

**FIRST
INTERVIEW**

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Barbara
Barrett

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AIR FORCE

MAGAZINE



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A Dozen Ways USAF Is Speeding Up Acquisition | 40



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Photo: Staff Sgt. Ashley Schellor

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Illustration: Mike Tsukamoto

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By Tobias Naegele

Transparency in Spending

It's budget season in Washington. The President's 2021 budget request delivered to Congress Feb. 10 is the start of an annual rite of spring in which political parties and branches of government spell out competing priorities for programs and spending and then (sometimes) reach bipartisan compromise to enact a budget for the following year.

This year will be unique, marking the first-ever budget submission that splits the Air Force budget, breaking out the new U.S. Space Force as an independent service. As such, it marks a turning point and a unique opportunity to bring sense and logic to a convoluted budget construct.

Creating an independent Space Force is, more than anything else, an investment strategy. The virtue of a separate force isn't about changing who designs, specifies, or operates military satellites—or who partakes of their services. It's about ensuring space requirements are prioritized and that those priorities get translated into investment.

To meet the demands of our National Defense Strategy, the same must also hold true for the Air Force.

That's why this year's legislative cycle presents a critical opportunity to repair long-term distortions in the U.S. defense budget. Like a warped mirror at a circus sideshow, these distortions skew reality, turning a thin Air Force fat by padding its budget with billions of dollars that are neither controlled nor used by the Air Force. Rather, these funds pay for classified intelligence programs, mostly in space.

Here's how the 2021 budget proposal breaks down—if you aren't paying attention:

- Department of the Army: \$178 billion (25.2% of total defense spending)
- Department of the Air Force: \$207 billion (29.3%)
- Department of the Navy: \$207 billion (29.3%)
- Other defense agencies: \$113 billion (16.0%)

These figures are roughly in line with one of the most persistent myths in Washington: that the Pentagon's budget is split into four pieces, with 30 percent each to the departments of the Army, Navy, and Air Force, and the balance, a slim 10 percent, funding civilian support agencies. It suggests relative parity among the services—but belies the truth about our national investment in defense.

Pull back the covers and the truth looks substantially different:

- Department of the Army: \$178 billion (25.2%)
- Navy: \$161 billion (22.8%)
- Air Force: \$154 billion (21.8%)
- Other Defense Agencies: \$150 billion (21.3%)
- Marine Corps: \$46 billion (6.5%)
- Pass-through funding in USAF budget: \$38.2 billion (5.4%)
- Space Force: \$15 billion (2.1%)

Even after a defense review helped identify billions that can be reinvested in other priorities, so-called Fourth Estate defense agencies still account for 21 cents of every dollar, double the supposed standard. Strikingly, this investment yields almost no fighting power, yet costs almost as much as the entire Air Force—and 10 times more than the fledgling Space Force.

The other market distortion here is pass-through funding. What

began as a way of obfuscating exactly what the nation was investing in intelligence technology during the Cold War has morphed over time into an entitlement for the Intelligence Community—a secret stash of cash that costs two-thirds as much as the Marine Corps, yet is hidden in the details of the Air Force budget. As convenient as this is for the IC, it is a burden the Air Force can ill afford.

Pass-through spending almost doubled in the past decade, even as the Air Force lost ground in its battle to modernize its aging fleets of geriatric aircraft. It's time to end the charade and deliver transparency to taxpayