not just an airplane up there. You have to have all of that sophisticated equipment on it to make it really a viable air platform."

—Gen. Herbert "Hawk" Carlisle, USAF (Ret.), former commander of ACC, on the Ukrainian Air Force using old jets to fight against a better-equipped, modern Russian air force [The Washington Post, April 13].

SPEAKING MY LANGUAGE

Senior Airman Jose Miguel Tamondong

"Ukraine just demonstrates even more, what matters to these guys is presence and power. And when you start to build ports, when you start to bring up icebreakers, when you start to bring up Navy shipping, when you have over 100 fifth-gen fighters in the Arctic in Alaska, we're starting to now talk Putin's language.."

—Sen. Dan Sullivan (R-Alaska), on strengthening U.S. military presence in Alaska [The New York Times, March 29].

Light Years

Sumitkumar Share/Pixabay

"It is no longer one small step. It's not even just one giant leap, it is the promise of a transformed world."

—Principal Deputy Director of National Intelligence **Stacey A. Dixon,** referring to the space domain, Space Symposium, Colorado Springs, Colo., April 4.

WE'D RATHER NOT

"We're ready to be killed. But we don't want this, of course. We want to kill Russians and take down their bombers that are killing our cities and our families."

—Ukraine Air Force pilot "Juice" (only call sign provided for security reasons), on the Ukrainian Air Force's fighting against a more modern Russian air force [The Washington Post, April 13].

WELL CONNECTED

"This is a conflict that's playing out for millions of people on social media. That wouldn't happen without an Internet connection."

—Doug Madory, Kentik director of Internet analysis, comment on resilience of Ukraine's internet despite Russian cyberattacks [The Washington Post, March 29].

Semper Supra

The first Chief of Space Operations and the Space Force's very first member, Gen. John W. "Jay" Raymond, shared some time at the Space Symposium in Colorado Springs, Colo., in April with Air Force Magazine's Amanda Miller to talk about the past and future of the new service and of space itself.

Q: What qualities have you found are needed in a CSO?

A: In some ways, it's the same qualities as all the other service Chiefs. You have to have competence, you have to have credibility, in the business that you're in. You know, it's interesting. The Secretary of the Air Force has all the authorities. The Chiefs have influence. So that combination, the partnership, between the service Chief and the Secretary is so critical. … I think you also have to have the ability to connect with people, and that's one of our core competencies ... connection.

If I look at the Space Force-unique aspects of it, as a new service, I think, courage … not physical courage, but the courage to make decisions and to be bold. Our goal is not to just incrementally change from where we were.

This is an opportunity to build a new service. It hasn't happened since 1947. … Our goal was to be bold, and in that boldness, it takes a lot to get that through a bureaucracy.

Q: You've mentioned how important it is for the CSO to have a "seat at the table." When were a couple times that really mattered?

A: I think it was very important when the law was passed establishing the Space Force that it designated, like all the other services, that the Chief is a member of the Joint Chiefs. And in that role, I have a seat at the table in helping build and shape our National Defense Strategy, in helping build and shape our joint wa fighting concepts. … Although I bring space expertise to the table, obviously, I also, as a member of the Joint Chiefs, think more broadly about the joint force.

But if you look at the challenges that we face today, they're global, multi-domain. That's the way I grew up. So I feel like I've been beneficial in helping shape strategies and concepts as a member of the Joint Chiefs.

As a service Chief, you have a seat at the table on the requirements that I never had before as a major command commander. And you have a seat at the table in budget as an independent service, not as a MAJCOM.

Q: On the trappings of a new service—symbols, uniform items, and the like—which have worked out the best, and which have gotten panned?

A: The thing that received widespread praise was our motto, "Semper Supra." And that came from a young public affairs Airman in Europe. He sent me an email, and he said, 'Sir, I've got the greatest motto for you, 'Semper Supra."

He walked through what all the other services' mottos were and how this kind of fit in alignment with that. It was perfect, "Always Above," for the space domain. It was just a perfect fit. And it was like immediate—I knew that was it. So, I told him, 'Hey, I like it. We're going to try to make that happen.' And it has received widespread support, and people are signing their email 'Semper Supra'—I mean, it's really been a really good motto.

USSF

CSO Gen. John "Jay" Raymond speaks during the 37th Space Symposium in Colorado Springs, Colo., April 5.

The things I would say—I think the term you used was 'panned,' right? What I would say is that the challenge that we have is a lot of the cool space stuff is in science fiction … or movies, pop culture—so not just science fiction. You know, there was talk about the logo being 'Star Trek.' Well, it wasn't. If you go look at the logo from Air Force Space Command, the delta, the orbit, the North Star is all there. If you look at 'Guardians,' people said we stole it from 'Guardians of Galaxy.' We didn't. Space Command was 'Guardians of the High Frontier'—that was our motto since 1982.

There's so much excitement about space, and there's so much pop culture about space, getting something that excites the force, without something that's already in some way been used by somebody else—it's almost impossible.

But the things we picked were very purposeful. They were rooted in our history. And I would tell you, they have widespread support across the members of the force.

Q: What is the status of the service dress uniform?

A: We came up with a prototype, and we rolled it out at AFA in September. After that, we took it on the road, and we went to pretty much every major installation that had Guardians and got their input.

If I'm not mistaken, it was [an] 81 percent favorable rating. And if you looked at the young Guardians, it was off-the-charts favorable. And so if you get 81 percent on anything, it's like a home run, and we're excited about the uniforms.

We've slapped the table on the final design of the Space Force uniform. It now goes into production. The Army logistics process takes over. The material gets wear-tested and color-tested and all of that, and then it goes through production. The challenge that we face is that by law, everything that is on a uniform has to be made in the United States.

There are only two fabric companies in the United States that

we can use, and the supply chain issues due to COVID have really put that industry in a bit of a bind. We're accelerating as fast as we can, but we're going to be paced by how fast the supply chain can produce.

Q: What's the recruiting situation like now, and what will it look like in five or 10 years?

A: First of all, I think it's one of the big success stories that we've had with the establishment of the force, is the advances we have made in all aspects of professional development. From recruiting to access to training throughout their careers to promoting, we have made strides on all fronts.

The recruiting picture for us is probably one of the biggest strengths that we've had. We only take about 450 enlisted Guardians a year—between 450 and 510—and about the equal number of officers. So we're really small in comparison to any other service. That allows us to do a couple things.

First, it allows us to completely redo how we recruit. The way we recruited in the past is those recruiting stations all over the country. If somebody comes in ... Colonel Hague were to come in to the recruiting station, and knocks on the door, and says, 'I'm interested in space' and met the qualifications, we'd take her. And the first 450 kind of got signed up. What we decided to do is rather than just take the first 450, let's be a little bit more selective.

So ... we use the recruiting stations to garner the pool of people. Then we make them write essays. And then we have boards, and we actually pick who is going to come in because we can, because of our numbers. So we're probably—not probably—we are the most selective service there is.

We have more people knocking on our door than we can take, and I think that's going to continue.

Q: Can you share details about the new force designs from the Space Warfighting Analysis Center?

A: So what we do is, we have ... set up an organization called SWAC, the Space Warfighting Analysis Center. They are force design experts. It's a small organization of big-brain Ph.D.s, coupled with some of our best operators. And they do all the analytical work to figure out what the force structure in space should look like. Should it be five big satellites, or should it be a hundred proliferated satellites, as an example? And what orbit should they be in? Should they be in geosynchronous orbit; should they be in low-Earth orbit; should they be in medium-Earth orbit?

And they do the design with several things in mind: First, how best to accomplish the mission; what's the best design to do mission accomplishment?

Second, what's the best force design to be more resilient to a threat? Third, what's the best force design as it relates to cost? [Fourth,] what's the best force design as it relates to integrating data into into the broader joint force?

There's others, but those are some of the biggies that they build into the calculus to determine what's the right answer.

Q: How does the 2023 budget help you progress toward Secretary Kendall's first operational imperative of "resilient and effective space order of battle and architectures?"

A: It's critical that we shift to a more resilient, defendable, mission-capable architecture ... [SWAC does]that analysis, to help us to determine how best to make that shift and what it is that we're shifting to.

The highest-priority mission that we have is missile warning/missile tracking. And so that was our first priority—that's the first design work that we've done, and that design work has been done over this past year.

This budget implements that design, takes the first step at that pivot to move away from large, exquisite satellites to a more proliferated architecture. That work all nests under the Secretary of the Air Force's operational imperative No. 1, which is designing a resilient space order of battle. That's the work that we've been doing for ... well over the last year, and that work was going to continue now as we progress into other mission areas, like data transport in space, tactical ISR in the future, GPS. [For] all of those capabilities we will do force design work to see if there's a pivot that's required.

Q: How many more events like the Russian anti-satellite test in 2021 could the environment sustain before it becomes unusable or exceeds the U.S. ability to track and maneuver?

A: We say that space is congested, contested, and competitive.

If we were doing this interview two years ago, I would have told you, there's about 22,000 objects in space that we are tracking; and there's about a half-a-million objects that are too small for us to track. Today that number of objects that we're tracking is 43,900 objects. So it's almost doubled.

The other thing I would have told you a couple of years ago: Of that 22,000 objects, only about 1,500 were satellites. Everything else was debris. Today, I'll tell you that the number of satellites is nearly 5,000 because of these proliferated, low-Earth-orbit constellations that are being launched.

So we see space as being congested today, and we see that just growing in the future. We act as the space traffic control for the world. We track all the debris; we track every object in space; and we do all the analysis on every object against every object to see if anything's going to collide.

And if we think that there's a potential that there's a collision, we provide a warning and tell people to move to keep that from happening.

It's manageable today. There have been a couple of big events, though—several big events—that have caused a significant portion of this debris. One was a Chinese anti-satellite test in 2007, which caused over 3,000 pieces of debris. It was pretty high up in low-Earth orbit, and almost all that debris is still there. ...

In 2008, there were two satellites that collided, and that caused about another 3,000 pieces of debris. And after that time, we started acting as the space traffic control for the world to keep that from happening again.

The Russian recent ASAT is about 1,500 pieces of debris. It was a little lower than what the Chinese did, but it was still high enough ... that debris will be with us for quite a while. ...

The way you solve the debris problem is quit creating debris in the first place ... things like acting as the space traffic control for the world so things don't collide; not doing irresponsible activities like blowing up satellites and [generating] the long, long-lasting debris; having better engineering standards on your rocket so when you do launch, you don't litter the domain with debris; having better engineering standards so when satellites reach the end of their life, they don't break apart into pieces. All of those things we can do to reduce the creation of debris in the first place.

There's lots of folks that are out there ... coming up with technical solutions on how they might go up and retrieve debris and clean up. It's a big problem. ... Space is very large, and things are moving really fast. So we're trying to handle this by being responsible actors in space, being transparent with the world—we've warned China that they're about to hit a piece of debris that they created in 2007. And we'll do the same thing for Russia, and we do that for the world because we want to keep the domain safe for all. ✪

Airman 1st Class Lance Lynch, left, and Senior Airman Gregory Hogle conduct a preflight inspection on a B-52H prior to take off from Andersen Air Force Base, Guam, in March 2022, as part of Pacific Air Forces' Bomber Task Force Mission. Such missions, performed in Europe, the Indo-Pacific and North America, aim to deter aggression by demonstrating the United States' ability to operate anywhere in the world, at any time.

Senior Airman Jonathan Ramos

Airmen and Guardians assemble a satellite training dish at Peterson Space Force Base, Colo. USSF's Space Delta 8's 4th SOPS is responsible for ensuring secure military satellite communications, day-to-day command and control, communications payload management, and ground segment maintenance for protected MILSATCOM systems. Peterson has a long history of supporting the Air Force's space operations and became a U.S. Space Force Base on July 22, 2020.

Tech. Sgt. J.T. Armstrong/USSF

Staff Sgt. Rafael Del Real, a military working dog (MWD) handler, carries his working dog Kevin during a ruck march, as part of a competition at Ali Al Salem Air Base, Kuwait. The MWD teams competed in events including explosive detection, a 2.45-mile ruck, an obedience portion, and various scenarios to test the teams endurance, communication, and knowledge. Participants included Navy and Army teams.

Tech. Sgt. Patrick Evenson

Airman 1st Class Yosselin Perla

Four F-35A Lightning IIs fly in a formation during a mission over the Indo-Pacific region, March 4. The fiscal 2023 request includes $56.5 to advance air power, including 33 F-35 fighters for the Air Force.

OSD Sends New Defense Strategy to Hill

By Greg Hadley

The Pentagon's $773 billion fiscal 2023 budget request, released March 28, is highlighted by inflation, a classified new National Defense Strategy, and a continued focus on China as the pacing challenge, while also categorizing Russia as an "acute" threat.

When accounting for inflation, the top line represents a growth of 1.5 percent over the fiscal 2022 appropriations approved in March, Defense Department comptroller Michael J. McCord told reporters. Without inflation, it is a 4 percent increase.

A few weeks after the budget release, top military brass went to Capitol Hill, saying the top line would be enough to pursue the Defense Department's goals of modernization to match the threat of China and Russia, while also acknowledging the budget was built on "inaccurate" rates.

"This budget assumes an inflation rate of 2.2 percent, which is obviously incorrect because it's almost 8 percent," Chairman of the Joint Chiefs of Staff Gen. Mark A. Milley said. "And it might go up, it might go down. But most forecasts indicate it's going to go up, and it could level out at 9 or 10 percent. Who knows? But it's clearly higher than what the assumption was in this budget."

The 2023 request marks a $30.7 billion increase over the $742.3 billion enacted budget for fiscal 2022. But nearly half of that increase—some $14 billion—was attributed to the Pentagon's need to incorporate a "goods and services inflation increase in our buying power," McCord said. Another $6 billion went to increases in compensation for personnel, including a 4.6 percent pay raise for service members and civilian employees, increases in the Basic Allowance for Housing and Basic Allowance for Subsistence, and a raised minimum wage for contractors.

Still, McCord and other Pentagon officials stressed that concerns about inflation, which has hit record highs in recent months, is difficult to project forward and subject to change.

"We built into this '23 budget the best information that we had at the time we built the budget," Deputy Defense Secretary Kathleen H. Hicks told reporters in March. "As in any year, we're going to be working that as we get closer to the reality, and even in execution, we'll have to work on that."

The 2023 budget request, McCord said, "is directly informed by the new National Defense Strategy … which in turn, builds on the Secretary's message to the force and outlines our defense priority."

The full text of that new NDS is still not public—a classified version was presented to Congress, while an unclassified fact sheet was released along with the budget.

The strategy outlines four defense priorities, nearly all of which can be directly tied to China. They are:

- "Defending the homeland, paced to the growing multi-domain threat posed by the PRC [People's Republic of China].
- Deterring strategic attacks against the United States, allies, and partners.
- Deterring aggression, while being prepared to prevail in conflict when necessary, prioritizing the PRC challenge in the Indo-Pacific, then the Russia challenge in Europe.
- Building a resilient joint force and defense ecosystem."

McCord outlined three main ways the 2023 request funds the new strategy: integrated deterrence, campaigning, and building enduring advantages.

INTEGRATED DETERRENCE

Integrated deterrence, which incorporates a broad range of capabilities across domains and locations to deter adversaries, has been a frequent theme of DOD leaders for months. The 2023 request includes $276 billion for procurement and research and development—the largest-ever such request. This includes $56.5 billion to advance air power, with the procurement of 61 F-35s across the department, of which 33 will be F-35As for the Air Force, as well as 24 F-15EXs, 15 KC-46s, and the B-21 bomber, among others. It also includes more than $34 billion for modernization across all three legs of the nuclear triad and $24.7 billion for missile defense.

"The three legs of the nuclear triad provide mutually supporting capabilities, and our investment to modernize the triad will help ensure that nuclear weapons continue to deter aggression and protect our allies and partners," said Vice Adm. Ronald A. Boxall, director of force structure, resources, and assessment for the Joint Staff.

Also included in integrated deterrence is the Pentagon's efforts in long-range fires, particularly hypersonic missiles. With $7.2 billion total in funding, the budget calls for the Army to be the first to field a hypersonic missile in 2023, followed by the Navy in 2025.

The Air Force, meanwhile, isn't scheduled to field a hypersonic cruise missile until fiscal 2027—the 2023 budget completes prototyping for the Air-launched Rapid Response Weapon, but it doesn't actually procure any of them, Boxall said.

CAMPAIGNING

Campaigning "refers to being intentional about the actions you take in your presence, in your posture, all of the things that you do on a more day-to-day basis, especially in the combatant commands, to achieve your strategic ends," McCord said.

In the Indo-Pacific, that means prioritizing China, with $6.1 billion for the Pacific Deterrence Initiative. Much of that funding goes toward new missile warning and tracking architecture, the defense of Guam, and more training and experimentation in the region, McCord said.

For Europe, campaigning means recognizing Russia as an "acute threat," a phrase repeated by officials across the budget rollout and a seeming nod to Russia's recent invasion of Ukraine. That invasion has sparked a strong response from the U.S. and NATO leaders, and the budget request includes funds to provide assistance to Ukraine as well as more than $5 billion for security cooperation and updated capabilities with allies.

But while the Russia-Ukraine conflict has drawn global attention, its effect on the 2023 budget was limited, McCord claimed.

"We did not feel that what is happening today altered the picture that China is the No. 1 issue to keep our eye on," McCord said. "Obviously you can draw your own conclusions about Russia's performance on the battlefield … but … all these documents were pretty much finalized some time ago, so this is not attempting to be a commentary on what's happening last week or the week before."

BUILDING ENDURING ADVANTAGES

Efforts to build enduring advantages run the gamut, from investments in personnel issues and military construction, to funds dedicated to dealing with the effects of climate change, to a record-breaking research budget.

For service members, in addition to the 4.6 percent pay raise, the budget also includes increased fee assistance for child care, $2 billion in family housing construction, and another $1.3 billion for quality-of-life and medical facilities.

Other efforts to bolster talent retention and support for service members include expanded diversity, equity, inclusion, and accessibility initiatives and $479 million to implement the recommendations of the Independent Review Commission on Sexual Assault in the Military, which DOD leaders have pledged to follow.

For research and development of future capabilities, the budget calls for $130.1 billion, the largest RDT&E budget ever and a 9.5 percent increase over the fiscal 2022 budget, itself already the largest research budget ever. Technologies such as artificial intelligence and 5G are particular focus points for more research.

And for the first time, the budget breaks down just how much money the entire department is spending on climate change initiatives: $3.1 billion, with $2 billion for installation resiliency, $807 million for science and technology, $247 million for operational energy, and $28 million for contingency preparedness.

The decision to separate out the funding for climate change is in keeping with the Biden administration's stated focus on the issue as a national security threat, but it does raise the possibility that some lawmakers may try to target the account while making cuts or shifting funds within the budget.

Hicks, however, expressed confidence that wouldn't happen.

"I don't think it creates an attack surface [for lawmakers]," Hicks said. "I think it demonstrates the administration's commitment to ensuring we are resilient. We have to be resilient to cyber threats. We have to be resilient to climate change. Every lawmaker comes from a state or district where they are seeing the effects firsthand: rising sea levels, drought, fires, hurricanes, … and that affects our installations. So we've seen a clear alignment in a bipartisan way with Congress on the installation resiliency piece of this."

LIKELY BUDGET BATTLE IN CONGRESS

While Hicks may not expect a battle over the budget's climate initiatives, it seems likely that there will be a real push by some in Congress to increase the budget's overall top line, given the impact of inflation and pressure by many lawmakers to increase spending for 3 percent to 5 percent real growth.

Already, Sen. Jim Inhofe (R-Okla.), ranking member of the Senate Armed Services Committee, has released a statement saying "this budget neglects to sufficiently account for historic inflation. The Pentagon's inflation assumptions for 2023 are almost certainly low, nor does the budget make up for current record inflation rates."

During the April House Armed Services Committee hearing in which Milley testified alongside Defense Secretary Lloyd J. Austin II and McCord, Rep. Mike Rogers (R-Ala.) argued inflation would have a detrimental impact on readiness and modernization efforts.

"Nearly every dollar of increase in this budget will be eaten by inflation," said Rogers. "Very little, if anything, will be left over to modernize and grow capability."

A similar process unfolded in the last budget cycle. President Joe Biden's budget request of $715 billion for DOD in fiscal 2022 was a slight decrease when adjusted for inflation, and Congress quickly moved to increase that top line, with bipartisan support from the Senate Armed Services Committee and the House Armed Services Committee. ✪

DAF Seeks 'Transformational' Change in 2023 Budget

By Abraham Mahshie and John A. Tirpak

The Department of the Air Force is requesting $234.1 billion in its 2023 budget request, of which $40.2 billion is "pass-through funds," or money the services will never see, while $169.5 billion is for USAF and $24.5 billion is for the Space Force. The budget request looks to cut 250 aircraft, including 33 fifth-generation F-22 stealth fighters and the majority of the AWACS fleet, to pay for additional research and development, long-delayed nuclear modernization programs, and the growing Space Force. It also significantly reduces the F-35 buy.

The 2023 budget request represents a $12 billion increase over the $182 billion enacted by Congress in 2022—one of the largest increases in years. Air Force Secretary Frank Kendall said the 2023 request attempts a "transformational" change in the services, motivated by China's rapid modernization and taking into account Russia's invasion of Ukraine.

Research, development, test, and evaluation would get a 20 percent boost when compared to the 2022 budget request, while procurement would get a 15 percent increase. Operations and maintenance would go up 4 percent, while military personnel accounts and military construction would increase by 2.3 percent and 2 percent, respectively.

The service would pay for much of the R&D increase by retiring some 150 aircraft, including the bulk of the E-3 AWACS and E-8 J STARS fleets, and about a sixth of the inventory of Air Force's premier air superiority fighter the F-22. USAF would also transfer 100 MQ-9 Reaper remotely piloted aircraft to an unnamed federal agency, so its total reduction comes to 250 airplanes. On the plus side, it is buying 82 new aircraft, for a net change of 158 fewer airplanes.

In last year's budget request, USAF wanted to retire 201 airplanes and buy 91. Congress allowed all of the divestments, with the exception of 42 A-10 Warthogs.

"What drives that is the threat," Kendall told reporters. "We need to move aggressively." Chief of Staff Gen. Charles Q. Brown Jr.'s "accelerate or change" motto "is very apt," Kendall said. Despite the "acute concern" over Russia's invasion of Ukraine, China remains "the pacing threat," he emphasized.

Kendall said the budget was built expecting "aggression" from Russia against Ukraine or from China against Taiwan in the Indo-Pacific. "Those of us who had access to the intelligence were not surprised by what happened," he said. "And so, our planning took into account that this type of event could occur."

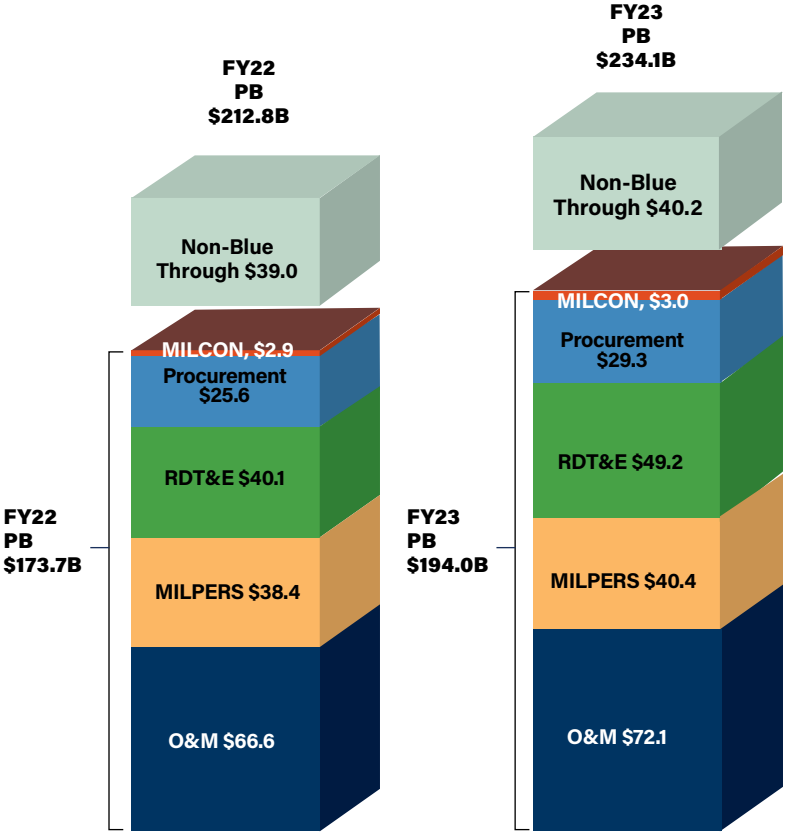
While the services for many years funded their war consumption and recapitalization of lost assets under the "Overseas Contingency Operations" account, such funding is now either funded through the base budget or a special congressional appropriation.

The boost in R&D, however, is only a "down payment" on future capabilities, he said. There will be more "hard choices" coming in the fiscal year 2024 budget and the outyears, Kendall warned.

The budget makes a big payment on the Ground Based Strategic Deterrent (GBSD), increasing funds by $1.1 billion as the service moves toward an initial operational capability date of 2029. It also adds $354 million to the B-21 bomber program to continue engineering, manufacturing, and development and to support nuclear certification. The Space Force budget, meanwhile, invests heavy in missile warning and tracking, air and ground moving target technology, and space domain awareness, senior Air Force leadership told journalists at a budget preview briefing.

Breaking Down the Fiscal 2023 Budget Request

The Department of the Air Force requested $234.1 billion in its fiscal 2023 budget. Of that, $40.2 billion is considered "pass-through" money, or funds that pass through the Air Force's budget but are not controlled or managed by the department. The Air Force's actual budget top line, or blue budget, is $169.5 billion in 2023, while the Space Force would get $24.5 billion.



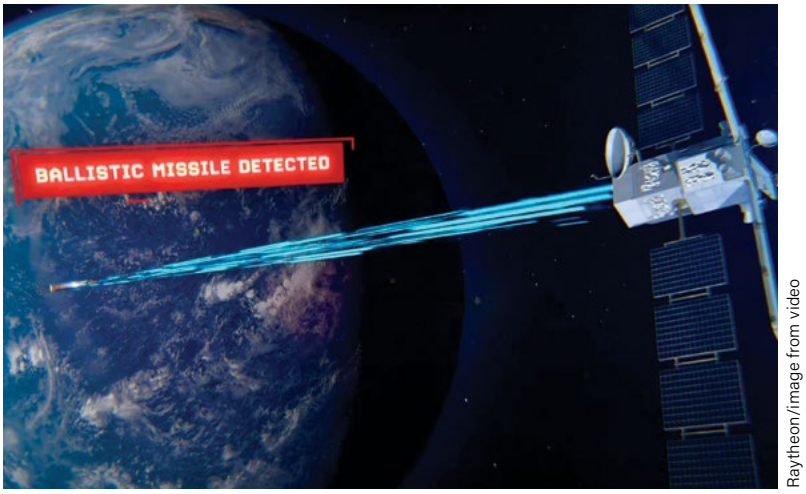
Source: Department of the Air Force

While air mobility is largely set, Kendall noted, "the transformation is more focused" on "the tactical side and the global strike side."

The budget only provides for 33 F-35 fighters, versus previous years' requests for 48, and Congress' frequent adds above even that level. Kendall said the reduction was to buy some time for Lockheed Martin to fix problems with the Technical Refresh 3 upgrade that makes the Block 4 version possible. He insisted that the Air Force "remains committed" to the F-35 and to the total buy of 1,763. "We'll probably be buying the F-35 another 15 years," he said.

The budget also calls for a speed-up in the acquisition of the F-15EX, which doubles from 12 bought last year to 24 in FY23. Kendall said there's an "opportunity" to replace the existing F-15C fleet with F-15EX, and the plan is to buy them as swiftly as possible.

Retired Lt. Gen. David A. Deptula, dean of AFA's Mitchell Institute for Aerospace Studies, said the F-35 buy is the "smallest number in years."



Raytheon/image from video

Raytheon and Northrop Grumman were selected to design the payload for its Next-Generation Overhead Persistent Infrared Resilient missile warning satellite. USSF will invest $1 billion in 2023 to field this new constellation.

"Given an F-35A production line that today can build 80 F-35As annually, this is truly high-risk to a vital program," Deptula said. "The choice to accelerate purchases of the F-15EX—a valuable, but technologically inferior airplane—is helpful, but not adequate to shore up the Air Force's declining combat capacity. USAF's FY23 budget request results in numbers less than those required to sustain existing force structure. Congress should not allow that to happen."

The 33 F-22s being retired are of the Block 20 model and are used as training airplanes. It would be too costly to modernize them to a combat-capable configuration, said USAF budget director Maj. Gen. James D. Peccia III. Even so, the remaining F-22 fleet would get $344 million for sensor upgrades and other improvements.

There's also $113 million in a line item for "Autonomous Collaborative Programs," the unmanned tactical and strategic platforms Kendall sees as complementing the B-21 and Next-Generation Air Dominance fleets. Though he noted it's not yet a program of record.

Research and development accounts for 25 percent of the total Department of the Air Force budget, or $49.2 billion, divided between $33.4 billion for the Air Force and $15.8 million for the Space Force.

GBSD tops the Air Force category with a $3.6 billion investment, followed by the B-21 at $3.25 billion.

Research, Development, Test, and Evaluation investment also calls for a $1.66 billion investment in the Next-Generation Air Dominance (NGAD) sixth-generation fighter and $1.08 billion in the F-35A. The NGAD investment is for advanced sensors and air vehicle technology.

Hypersonics research is proposed to receive $577 million divided between fighter-launched Hypersonic Attack Cruise Missile (HACM) and the bomber-launched Air-launched Rapid Response Weapon (ARRW). Kendall has said he plans to reduce the emphasis on hypersonics because while they are an asymmetric necessity for China, USAF has different priorities. Peccia said that most of the $138 million increase would be directed toward HACM.

The Space Force will absorb the Space Development Agency (SDA) budget in 2023, and invest an additional $1 billion for the ground and geosynchronous orbit space segments of the Next-Generation Overhead Persistent Infrared (OPIR) missile warning system, a constellation of new satellites. In all, Next-Gen OPIR would be slated for $3.48 billion.

Another $1 billion would go to resilient missile warning and missile tracking to address hypersonic weapons and maneuverable reentry vehicles. Meanwhile, $987 million would go toward missile warning and tracking. On the acquisition side, the Space Force proposes a $1.1 billion investment in three additional National Security Space launches and $314 million for three SDA launches.

The Air Force end strength will decrease by 4,900 to 510,400 in fiscal 23, with Kendall indicating that would happen by attrition. The Space Force will add 200 Guardians to its ranks.

Airmen and Guardians will receive a 4.6 percent pay raise, a 4.2 percent basic allowance housing raise, and a fund of $300,000 will be created for basic needs allowance that they can apply for under special economic circumstances. Inflation in the budget accounts for some $6.3 billion, or a rate of 2.2 percent, a number that is in line with government standards, though military officials have acknowledged is significantly below 8 percent inflation rate as of early April.

While the President's Budget is a wish list until it passes Congress, Kendall was hopeful that like last year he will get the divestments he needs to transform the services for the future.

"As we go forward, I think they're going to be some hard choices. We are going to do some divestments," said Kendall. "That change will continue, we have to do that. We have to really get rid of what I'll call legacy equipment in order to have the resources to modernize."

The Air & Space Forces Association praised the decision to fund long-delayed strategic nuclear modernization programs, such as the Ground-Based Strategic Deterrent and B-21 bomber, as well as the boost in R&D funds. However, AFA president, retired Air Force Lt. Gen. Bruce Wright, said the budget is insufficient to meet the growing demand for air power around the globe.

"The Air Force budget remains flat at a time when it is shouldering costs for two legs of the nuclear triad and three decades of deferred modernization," Wright said in a statement. "The United States justifiably surged investment in our land components funding to deal with Afghanistan and Iraq; to do that, the nation took risk and deferred investment in air and space. Now it is time to surge air and space to solve today's threat-based demands."

Divestitures and Purchases: USAF's 2023 Aircraft Plans

By John A. Tirpak

The Air Force will retire or divest 250 aging aircraft in 2023 if given a greenlight by Congress, and acquire 82 others. Here's what those cuts would entail:

Divestments

A-10

Senior Airman Jake Jacobsen

21 jets from the Air National Guard at Fort Wayne, Ind. The unit would gain 21 F-16s.

F-22

Senior Airman John Strong II

33 of 36 Block 20 F-22s. The cuts would decrease the F-22 fleet to 153 airplanes. Later model F-22s would be transitioned to the training role these aircraft now fulfill.

Air Force Secretary Frank Kendall said, "We see an efficiency, effectively, in removing those aircraft at this point." However, USAF asked for $344 million to upgrade the sensors and other systems on the remaining Raptors in fiscal 2023.

E-3 AWACS

Staff Sgt. Michael Battles

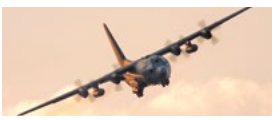
15 aircraft at Tinker Air Force Base, Okla. Only 16 AWACS will remain. A program to acquire a replacement will proceed within months..

E-8 Joint STARS

Master Sgt. Jeremy Lock

Eight JSTARS would be retired in 2023 and four more in 2024."Basically, both the JSTARS fleet and the AWACS fleet are aging out and need to be replaced," Kendall said.

C-130H



Yasuo Osakabe/ USAF

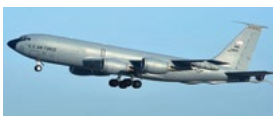
12 C-130s from Maxwell Air Force Base, Ala., would be cut, while four new C-130-Js would be acquired, for a net reduction of eight aircraft. The C-130s would be backfilled with the new MH-139 helicopter.

T-1 Trainer

Senior Airman Davis Donaldson

The Air Force is introducing new simulation and training techniques to obviate the need to re-engine or replace the T-1, relying on the T-6 for the newly determined actual flying hours. Aircraft will be redistributed among Undergraduate Pilot Training bases and will phase out as new simulation and training gear is brought online.

KC-135



Airman Erin McClellan

13 KC-135s from March Air Reserve Base, Calif., and Joint Base McGuire-Dix-Lakehurst, N.J. They will eventually be replaced by new KC-46A Pegasus tankers. The service will take "a measured amount of risk" in the gap between the departure of the old aircraft and arrival of the new.

MQ-9

Airman 1st Class William Rio Rosado

100 MQ-9s will move "to another government organization," Kendall said, not specifying the agency. "It comes up as a divestment, but it's not a change in capability."

Procurement

The Air Force's list of new aircraft buys is a bit shorter than the list of divestitures.

F-35

Senior Airman Erica Webster

After several years of requesting 48 F-35s—and being given up to 12 more in 2019 and 2020—the Air Force is requesting only 33 F-35s in 2023.

There's "a whole collection of reasons" for the reduction, Kendall said. First, the performance of the F-35's Tech Refresh 3 update is "not what we wanted," he said, and the TR3 is the basis for the Block 4 version of the jet, the version USAF has long said it wants to buy. The Air Force is investing additional money in the Advanced Engine Technology Program (AETP) that could power an upgraded F-35.

Asked if the Air Force remains committed to the fighter, Kendall said, "Of course."
"We're 15 years into production, and we'll be building F-35s probably another 15 years. So, absolutely." Kendall added the F-35 will continue to be, as Chief of Staff Gen. Charles Q. Brown Jr. has said, the "cornerstone" of the tactical fleet "for the foreseeable future. So there's no question about that."

Kendall noted that the AETP is a costly development program and that USAF is still courting "partners" among the other services to share the cost and the benefit of a new powerplant.

F-15EX

1st Lt Savanah Bray

The Air Force doubles its 2022 request, from 12 Eagle IIs to 24 in 2023.

Kendall said Brown wants to "replace F-15Cs as quickly as possible," and the availability of the F-15EX makes that possible. "It's really a 4.5-generation kind of an airplane, but it provides more weapons carriage capabilities, writ large, than the F-35 does. So, for the homeland defense mission, and for some defensive counterair applications overseas, it has features that are desirable, operationally."

USAF budget director James D. Peccia III said the F-15C/Ds will retire completely by fiscal 2026.

"One of the fundamental things motivating me on the operational imperatives in the TacAir area is the affordability of the future force," Kendall noted. If we're only buying NGAD, which is a very expensive platform; F-35s at $80 million a copy; and F-15EXs at $80 million a copy; we can't afford the Air Force. So we've got to get a mix of lower-cost platforms, as well."

B-21 Bomber

USAF/illustration

The FY23 budget grows by $1.7 billion to start low-rate initial production of the B-21 bomber, but Peccia said he could not reveal how many aircraft that will entail. At the time of the program's unveiling, USAF officials said low-rate would probably entail five aircraft a year for several years.

KC-46A

Staff Sgt. Mary McKnight

The Air Force upped its 2022 buy from 14 to 15 in 2023, adding $220 million for the additional aircraft and getting the KC-46 rate up to where it was already planned to be. Kendall thinks the Air Force will likely stay with the KC-46 as it plans its next tranche of tanker buys.

"We had a KC-X, Y, and Z" scheme, Kendall said. "As we look at our requirements further out, [they] start to look more like a modified KC-46 than they do a completely new design."

"I want to be very transparent about this," he said. "I think there's still a possibility of competition out there, but as we've looked at our requirements, the likelihood of a competition has come down."

HH-60W

Staff Sgt. Enrique Barcelo

The Air Force's plan was to buy 113 HH-60W helicopters for combat search and rescue, but USAF said it will "complete the buy" with 10 more aircraft in 2023, cutting the acquisition short at 75 helicopters.

Last August, Air Combat Command Chief Gen. Mark D. Kelly said Airmen who go down in contested areas of the Pacific may have to get themselves to a place where they can be picked up, given that the air defense threat will be so challenging to manage a rescue.

MH-139

Samuel King Jr./ USAF

The Air Force is buying five MH-139s in fiscal 2023. Peccia said they were in the 2022 budget but had several certifications yet to be completed. Those are now done, or will be in "the next couple of months," and the program can proceed, he said. The goal remains to buy 80 of the Grey Wolf helos.

Air Force, Space Force Unfunded Priorities

By Amy Hudson

The Air Force's unfunded priorities list (UPL)—things it wants but couldn't squeeze into its fiscal 2023 budget request—would leave it to Congress to boost the F-35 fighter buy, as part of a list of things it would acquire if it had another $4.6 billion to spend.

The Air Force only asked Congress for 33 F-35s in its 2023 budget proposal, 15 fewer than it bought in 2022 and 27 fewer than 2021. USAF said it prefers to spend that money on other needed modernization programs and wait until the Block 4 version of the jet is ready. The unfunded priorities list looks to close that gap slightly, asking for $921 million for seven more strike fighters, bringing the service's total 2023 buy to 40 F-35As—still eight fewer than 2022.

The UPL, which was obtained by Air Force Magazine but not released by the department, lists eight priorities the service wants but couldn't afford in its 2023 budget request, released in late March. The F-35 is fifth on that list.

"The Air Force unfunded list would add just seven F-35 jets, less than half of what's needed to match the 48 requested in each of the past three years," said Air & Space Forces Association President retired Lt. Gen. Bruce Wright. "Indeed, in 2020 and 2021, Congress increased the Air Force request from 48 to 60, and we would urge lawmakers to do the same in 2023."

Tech. Sgt. J.T. Armstrong/USSF

A big chunk of the budget request will go toward improving missile warning, defense, and space domain awareness. Filling that mission now, in part, are radomes at Buckley Space Force Base, Colo.

In fiscal 2022, the Air Force asked for another dozen F-15EXs as part of that year's $4.2 billion unfunded priorities list, but it did not ask for any additional F-35A strike fighters—a departure from previous years.

The Space Force offered Congress its own $6 million unfunded priorities list. More than half that request ($327 million) would go to classified programs, while the rest would be split between more resilient missile warning and missile tracking ($200 million) and weapons systems sustainment ($112 million).

Weapons system sustainment is the Air Force's No. 1 unfunded priority. The service requested $579 million, which it said would support its "highest priority" depot programs, including the B-52, F-16, T-38, C-17, Battle Management System, C-5, and the Distributed Common Ground System.

Listed as its second-highest wish—though the biggest ask financially—is a request for $978.5 million to procure four EC-37B Compass Call electronic warfare aircraft, which would bring the total fleet to 10 aircraft.

Other requests, listed in order of priority, include:

■ $397 million to repair, replace, or restore "facilities damaged by inadequate sustainment, excessive age, natural disaster, fire, accident, or other causes, or to alter or replace facilities to implement new or higher standards, accommodate new functions, or replace building components that typically last more than 50 years." The UPL did not list specific locations.

■ $276 million for additional Small Diameter Bomb IIs, which the service says suffers from diminishing manufacturing sources and material shortages for weapon procurement. Standoff munitions, such as the AGM-158 Joint Air-to-Surface Standoff Missile series took priority in the Air Force's 2023 budget request, which looks to buy 550 extended-range JASSMs and 28 Long-Range Anti-Ship Missile variants. Meanwhile, the 2023 budget request asked to procure 761 SDB II bombs, also known as the StormBreaker, down from 985 units in 2022.

■ The F-35 request of $921 million would restore some of the aircraft subtracted from the yet-to-be-awarded Lot 17, which will have Block 4 capability. In an interview with Air Force Magazine shortly after the budget release, USAF Deputy Chief of Staff for Plans and Programs, Lt. Gen. David S. Nahom, said the Air Force would buy more F-35s if resources allowed, but given the delay with Block 4, the Air Force opted to speed up the F-15EX buy, while also freeing up some money to help pay the multibillion-dollar nuclear modernization bill.

■ $749 million for at least 26 military construction projects across the globe, ranging from new child development centers to simulators to a military working dog kennel. The biggest portion of that ask ($286 million) would fund ongoing natural disaster recovery at Tyndall Air Force Base, Fla., Offutt Air Force Base, Neb., and Joint Base Langley-Eustis, Va. Another large chunk, $114 million, would fund a KC-46A bay in the depot corrosion control hangar at Tinker Air Force Base, Okla.

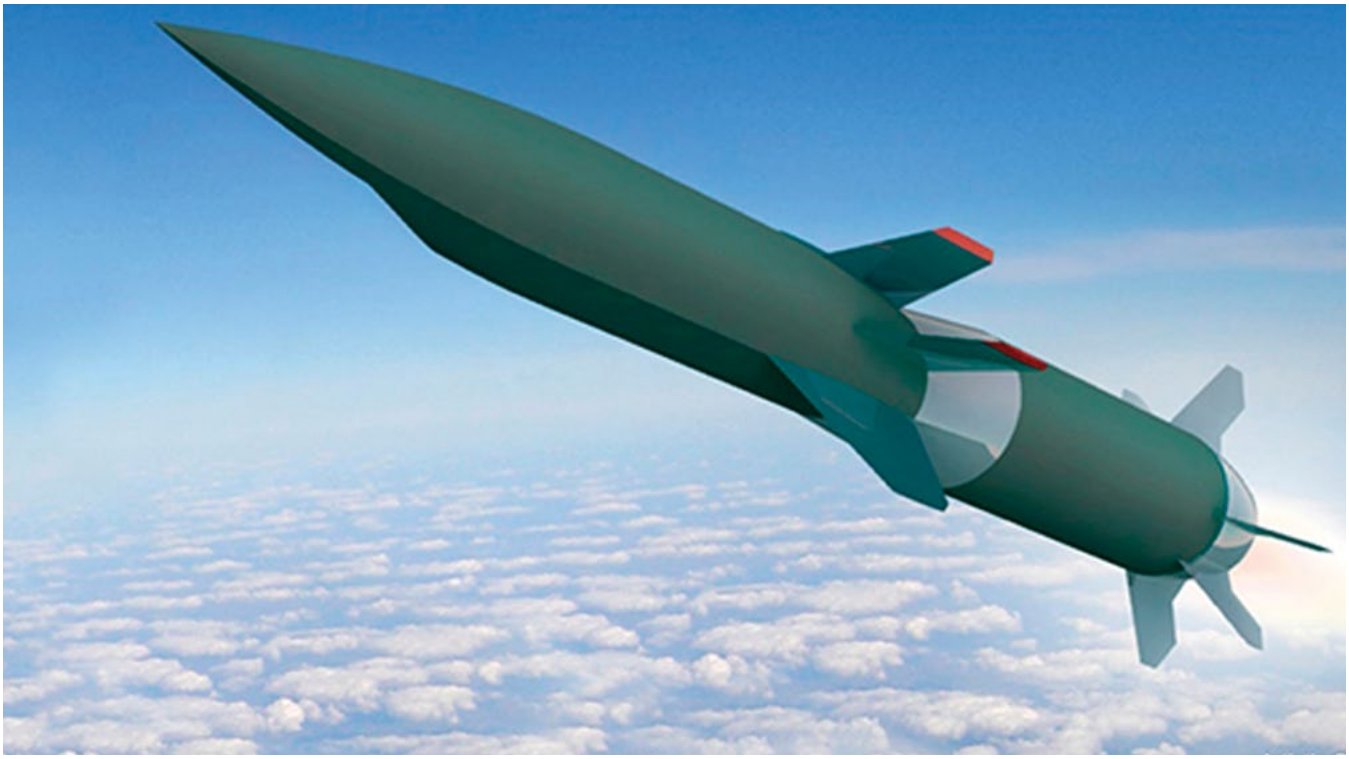
■ $197 million for hypersonic testing with B-52s, F-15s, F-16s, and "tanker ops" at two locations, adding contractor capacity and absorbing the mounting workload. Specifically, the UPL asks for $55 million to enable "open-air hypersonic testing," which "expands high fidelity coverage for extreme velocities beyond 350 [nautical miles] allowing for more shots of longer distance and duration." The funds also would help "close capability gaps for hypersonics intercept, reusable vehicles, boost glide, and stores separation," according to the document.

■ $516 million to restore readiness spares packages (RSP), which the service says are "critically below required readiness levels" after 20 years of Middle East contingency operations. RSP kits are tailored to specific aircraft variants and are intended to provide support for 30 consecutive days. However, according to the UPL, "if conflict with a near-peer adversary were to kick off today, only 15 days of support would be immediately available to support these platforms in a contested environment."

The Space Force unfunded priorities list, on the other hand, looks to procure two additional launches in 2023 to accelerate initial launch capability of the mission warning/mission tracking layer to fiscal 2025.

The new service's weapons system sustainment request would go toward improving missile warning and defense, space domain awareness, integrated tactical warning/attach assessment, launch range, military satellite communications, satellite control network, global positioning system, and space-based infrared systems shortfalls.

"The Department of the Air Force has been underfunded for nearly three decades, delaying modernization and leading to a perpetually shrinking force that is now too small to meet the nation's expectations," Wright said. "Congress should not only approve every single unfunded priority on the Air Force and Space Force lists, it should go one better and increase those investments." ✪



DARPA

DARPA and the Air Force completed a free-flight test of the Lockheed Martin version of the Hypersonic Air-breathing Weapon Concept (HAWC), shown here in an artist's illustration. The vehicle, after release from a carrier aircraft, achieved 327 seconds of hypersonic flight.

New HAWC Hypersonic Missile Sets Record for Endurance

By John A. Tirpak

Lockheed Martin's version of the Hypersonic Air-breathing Weapon Concept missile demonstrator set a record for hypersonic flight under scramjet power in a March flight-test, the Defense Advanced Research Projects Agency (DARPA) confirmed in April.

The flight-test likely achieved about 327 seconds of hypersonic flight under scramjet power, versus 200 seconds achieved by the Boeing X-51 Waverider in 2010, based on figures provided by DARPA.

"DARPA, in partnership with the U.S. Air Force, recently completed a second successful test of a Hypersonic Air-breathing Concept, known as HAWC," Stefanie Tompkins, head of DARPA, told the Senate Armed Services subcommittee on emerging threats and capabilities. "This test set a record for scramjet endurance, and we believe it's an inflection point on the path to reclaiming U.S. leadership in hypersonic weapons."

Tompkins did not provide details, but DARPA issued a release saying it had flown the Lockheed HAWC 300 miles at altitudes up to 65,000 feet. Scramjets require supersonic speeds to ignite and are boosted to those speeds by a detachable rocket. Since hypersonic flight begins very quickly after the rocket fires, most of the 300 miles would be flown under scramjet power.

At 65,000 feet, the speed of sound is 660 mph. Hypersonic flight is considered above Mach 5, or five times the speed of sound, meaning the HAWC's speed at that altitude would be at least 3,300 mph. At that speed, 300 miles would be covered in 1/11 of an hour, translating to a flight time of 5.45 minutes, or about 327 seconds.

"We were at hypersonic speeds for the majority of that distance, and it would be a longer flight than X-51," a DARPA spokesman said in response to that calculation.

Tompkins' testimony remark also suggests the duration of flight by the Lockheed HAWC bested the performance of the competing Raytheon HAWC, which made a free flight in September 2021. Few details of that test were revealed, although it was touted as a success by DARPA.

Pentagon officials said the Lockheed HAWC test was not immediately made public to avoid escalation in the Ukraine war, in which Russia had just used a hypersonic missile to attack a weapons depot.

"This Lockheed Martin HAWC flight-test successfully demonstrated a second design that will allow our warfighters to competitively select the right capabilities to dominate the battlefield," said Andrew Knoedler, HAWC program manager in DARPA's tactical technology office, in a DARPA press release. "These achievements increase the level of technical maturity for transitioning HAWC to a service program of record."

In the September test, DARPA said the Raytheon missile "kicked on" just seconds after being released from its launch aircraft, then "compressed incoming air mixed with its hydrocarbon fuel and began igniting that fast-moving airflow

mixture, propelling the cruiser at a speed greater than Mach 5."

DARPA said the Raytheon missile achieved all its primary goals for the test, including vehicle integration and release, safe separation from the launch aircraft, booster ignition, boost, booster separation, engine ignition, and cruise."

In budget briefings in March, the Air Force signaled that it is emphasizing the HAWC over the boost-glide AGM-183A Air-launched Rapid Response Weapon, or ARRW, as the ARRW has failed a number of attempts to make a successful free flight.

Air Force budget director Maj. Gen. James D. Peccia III said USAF is "not walking away" from ARRW.

"It's funded" in the fiscal 2023 budget, he said during the rollout briefing, and after further scrutiny, "we'll make an assessment" about whether to continue the program.

The $577 million for hypersonics weapon research in the fiscal 2023 budget covers both ARRW and the Hypersonic Attack Cruise Missile, the latter of which will build on HAWC research. The budget request was to include $160 million to buy 12 ARRWs, but that money has been almost entirely shifted back to research, development, test, and evaluation, Peccia said. ✪

GBSD Finally Gets a Name: 'Sentinel'

By Greg Hadley and John A. Tirpak

The Air Force announced a name and designation for the intercontinental ballistic missile system-replacement, long known as the Ground-Based Strategic Deterrent: LGM-35A Sentinel. The name recycles one already given to one of the Air Force's secret spy drones.

The Sentinel, being developed by Northrop Grumman, is set to replace the Minuteman III as the land leg of the U.S. nuclear triad, beginning with initial operational capability in 2029 and full operational capability by 2036.

"The name Sentinel recognizes the mindset that thousands of Airmen, past and present, have brought to the deterrence mission" over decades, said Air Force Secretary Frank Kendall in an official release. As those Airmen have "kept the watch; always vigilant and ready," the name will "serve as a reminder for those who operate, secure, and maintain this system in the future about the discipline and responsibility their duty entails."

USAF/Illustration

The LGM-35A Sentinel in this illustration is the Air Force's newest weapon system, known as the Ground Based Strategic Deterrent. The new designation modernizes the ICBM leg of the nation's nuclear triad.

Sentinel joins the ranks of Atlas, Titan, Minuteman, and Peacekeeper as the land-based ICBM missiles that have maintained America's nuclear deterrent since the early 1960s. Its nomenclature—LGM-35A—is a bit puzzling, however, as the Minuteman was the LGM-30 and the LGM-118 was the successor Peacekeeper. The Air Force could not immediately explain the derivation of the nomenclature.

The GBSD name has been assigned to the new missile program for years now as the Air Force's modernization efforts have wound their way through Congress and the Pentagon. In February 2021, then-Vice Chairman of the Joint Chiefs of Staff Gen. John E. Hyten lamented the lack of an official name for the project.

"We've got to find a name for the GBSD," Hyten said. "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."

The missile will, however, have to share the "Sentinel" moniker. The Air Force named its stealthy RQ-170 intelligence, surveillance, and reconnaissance drone the Sentinel in the mid-2000s. That Sentinel, built by Lockheed Martin, was considered a key element in locating and tracking Osama bin Laden, leading to the special operations raid that killed him in Pakistan in 2011. An RQ-170 also crashed in Iran, where that government claimed to have back-engineered it and built their own version. An Air Force spokeswoman told Air Force Magazine there are no plans as yet to rename the RQ-170.

The LGM-35A will be stationed at missile bases where the Minuteman III is already emplaced—F.E. Warren Air Force Base, Wyo.; Malmstrom Air Force Base, Mont.; and Minot Air Force Base, N.D. ✪

How GBSD/Sentinel is Using Digital Twins

By Shaun Waterman

The Air Force-managed modernization of America's ground-based nuclear missiles has emerged as a test-bed for the use of digital twins—virtual models of real weapons systems—at every stage of the program life cycle.

"I have a front row seat right now," USAF Col. Jason E. Bartolomei, the system program manager for the Ground Based Strategic Deterrent program, told a panel at the Space Symposium on April 7. GBSD is employing digital twins at every stage of the program life cycle from "an early conceptual design frame [at the start of a program] to currently right now in the middle of the [Engineering and Manufacturing Development, or] EMD phase [in which prototypes are built] … getting ready for first flight. I have another program going into production, and then I get to see how the Minuteman III is [using digital twinning as it is] transitioning into the sustainment arena."

Using digital twinning in each of these phases "has its own unique challenges that really need to be taken on front and center," said Bartolomei.

He said that the digital tools the program used for the new Sentinel ICBM enabled it to scan and asses "six billion [potential] different system designs," looking for the one that best-balanced capabilities with cost.

As part of Space Force's commitment to being a digital-first service, "we are really focused on [using] digital engineering and digital twins in the entire ecosystem," said Lisa Costa, the chief technology and innovation officer for the U.S. Space Force. "Not just for acquisition, but we're really looking at how we embed digital engineering and digital twins into our training, our doctrine, our red teaming, our force design."

Digital twinning uses software models of real components or systems to help guide designers as they develop plans for a prototype and later, as they work out how to manufacture the real thing. Once a system is in service, digital twins can also be used to work out how often parts need to be replaced, or how to minimize fuel consumption and conduct maintenance more efficiently. But the models need to answer very different questions at each stage, panelists said.

"Digital engineering and digital twinning can mean a million things to a million people, but it can also mean a million different things within a single program or a single program office, depending on the life cycle, depending on the use case," said moderator Sian Griffiths, a partner at McKinsey and Company.

She noted that Bartolomei was, "at the program pointy end of making this [digital twinning] actually work and actually deriving program value from it."

The GBSD program had been using digital twinning for eight years, the program's ambitions have expanded with each success.

Early on, there was "a lot of concern" that design choices made to maximize capabilities might introduce "cost and schedule risk," he explained.

"What the digital environment allowed us to do was to bring our multidisciplinary engineering models in with our cost models, to examine a trade space" where different capabilities and different ways to achieve them could be costed against each other, he said.

Decisions made early in the acquisition process could have huge implications downstream, and digital engineering tools made it possible to predict how choices would cost out, panelists said.

USAF/illustration

The LGM-35A Sentinel in its launch silo. Shown here in a design illustration, Sentinel will cost less than extending the life of the current ICBM fleet—the aging Minuteman III.

"Once you start building the wrong thing," observed Rob Wavra, a Mckinsey partner and panelist, "recovering that is challenging." Early choices could be helped by models that "might be lower fidelity, … but support decisions that are incredibly important at the initiation of a program to shape what it is."

And digital twinning also opened the aperture for acquisition teams, said Bartolomei.

"Industry showed us nine booster designs. And we challenged our team to look at 1,000 booster designs. And lo and behold, our government team found many, many designs that were more affordable and better performing than the ones industry was showing us," he said. Flush with that success, Bartolomei said, "We got greedy. And we went and looked at not just the booster design, but the total system design." The team developed "some pretty sophisticated algorithms" that enabled it to examine cost trade-offs in "a trade space of six billion different system designs." ✪

Romania Calls for Permanent US Presence, Air Policing to Deter Russia

By Abraham Mahshie

OTOPENI AIR BASE, Romania

NATO Air Command pivoted quickly when Russia invaded Ukraine, deploying U.S. assets to conduct enhanced Air Policing in the Black Sea region, where years of investment are now bearing fruit. But Romanian defense officials say that the deterrence mission must change to a permanent defense mission to prevent future Russian aggression.

"We are living a new normal," Romanian Air Chief Lt. Gen. Viorel Pana told Air Force Magazine during an interview at Otopeni Air Base in Bucharest.

"Even the plans that we have for a confrontation against a peer competitor need to be adapted," he said while walking the flight line of Romania's airlift base. "The key word is flexibility."

To flex muscle in the weeks and days preceding and immediately following Russia's Feb. 24 invasion of Ukraine, the U.S.

Senior Airman Ali Stewart

Two U.S. Air Force F-16 Fighting Falcon based at Spangdahlem Air Base, Germany, fly alongside two Romanian F-16s over Romania, March 14.

repositioned F-15s, F-16s, and F-35s to conduct enhanced Air Policing missions along the eastern flank of NATO, reaching from the Baltics to the Black Sea.

It did not deter Russia in Ukraine, but it has, thus far, kept Russia from striking the former Soviet and Warsaw Pact nations that in December Russian President Vladimir Putin called on to withdraw NATO firepower.

Romanian defense officials who spoke to Air Force Magazine in Bucharest applauded Chairman of the Joint Chiefs Gen. Mark A. Milley's remarks to Congress in April proposing rotational troops at permanent Eastern European bases to deter Russia. They argue Russia's invasion of Ukraine could have been prevented, and with Russia closer than ever to NATO's southeastern border, only a permanent presence will deter future aggression.

In Romania, the United States, NATO, and Romania have invested tens of millions of dollars in air base infrastructure, training, and exercises to prepare for the type of contingency now playing out. Russia now occupies Ukraine's Snake Island, located in the Black Sea at the mouth of the Danube River, some 22 miles from Romania's coast.

Pana said years of close cooperation with the U.S. Air Force has built wing-to-wing trust between American and Romanian aviators.

"The results can be seen in how we are doing things together," said Pana, reflecting on the quick repositioning of American F-16s, which are flying from multiple air bases across Romania. "They can operate together, do missions together, plan together."

Pana explained that the U.S. regularly operates from Romania's air bases, rotating units and doing missions and training. But Romania wants a permanent American presence in order to stop Russia.

"The aim is to transition from forward presence to forward defense," said State Secretary for Defense Planning Simona Cojocaru, the equivalent of Romania's deputy minister of defense. "It's such a leap. And this cannot be done without U.S. support, without the permanent presence."

NATO has announced the creation of a new battle group to be hosted in Romania, which already hosts command and control centers and the NATO Headquarters Multinational Corps South-East. The Black Sea country is situated just 200 miles from occupied Crimea, home to Russia's anti-access, area-denial bubble.

Cojocaru said that at the June NATO summit in Madrid, Romania plans to make its case for a brigade-sized NATO presence. An increase in Romanian defense spending to 2.5 percent of GDP, or $1 billion more per year, is proof that Romania is doing its share, she says.

"We are the front-runners here on the eastern flank," Cojocaru said at an interview conducted at Romania's Ministry of Defense. "The Black Sea today is the focal point for deterrence and defense."

Local defense experts agree that it is not enough for the U.S. and NATO partners to show their presence in a crisis and then recede.

"If you continue to come like a fireman, only when the fires are rising, you will come back after five years or 10 years because Russia will not change their behavior," said George Scutaru, a former Romanian parliamentarian who now heads the think tank New Strategy Center, which hosted a defense discussion April 7 in Bucharest with the Washington-based Center for European Policy Analysis (CEPA).

Scutaru pointed to Russian aggression in Georgia in 2008 and in Ukraine in 2014, prior to the current crisis, as evidence Russia will strike again if not adequately deterred.

"What is necessary? To have another war in Georgia or to [have fighting in] Moldova to come back?" he posed when asked why the U.S. should maintain a permanent presence in Romania. "It's necessary to be here." ✪

Ukraine Crisis to Influence Growth of US Cyber Force, Nakasone Says

By Hope Hodge Seck

In the lead-up to Russia's invasion of Ukraine, "hunt-forward" teams deployed from U.S. Cyber Command to help the Ukrainians harden their networks and identify vulnerabilities—an early defensive play in a conflict that would be dominated by information operations and cyber threats. CYBERCOM also provided remote analysis to Ukraine and moved into high gear

House Armed Services Committee/video

U.S. Army Gen. Paul Nakasone, commander of U.S. Cyber Command, testifies before the House Armed Services subcommittee on April 5.

when the invasion began to mitigate threats and offer support for critical networks. The prominent cyber element in the current war has captured public attention and underscored the Pentagon's emphasis on this emerging capability. And it will likely have implications for future defense budgets and growth strategies, the head of CYBERCOM said April 5.

"My sense is, we are learning a tremendous amount from our operations right now in support of the crisis in Ukraine that will likely inform us," Gen. Paul M. Nakasone told the House Armed Services Committee's subcommittee on cyber, innovative technologies, and information systems (CITI). "We're a different force today than we were even four years ago when I took over."

As Air Force Magazine reported in March, Air Force leaders have acknowledged that the Ukraine mission has stretched U.S. cyber forces thin and demonstrated the limitations of what they can accomplish at their current size and resourcing levels.

Asked about that report in the hearing, Nakasone acknowledged that Ukraine had been formative, though he deferred a detailed discussion of capabilities to a later classified briefing.

"What I would offer here is that one of the very big lessons that we've learned is the ability to deploy a number of different teams early on in a crisis to U.S. European Command," he said. "And then working with [EUCOM Commander Gen. Tod] Wolters and his staff to make sure those experts, those teams, go to the places that are necessary."

Created in 2012 with 133 teams and roughly 6,200 personnel, CYBERCOM is slated to grow by 14 more teams between now and fiscal 2024, with five teams added this year. About half of the 14 teams are slated to come from the Air Force. But Nakasone indicated that growth, authorized in the fiscal 2022 defense budget, could well be just a starting point.

"The question I often get asked is, is this enough? What's the number of teams that you need?" Nakasone said. "And this is a study that's ongoing right now within the department, to really determine what is the final number of teams we need for the future."

Nakasone, during four hearings, received questions on cyber warfare and resourcing, even while testifying alongside U.S. Special Operations Command leaders on the Senate side, highlighting the growing interest in cyber. Lawmakers invited Nakasone to ask for anything he needed and to be honest about any shortfalls or unmet requests. Many also asked detailed questions about CYBERCOM's strategy to recruit and retain top talent, a particular challenge in light of competition from the civilian sector and immature career pipelines that are not yet standardized across the services.

Nakasone told CITI subcommittee chairman Rep. Jim Langevin (D-R.I.) that this standardization was a particular priority, and an area where change was coming soon.

"I'm working this very closely with the service Chiefs now," Nakasone said. "This is something that Command Sgt. Maj. [Sheryl] Lyon is also working with the senior enlisted leaders: we have to standardize tour lengths, we need to standardize Active-duty service obligations."

The Marine Corps in particular is a model in this area, he said. The Marines launched a cyberspace career track in 2018 and have emphasized policies that allow cyber troops to stay in that field once established.

Other creative efforts to attract cyber talent are also on the table. Nakasone mentioned targeted local supplements, a strategy rolled out in 2021 that allows CYBERCOM to pay rates higher than the set military schedule for high-end talent.

"People that are coders or people that have significant technical abilities, pay them at 28 percent more than the going rate," he said. "That's never going to, perhaps, compete with the private sector. But what it does do, it does give us a leg up on being able to say what you do is valued."

Nakasone also discussed the incentive of direct commissioning, suggesting it may be employed more broadly as CYBERCOM grows. Currently, the Army and Coast Guard allow civilians to commission directly into the cyber officer corps. Like the Navy and Marine Corps, the Air Force has resisted using the direct-commission authority to bring civilians in, although it has employed it in limited cases for enlisted Airmen.

In a post on LinkedIn in April, Space Force Senior Cyber Officer Col. John Smail said that service was all in on civilian direct-commissioning.

Nakasone said this authority gave CYBERCOM "a certain amount of dynamic" in recruiting.

"Being able to do recruiting from a population of civilians, 'Hey, come in and be a mid-grade officer.' Or, as we take a look at our enlisted workforce and say, 'Hey, why don't you go spend six months with industry, or go get a graduate degree.' These are all areas that perhaps we haven't traditionally done within our services," he said. "But this is a dynamic nature that I think we've got to approach the problem here in cyberspace."

The Defense Department is now conducting the 2022 Cyber Posture Review, the first since 2018 on the size and capabilities of the cyber force. Once complete, it will inform CYBERCOM's forward strategy and resource priorities. The conclusions are likely to emphasize the continued need to develop cyber talent as well as to recruit and retain those with the desired skills.

"Broadly," Nakasone said, "Our supply is not large enough in nation."

Space Force Woos Industry

By Hope Hodge Seck

As commercial satellites feed images from Ukraine to U.S. space and intelligence agencies in a historically collaborative effort, Space Force leaders are eager to learn how else they can put the commercial sector to work for the service.

In an April 6 hearing before the House Armed Services Committee's subcommittee on strategic forces, National Geospatial-Intelligence Agency (NGA) Deputy Director Tonya P. Wilkerson alluded to the role the private sector is playing in monitoring Russia's war on Ukraine.

"[Geospatial Intelligence] has been a central element of our nation's understanding of the Russia-Ukraine crisis," she said.

Boeing illustration

Boeing's WGS-11+ or Wideband Global SATCOM 11+ is a United States military communications satellite to be operated by the United States Space Force.

"NGA is closely monitoring events in Ukraine while we provide partners across the globe access to numerous sources of intelligence, including commercial space-based imagery."

While the hearing was taking place, officials at the Space Symposium in Colorado Springs offered more details: some 200 commercial satellites fed imagery into NGA's pipeline, allowing the agency to anticipate Russia's moves, David Gauthier, the agency's deputy director of commercial and business operations, reportedly told an audience there.

This government dependence on commercial space infrastructure illustrates the complexity of the domain. And it's informing how military leaders are thinking about building up space capabilities.

Lt. Gen. Michael A. Guetlein, commander of U.S. Space Systems Command (SSC), said Space Force was planning a "reverse industry day," an opportunity for space-focused companies to share what they could offer the service in the realm of intelligence, surveillance, and reconnaissance (ISR). A traditional industry day, by comparison, features a specific solicitation or needs statement and invites businesses to show how they could meet the predetermined requirements.

The current conflict highlights unfamiliar territory for the Defense Department: operating in a domain where commercial and civil enterprises have more resources, more infrastructure, and sometimes more experience.

In opening remarks, Guetlein described Space Force's acquisitions strategy: "Buy what we can, build only what we must." This partnership-heavy approach will make the space enterprise more resilient, he said, and result in a deterrent network "that transcends national borders and bolsters American security and prosperity."

On the heels of investing $135 million in space domain awareness, $2.3 billion on satellite communications, and $22 million on commercial SATCOM command and control, Guetlein said the next major investment area for Space Force would be ISR.

"We're just starting to do studies to determine how much ISR we can buy from space," he said.

Space Systems Command also recently rolled out a new initiative to grease the skids for collaboration between Space Force and the commercial sector: SSC Front Door. Guetlein described the effort as a "one-stop shop" for would-be commercial partners of all sizes, offering them a single site to access and a single email address through which to communicate with the service.

"We will paint the path to opportunities depending on what they're offering to bring to the table," Guetlein said.

Jon Ludwigson, director for contracting and national security acquisitions at the Government Accountability Office, did sound a note of caution. He said the increased number of satellites on orbit as the commercial space industry expands requires greater levels of tracking and risk mitigation, particularly in low-Earth orbit, where the Defense Department also hopes to expand operations.

"However, the burgeoning commercial industry provides more options for DOD to procure commercial data and services to complement DOD's, or in place of DOD developing its own systems," he said. "We're examining the opportunities and challenges DOD faces on this front." ✪

General Officer Movements

By Greg Hadley

President Joe Biden nominated Lt. Gen. Duke Z. Richardson to receive a fourth star and lead Air Force Materiel Command and Lt. Gen. Brian S. Robinson to take over Air Education and Training Command.

Richardson currently serves as the service's uniformed acquisition chief—the military deputy in the office of the assistant secretary for acquisition, technology, and logistics. His nomination signals that AFMC's current commander, Gen. Arnold W. Bunch Jr., is slated to leave the job soon; Bunch has led Air Force Materiel Command since May 2019.

As commander of AFMC, Richardson would oversee installation and mission support, discovery and development, test and evaluation, life cycle management services, and sustainment. He would come into the job with a long history in acquisition.

In his 39 years in uniform, Richardson has observed five major changes that would define the service moving forward, he remarked at a recent conference—higher quality threats, a need for interoperability, changes to the workforce, software-defined hardware, and accelerating change.

Robinson, currently serves as deputy commander of Air Mobility Command. He has also served as director of operations at U.S. Transportation Command. If confirmed, he would replace Lt. Gen. Marshall B. "Brad" Webb, who took on the job in July 2019.

Richardson and Robinson's nominations were received in the Senate on April 4 and referred to the Senate Armed Services Committee.

The Air Force also announced a slate of nominations shuffling several other key positions. They include:

■ Lt. Gen. David S. Nahom, the service's deputy chief of staff for plans and programs, is being nominated to take over as the commander of U.S. Northern Command's Alaskan Command, as well as commander of the 11th Air Force and NORAD's Alaskan region.

■ Lt. Gen. Mary F. O'Brien, who serves as the deputy chief of staff for intelligence, surveillance, reconnaissance and cyber effects operations, is nominated to be Chief Information Officer for the Joint Staff and the director for command, control, communications, and computers/cyber.

■ Lt. Gen. Tom D. Miller, the current commander of the Air Force Sustainment Center, is nominated to be deputy chief of staff for logistics, engineering, and force protection.

Meanwhile, three major generals have been nominated for a third star and a new position:

■ Maj. Gen. Leonard J. Kosinski, deputy commander of the 5th Air Force, is slated to be director of logistics for the Joint Staff.

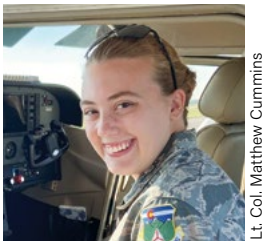
■ Maj. Gen. John D. Lamontagne, chief of staff for U.S. European Command, has been tapped to be deputy commander for U.S. Air Forces in Europe and Air Forces Africa.

■ Maj. Gen. Randall Reed, commander of the 3rd Air Force, has been nominated to replace Robinson as deputy commander of AMC. ✪

FACES OF THE FORCE

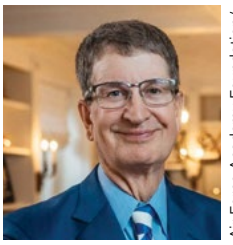
Staff Sgt. Ryan Green

Lt. Col. Dominic Calderon, 1st Lt. Kyle Anderson, and **Master Sgt. Silva Foster** of the 349th Air Mobility Wing, and **Senior Airman Michael Geller** from the 3rd Wing, were each awarded the Distinguished Flying Cross after they crewed a C-17 during the noncombatant evacuation out of Kabul, Afghanistan, in August 2021, saving the lives of 153 people amid a chaotic situation as the Taliban seized control of the city and desperate Afghans swarmed the airfield at Hamid Karzai International Airport. Also honored at the ceremony was **Staff Sgt. Dennis Gonzales-Furman**, from the 437th Aircraft Maintenance Squadron, who served as the aircrew's flying crew chief during the mission in Afghanistan.



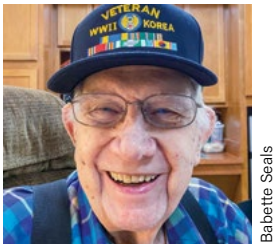
Lt. Col. Matthew Cummins

Anna Cummins, 16, was named the Air Force Military Child of the Year and honored during an April gala by Air Force Chief of Staff Gen. Charles Q. Brown Jr. The daughter of Amy and Lt. Col. Matthew Cummins, Anna, 70th Flying Training Squadron flight commander, volunteers at hospitals, helps care for her older sister Maddy who lives with Rett syndrome, founded the Aviation and Aerospace Club at her Colorado high school, and has a leadership role in the Civil Air Patrol. She hopes to become a physician's assistant and to join the Air Force.



Air Force Academy Foundation/courtesy photo

Businessman and philanthropist **John Martinson**, a 1970 graduate of the U.S. Air Force Academy, made the largest philanthropic gift supporting academics in Academy history—$10 million to expand and elevate USAFA's honors program. The Martinson Honors Program impacts cadets and faculty, including the outfitting of a new space in the library. The program will prepare cadets "to win scholarships, to be accepted into graduate school, to compete ... and to accelerate their Air Force careers," Martinson said.

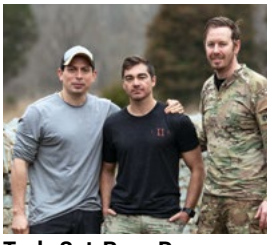


Babette Seals

Retired **Col. Fred C. Seals Jr.,** who served as commander of the then-137th Military Airlift Wing in the early 1970s, turned 100 years old on April 9 and was honored with the Stanley F.H. Newman Award, given to civilians who contribute to the Oklahoma ANG mission. Seals is a veteran of World War II, the Berlin Airlift, the Korean War, and the Vietnam War. He flew C-124s, C-46s, and B-17s before retiring in 1973 and continued to stay involved with the Oklahoma ANG, with two of his sons joining the Air National Guard.

Samuel King Jr./USAF

Tech. Sgt. Andrew Brockman, a senior munitions inspector at Eglin Air Force Base, Fla., beat out his fellow Airmen in a contest sponsored by Petty Motorsports and the Air Force Recruiting Service with his paint scheme for NASCAR's No. 43 car, which is sponsored by the Air Force. The design, which came out on top in a social media poll, is modeled after a B-29 Superfortress, with glass up front and riveted panel design.



Dale Greer/ANG

Tech. Sgt. Ryan Penne, Master Sgt. Elmer Quijada, and **Master Sgt. Devin Butcher**, pararescuemen with the Kentucky ANG, worked together to save the life of a drowning infant on March 15. At an aquatic center, Butcher noticed a swim instructor holding an infant that was blue. Butcher assessed the situation, handed the baby off to Penne and Quijada who performed CPR, and directed other members of the team to call an ambulance and gather needed supplies. The infant is now doing well.

Senior Airman Duane Ramos/ANG

Master Sgt. Hong Zhou is a USAF budget analyst. But twice over the past decade, she has been called upon to use her Mandarin language skills as an impromptu aircrew member providing airborne language translation between pararescue operations and civilian ships thousands of miles off the coast of California. Volunteering for the missions led to an Aerial Achievement Medal—uncommon for an Airman working in finance.

Staff Sgt. Jay Grabiec/ANG

Master Sgt. William Patrick (right), superintendent of plans and programs with the 182nd Security Forces Squadron and a part-time police deputy in Stanford, Ill., was honored by the Illinois Air National Guard in April for recognition of his bravery while serving as a police officer—responding to a suspicious vehicle complaint in a rural area, Patrick identified a felony suspect who had kidnapped a five-year-old girl. Not having time to wait for assistance, Patrick extricated and arrested the suspect, with a subsequent investigation concluding that his actions "undoubtedly saved the young girl's life." Patrick "did some truly heroic things and it's just awesome," Col. Daniel McDonough, the wing's commander, said. "He realized how dire that situation was and assessed the situation. I'm sure he would not like me talking about him as a hero, but there's no other way to put it. He saved that girl's life."

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Honing the Arctic Edge

U.S. forces rally near the Arctic Circle, testing troops' mettle in the Big Chill.

Staff photo by Amy Hudson

A soldier with the Florida National Guard's 1st Battalion, 265th Air Defense Artillery Regiment guards an Avenger air defense system during Exercise Arctic Edge at Eielson Air Force Base, Alaska, on March 15. This was the first time the Army's Avenger and Patriot ground based air defense systems deployed to Alaska.

By Amy Hudson

JB ELMENDORF-RICHARDSON AND EIELSON AFBs, ALASKA

The temperature hovered in the mid-teens, and the skies were crystal blue as members of the Alaska Air National Guard's 211th Rescue Squadron (RQS) prepared for a seven-hour round-trip flight beyond the Arctic Circle. Their mission, part of U.S. Northern Command's biannual Arctic Edge exercise, was to drop an Arctic Sustainment Package, consisting of six Guardian Angel Airmen and a pallet of survival gear, onto an ice floe 200 miles off the northern coast of Alaska.

The U.S. Navy already had an encampment on the 10-foot-thick floating ice island as part of its Ice Exercise 2022 (ICEX), a concurrent joint force exercise. Dubbed Ice Camp Queenfish, it was home to some 60 Sailors and Arctic researchers for three weeks, complete with a 2,500-foot-long runway, eight berthing tents, a command center, restrooms, and a dining tent. Two submarines, the Los Angeles-class fast attack sub USS *Pasadena* and the Virginia-class fast attack sub USS *Illinois* practiced breaching the ice not far away.

"What a lot of people who don't operate in the Arctic realize is how dynamic it is. ... So, just because you got in, doesn't mean you are going to get out right away."
— Commander, 212th RQS, Lt. Col. John Romspert

Weather changes rapidly in the region, and despite the near-perfect conditions at Elmendorf, members of the 211th Rescue Squadron faced potential whiteout conditions as they headed north. "It's [going to be] white on white," said Capt. Chris McKnight, the mission's HC-130J pilot, just before the flight. "It's like flying in a golf ball."

Temperatures in Alaska can dip as low as minus 60 degrees, so when the rear ramp opens for the air drop, the temperature will be at least minus 20 degrees and probably colder. The aircraft will be flying at 130 knots—about 150 miles per hour—making it seem even colder. That's a shock to anyone's system. But to Capt. Miles Brodsky, a combat rescue officer with the Alaska ANG's 212th Rescue Squadron and the flight commander for the mission, it's something to behold: "It's one of the most amazing experiences ever."

"It's like everything we train for coming up to that one moment," Brodsky said. "It's almost like everything goes in slow motion, and you can see every step forward, 10 steps at a time. It is the ultimate 'being in the moment,' I would say, because you're just completely focused on executing this mission properly and getting out of the plane."

The 212th has a unique mission. It is the only unit in the entire Department of Defense with an Arctic Sustainment Package capability—Canada is the only other country in the world that can execute this mission, said Lt. Col. John Romspert, commander of the 212th RQS. Created in 2010 after the Northwest Passage and Polar Ice Cap started melting, the baseline Arctic Sustainment Package is capable of treating 23 people in 96 hours in the harshest of conditions. Changing conditions in the region opened up Arctic exploration, eco-tourism, and expanded settlements up north, and that drove the need for an emergency response capability.

The "package" includes one combat rescue officer, one survival, evasion, resistance, and escape (SERE) specialist, and four pararescue jumpers (PJs). They jump with up to five modular pallets of survival gear—everything from vehicles to tents.

Despite the runway at Queenfish, the HC-130 did not land that day. The aircraft flew over the ice floe and dropped the pallets of arctic survival equipment, including tents, heaters, and fuel, onto the ice adjacent to the Navy's camp. The objective: have the Guardian Angels jump as close to the pallet as possible, simulating a real-world mission in which the team is tasked with rescuing a downed pilot. Once on the ground, the SERE specialist will quickly set up the camp and keep an eye out for rapidly changing environmental conditions as the PJs treat any survivors. The combat rescue officer focuses on

Staff Sgt. Taylor Crul

An Airman jumps out of an HC-130J Hercules during Exercise Arctic Edge 2022 over Northern Alaska. AE22 is a biennial defense exercise for U.S. Northern Command and Canadian Armed Forces to demonstrate and exercise joint capabilities.

resupply and getting everyone safely home, Romspert said.

"What a lot of people who don't operate in the Arctic realize is how dynamic it is," he said. "It could be clear blue when you jump in, and 45 minutes later, you're in a storm that lasts for 10 days at minus 60 degrees. So, just because you got in, doesn't mean you're going to get out right away. It takes a team effort and constant coordination to make sure that the operation is just running smoothly."

Arctic Edge—the largest exercise to take place in Alaska—included 1,000 U.S. and Canadian military personnel from more than 35 units. This year's exercise also included Danish observers. Several service-specific exercises took place concurrently in February and March, including the National Guard's Arctic Eagle-Patriot, the U.S. Army's Joint Pacific Multinational Readiness Capability (JPMRC) exercise, and the Navy's ICE-X.

Alaska is bigger than most people realize. If you superimposed a map of the state, in scale, over the lower 48, it would span from Jacksonville, Fla., to San Francisco—and there would not be any roads west of the Mississippi. The tyranny of distance and the lack of infrastructure here, in addition to the wild weather makes doing anything here complicated.

"By going all over the state, we were able to demonstrate that we can cover these facets as we work together," said Lt. Gen. David A. Krumm, commander of Alaskan Command, U.S. Northern Command. "That was an important aspect of Arctic Edge."

The exercise also demonstrated interoperability. "We were able to protect our homeland … to do all-domain operations on the sea, land, and in the air, using space and cyberspace," Krumm said.

Arctic Edge tests the ability "to train, practice, and learn together in a very, very tough environment, where you can't just exist on normal equipment, with normal clothing," he added. "You have to have the right outfits, you have to have the right shelters, you have to have the right modifications to be able to function in the Arctic environment."

It costs about $65,000 to equip just one Guardian Angel to safely operate in the Arctic. That covers things like base layers, socks, long underwear, mid layers, Gore-Tex, wet suits, parkas, sleeping bags, glacier glasses and goggles, gloves, heavy mittens, climbing harnesses, ropes, various types of boots, snow shoes, skis, and a helmet. Radios, tactical gear, and vehicles are extra.

Airmen here must learn to control their own body temperature. Too many layers makes you sweat, which could leave you wet enough to freeze later, leading to hypothermia. Not enough layers, and again, hypothermia could set in.

"We are constantly managing our own bodies in the situation, our own layers, just to exist in the environment," Brodsky said. "We always have to be thinking ahead because if we're staying in the evening, or a couple of nights, the environment becomes a huge factor. … It's just a constant challenge … that's why we train a lot."

One of the goals of the concurrent exercises was to indoctrinate troops in the unusual and tough environment.

"You start with making sure the individual is ready, and once the individual is trained and equipped, then we move on to his or her equipment," Krumm said. "What we know about this sort of environment is that if the individual isn't ready, nothing else can happen."

Army Patriot surface-to-air missile systems and short-range Avenger air defense systems faced the Alaska test for the first time. Those new twists were planned long before Russia launched its war in Ukraine and caused tensions to skyrocket around the globe. But putting ground-based air defense systems in Alaska shows a capability that hasn't been seen before.

"Having air defense forces in Alaska in cold weather times proves that we can do it," said Army Maj. Gen. Frank M. Rice, commander of the South Carolina National Guard's 263rd Army Air and Missile Defense Command. "It sends a message to not only our adversaries but to our allies that we are willing and capable of defending the homeland."

Patriot, which is actually an acronym short for Phased Array Tracking Radar to Intercept of Target, has seen its heaviest use in the U.S. Central Command area of operations, and Arctic Edge was its first test in extreme cold.

The Florida National Guard's Avenger air defense system also figured into the exercise, tasked with defending a drop zone from cruise missiles about 40-minutes away from where the Patriots were set up. For Florida Soldiers, the entire operation was a shock: Some had never seen snow before, let alone experienced minus 30-degree temperatures. They had to take turns manning the equipment 24 hours a day.

"Being that this is such a different environment, such a rigid environment, the equipment has issues," Rice said. "We're looking at training issues—things that we have to do differently here than we would at home."

One of the lessons learned: Everything takes longer in the Arctic. The Patriot needs a level, stable platform to operate, so planning ahead is important. The Army began rotating small groups of Soldiers to Alaska in 2018 to plan the defense design, Rice said, and with the ground frozen for so much of the year, the summer construction season is short and busy.

"All construction happens here in the two-and-a-half months of summer before the ground freezes again," Rice said. To prepare for the exercise, Army North built a concrete pad, driving rods into the ground during the summer then placing a narrow 4-foot flagpole on top for snow plows to spot the rods once they were covered in snow.

It took 50 percent longer than normal to navigate Eielson's icy roads and set up the Patriot MIM-104 air defense system on the new ice-covered concrete pad, said Capt. Robert Mock, commander of the Texas National Guard's 5th Battalion, 52nd Air Defense Artillery Regiment, Alpha Battery, as he walked through the trench dug in waist-deep snow. The battery's Soldiers dug the trench between the radar system and the launcher itself.

"As you train into an environment, you can get faster, but the first time you have to do it slow. There are slip-and-fall hazards everywhere," Rice said. "It's such a different environment from what we normally operate in that it takes some learning, and we're making those gates."

Mock said each fire unit can support up to eight launchers at a time, but the battery brought just a minimum engagement package of two launchers this time.

The Patriot fires a solid-fuel interceptor capable of destroying tactical ballistic missiles, cruise missiles, or aircraft, with a range in excess of 60 miles, according to the Missile Defense Agency. Avenger is for shorter-range, low-altitude air defense, using a 50-caliber machine gun and two 360-degree rotating turrets with missile pods capable of holding up to four Stinger missiles.

Although China remains the pacing threat to U.S. interests globally, U.S. Northern Command boss USAF Gen. Glen D. VanHerck has said repeatedly that Russia is the primary threat to U.S. homeland today. In prepared testimony to the Senate Armed Services Committee on March 24, VanHerck noted that both China and Russia are aggressively pursuing weapons that can strike the U.S. homeland, including new cruise missiles, hypersonic weapons, as well as advanced offensive cyber and space capabilities.

Geographically, Alaska is closer to China and Russia than to Hawaii or the U.S. mainland.

In 2019, Russia designed the world's first intercontinental ballistic missile equipped with a hypersonic glide vehicle payload, and in the next few years it's expected to field a new

Senior Airman Joseph LeVeille

The northern lights glow behind a Patriot M903 launcher station assigned to the U.S. Army during Arctic Edge 2022. The exercise is Alaska's largest and is increasingly more vital to national defense.

Staff Sgt. Kregg York/ANG

U.S. Air Force maintenance crews run morning inspections on an F-16 Fighting Falcon, assigned to the 180th FW, at JB Elmendorf-Richardson, Alaska, during Arctic Edge 2022. Airmen here must learn to control their own body temperatures.

heavy-lift ICBM potentially capable of delivering a nuclear weapon, wrote VanHerck.

"Russia has fielded a new family of advanced air-, sea-, and ground-based cruise missiles to threaten critical civilian and military infrastructure," he wrote. "The AS-23a air-launched cruise missile, for instance, features an extended range that enables Russian bombers flying well outside NORAD radar coverage—and in some cases from inside Russian airspace—to threaten targets throughout North America. This capability challenges my ability to detect an attack and mount an effective defense."

Russia also has fielded two of nine Severodvinsk-class guided-missile submarines, "designed to deploy undetected within cruise missile range of our coastlines to threaten critical infrastructure during an escalating crisis," wrote VanHerck. "This challenge will be compounded in the next few years as the Russian Navy adds the Tsirkon hypersonic cruise missile to the Severodvinsk's arsenal.

"All of the Russian cruise missile capabilities present a significant domain awareness challenge," added VanHerck.

Under his leadership, NORTHCOM has been conducting a series of Global Information Dominance Experiments, or GIDE, aimed at giving senior leaders more "decision space" so they can deter, de-escalate, and ultimately defeat an adversary if necessary.

During Arctic Edge, commanders utilized NORAD and NORTHCOM's project NorthStar to improve domain awareness. The system, part of the fourth GIDE experiment, integrates multiple warfighting domains, providing real-time force posture and eliminating the need for "exhaustive manual reporting procedures," according to a command spokesperson. It includes "data related to the health, readiness, and maintenance status of warfighting units."

"We used the integration of NorthStar to build a common operating picture in which all of our units participating fed into," Krumm said. "It's the first time that we had that, so we used technology to do status reporting, to understand the operations that were ongoing and what the needs were on the ground, and what all was happening. … We also are looking at technologies in the future for all-domain awareness. General VanHerck has been very clear that we need to look at some of the newer technologies to do all-domain awareness from the C4 up to space. I think those will be a continuous effort to get those up here and working."

Arctic Edge will continue to evolve, becoming larger and more integrated in future iterations, said Krumm. "We need to. We need to be able to work together in this very, very tough environment and make sure that our homeland is always protected."

Russia Ministry of Defense

Russian Kh-101 nuclear-armed air-launched conventional long-range, standoff cruise missiles are mounted on Tu-95MS Bear bombers at an undisclosed location.

Mike Tsukamoto/staff; Airman 1st Class Erin Baxter

The NGAD concept calls for a manned aircraft with next-generation stealth collaborating with uncrewed escorts that will carry munitions, observe the battlespace, perform electronic warfare and possibly conduct attacks against ground-based air defenses.

Piecing Together the NGAD Puzzle

The Next-Generation Air Dominance family of systems remains highly classified. But some details are beginning to emerge.

By John A. Tirpak

Control of the air is the Air Force's top core competency, but as its premier fighters age, its ability to perform that mission in the future is increasingly in question. By 2030, the Air Force anticipates its F-22 Raptors will no longer be sufficiently survivable in contested air space, potentially leaving the joint force vulnerable to air attack. To stay well ahead of China's J-20 and other adversary aircraft, as well as increasingly sophisticated ground-based air defenses around the world, a follow-on air superiority fighter is urgently needed.

The Air Force has invested more than $2.5 billion since 2018 to develop that successor: the Next-Generation Air Dominance (NGAD) family of systems. By 2025, that number will have grown to at least $9 billion. While still highly classified, the Air Force has gradually begun to reveal limited details about NGAD, which it describes as a "family of systems" that will collaboratively gain air dominance in combat. The NGAD family will include at least one crewed aircraft and an undisclosed number of uncrewed aircraft, along with other technologies that could include optionally crewed platforms, missiles, pods, and offboard capabilities, some of which could operate from space. Some flying escorts will carry sensors or more weapons, while others will provide electronic or ground attack capabilities so that NGAD can get through enemy defenses to hold at risk any target in the battlespace.

"We can't modernize our way out of the problem ... just using an updated F-22."
—Lt. Gen. S. Clinton Hinote, deputy chief of staff for Air Force futures

A year ago, when Air Force leaders unveiled their "4+1" plan for the fighter force of the late 2020s and 2030s, many were stunned to learn it called for phas-

ing out the F-22. The No. 1 element of that plan identified the "F-22, transitioning to NGAD."

Lt. Gen. S. Clinton Hinote, USAF's deputy chief of staff for Air Force futures (formerly strategy, integration, and requirements), told Air Force Magazine last May that the F-22 is coming up on 20 years of operational service, and is suffering from parts obsolescence and "limitations" that "we can't modernize our way out of."

Advanced sensors in the hands of adversaries are starting to overcome the F-22's radar-evading stealth characteristics. Retrofitting the Raptors 1990s—and even late 1980s—design with new materials or active measures will only extend it so far. New sensors, funded at $344 million in fiscal 2023, will help it bridge to NGAD. "This is not an area … where we feel we can take a lot of risk," Hinote said.

With a looming "large … commitment" to NGAD in the fiscal 2023 budget, the Air Force began talking more about it over the past year. Its fiscal 2022 request for NGAD was $1.525 billion, and for fiscal 2023 that rises to $1.658 billion. To fund it, Air Force leaders are willing to sacrifice existing force structure, including some of the oldest F-22s, next year.

NGAD first appeared in the 2018 budget as a $295 million line item; the following year the "Air Superiority Family of Systems" called for $430 million.

In Its fiscal 2022 budget rationale, the Air Force said NGAD "ensures we maintain air superiority in the future by introducing game-changing technology now." NGAD is "not a single platform—USAF is focused on fielding capabilities to mitigate identified gaps, not on creating a 'next generation' aircraft."

But at least one part of the NGAD family will be a manned aircraft that will be accompanied by unmanned escorts. Former USAF acquisition executive Will Roper revealed in September 2020 that an NGAD "full-scale flight demonstrator" had already flown, adding coyly that it had "broken a lot of records." He told reporters later that he had fought to make that revelation to reassure the Air Force community that the service's embrace of digital engineering was delivering "real things in the real world."

Roper's concept for NGAD was to draw both traditional prime contractors as well as startups to compete; new aircraft didn't necessarily have to be built by the companies that designed them. Roper envisaged short production runs of 50 to 100 airplanes, each succeeded in close order by another more advanced design, with new types developed roughly every five years. This development frequency would replace the "winner-take-all" competitions that characterized the F-22 and F-35 programs with a more iterative, rapid development cycle to slash the Air Force's technology refresh rate from decades to years. The approach, which the Air Force has not abandoned, meshes well with Chief of Staff Gen. Charles Q. Brown Jr.'s admonition to the service to "Accelerate Change … or Lose."

"The announcement isn't that we just built an 'e-plane' and have flown it a lot of times in a virtual world, which we've done" Roper said at the time. "But we built a full-scale flight demonstrator, and we flew it in the real world."

Hinote, in the May 2021 interview, said he's been "surprised at how well [NGAD] is doing." He said he's escorted cleared members of Congress to see the aircraft, and that they came away "impressed." While "we still have to make it real," he said, "there's a lot to do in the program" and the test pilots flying

Staff Sgt. Betty Chevalier

Designed in the 1980s and operational in 2005, the F-22's stealth will be overcome by adversary sensors by the end of this decade. The NGAD family should be "orders of magnitude" stealthier.

Mike Tsukamoto/staff; Greg Davis/USAF

The primary NGAD aircraft may not look like a traditional fighter if the Air Force decides that long range and weapons capacity take precedence over maneuverability in future air combat, particularly for the Pacific theater. In this illustration, a group of escorts support an NGAD resembling the B-21 bomber.

the NGAD demonstrator gave it high marks.

Hinote did not offer a timeline for NGAD's introduction, but referred to some elements of the system as "optionally manned." NGAD will not replace the F-22 "one-for-one," he said.

Given that there are 185 F-22s, Hinote's characterization fits with Roper's plan to only buy 100 or fewer of the first NGAD before moving on to its successor.

While Hinote could not "confirm or deny" that the second NGAD is already in development, he said the fast-turn sequential developments will allow "the great companies of our industrial base to reenter the competition at the design phase, as opposed to crowding them out in the sustainability phase."

One of the key aspects of Roper's vision for NGAD was that it would not be built to last 30 to 40 years, but rather live a shorter operational life in which it is introduced, operated, and retired inside 12 to15 years. "This approach shifts funding emphasis from sustainment—typically, 70 percent of a weapon system's cost—to design and procurement. The old model ensures that vendors make most of their money sustaining aircraft, rather than creating them; Roper wanted to turn that model on its head. Parts obsolescence afflicts nearly every legacy system in the Air Force today. NGAD, Hinote said, is aimed at eliminating "vendor lock," where the original manufacturer controls sustainment and has an incentive to perpetuate upgrades and maintenance over creating new programs.

By contrast, NGAD will perpetually roll out hardware and software enhancements, with each iteration aiming to "jump over" the prior one. Roper had hoped that these generational advances would come every five to eight years.

Just as the F-22 was equipped to attack ground targets, NGAD will as well. In June 2021, Air Force Chief of Staff Gen. Charles Q. Brown, Jr. told the House Armed Services Committee that NGAD will have "some air-to-ground capability to ensure, one, that it can survive, but also to provide options for our air component commanders and for the joint force."

Based on senior Air Force leader comments and generic industry information, it's possible to bound some of the NGAD's characteristics.

FLIGHT PERFORMANCE

The primary aircraft of NGAD is likely to fly at least as high and fast as the F-22, meaning an upper ceiling of about 65,000 to 70,000 feet and a top speed of about Mach 2.8. The F-22 was designed for extreme maneuverability, but the Air Force hasn't divulged whether NGAD needs to be capable of engaging in a tight-turning dogfight. Given the accuracy of advanced sensors and missiles—the F-35, for example, can shoot a missile at a fighter to its rear—the NGAD may forgo extreme maneuverability in favor of larger internal fuel tanks and a heavier weapons payload.

Former Air Combat Command Commander Gen. Herbert "Hawk" Carlisle speculated in 2017 that the "Penetrating Combat Aircraft" that is believed to have evolved into NGAD could be something like the B-21 bomber, equipped with large wings and big fuel tanks for the long ranges of the Pacific theater and a greater magazine capacity for more shots.

In March, as the budget was being revealed, Lt. Gen. David S. Nahom, deputy chief of staff for plans and programs, said the Air Force traditionally focused on Europe and Russia in developing fighter aircraft, but NGAD will be different: "We've never developed a fighter with the ranges of the Pacific in mind before," he said in an Air Force Magazine interview. "So

this would be a first."

Other service leaders have said recently that there could be two versions of NGAD, one optimized for the Pacific theater's long-range requirements and another for the more compact European theater.

STEALTH

Service officials have kept largely mum about how stealthy the NGAD will have to be. Some have suggested that speed could be traded for stealth, if the speed of the aircraft was such that by the time it was spotted, a defender wouldn't have enough time to engage it with missiles.

On the other hand, leaders have sounded greater alarm in recent years that China may be able to detect America's fifth-generation aircraft. ACC Commander Gen. Mark D. Kelly often says stealth "does not mean invisibility," and that stealth aircraft will be detectable at certain ranges, requiring close-in electronic jamming for protection.

Industry sources say NGAD will be "orders of magnitiude" harder to detect than even the fifth-generation fighters of today, with the same radar cross section as a BB shot. It will also be stealthier in many different bandwidths, rather than optimized against a few key bands of search-and-track radars.

In recent months, F-22s, F-35s, and even older F-117s have been spotted and photographed wearing unusual shiny metallic panels; in some case, over the entire aircraft. The Air Force will not disclose the purpose, but it is likely they are testing potential upgrades for fifth-generation fighters or perhaps a new kind of stealth treatment for NGAD.

Air Force officials spoke openly in the mid-2010s about a possible jamming escort for the next-generation fighter, to be called the Penetrating Electronic Attack aircraft, or PEA. They've stopped discussing it, but a jamming escort is certainly one of the NGAD "family."

SENSORS

Today's fifth-generation fighters use Active Electronically Scanned Array (AESA) radars that hop frequencies very rapidly, to diminish the amount of time their electronic emissions can be spotted and tracked. NGAD may dispense with an AESA on the manned fighter and rely on escort aircraft to provide that function, which would make the manned platform harder to detect.

The NGAD will also certainly have an infrared search-and-track system to identify enemy stealth aircraft by their heat signatures. An IRST is one of the sensor upgrades planned for the F-22, which has been seen lately flying with slender, stealthy-looking pods on its outer wings. The Air Force will not discuss the pods, which appear to have a dielectric transparency at the front.

ENGINES

NGAD aircraft will have to penetrate deep inside enemy territory and operate there, far from tanker support. To do that, it will need both capacious internal fuel tanks and the ability to use that fuel sparingly. Since 2007, the Air Force has invested billions in the Adaptive Engine Transition Program (AETP), developing powerplants with greater thrust and fuel efficiency. They can adapt to mission conditions demanding either more "turn and burn" kinematic performance, or sip fuel for persistence. Other new technologies involve additive printing of parts, adaptive seals, and high-temperature ceramics to allow the engine to run hotter than today's turbofans.

There are two AETP engines, GE Aviation's XA100 and Pratt & Whitney's XA101. Both progressed to the testing phase last fall, and both will undergo durability and other testing over the next two years. Both companies said they've met the Air Force's goals: extending range by 25 to 30 percent and improving acceleration by 18 percent. To this: The AETP engines were meant to generate 45,000 pounds of thrust. They will also be

Mike Tsukamoto/staff; Boeing

Concept art of future fighters indicates that, with or without a pilot, NGAD aircraft won't have tail fins, to further reduce their radar cross sections. While the Air Force and Navy are sharing NGAD technology, the goal isn't a joint aircraft like the F-35, built in thousands. Rather, NGAD is expected to be the first of a series of aircraft built in lots of 50 to 100, with iterations appearing every five to eight years. The Air Force also wants to attract small businesses to compete with digital designs.

able to pump more electricity to electronic warfare systems or directed-energy weapons than today's fighter engines can.

Although the contractors won't discuss how, both also say their AETP engines make an aircraft stealthier, presumably by reducing their heat signature.

Air Force and industry officials say the AETP program was always aimed at NGAD. After testing and tweaking, the AETP engines are expected to be available for production around 2027, just in time to equip the first production-representative NGAD test aircraft. Meanwhile, the Air Force is also contemplating applying such technology to power the Block 4 version of the F-35 fighter.

Asked how AETP fared in the fiscal 2023 budget request, Air Force Secretary Frank Kendall said, "We're continuing the R&D," but he added, "The cost of development of a new engine is pretty significant. … We're looking for partnerships [with] the other services to be able to afford that going forward." Lt. Gen. Eric T. Fick, head of the F-35 Joint Program Office, has said that under the multinational F-35 partnership rules, "you have to pay to be different," and if the Air Force wants to put a nonstandard engine on its F-35As, it would have to cover the cost of development and production on its own dime. The Air Force trebled its fiscal 2023 funding request for AETP versus FY'22, to $354 million.

The Navy has its own NGAD-like program, and Pentagon officials have long said it will almost certainly use the same AETP engines the Air Force is developing.

WEAPONS

AIM. The main weapon for the NGAD is most likely to be the AIM-260A Joint Advanced Tactical Missile, or JATM, now under development by Lockheed Martin. First revealed at an Air Force industry conference in 2019, the JATM is meant to counter China's long-range PL-15 air-to-air missile, and restore to the U.S. a monopoly on "first shot, first kill" in dogfighting. ACC's Kelly told an AFA conference last September that USAF needs "fifth-generation weapons" to arm its fifth-generation aircraft.

Today's weapons negate the advantages of stealth, he suggested. "If we push [stealth aircraft] into ranges where everyone is observable," there's no point in having a stealth force, Kelly said. China's PL-15 has a range of about 80 miles, so the AIM-260's range will likely be considerably greater. The JATM "gets us there," Kelly said.

In order to remain stealthy, the F-22 will have to carry the JATM internally, which suggests the missile's dimensions must be about the same as that of the AIM-120A AMRAAM, the F-22's primary weapon today.

The JATM is likely to have a multimode seeker including both infrared and millimeter wave radar. While AMRAAM is still a good missile, Kelly said, "we've squeezed most all we can" out of it. The Air Force has been testing JATM at Eglin Air Force Base, Fla., ranges, and the fact that it hasn't been spotted and photographed by airplane enthusiasts there may indicate that it bears a close resemblance to AMRAAM. That suggests Lockheed Martin has managed to miniaturize components in order to add more propellant. It may be a hittile, striking its target directly rather than using a blast-fragmentation warhead. That too could free up space for propellant.

MAM: The Modular Advanced Missile is another highly classified system due to undergo "kinematic tests" from a fighter in 2023, according to Air Force budget documents. The weapon likely features interchangeable warheads and seekers, potentially usable as either an air-to-air or air-to-ground missile. It may also have a "stackable" and modular propellant system to give it longer range.

LREW and LRAAM: The Long-Range Engagement Weapon, being developed by Raytheon, and the Long Range Air-to-Air Missile, being developed by Boeing, might actually be the MAM, since both are modular in the sense that extra propulsion segments can be added to the missile to increase range.

Peregrine and Cuda: The Peregrine, developed by Raytheon with its own funds and announced by the company in 2019, is half the size of AMRAAM, but faster and able to travel farther, the company says. Being smaller, but with roughly the same capabilities as AMRAAM, it might be ideal for the escort aircraft in the NGAD "family" of systems, adding to the weapons NGAD can bring to bear. Lockheed Martin's Cuda is about the same size, but with a unique control system, and was Lockheed's answer to the Small Advanced Capabilities Missile project run by the Air Force Research Laboratory.

Some of these missiles may be planned for a later incarnation of NGAD or its successor. Kelly, at the AFA Air, Space & Cyber Conference in September 2021, said "we can't, sequentially, heel-to-toe, start working on Problem A and not even eyeball Problem B. We've got to keep looking forward." Kelly noted that China begins the successor to its new systems even before they are fielded.

Hypersonics: Hypersonic weapons are not necessarily just for striking ground targets. Senior Pentagon officials have been promoting air-breathing hypersonic systems as the vehicle for future air-to-air weapons for more than a decade. Kelly said hypersonics can "shorten that time of flight" from a shooter to the target aircraft, but "we just have to make sure we can reach out and touch [an enemy] at a range that is equal to or exceeds their ability to reach out and touch us."

Directed Energy: Although the Air Force today can only muster laser systems capable of generating about 150 kw of focused power with the Self-protect High-Energy Laser Demonstrator (SHiELD) program—this pod is not the final answer. Industry sources have said USAF intends to make laser systems part of the regular complement of future air combat systems, at a minimum to protect aircraft against incoming missiles, by blinding or frying their seekers.

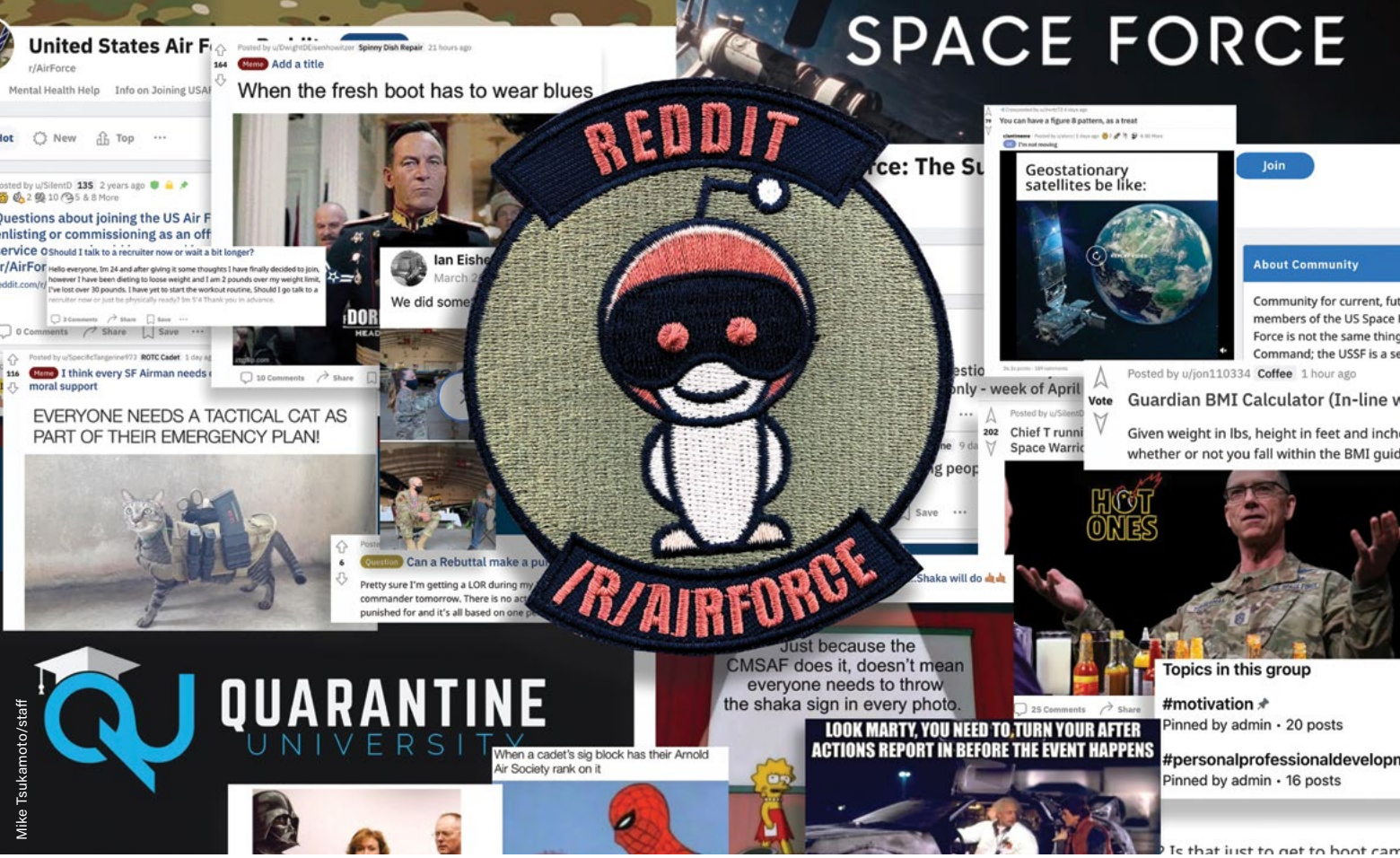
OTHER TECHNOLOGIES

Now retired, former Air Force Chief of Staff Gen. David L. Goldfein said in 2019 that NGAD will be comprised of "five key technologies" that would not all "come together on a single platform" and would not all mature simultaneously. Goldfein did not enumerate the five technologies, but he later alluded to them including engines, weapons, sensors, artificial intelligence, and connectivity.

CONTRACTORS

Lockheed Martin CEO James D. Taiclet and Northrop Grumman CEO Kathy J. Warden, in earnings calls with reporters over the past year, both noted that their companies are working on technologies applicable to NGAD. Lockheed Executive Vice President for Aeronautics, Gregory M. Ulmer, told Air Force Magazine he sees a big role for his company's "Skunk Works" shop in manned/unmanned teaming.

NGAD is likely to remain highly classified as long as the Air Force can keep it that way. Kendall, taking a page from Cold War practice, has said he's reluctant to share the shape and features of future combat aircraft lest the U.S. provide its opponents with a "head start" on developing countermeasures. ✪



Mike Tsukamoto/staff

Reddit, Twitter, and Facebook are popular social media hangouts for Airmen and Guardians. Increasingly, leaders are going there too.

The Social Networks

Online communities are helping Airmen connect with one another and their leaders. That's a good thing.

By Greg Hadley

Memes about computers and finance. Advice on housing options at different bases. Links to the latest news in Ukraine. Rants about leadership. Posts from Airmen and Guardians struggling from confusion, burnout, even depression.

Welcome to the unfiltered, fast-growing, increasingly influential world of unofficial Air Force social media.

The official Air Force social media outlets boast more than 2.9 million followers on Facebook, 2.2 million on Instagram, and 1.4 million on Twitter. The Space Force, just over two years of age and still building, has 519,000 followers on Twitter and 330,000 followers on Facebook.

But for insiders of various stripes, unofficial social media pages such as Reddit's r/AirForce and r/SpaceForce, or Facebook's amn/nco/snco or Quarantine University, are rich sources of news, insight and, of course, gossip. Many Airmen and Guardians, especially younger service members, see these pages as crucial to navigating their lives and careers in uniform. And leadership is paying attention.

Airmen and Guardians live online now. "We've got to go there with them. We've got to be there with them."
—Chief Master Sergeant of the Space Force Roger Towberman

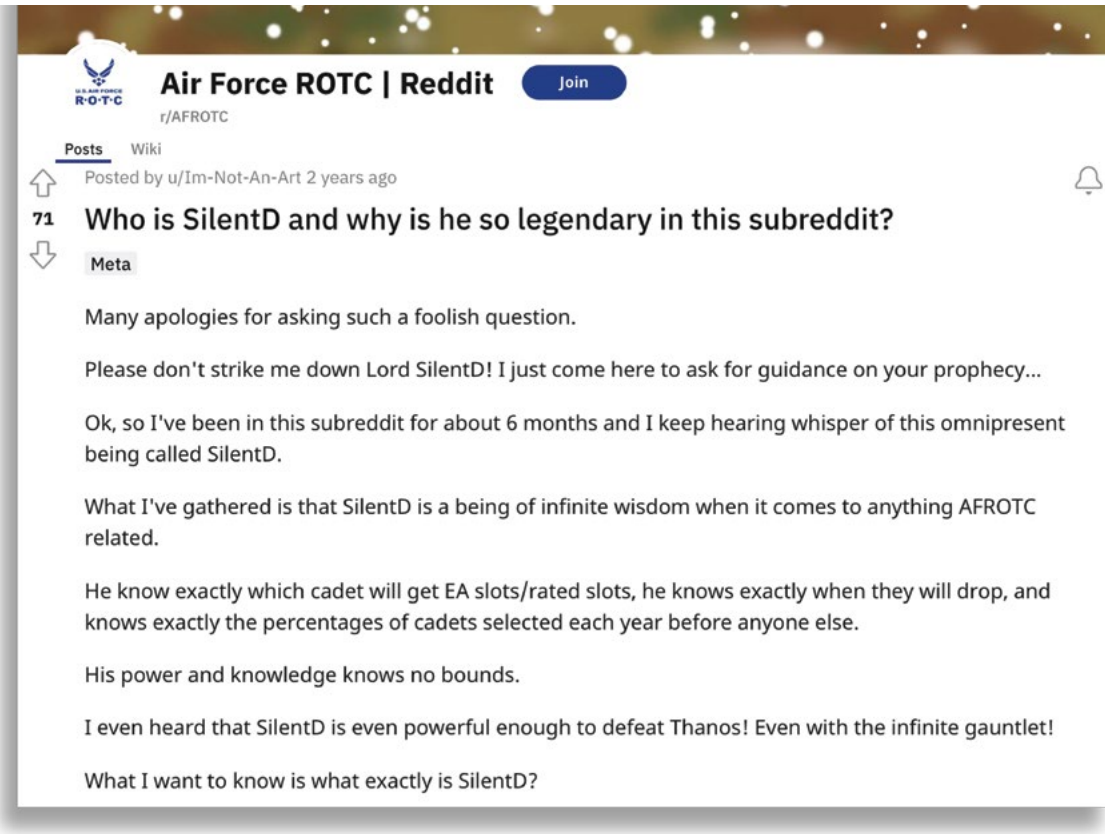
"We grew up being taught to go to the DFAC [dining facilities], to go to the dormitories because that's where young people lived, that's where they lived, and you need to go there, and you need to see it and you need to be with them," said Chief Master Sergeant of the Space Force Roger A. Towberman in a panel discussion at the AFA Warfare Symposium in March. "Well, they live in social media now. And we've got to go there. We've got to see it. We've got to be there with them."

Doing so is still a work in progress. Leaders, page administrators, and community moderators are all reckoning with how to mesh military hierarchy with the usually anonymous, often irreverent nature of social media.

REDDIT COMMUNITIES

Reddit.com is a collection of online communities (called "subreddits") where users share notes about everything from nuclear weapons to cat memes to the Air Force and Space Force. It is among the most highly trafficked websites on the internet. The unofficial r/AirForce and r/SpaceForce subreddits are not sanctioned by the services, but governed by anonymous

SilentD is a prior-enlisted Airman, now Guardian, who moonlights anonymously as a moderator on r/AirForce, r/SpaceForce, r/AFROTC, and r/AirForceRecruits. Young Airmen and Guardians trust these so-called sub-Reddits and the information shared there.



Mike Tsukamoto/staff

moderators such as "SilentD," a user who helps run r/AirForce, r/SpaceForce, r/AFROTC, and r/AirForceRecruits.

SilentD, who asked to remain anonymous, is a prior-enlisted officer whose career started in the Air Force and now continues in the Space Force. SilentD began using Reddit in 2011 as "just a community member ... interested in finding like-minded other Air Force members and stuff," but after a year or two of regular posts and interactions, was invited by other moderators to become a moderator. When r/SpaceForce was launched in 2017, a similar process unfolded.

These pages started small—it took r/AirForce a year to compile 1,000 members—but the audience has grown steadily, fueled by a generation of "digital natives" now joining the Air Force and Space Force.

"Shooting the crap and venting to each other and supporting each other, you'll see people asking about 'How do I do my basic preference?' [or] 'My supervisor said this, is that true? Can you back it up with an AFI reference?'" SilentD said.

That's really no different than "the mentorship that happens in on-base organizations with the junior enlisted club or the NCO club or whatever. All of those things happen in-person on bases. But with an online community, you can reach an NCO on the other side of the world that has the information that you need," he said.

On any given day, r/AirForce features questions about permanent change of station moves; rules about taking leave; how best to raise issues with unit leaders; or what the separation process is really like.

There are also jokes—plenty of jokes—many mocking the Air Force's outdated IT systems, everyday bureaucracy, or uniform policies like the one restricting beards.

Chief Master Sergeant of the Air Force JoAnne S. Bass enjoys the humor. "I love the memes," she said at the AFA Warfare Symposium. "The memes are funny. There's a couple funny meme people out there. As long as you're not mean about it, right? Like, I think the IT memes are hilarious. Actually, I sent some of the memes to [Chief of Staff Gen. Charles Q. Brown Jr.], and I'm like, 'Sir, we've become a meme.'"

Yes, the services' top leaders monitor Reddit, and no wonder: r/AirForce now has 179,000 members, equivalent to more than half the Active-duty force; r/SpaceForce has more than 20,000 members, more than twice as many as Guardians in the Space Force.

Some leaders aren't just monitoring. They're wading right into the discussion.

"I remember as a new command chief, Air Force command chief in 2013 being told to stay off, just don't go there," Towberman said of social media. "And I can't even imagine that today. I can't imagine ignoring this incredibly powerful tool."

Towberman has been at the forefront. In 2015, as the Command Chief Master Sergeant for 25th Air Force, he hosted an "Ask Me Anything" session on r/AirForce, tackling questions ranging from whether he'd rather fight a horse-sized duck or 100 duck-sized horses to detailed queries about intelligence careers.

"I had two senior Airmen that were there as social media advisers," he recalled in an interview. "I had a PA person, I had a lawyer in the room. I had all these people. Everyone was nervous. I was nervous. And one of the first questions was, 'Oh, I bet you're there with a whole roomful of people.' And I had to make a decision, right? And I said, 'Yeah, I am, because I'm scared.' I said, 'Yeah, I got this person here and this person and this person because I want to get this right. And I don't know what I'm doing. I'm 48 years old,' or whatever I was at the time."

He did it, he said, because "it's kind of naturally me to try new things," and "I felt like that was a place where we needed to do a better job than we were doing at the time."

Around that same time, then-CMSAF James A. Cody hosted an "Ask Me Anything," as well. SilentD recalls mixed results.

"I think he answered 11 questions and only had an hour to do it," SilentD said. "So it was kind of negative in one way because he didn't answer many questions, and they weren't

great answers. They were kind of political and politically correct answers that [the audience] didn't want to hear."

But there was no going back. Cody's successor as CMSAF, Kaleth O. Wright, hosted a session in 2018, then followed the next year with a joint session with then-Chief of Staff Gen. David L. Goldfein.

Helping to facilitate these sessions has given SilentD a unique role helping to "educate" senior leaders about how to communicate effectively on Reddit.

It's not always easy, Towberman acknowledged.

"[Leaders] have to continue to stretch themselves, but they need to be themselves," Towberman said. "We're in a transition period. We're moving through some generational changes. And it was my wife last week that told me, she said, 'If everything that you believe about young people is true, and everything you believe about the future is true, you don't have to worry about these few people that haven't caught up yet. They'll be out of the way soon enough.'"

RETHINKING THE CHAIN OF COMMAND

What makes Reddit worth embracing right now, advocates say, is how it can allow for service members with vastly different experiences or backgrounds to connect, discuss, and debate—anonymously.

"A specialist or an E-2 is not going to feel comfortable questioning a colonel or general or something with their name attached to it," SilentD said. "And that's also going to come with some bias, like, if you see an E-2 questioning something, you're going to be like, 'Well, you're brand-new, you don't know what you're talking about. Shut up specialist, go do your work.' Whereas [on] Reddit, you're only judged on your ideas. There's no rank attached. You could be a general or an E-1, it doesn't matter—as long as you can communicate well and write well and form coherent thoughts."

That dynamic flies in the face of conventional thinking about the chain of command, but that's exactly the point, said Chief Master Sgt. Ian Eishen, a regular Reddit user.

"I've always thought structure and chain of command is a very good place when it comes to things like execution of money and discipline and time-sensitive situations—critical loss of life or anything where the risk of doing it wrong" could be life altering, Eishen said. "But when we get into brainstorming and collaboration, there really is no chain of command, there's no reason for it. And if we focus on a chain of command, and we filter that information as it goes up the chain, it's bound to get tweaked, or biases put into it unintentionally."

Prior to the internet, the chain of command was considered the most efficient way to spread information to the force—changes were communicated down the line until they reached the junior enlisted ranks. But that approach is "really outdated," SilentD said.

Senior leaders "have to utilize these platforms to get the information out to everyone instantly at the same time," SilentD added. "Because otherwise, the first person that gets it is going to post it on social media. And then someone else might contradict that and now you have rumors spreading and confusion, and no one knows what's going on."

Such situations happen all the time, from the release of new temporary BAH [basic allowance for housing] increases to body measurement tests to medal designs have all leaked on social media in recent months.

The chain of command, Towberman said, is "not a chain of communication, not a chain of care."

"I don't need to pass along, 'Hey, we got a new PT test. Tell a general that tells a colonel that tells a lieutenant colonel that tells a major that tells …,' I don't have to do that. That's ridiculous," Towberman said. "And so to me, that's really the difference: We communicate very flatly, we communicate in all directions at all times. Commands are given by commanders. So to me, that's how, in our profession, that's how you kind of navigate that: There is a lot of free flow in social media, and that's OK. When it's communication, it's OK."

At the same time, frustrations and even anger sometimes colors the debate. When that happens, leaders need to reach

Chief Master Sgt. Ian Eishen, left, and Brig. Gen. John Teichert, the assistant deputy undersecretary of the Air Force for international affairs, hosted an "Ask Me Anything" session on Reddit.

Mike Tsukamoto/staff; 412 Test Wing/ reddit.com/r/AirForce

Quarantine University, founded during the pandemic, became so popular that it was chosen to host the AF 2020 Impact Symposium. Speakers included CMSAF JoAnne Bass, CMSSF Roger Towberman, then-Lt. Gen. Anthony Cotton, and other high-profile leaders.

Mike Tsukamoto/staff; AF 2020 Impact Symposium

out to Airmen and Guardians directly—and help set guidelines for professional behavior.

"What I've learned in the past several years," Bass said, "is typically [your] online behavior reflects your offline character. … So to that end, we have to understand this information domain. … We have to hold ourselves accountable. Our Airmen are pretty good at understanding right and left boundaries and understanding respect, in uniform, out of uniform, on duty, off duty."

On the other hand, monitoring what's posted on r/Air Force is like listening into the conversation around the proverbial watercooler. It's an insight into what's on Airmen's minds, Eishen said.

"If you read everything on our Air Force subreddit—and I read almost everything on there—I get a pretty good idea of some of the things that exist in the Air Force," Eishen said. "That doesn't mean that out of [USAF's] 330,000 Airmen all 330,000 believe this, but if there's enough confusion about a certain policy or an idea or enough distrust of something, then you can add everybody who says those words, multiply them by 10 or 20, and there's a good chunk of people."

FACEBOOK GROUPS AND PAGES

Facebook isn't anonymous, but it has also spawned a large and vociferous community where Airmen voice their frustrations, seek help, and even find mentors.

When the COVID-19 pandemic first began to spread in 2020, Eishen and several friends wanted a way to stay connected with their Airmen and to foster professional development. That's how AF Quarantine University (QU) was born.

"In Professional Military Education, there's a saying: 'You can talk about anything you want to talk about.' It's very much a judgment-free zone, where we're learning together and so you're allowed to say very ignorant things, and we all talk about it," Eishen noted. "And so we kept Quarantine University in the exact same way. And through COVID, and through Black Lives Matter, and through the Capitol Riots, and all these different things that happened, it kind of became a place that people could talk … especially with people that were home and people that wanted to talk across spaces or across units."

While the group looked to PME for inspiration, though, it wasn't organized by leadership, Eishen said. Indeed, the founders didn't even tell leadership what they were doing. The pandemic was underway. People were stuck at home. They took their own initiative.

"If we would have asked permission, it would have taken forever," Eishen stated.

The group grew quickly—it now has more than 29,000 members—so Air Force leveraged the community rather than ignoring it. When the group hosted the AF 2020 Impact Symposium in October 2020, Bass, Towberman, and then-Lt. Gen. Anthony J. Cotton all participated.

"And then a few months after that … Air Education and Training Command and Air Force Headquarters, they were doing meetings on 'Hey, what is the future of education in the Air Force?'" said Eishen. "And QU actually got a seat at that table!" Not bad for a group that started with "a couple of people sitting in the chow hall, making something up, and then jumping online and trying it out."

It turned out not to be as great a leap as they would have guessed, he said, to be "able to start influencing what's happening in Air Force education."

SCANDAL SHEET?

One of the most notable Facebook pages for Airmen is "amn/nco/snco." Started in 2013 by a retired enlisted Airman,

the page quickly established itself by not only posting all the latest news articles about the Air Force, but also submissions from readers, often including documents, pictures, and videos that had not previously been shared publicly.

Because some of the posts have highlighted accusations about toxic leadership, problems at particular bases, or frustrating stories of bureaucracy, the page has not always been beloved by leadership, its administrator, who asked to remain anonymous, told Air Force Magazine. But it has led to changes.

"All these outlets, they give a voice to Airmen … who don't have a voice. They're not being heard. And what's happened with social media is people realize it's not just them. It's not just their shop, their base. Some of this stuff is systemic," the admin said. "Where before the advent of social media, they're like, well, you know, I'm just gonna suck it up, maybe this is just my unit. They're realizing cross-talking amongst everybody in the services all over the world. Like … for instance, there's mold in Lackland [Air Force Base, Texas]. Oh, guess what, my Army barracks has mold too. And oh, at Al Udeid, at this deployment over in Qatar, we've got mold too. And guess what? You start finding ways to benchmark solutions."

There's also a deterrent effect, the admin argued.

"There's kind of a running joke: Some people tell their people, 'Hey, you better not end up on that page.' And things will be posted and other leaders will say, 'Hey, can you go check to make sure we're not doing that?' And that doesn't really get seen very often. I hear about them behind the scenes," he said.

Like Quarantine University, amn/nco/snco has been a resource where Airmen answer questions for other Airmen.

In many cases, the admin said, the people asking the questions didn't receive the help they need from their commands and look to social media to fill in the gap.

"Basically what you have is a lot of people who have questions and they're afraid to ask or they've asked and they've been told, 'Hey you need to get that information yourself,' " the admin said. "Or … 'Why don't you know that information?' Then they have to worry about their performance report coming up … and they're worried that 'Woah, if I'm known to constantly ask questions, that's not a good thing.' "

The Facebook page has some rough edges—the admin acknowledged "mistakes" posting things in the past, including one that drew the attention of the Air Force Office of Special Investigations (OSI), which wanted to know its source. Asked about the incident, the admin's lawyer told Air Force Magazine that they declined to participate in the investigation. OSI did not respond to a query about the incident.

In March 2021 the page was briefly shut down for unknown reasons. The disruption cost the page many of its followers, which declined from 350,000 at the time to about 65,000 today. Facebook's parent company, Meta, did not respond to a query about the matter before press time.

"The bottom line is all of these social media and regular media, it improves the lives of Airmen," the admin said, sounding every bit like a newspaper publisher defending its First Amendment rights. "That's the bottom line. And if one Airman's life is improved and one family's improved, that's what it's about."

HELPING AIRMEN

Airmen and Guardians on social media frequently rally in response to members who post about personal struggles, from financial difficulties to depression to thoughts about suicide.

"Even on Reddit, you'll see trolls and you'll see arguing," Eishen said. "But when somebody really needs help, 90 percent of the people come out and are immediately helpful."

Air Force amn/nco/snco/Facebook

Memes can help blunt the sometimes rough-and-tumble comments on social media, as in this Facebook post that sought to lower the temperature by suggesting an edgy comment was intended to be humor, not closed-mindedness.

Eishen recalled an incident one Christmas where an Airmen and his wife had PCSed but had no cash and couldn't get in touch with his first sergeant on base. Desperate, the Airman appealed for help on Reddit.

"Within about 30 minutes, I was able to get a hold of him directly, start talking to him, call the base, get him in a room on base and work through, 'Hey, we'll get his first sergeant in the next day or two to pay for it," Eishen said. "Then we shot him some money over Apple Pay so he can buy dinner for him and his wife and make sure that they had a Christmas meal, and all that was good to go."

In other cases, service members can be in crisis, sometimes unable to get the mental health help they require, and turn to Reddit or Facebook as a last resort.

"You have people who have to reach out, basically only because they're anonymous, to get help," the amn/nco/snco admin said. "I can't even count, probably over 10 people I've helped with suicide—setting up a wellness call, talking them down from committing suicide."

SilentD echoed the sentiment. "I have intervened with dozens of suicidal members on Air Force and Space Force subreddits," SilentD said. "So we've had everything from someone posting that they're just sad, they just broke up with their significant other and they're depressed about it, to posting their actual suicide note on Reddit or posting a picture of their pills that they're about to swallow to try to kill themselves. And I've tried to intervene on dozens of those. … And others in the community do the same thing. So if they see something like that, then you'll immediately see usually dozens of posts, like 'Hey, man, give me a call. Here's my number. I'm going to private message you. Reach out. Don't do this, you know, talk to me. I'll listen to you.'"

Often it's the anonymity social media provides that enables intervention.

"Anonymity gives people courage," Towberman said. "I wish that wasn't required to talk about your struggles. But when they do, and then to see the community kind of rally around them, we know that we have saved lives with social media. And so just to see that happen is amazing."

This is where the importance of unofficial, slightly uncouth, tightly knit support communities shines most.

"Yeah, we post stupid memes," SilentD said. "And maybe sometimes we're too critical of senior leaders or something like that. But there's so much value in that community and looking out for each other that I personally think makes up for all of that." ✪

Accelerating Change at Space Force Delta 45

Guardians and Airmen innovate and renovate, doubling the rate of launch at Cape Canaveral.

Ten years ago, Cape Canaveral launched less than 10 rockets per year. In 2021, it launched 37 and aims for 67 launches in 2022. The goal is 100 launches from the station per year.

By Abraham Mahshie

CAPE CANAVERAL SPACE FORCE STATION, FLA.

The mission control room at Space Launch Delta 45 looks much like what you've seen in old TV footage and space movies from the 1960s. The technology and clothes have changed, but the vibe is the same: Launch data is projected on large screens for all to see. Desks rise up from the front in semicircles, each presenting its operator with uniform modular control consoles featuring big, square keys fixed on a sloped panel.

The U.S. Space Force is responsible for launch and space assets at Cape Canaveral Space Force Station, which is set to break the record for launches this year with 67. For the first time, polar launches can now lift off from Florida's Space Coast; in the past those were exclusively the province of Vandenberg Space Force Base, Calif.

"I started to sense there was a real culture change when I started seeing the speed of adaptation of new things."
—Capt. Oliver Cheng, an operations support flight commander

To pick up the pace, SLD 45 leaders say they must offer a faster turnaround than was ever demanded in the past. New weather tracking programs and more sophisticated risk assessment technology make this possible. The 2-year-old Space Force is inculcating a culture of innovation and responsible risk-taking, an approach Chief of Space Operations Gen. John "Jay" Raymond likens to the Silicon Valley mindset, where even the lowest-ranking individuals can speak truth to power and offer ideas for better ways to accomplish the mission.

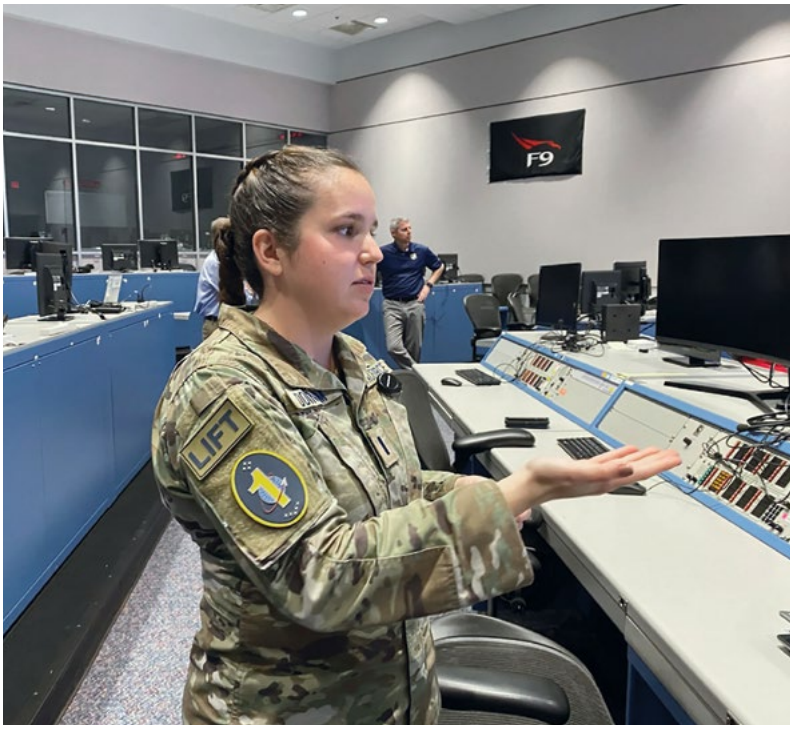
Raymond is responding to pressure. China's heavy investment in space capabilities—and Russia's demonstration of counter-space weapons—raise the stakes for future operations dependent on space. Increasing the launch pace is about lowering launch costs and realizing national security imperatives, while at the same time enabling a growing and vibrant commercial space

Airman 1st Class Thomas Sjoberg/USSF

Space Force Gen. John Raymond, Chief of Space Operations, speaks with senior leaders in the Morrell Operations Center at Cape Canaveral Space Force Station, Fla., in May 2021. Raymond toured several facilities on CCSFS and met with Airmen and Guardians supporting space launch operations.

business that will help enable the Space Force to achieve its mission objectives, including establishing a more resilient space architecture.

SLD 45 is at the forefront of the policy adjustments, digital transformation, and innovative new ways of thinking that will help realize Raymond's vision of a space—"Range of the Future"—an urgent national security challenge.



Abraham Mahshie/staff

1st Lt. Ascheleigh Downum oversees Mission Control Room One at SLD 45, Cape Canaveral Space Force Station. She's committed to advancing the digital transformation for launch.

DIGITAL TRANSFORMATION

Sometimes, the control room launch keys stick.

Space Force Range Operation Commander Instructor 1st Lt. Ascheleigh Downum oversees Mission Control Room One at SLD 45, and she is committed to advancing digital transformation for launch. The 26-year-old millennial grew up with more advanced technology than what she's using today.

"As you can see a lot of our technology here is kind of outdated," Downum said, pointing to the built-in communications panels with push buttons. "It can get confusing. There are a lot of buttons that do a lot of different things that are also similar, but they don't do the thing you want it to do."

When buttons stick, they can trigger unintended consequences. "We have issues with buttons getting stuck and it sends the panel into a test mode, which renders our console unusable," said Downum.

"We've had nets just go down completely, lost talk monitor capability—just randomly end count for a launch—and that, sometimes, can have a mission impact."

If a mandatory item goes down, launch sequences must be suspended.

"We've lost those channels directly to the user, and we've had to find some workarounds ... on launch day."

Now, at last, a digital update is in the works.

"Basically, what we've been trying to do is bring all of that technology into the 21st century," she said. Compunetix, a software program hosted on the Range Application Deployment (RAD) system, is now in the operational test phase. Every console has a large curved monitor set on the top of the communications panel.

The RAD system's on-screen buttons resemble the old-fashioned control panel, but can be customized to the operators' needs, depending on their role: range operations commander, safety officer, or surveillance control officer.

The visual display reproduces the live range count and live video on every operator's screen and allows each operator to communicate in real time over chat and "significantly more" communications channels. The RAD system can support pages for communications networks customized to both SpaceX and ULA Atlas rockets simultaneously, and if a console goes down, the operator can just move to another workstation in mission control and log in there.

RAD even has a remote capability. A mission dress rehearsal recently tested the remote system by communicating with a launch commander at Patrick Space Force Base—20 miles south of Cape Canaveral.

"Our launch decision authority was sitting down in his office at Patrick and he was able to do full communication with the crew [and] give his clear to launch over these digital networks," Downum said.

As launch tempo increases, leadership will require the remote capacity to approve launches.

RAD was used in shadow mode March 1 for a ULA Atlas V launch of NASA's GOES-T weather satellite. It will remain in that role until RAD is fully tested and approved.

Abraham Mahshie/staff

Space Force Capt. Oliver Cheng spent eight years in the Air Force before transitioning into the Space Force. He believes the emerging culture of the Space Force is real, and it genuinely supports innovation.

Down the hall from the control room, the 45th Weather Squadron Multi-Domain Operations Center, a circular enclave of desks with six or more monitors each face a giant video display of weather data. The center processes feeds from $80 million worth of weather sensors, winds, temperature and surface electric fields, clouds, lightning strikes, and more; digital models display insights intelligible only to meteorologists.

"All these different monitors, they're all feeding from different sources of information, and we use all of these separately to interrogate what's going on in the atmosphere," said Air Force Lt. Adam Thaler.

Weather in different parts of the atmosphere affect rockets at different stages of launch and recovery. Increased precision and faster updates can mitigate against unnecessary weather holds, reducing the chance of a badly timed launch.

"We're using that information to make the go and no-go calls for the weather status," Thaler said. Further integration is on the way, however.

Today, said Taylor, "If I want to look at lightning, then I have to go over here. If I want to look at radar, then I have to go over there. So, it's not as efficient as it could be."

A new tool called CLEER, for Cloud and Lightning Evaluation for the Eastern Range, brings all the data into a single 3D weather visualization. Developed in just nine months, this agile software development project delivered a prototype for shadow testing in October.

"It takes our radar data, it takes lightning data, it takes temperature levels, and it puts them all into one 3D visualization," according to Thaler.

Col. Jason King, commander of the 45th Weather Squadron, broke down the simplicity of the new digital system, which could be fully implemented as soon as early 2023.

"If you could imagine sitting in this chair here, looking at the weather radar, and then looking at lightning and looking at satellite, and trying to put all that together in your head, it's hard," he said. "What's the distance between that cloud and where the rocket is going to be at 30,000 feet? You're kind of guessing," he continued. But with the new technology, "you click on a cloud, it tells you exactly, it's going to be 4.3 miles away from the launch trajectory. And there's no human error there—it's just automatic."

The precise computerized calculations factoring in all the atmospheric data gathered by the weather squadron will mean more launches.

"We're able to evaluate faster, quicker, more accurately, and we don't have to be as conservative," said King. That's important because being too conservative means "you can scrub a mission, which may impact the one for the next day. It's kind of a chain reaction."

NURTURING A GUARDIAN CULTURE OF RISK-TAKING

Squadron commanders and operators across SLD 45 mimic the same refrain spoken by Space Force leaders calling on them to take risks. Risks, of course, come with the possibility of failure. At SLD 45, young Guardians and Airmen say they are confident they can make a mistake and their leaders will have their backs.

Guardians and Airmen at all levels are encouraged to speak up, and they say they are comfortable doing so. Older leaders with decades of experience are buying into new ways of doing things.

"You can tell that the culture is changing," said Space Force Capt. Oliver Cheng, 34, an operations support flight commander who spent eight years in the Air Force before transitioning into the Space Force. "For me, every time I heard the word 'innovation,' at least in the previous decade

Abraham Mahshie/staff

Brig. Gen. Stephen Purdy Jr. has been driving the risk-taking at SLD 45 since taking command last August. The new Gaming Lounge is his way to encourage young Guardians to play—and work—together.

of my career, I'd always listen to that word and have guarded ears. I'd be like, 'Oh, here we go he said,'" recalled Cheng. But at SLD 45 it's been different.

"I started to sense there was a real culture change when I started seeing the speed of adaptation of new things," Cheng said. "There's really a willingness to listen, and just an attitude of, 'Show me. Don't just tell me.'"

The mission assurance team he is part of got the green-light to use commercial Jira software to create a program for the Delta to help improve its processes. The program was developed on the Air Force's cloud-based Platform One.

The resulting Falcon Issue Tracker helps download, study, generate feedback on SpaceX launch data to identify potential problems. The issue tracker looks at every step of the launch process from manufacturing to lift off and deploying the payload into orbit.

Similarly, a new Launch Verification Database (LVDB) captures a line-by-line record of everything the mission assurance team does to assess risk.

Cheng and others visited the "Space Camp" software factory at Peterson Space Force Base, Colo., where they learned how they could leverage new software at SLD 45.

Using Platform One, these tools bypass aging IT infrastructure and overcome the network problems that used to grind progress to a halt here. "We used to have, literally, whole days where the whole tool would be down," Cheng said. Moving the LVDB to Platform One improved security and added speed and efficiency. Now, operators can use their secure cell phones and tablets to do mission tracking tasks.

The list of new software being adopted by SLD 45 goes on. "I'm seriously just hearing about new things dropped, like, almost weekly. And it's, it's awesome," Cheng said.

Down the road at Patrick Space Force Base there's a room full of 3D printers and laptops called "the Forge." It's a place where Guardians and Airmen go on their own time to develop new solutions to "pain points" across the Delta. Many of those present attended a three-month coding workshop in Colorado to become "Supra Coders" capable of writing their own software solutions.

GETTING TO 100 LAUNCHES

In a space that houses Patrick's bowling alley, the lanes are dark, but neon lights flicker where part of the empty space is being prepared to house $300,000 worth of PC consoles, Xboxes, PlayStations, a 75-inch TV screen, and more—a 24/7 gaming and entertainment mecca for Guardians and Airmen. On the far corner stool of a center bar sat a one-star acquisitions professional and engineer by trade, known to be a gamer and tech nerd himself, Brig. Gen. Stephen G. Purdy Jr.

Purdy has been driving the risk-taking at SLD 45 since taking command last August. The gaming lounge is his alternative to leaving young service members to hang out solo in their dorm rooms "with their Mountain Dew and their Twizzlers, playing games all night."

Purdy touts characteristics he values in his people. "We like to play. We like to experiment, but it's with a purpose in mind, and we have an overriding focus," he said. "We're really, really focused on implementation, getting that capability to the warfighter."

Purdy's apprach is to apply resources and empower leaders across the base to get the job done. He turned his acquisitions training on end; instead of contracting out, he helped service members to learn to help themselves.

He embraces both Air Force Chief of Staff Gen. Charles Q. Brown Jr.'s "Accelerate Change, or Lose" and CSO Raymond's call for the Space Force to become the nation's first true digital service.

"Here, we're more vertically integrated," he said. "We kind of own our acquisition and our operations in many ways. And so, we can move on out."

The shift in America's approach to its rivals and emerging threats underscores a sense or urgency here.

"There's a real threat," Purdy said. "A China threat, a Russia threat. ... But the threat base, it has definitely changed the nature of stuff, the rise of the Space Force."

Launching more rockets faster means putting Raymond's vision of a resilient space architecture in place more quickly.

A decade ago, Cape Canaveral was launching less than 10 rockets per year. It launched 37 rockets in 2021 and aims for 67 in 2022. "We tell ourselves, in a few years, you need to be ready to go launch 100 rockets a year," Purdy said. "How do you get to that point? You have to change almost everything. You have to change your philosophy. You have to change your processes. You have to look at what you're doing. You have to look at your technology."

These are all happening now.

"And, so this gaming, and this innovation, and this whole attitude of innovation and change and whatnot, fits right into it," Purdy admitted. Culture. Process. Technology. Each must advance more rapidly to meet the threat and the growing demand for launch. Each plays a role, Purdy said.

"All of those are how I get to increased launch." ✪

Tracking Hypersonics in Real Time

New capabilities are required—*now*—to combat long-range precision missiles being tested by adversaries.

Anthony Mendez/Missile Defense Agency

The first flight-test of a long-range, ground-based interceptor is launched from Vandenberg Air Force Base, Calif., Sept. 12, 2021. Funded improvements to the Ground-Based Midcourse Defense system will help the U.S. defend against the threats from China, Russia, and North Korea.

By Amanda Miller

The Department of the Air Force is rolling out plans to beef up missile warning and tracking as China, North Korea, Russia, and even Iran develop, build, test, and field new long-range missiles.

New details emerged during the Space Symposium in Colorado Springs, Colo., in April about plans for space-based missile warning and tracking, which Air Force Secretary Frank Kendall called a top priority of the Biden administration.

Kendall said long-range precision missiles "place the entire joint force at risk" and referred to missile warning and tracking as "a no-fail space mission."

"I know from my leadership in the administration, there are no more important areas to prioritize than missile warning and nuclear command and control," Kendall said.

A combined $1 billion in the fiscal 2023 President's Budget request addresses missile warning and tracking by allowing the Space Force "to grow a proliferated, multi-orbit, disaggregated architecture over the next several years," Kendall said. "To be able to track objects like China's hypersonic weapon systems or their potential fractional orbital bombardment system, the Department of the Air Force will invest in disaggregated missile warning and missile tracking capabilities from space."

"North Korea ... obviously has an intercontinental ballistic capacity. ... And Iran hopes to develop one." —Sen. Mark Kelly (D-Ariz.), member of the Senate Armed Services Committee and former astronaut

The amount pays for portions of infrared satellite constellations in two orbital layers along with related ground facilities. The Space Development Agency (SDA) and Space Force's Space Systems Command (SSC) each have responsibility for a new "layer" of missile-tracking satellites.

EVOLVING ARSENALS

Evidence of new intercontinental ballistic missile (ICBM) silos in China has raised more concerns on top of the country's advancing its hypersonic and orbital systems.

Senate Armed Services Committee chair Sen. Jack

Reed (D-R.I.) cited China's building of "three missile fields in hardened silos throughout the country" during a hearing that featured testimony by military commanders March 8.

"Ensuring we can accurately warn both Strategic and Northern Commands, and our senior leadership, of a missile attack on the homeland is of the utmost importance," Reed said.

At the same hearing, former Navy pilot and astronaut Sen. Mark Kelly (D-Ariz.) acknowledged that "North Korea … obviously has an intercontinental ballistic missile capability" and that "Iran hopes to develop one."

Soon thereafter, North Korea tested a new intercontinental ballistic missile that reached more than 6,200 kilometers in altitude and splashed down about 1,100 kilometers off Japan's western coast, according to information from the Japanese and South Korean defense ministries. The test was North Korea's third in a month, following two that officials said didn't reach ICBM range.

North Korea could surpass the U.S.' ability to protect the homeland, the head of U.S. Indo-Pacific Command Gen. Glen D. VanHerck told the SASC on March 24. VanHerck advocated for planned upgrades to U.S. defensive weapon systems for shooting down ICBM's. He said funded improvements to the Ground-based Midcourse Defense system and the planned Next-Generation Interceptor "will help both get after the additional capacity problems and the capability problems."

Also in March, Russia claimed to have fired hypersonic missiles on ammunition and fuel depots in Ukraine, though their use prompted speculation that Russia had run low on other precision-guided munitions.

TRACKING HYPERSONICS

Even though Russia says it's already fielded hypersonics in Ukraine, mid-2025 is the soonest the U.S. could expect to place its planned constellation of 28 infrared missile-tracking satellites into low-Earth orbit (LEO). The Space Development Agency's constellation should be able to track maneuverable hypersonic vehicles, something today's systems weren't designed to do.

SDA Director Derek M. Tournear briefed reporters during the symposium on the agency's already-accelerated schedule to launch its "Tracking Layer" satellites.

Much like U.S. Space Command and the Space Force, SDA considers itself a startup. All three organizations started—or restarted, in the case of the combatant command—in 2019. SDA's role was to try to disrupt and speed up the historically lengthy and expensive process of acquiring new satellites. The agency moves organizationally from the Office of the Secretary of Defense to the Space Force in fiscal 2022.

SDA's planned National Defense Space Architecture relies on lower-cost parts having become more readily available and a "spiral" concept of de-orbiting and replacing full "tranches" of comparatively low-cost satellites with upgraded batches every two years. The agency expects the architecture to total about 400 satellites, some monitoring for missiles and others transporting data around a mesh network.

In fiscal 2022, Congress gave SDA an extra $550 million above the Defense Department's original request. The extra is for SDA to accelerate the first full tranche of the infrared Tracking Layer of its planned architecture.

Today, infrared satellites in high geosynchronous orbits detect the hotter "boost" phase of a missile launch, Tournear explained, and information from ground-based radars helps in calculating the missile's trajectory. That method works well for predicting the paths of ballistic missiles that don't maneuver.

But with maneuverable hypersonics entering the picture, the military won't be able to rely so much on math to deduce the trajectory. SDA's lower-altitude Tracking Layer satellites will pick up the slack by virtue of orbiting a lot closer, presumably giving them the ability to detect a missile "from liftoff, all the way through the glide phase—essentially all the way to the terminal phase," Tournear explained.

With proposals pending to build Tranche 1 of the Tracking Layer, Tournear said his office expected to award multiple contracts in June for 28 total satellites to launch in May 2025.

"With the acceleration in '22, I think that we are going as rapidly as possible," he said, describing the 2025 launch date as "what is achievable based on the current technology—what we think can be delivered."

Korea Central News Agency

North Korean dictator Kim Jong Un (center) and military leaders attend the March 23 firing of a new Hwaseongpo-17 intercontinental ballistic missile (background) at Pyongyang International Airport in North Korea. The missile attained a peak altitude of approximately 3,882 feet, flew roughly 677 miles, and landed in the East Sea of Korea.

Contracts to build the satellites will go to multiple vendors within each tranche for a reason, Tournear said.

"It's SDAs model that we will always have full and open competition for every layer, for every tranche to make sure that that market continues to grow because we do not want to get stuck in a vendor lock situation," Tournear noted.

SpaceX and L3Harris have already received contracts to build the Tracking Layer's "Tranche 0" proofs of concept launching in 2023.

"We anticipate probably between six and 10 bidders on Tranche 1 Tracking," Tournear said. "While the technology may be more mature based on the fact that there are already some incumbents," other companies may also become more competitive, for example, by working with Space Systems Command on its parallel missile-tracking constellation.

ADDING RESILIENCY

Consistent with Kendall's top "operational imperative" to create a resilient space architecture, SSC's new constellation will orbit higher up—in medium-Earth orbit (MEO)—potentially making its satellites harder to reach by ground-launched, anti-satellite weapons.

The current infrared missile-tracking satellites orbit highest of all. Their geosynchronous orbits allow for fewer satellites to monitor wider swaths of the atmosphere but also call for bigger optics to see farther, translating to bigger, more expensive satellites.

Out of the $1 billion in the fiscal 2023 budget request, Tournear said about $130 million is for Space Systems Command to start work on its MEO constellation. Another $500 million is for SDA to continue its Tranche 1 Tracking Layer, and $226 million and $164 million are for ground elements associated with the LEO and MEO constellations, respectively.

Adding the MEO perspective could also help in detecting a fractional orbital bombardment system, or FOBS, like the one China demonstrated in 2021. In that test, a hypersonic vehicle launched atop a rocket, orbited almost once around the Earth, then reentered the atmosphere at hypersonic speed.

"Those are systems that can reenter anywhere over the globe," according to Tournear. "That's where you need these LEO and MEO tracking layers. You would detect the system as it reenters, and then detect it as it maneuvers, and so you would be able to tie all that together."

LOOKING FURTHER OUT

Right now "missile warning/missile tracking" are all the buzz.

"In the future, we're going to be talking about 'missile warning/missile tracking/missile defense," Tournear said, because in the big picture "all three of those missions are rolled into one."

"After we develop and field the operational missile warning/missile tracking constellations, we will be fielding the missile defense systems, which are able to do the actual fire-control quality [data] from space—so we can send those down directly to interceptors," he explained.

"Beyond what we're currently building out for [data] transport and tracking—for missile warning/missile tracking—I would say the next steps that are needed are more integration of capabilities from what we call the custody layer, which is from our commercial and other government partners for the [intelligence, surveillance, and reconnaissance] layer, into our Transport Layer so we can actually calculate fire-control solutions based on that for those time-sensitive targets."

Stitching all that together won't happen until Tranche 2 of the Tracking Layer goes live further down the road. Once that happens, "then we have a global capability for missile warning/missile tracking," Tournear added.

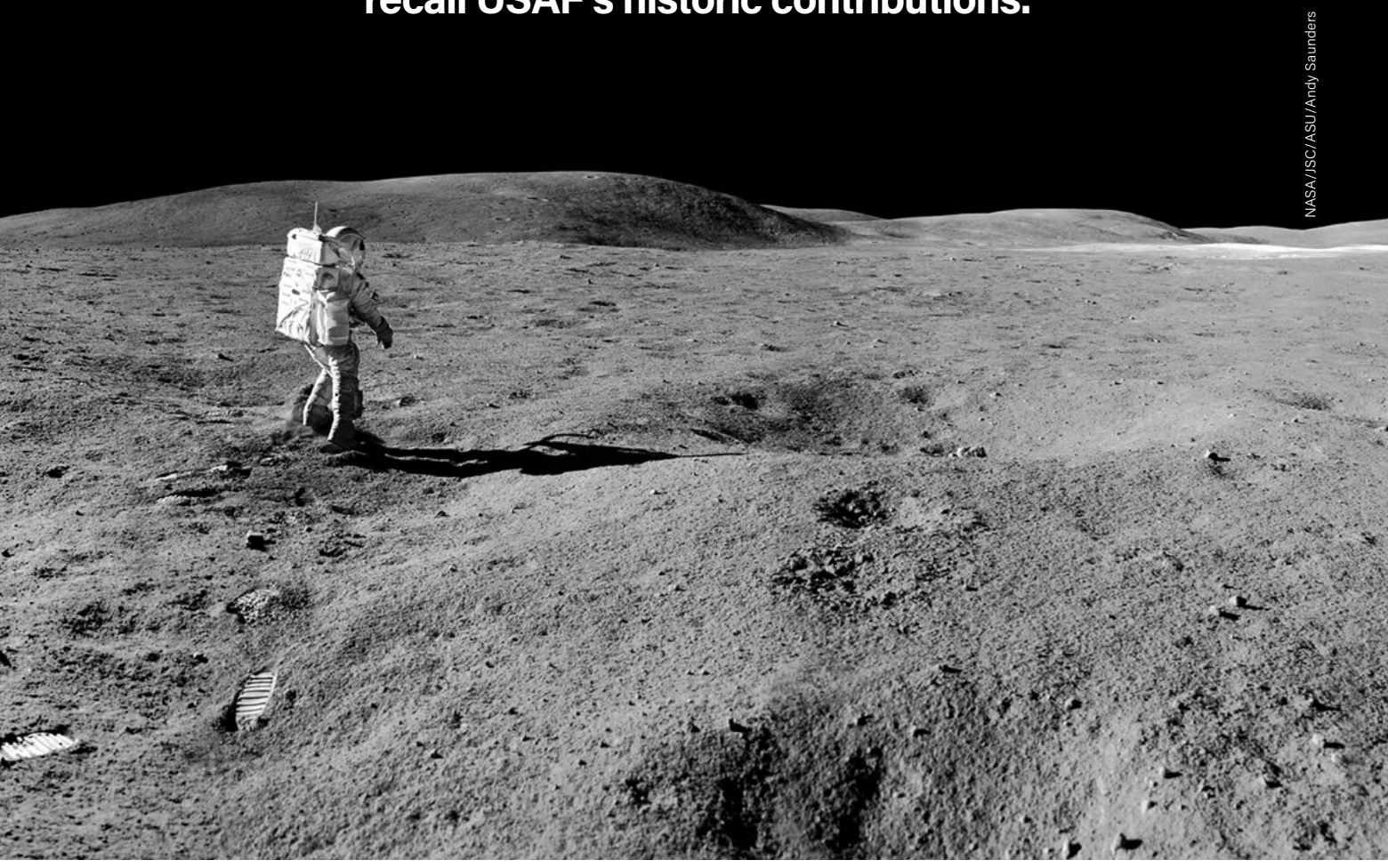
"And then as time progresses," he said without going into more detail, "as our technology advances and we field more capabilities, the Missile Defense Agency is going to field capabilities to actually engage in the glide phase." ✪

Northrop Grumman graphic

Northrop Grumman's proposed Tranche 1 Transport Layer (T1TL) mesh satellite communications network—a constellation of 42 low-Earth orbit satellites—aims to provide resilient, low-latency, high-volume data transport supporting U.S. military missions globally.

Airman on the Moon

Newly remastered images of NASA's Apollo 16 Moon mission recall USAF's historic contributions.



NASA/JSC/ASU/Andy Saunders

NASA astronaut and Air Force Lt. Col. Charlie Duke takes in the breathtaking view across the Descartes Highlands during his Apollo 16 mission in April 1972. It was America's next-to-last mission to the moon.

By Andy Saunders

America's race to the Moon was all-consuming in the go-go years of the 1960s. President John F. Kennedy had set the course to reach the Moon "by the end of this decade," and in the wake of his assassination in 1963, the promise would not be broken. Kennedy's invocation was that this American imperative was a choice, and one that would not be made lightly.

"We choose to go to the Moon and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skill," Kennedy said. But no sooner had astronauts Neil Armstrong, Buzz Aldrin, and Michael Collins returned from their Apollo 11 Moon landing than the magic seemed to escape from the enterprise. Within just three years, the entire program would cease. The ill-fated Apollo 13 mission, despite its miraculous recovery, injected a new sense of risk in space travel and, in April 1972, NASA's Apollo 16 marked what would be America's next-to-last trip to the lunar surface.

Duke left a 25th USAF Silver Anniversary coin and a family photo on the lunar surface, then photographed them in the dust.

The Air Force was celebrating its 25th birthday that spring, a still-new service that captured America's sense of daring, technological prowess, and future-forward thinking. How strange to think now, 50 years later, that despite massive technological change and breakthroughs in the ensuing years, that mystical concept of walking on the lunar surface is now, at once, something for the history books and in another sense still a dream for many to return there once again.

Air Force Lt. Col. Charlie Duke was the Lunar Module Pilot for Apollo 16 and one of the last few Americans to shake lunar dust from his feet. Now, at 86, it is half a century since he left momentos of that journey, including an Air Force anniversary coin and a family photo, on the Moon. He also left a scrap of

USAF

Three members of Aerospace Research Pilot School (ARPS) Class 64-C went on to fly Apollo missions. Apollo 16's Charlie Duke (standing, third from left); Apollo 15's Al Worden (standing, far right), and Apollo 14's Stuart Roosa (kneeling, fourth from left) posed with classmates in 1964.

NASA/JSC/ASU/Andy Saunders

Duke's family portrait on the lunar surface.

NASA/JSC/ASU/Andy Saunders

Beta cloth, bearing Duke's test pilot school "64-C" imprint.

fabric celebrating his time at test pilot school. Nearly half the men who made the journey from Earth to the Moon had Air Force roots, whether Airmen from the start like Gus Grissom and Ed White—Air Force officers turned NASA astronauts—who died in the Apollo 1 launchpad fire, or those like Duke and his crew mate, Command Module Pilot (CMP) Ken Mattingly, who started in the Navy but got to space by way of the Air Force.

Duke was born in Charlotte, N.C., and graduated from the U.S. Naval Academy in 1957 before joining the Air Force and serving three years as a fighter pilot with the 526th Fighter-Interceptor Squadron at Ramstein Air Base in West Germany. He later qualified for USAF Aerospace Research Pilot School (ARPS) at Edwards Air Force Base, Calif., attending in August 1964. Mattingly, a naval officer, managed to secure a seat in the same program, a year behind Duke, who was one of his instructors.

Duke's class at ARPS was 64-C; the commandant at the time was the legendary Chuck Yeager. That class produced three Apollo astronauts from among its dozen students.

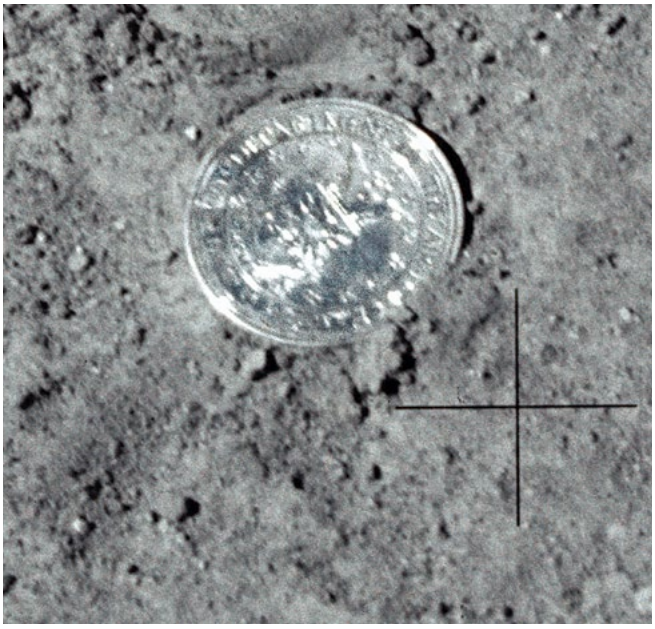
Duke was admitted to Project Apollo in 1966 as part of NASA's fifth intake of astronauts, along with ARPS classmates Stuart Roosa and Al Worden. He was later assigned to Apollo 16 as Lunar Module Pilot, and in April 1972, at the age of 36, Duke became the 10th and youngest man to walk on the Moon.

Apollo astronauts, understandably, were not known for their outward displays of emotion. Trained to subdue emotion and maintain focus, they were cool, calculating engineers, and steely eyed fearless fighter and test pilots, accustomed to putting their lives on the line. Rarely did any display the raw human emotions of their experiences to others; Charlie Duke was an exception.

Each astronaut carried personal preference kit, in which they could bring small personal items for the nearly 500,000-mile journey. Duke's handwritten declaration of the contents of his kit included: "1 family picture" and "2 medallions for [the] Air Force."

Following their third and final "Extravehicular Activity," when Duke and mission Commander John Young were safely back in the vicinity of the lunar module, Duke deposited the

NASA/JSC/ASU/Andy Saunders



NASA/JSC/ASU/Andy Saunders

Duke dropped the Air Force anniversary coin on the surface, where it came up "tails." Using a scan from the original film and advanced digital techniques, the author enhanced the image to confirm that the coin is a match with another one that made the trip and now is exhibited at the Air Force Museum in Dayton, Ohio.

U.S. Air Force photo by Ty Greenlees

family portrait on the lunar surface and photographed it in the dust. It shows Duke, his wife, Dotty, and children Charles (then seven) and Tom (then five) in the backyard of their home. On the back he had written "This is the family of Astronaut Duke from Planet Earth. Landed on the Moon, April 1972."

In researching my book, "Apollo Remastered," Duke confirmed this as an emotional moment. He wanted to excite his kids about what their dad was doing and saw it as a way to connect them to the mission and all the time he was spending away from them while training in Florida.

Nearby, Duke dropped a piece of beta cloth, the material used in the manufacture of the Apollo space suits, on which he'd written, "64-C," his class at the test pilot school. He referenced it as he radioed to Mission Control, in a message understandable only to his classmates from ARPS:

Duke: "Hey, Tony"
Capsule Communicator Tony England: "Yeah, Charlie?"
Duke: "Is Stu (Roosa) around?"
England: "Yeah, he's right here."
Duke: "Tell him 'Sixty Four Charlie' just topped the Mount Whitney event!"

Duke later explained the exchange in the Apollo Lunar Surface Journal: "'Sixty-four Charlie' was our test pilot school class. [Roosa] and I went to test pilot school together. The class climbed up to the top of Mount Whitney (in California) and everybody had a ball. And that's what I was referring to: [The Descartes landing site] was better than the Mount Whitney event."

After dropping the cloth, Duke took a few more steps for-

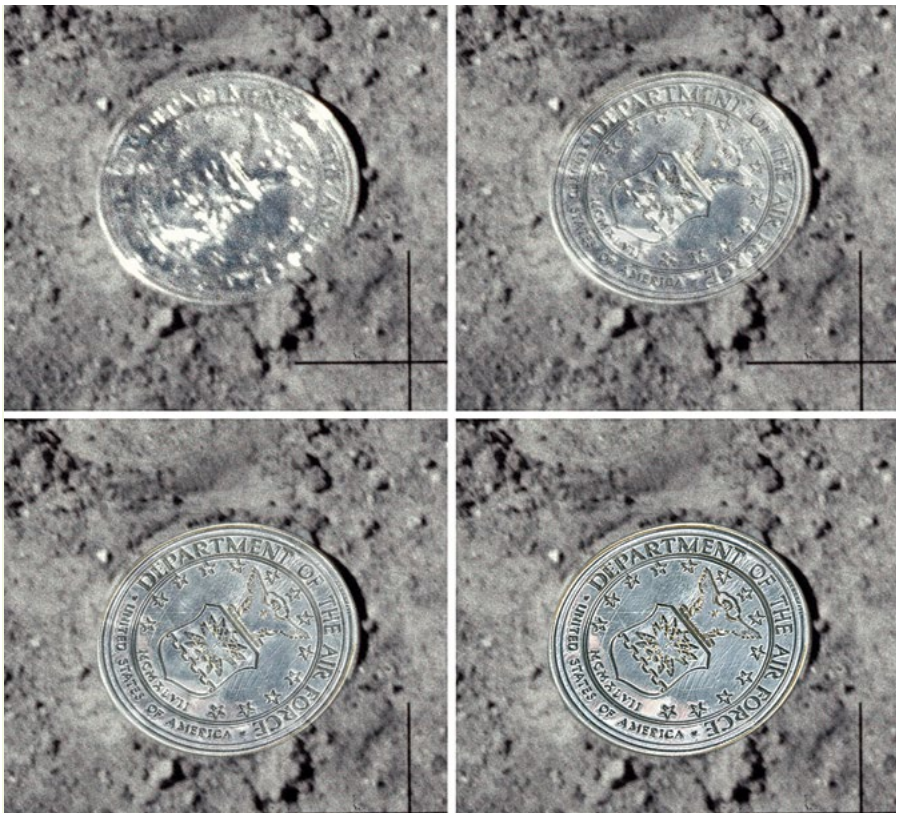
ward and dropped the Air Force 25th Anniversary Medallion to commemorate his service's birthday.

The photograph of a coin has been seen previously in lower-resolution scans of duplicate film, but the images were too blurry to be clearly recognizable. Thanks to recent high-resolution scans of the original flight film, along with modern-day digital enhancement, it is now possible to more clearly see details on the face of the coin and confirm that it is, in fact, identical to another Air Force medallion Duke carried with him.

Around its circumference, the medallion reads: "DEPARTMENT OF THE AIR FORCE." The Air Force crest is in the center, and the year 1947 is spelled out in Roman numerals underneath: "MCMXLVII."

The second medallion made the round trip and Duke later presented it for display at the National Museum of the United States Air Force, in Dayton, Ohio. It remains on display there to this day.

By superimposing a photograph of this medallion over the enhanced image of the medallion on the Moon, we can confirm with certainty that the coins are a perfect match. Gradually changing the opacity also allows us to highlight additional details on the face of the Air Force medallion that still resides 240,000 miles away on the Descartes Highlands.



NASA/JSC/ASU/Andy Saunders

A gradual overlay of the museum's medallion confirms a match and highlights the details visible on the medallion (upper left) that resides 240,000 miles away on the lunar surface.

Half a century on, how would these momentos have fared in the harsh lunar environment? The 64-C inscription on the beta cloth will likely have faded due to extreme UV radiation from unfiltered sunlight. Similarly, in the extreme temperatures, the shrink-wrapped Duke family photograph will have quickly curled up and its contents bleached. The Duke's are therefore delighted that I'm sending a very small copy of that same photograph back to the Moon at the end of this year, on Astrobotic's Peregrine lander. And because it will remain encapsulated, the photograph should last significantly longer than the original.

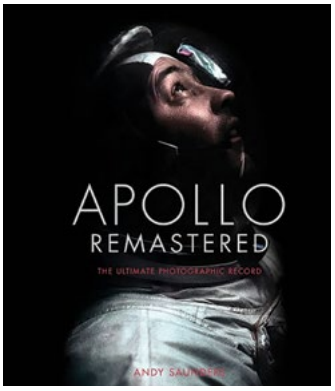
With no atmospheric pollutants, no wind, and no water to erode or corrode the medallion, that particular tribute to the Air Force should remain, like many of the astronaut's footprints, for millions of years to come.

Duke's mementos and photographs remind us that we humans made this incredible journey, slipping the bonds of gravity and traversing the emptiness of space to set foot on a heavenly body so very far from Earth. Duke understood that he was leaving his mark, just as other explorers left their marks on the far-away places they visited on Earth. He was driven to commemorate the things that were important to him, the things that shaped him and prepared him to complete his momentous journey from North Carolina to Edwards Air Force Base to the Descartes Highlands on the surface of the Moon. As his time there dwindled down to the end, on April 23, 1972, Duke transmitted this message to Earth:

"Tony, a special salute from me to the United States Air Force on their silver anniversary this year: From one of the boys in blue that's pretty far out right now. …" ✪

Andy Saunders

A small copy of the Duke family portrait that will return to the Moon later in 2022.



***Andy Saunders** is an imaging specialist and lifelong space aficionado. He is the author of the upcoming book Apollo Remastered, now available for pre-order from BlackDogAndLeventhal.com. Learn more at ApolloRemastered.com. You can follow him on Twitter (@AndySaunders_1) and Instagram (@andysaunders_1).*

Building Alliances and Competing with China

It's time to fix the perception of RPA exportation.

Tech. Sgt. Emerson Nuñez

Remotely piloted aircraft such as the MQ-9 Reaper are considered "missiles" under the Missile Technology Control Regime guidelines, undermining efforts to share this technology with allies.

By Heather R. Penney

The near-monopoly on remotely piloted aircraft (RPA) that the United States once enjoyed is rapidly eroding as other countries build and export their own unmanned aircraft. Their persistent intelligence, surveillance, and reconnaissance (ISR) and precision strike capabilities, as well as lower cost, are huge force multipliers, and countries around the world are recognizing the asymmetric advantages RPAs provide. As of 2019, over 95 countries operated RPAs, and more than three dozen militaries operated large, armed unmanned aircraft.

Despite this global growth in demand, the United States has continued to adhere to overly restrictive policies for U.S. RPA exports. These mistaken policies work against U.S. national security objectives of building the capabilities and capacity of its allies and friends. On the one hand, the U.S. Government has approved export of the state-of-the-art MQ-9 Reaper RPA to the United Kingdom, France, Italy, Spain, Belgium, and the Netherlands, but on the other denied them to key partners like Jordan, the United Arab Emirates, Iraq, and others. These and other countries have subsequently turned to America's greatest competitor—China—to purchase RPAs.

U.S. RPA export policy is largely driven by concerns over how RPAs might be used. Some fear their use could undermine regional stability, encouraging regional disputes to turn hot. Others suppose RPA exports could kick off regional arms races, while still others see RPAs as delivery systems for weapons of mass destruction. Together, these misplaced fears prevent implementing a reasonable RPA export policy can facilitate U.S. national security interests.

Heather Penney is a senior resident fellow at the Mitchell Institute for Aerospace Studies. Download the entire report at *http://MitchellAerospacePower.org.*

RPAs are included in the Missile Technology Control Regime (MTCR), a non-compulsory international agreement that was established to prevent the sharing of nuclear weapons and other weapons of mass destruction (WMD) delivery technologies. The MTCR effectively treats RPAs like cruise or ballistic missiles rather than the tactical aircraft they really are. Because of this, unmanned aerial systems capable of delivering 500 kg or greater payloads over ranges of 300 km or more are subject to a "strong presumption of denial," empowering some arms control advocates to oppose RPA sales in support of nuclear nonproliferation.

Not only have these outdated policies greatly constrained RPA exports to America's allies and friends—to the benefit of China and other strategic competitors—they have undermined efforts to build regional coalitions, diminished U.S. diplomatic and operational influence, and weakened the U.S.

defense industrial base. These restrictions pave the way for China to expand its influence and gather intelligence—and China's RPA sales do not come with the same end-use restrictions that accompany U.S. military equipment exports. Since 2014, China has exported more RPAs than any other country, and Russia is not far behind in exploiting growing demand for these capabilities.

The era of RPA proliferation is already here. Like other military technologies, U.S. decisions to export RPAs should be based on a realistic view of how they can and should contribute to U.S. national security. The fact is, exporting armed RPAs can provide significant value by building relationships and the capacity for U.S. friends, allies, and partners to defend themselves against aggression and contribute to future coalitions to defeat threats to regional stability. Assistance to Ukraine is a recent case in point. U.S. State Department's export restrictions on RPAs are essentially preventing the provision of RPAs as vital tools to counter the aggression of the Putin regime, which has been condemned by the rest of the world.

The administration should update its RPA export policies and aggressively pursue opportunities to share these capabilities with allies and partners critical to integrated deterrence.

UNDERSTANDING RPA OPERATIONS

Misperceptions about RPAs, how they operate, and the effects they can create in the battlespace have misinformed U.S. export policies. Because these aircraft are uninhabited, many people believe that humans are not fully in control or even involved in RPA kinetic strike operations. Questions often raised during debates over U.S. RPA exports include: Will their use be less discriminatory than manned aircraft operations? Could their use by U.S. allies and partners lead to increased collateral damage and harm to civilians? Will the export of RPAs contribute to the violation of human rights and the laws of war?

In reality, armed RPAs are the most controlled aircraft in the U.S. military. Humans "in the loop" control RPA operations for the purpose of achieving valid and proportional military objectives in the battlespace while avoiding unnecessary collateral damage and loss of life.

THE HUMAN TEAM BEHIND RPA OPERATIONS

More people are involved in the real-time mission employment of RPAs than for manned strike aircraft. In addition to the local launch support element responsible for takeoff and landing operations, RPA remote crews include a pilot, sensor operator, and a dedicated intelligence team. In a typical RPA mission, the pilot is still responsible for navigating and flying the RPA, just like a pilot would in a manned aircraft. The only difference is all this is done remotely through satellite data links. A sensor operator sitting next to the pilot controls an RPA's sensors and works closely with the pilot to maneuver the aircraft. Sensor options on RPAs include infrared, color, monochrome daylight TV camera, shortwave infrared camera, synthetic aperture radar, electronic signals collection, electronic warfare, and other types of ISR equipment.

The RPA's dedicated intelligence analysis team is free to rewind, review, or even pause the aircraft's feed to get clarity on images and detect changes or movements on the ground that may not be immediately apparent to the pilot and sensor operator controlling the aircraft. The intelligence analyst team directs the sensor operator's management based on mission objectives. "Targeteers," who are professionals skilled in identifying targets, attack planning, collateral damage assessments, and rules of engagement are also part of the intelligence team. Targeteers and other team members identify valid targets, determine if a strike against it is needed, what kind of weapons are appropriate, and then forward a recommendation to an air operations center (AOC).

The air operations center integrates RPA operations with other joint combat operations, including additional intelligence analysts and lawyers to help commanders assess potential actions. Veteran Air Force RPA pilot Col. Johnny Duray, who has conducted armed RPA operations in Iraq, Syria, Afghanistan, Libya, and other parts of the world, ob-

Staff Sgt. Omari Bernard

Remotely piloted aircraft enable greater human oversight in real time than manned aircraft. Airmen at Creech Air Force Base, Nev., go through preflight safety checks before initiating an automated takeoff for an MQ-9 Reaper.

Staff Sgt. Jeremy Mosier

RPAs operate at slower speeds than fighter aircraft and offer commanders more stable video of potential ground targets. The MQ-9 Reapers operating from bases in Southwest Asia provide the persistence needed to positively identify targets despite factors that would obscure targets from being seen by higher-flying or faster-moving aircraft.

served that "RPA operations are the most controlled aircraft operations conducted by the U.S. There is more oversight than any other platform." When an RPA's intelligence team determines a target meets a commander's rules of engagement, they nominate the strike to the team at the AOC, which weighs the context, risk of collateral damage, and legality before approving or denying the request. For many armed RPA operations, target engagement decisions reside with commanders in an AOC. For some scenarios, final approval authority may be delegated down to the unit level, or it can be elevated to the Secretary of Defense or even the President of the United States.

The teams of military and civilian professionals located in theater and at remote operating locations provide an unprecedented degree of control and oversight at every step of an RPA mission. RPAs are not "killer bots" that populate science fiction, and they are not launch-and-leave cruise missiles. Instead, they are like any other combat aircraft that depends on human beings to direct and control their operations. Yet RPA export policies assume otherwise and are therefore outdated and uninformed as to the true nature of modern RPA operations.

COMPARATIVE ADVANTAGES

The ability of RPAs to provide persistent full motion video of a specific battlespace—essentially, a birds-eye view of the operational area—and strike during fleeting moments of opportunity is a distinct combat advantage to supported ground troops. Fighters often arrive on station just in time for a quick overview of the tactical situation before conducting strikes—often rushing to execute their missions due to limited fuel and time-on-station. Furthermore, fighters move so fast that their pilots have to constantly maneuver to remain over target areas and split their attention between interacting with ground crews, managing their sensors, and conducting real-time attack planning and execution while flying in hostile airspace. By contrast, slower RPAs can provide a better, higher quality picture of the battlespace to ground troops, and their long loiter allowed RPA teams to spend more time honing their attacks to minimize collateral damage. Using RPAs for close air support missions in permissive environments can often lead to more discriminate use of force.

The slower speeds of RPAs and better targeting pod depression angles compared to fast-moving fighters present a more stable video image of potential ground targets to analysts, targeteers, and operators. In contrast, the view of fighter targeting pods have shallower depression angles and can be masked by buildings in urban areas or by terrain features, obscuring potential targets. This does not mean that RPAs and manned fighters cannot be exceptionally effective when operating as teammates. A case in point is the successful attack on Abu Musab al-Zarqawi, the leader of al Qaeda in Iraq. Al-Zarqawi had successfully evaded U.S. and coalition efforts to find him for years. On June 7, 2006, a Predator observed Rahman and positively identified the target and provided target cues to two F-16 fighters. Minutes later, the F-16s dropped two 500-pound laser guided bombs that killed al-Zarqawi and several of his associates. Only an RPA had the ability to provide such persistent and precise tracking and, in this case, F-16s were the best choice to prosecute the target.

Whether conducting the strikes themselves or cuing other assets, over the past 20 years RPAs have transformed the American public's expectations of warfare. The ability of RPAs to persistently loiter over key targets and follow them has enabled the U.S. military to conduct warfare in a manner that is robustly evaluated, exceedingly precise, and results in minimum collateral damage or harm to civilians. For the types of targets that RPAs track and the permissive environment they operate in, this has indeed become the standard for operations. The ability of RPAs to limit harm to both U.S. military and innocent civilians has contributed to a belief

that conflict can and should be error-free. When it is not, it is important to understand the contributing factors and why things went awry—and experience has shown mistakes are very rarely the fault of the RPA itself.

HIGH-RISK SCENARIOS

Some RPA export critics continue to cite the potential for their operations to harm civilians, pointing to examples like the MQ-9 strike during the 2021 evacuation of Kabul that killed 10 innocent civilians. The fault here lies not with the RPA as a weapons system but in the many factors that led authorities to approve the attack. The same outcome could have occurred had the mission been flown by a manned aircraft.

Ten people were killed. Initial reports were that another attack on U.S. forces and Afghan evacuees had been preempted. Instead, the attack turned out to have killed Zemari Ahmadi, a longtime worker for a U.S. aid group, and nine others, including seven children.

An MQ-9 intelligence officer familiar with the incident acknowledged the RPA team knew the strike had a higher level of risk than most operations. He also stated that the vehicle type, electronic intelligence, and even the behavior of Zemari the day of the strike fit the known behavior patterns of suicide car bombers and ISIS-K operatives. Plus, the security situation in Kabul was continuing to devolve, and the U.S. Intelligence Community had just received a warning another terrorist attack was imminent. Based on these conditions, President Joseph R. Biden directed DOD to "take every possible measure to prioritize force protection."

Critics often cite examples like this one to press their case against such weapons. However, studies have quantitatively demonstrated the opposite is true. RPAs capable of assessing potential targets over long periods of time and providing teams of intelligence experts and strike authorities with more real-time information than ever before have, in fact, improved the targeting, decisions, timing, and precision of strikes, decreasing the risk of harm to noncombatants.

FOREIGN MILITARY SALES

■ **Building Partner Capability:** Every U.S. National Security Strategy and National Defense Strategy published over the past 30 years has emphasized how essential allies and partners are to our nation's security. Building their defensive capabilities and capacity through military personnel exchange programs, training activities, exercises, and equipment exports are widely recognized as critical means to create new and strengthen existing relationships. Sharing military equipment also sends a strong signal of U.S. commitment and intent to defend its allies and friends. But overly restrictive military export policies—including policies for RPA exports—can deny allies and friends the means to detect and respond to threats to their sovereign territory and airspace. Forcing them to seek RPAs from China, Russia, and others can erode the effectiveness of America's integrated deterrence strategy.

■ Coalition members that do not share the same or similar types of weapon systems can struggle with the interoperability challenges that creates operational friction. Furthermore, it is precisely this kind of interoperability that is crucial to the seamless integration of military forces across an international coalition.

■ **The Missile Technology Control Regime:** Exporting RPAs should be an important means for the United States to strengthen alliances and partnerships. Instead, the Department of State continues to include all RPAs in the MTCR's guidelines, thereby working against these priorities.

In the early 1990s, MTCR members added "drones" to the regime due to their superficial similarity to cruise missiles. They have since applied the regime to remotely piloted aircraft. The entire premise of this classification is that these technologies are exceedingly difficult and expensive to develop. There was a logic back then to this approach; even if a state were able to develop a nuclear or WMD weapon, it would not be pragmatically useful without the associated delivery mechanism. However, this means the efficacy of the MTCR in limiting the proliferation of delivery vehicles hinges on whether MTCR adherents hold a near-monopoly on these systems.

For RPAs, this "near-monopoly" is an artifact of the past. The United States is no longer the sole or even dominant manufacturer of large RPAs. Michael Horowitz, RPA expert and University of Pennsylvania professor, explained that "treating uninhabited aircraft as missiles for export policy purposes doesn't work. This has allowed China to capture a significant chunk of the unmanned aircraft export market, including with U.S. allies and partners." In other words, the United States' adherence to the MTCR has ceded to China the opportunity to export RPAs to U.S. allies and partners. Without opportunities to export RPAs, U.S. defense compa-

Deng Hua/Xinhua/via China Ministry of Defense

China leveraged restrictions on U.S. RPA sales to gain market share and, by extension, access to the military activities of numerous international partners who would rather purchase their weapons from the U.S.

nies do not have access to revenue that can be reinvested in next-generation capabilities needed to maintain the U.S. military's competitive edge. China's defense industry is taking advantage of this influx of revenue to continue to advance their capabilities.

■ Other nations are not idly standing by: the Czech Republic, France, Spain, Germany, Italy, Turkey, and the United Arab Emirates are all beginning to develop, produce, and export advanced RPAs. Continuing to cover RPAs under the MTCR guidelines threatens to distort the global RPA market in favor of U.S. competitors, encourage the expansion of RPA production capabilities while constraining U.S. innovation, and even weaken the efficacy of the MTCR regime itself.

A MORE COMPETITIVE INTERNATIONAL MARKET

The military RPA market is far more competitive and dynamic than many in the U.S. export policy community understand and appreciate. Despite significant growth in global RPA sales, the United States has lost the opportunity to gain a dominate position—and, therefore, shape and manage—the RPA market. In 2010, 60 countries operated military RPAs. By 2019, 95 counties did, and that number is growing. Nearly 40 countries currently operate, or intend to acquire, medium-altitude, long-endurance (MALE) or high-altitude, long-endurance (HALE) aircraft with endurance of over 24 hours and the ability to carry meaningful payloads of weapons or sensors. At least 18 companies in seven nations produce these larger military RPAs.

China is aggressively selling RPAs to whoever is interested. Between 2011 and 2019, dozens of countries acquired armed RPAs, 11 of which bought them from China. The United Arab Emirates has purchased Chinese produced Wing Loong I RPAs and was the first export customer for China's more sophisticated Wing Loong II armed RPAs. Saudi Arabia purchased a handful of Chinese CH-4 RPAs in 2014 and has since acquired more than a dozen Loong II armed RPAs, and it has expressed an interest in buying 285 more. Pakistan deployed its first operational indigenous RPA in 2015 and increased its RPA force size by procuring Chinese CH-4s. Nigeria also designed its own RPA in 2014 and 2015 but decided to buy the Chinese CH-3A Rainbow RPA instead—and has since placed more orders for CH-4s and the Wing Loong IIs. Iraq also procured the Chinese CH-4B. Chinese companies further penetrated the global RPA marketplace by establishing production lines in Saudi Arabia, Pakistan, Myanmar, and other countries. Over the same period of time, the United States only sold armed RPAs to one country—France.

There is still an opportunity for the United States to reverse these trends. China has achieved success through a combination of aggressive marketing, conditions-free or constraint-free transfers, and offers to share RPA production jobs with customers. Chinese RPAs also can cost less—up to one-fourth of the price—of some American RPAs. Yet Chinese RPAs are not yet as capable nor as reliable as American-built RPAs. Jordan experienced buyer's remorse after they purchased several CH-4B "Rainbow" RPAs in 2016. Only two years later, Jordan sought to sell the CH-4Bs at auction, noting their dissatisfaction with their performance.

The Jordan example offers clear insight regarding the opportunity the United States now has to replace China and rebuild relationships by becoming the RPA provider of choice. U.S. RPAs are more capable, more reliable, of better quality, and have a deeper support infrastructure compared to what China can offer. But the window of opportunity is short. If the United States does not quickly act to reverse China's market expansion and proliferation of RPAs, it may lose the chance to regain its global leadership.

RECOMMENDATIONS

The era of RPA proliferation is here, and the United States risks falling behind its global competitors due to its reticence to export these capabilities. Overly restrictive U.S. RPA export policies persist because of unproven concerns over how these aircraft could be used, how they might impact regional stability, and the potential for them to contribute to regional arms races.

Moreover, overly restrictive RPA export policies reduce opportunities to build U.S. relationships with other countries, undermine its efforts to expand regional alliances and coalitions, diminish U.S. diplomatic and operational influence, and weaken our nation's industrial base. They also continue to benefit China and other strategic competitors, who can use their RPA exports to create additional avenues to expand their influence and gather intelligence. Since 2014, China has exported more RPAs than any other country, and Russia is not far behind. If this trend continues, the United States may find itself further marginalized in regions of the world where it seeks to wield influence and deter conflict.

RPA export policies should be reformed to affirm America's commitment to upholding international norms and further its nonproliferation priorities. Working together, the U.S. State Department and Department of Defense should:

■ Define medium and large RPAs, including armed RPAs, as military aircraft instead of cruise missiles for the purposes of export.

■ Engage with other MTCR signatories to affirm the United States' commitment to nonproliferation while simultaneously removing RPAs as MTCR-controlled technologies.

■ Work with states that are not yet signatories to adopt the 2016 "Joint Declaration for the Export and Subsequent Use of Armed or Strike-Enabled Unmanned Aerial Vehicles." The United States should encourage states unwilling to agree to this declaration's principles in part, if not in whole, as part of RPA export agreements.

■ Convene a working group to enhance monitoring protocols and end-use agreements for armed RPA exports.

■ Engage with allies and partners who have pursued opportunities to purchase Chinese RPAs and encourage them to revisit U.S. RPAs as their system of choice.

■ Publicly articulate the strategic benefits of increasing armed RPA exports including building partner capabilities, protecting the U.S. defense industrial base, and the value of gaining greater influence in the global RPA market.

RPA exports are an important and legitimate tool that can be used to support America's national interests, promote regional stability, and increase global security. Today, this is a grossly underused tool. Worse still, continuing to adhere to outdated RPA export policies is ceding the global RPA market to China and other adversaries. It is time to recognize that RPAs are aircraft for the purpose of exports to trusted allies and partners that support America's national security interests. At a time when the U.S. defense establishment is facing an unprecedented array of threats, it can no longer afford to neglect such a valuable tool. ✪

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01-24929-001-E61013

1. 2nd Lt. Samuel Howard Davis
2. 1st Lt. Oscar Monthan
3. B-52s at the "Boneyard," at Davis-Monthan.
4. Two A-10 Thunderbolt IIs from the 355th Fighter Wing.

Courtesy (1,2); Tech Sgt. John McDowell via National Archives; Staff Sgt. Beverly Chevalier

DAVIS-MONTHAN

Fliers of Tucson

Their names are inextricably linked. Though in background Samuel Howard Davis and Oscar Monthan were nothing alike, these two World War I-era Army pilots met similarly tragic ends and their lives are honored in the naming of Davis-Monthan Air Force Base, Ariz.

Davis was of Southern heritage, having been born in rural Tennessee in 1896. When he was 8 years old, his family moved to Tucson, Ariz. He attended public schools and took a keen interest in agriculture. In 1913, he departed for Texas A&M but returned to the University of Arizona, from which he graduated in 1917.

The base's other namesake came from England. His birth name was Oscar Tattersfield. His family in July 1900 moved to the United States and settled in Tucson. Oscar attended public schools and took an engineer degree at Boston School of Technology. He dropped "Tattersfield" and replaced it with his mother's surname, Monthan.

When America entered the World War in April 1917, both Tucson men immediately joined the Army to become aviators.

Davis proved to be a superb pilot, receiving his wings and commission at Kelly Field, Tex., where he served out the war years as an instructor. After the armistice, he returned to Arizona but was soon assigned to instructor duty at Carlstrom Field, Fla.

On Dec. 28, 1921, Lieutenant Davis boarded a Curtiss JN-6 biplane and took off on a training flight. Seated in the front seat was his student, 2nd Lt. William Sinclair. The Jenny ran afoul of a mechanical problem, entered a tailspin, and crashed. Davis and Sinclair burned to death in the resulting fire.

Monthan's demise came three years later.

As an engineer, Monthan at first was given Army technical work. In 1918, however, he received his wings and was stationed at Rockwell Field, Calif., where he was chief engineer, and McCook Field, Ohio, where he headed the Air Service's Engineering School. In both places, he engaged in cutting-edge aeronautical work. He also became friends with Brig. Gen. William "Billy" Mitchell.

The Army next assigned Monthan to be chief engineer for the 5th Composite Group, Luke Field, Hawaii. On March 27, 1924, Monthan boarded a Martin MB-2 and, with Lt. W. G. Moore piloting, took off on a test flight. The bomber struck an obstacle at the end of the runway and crashed, killing Monthan and four others on board.

So run the stories of two men who came from widely separated parts of the world, with greatly varying backgrounds and interests, who both nevertheless ended up in Tucson, became outstanding pilots and Army officers, and died in doomed aircraft which they did not themselves personally command. They are even buried in the same spot—Evergreen Memorial Park in Tucson.

What is now Davis-Monthan Air Force Base began as a civilian airport, dedicated in 1927 by Charles Lindbergh, the famous "Spirit of St. Louis" aviator. Today, the base is home to the 355th Fighter Wing—an A-10 outfit—and the 309th Aerospace Maintenance and Regeneration Group—the "Boneyard" of mothballed aircraft and other services. ✪

SAMUEL HOWARD DAVIS

Born: Nov. 20, 1896, Dyer County, Tenn.
Died: Dec. 28, 1921, DeSoto County, Fla.
Colleges: Texas A&M, University of Arizona
Occupation: U.S. military officer
Citizenship: United States
Service: United States Army Air Service
Main Era: World War I
Years Active: 1917-21
Final Grade: Second lieutenant
Interred: Evergreen Memorial Park, Tucson

OSCAR MONTHAN

Born: June 4, 1885, Dewsbury, England
Died: March 27, 1924, Luke Field, Hawaii
College: Boston School of Technology
Occupations: Rancher, engineer, U.S. military officer
Citizenship: United States (naturalized)
Service: United States Army Air Service
Main Era: World War I
Years Active: 1917-24
Final Grade: First lieutenant
Interred: Evergreen Memorial Park, Tucson

DAVIS-MONTHAN AIR FORCE BASE

State: Arizona
Nearest City: Tucson
Area: 16.6 sq mi / 10,633 acres
Status: Open, operational
Opened as Davis-Monthan Field (civil): Sept. 23, 1927
Re-established as Tucson Army Air Base: April 17, 1941
Renamed Davis-Monthan Army Air Field: Dec. 1, 1941
Renamed Davis-Monthan Air Force Base: Jan. 13, 1948
Current owner: Air Combat Command
Former owners: Fourth Air Force, Second Air Force, Strategic Air Command, Tactical Air Command
Home of: 355th Wing, 309th Aerospace Maintenance and Regeneration Group

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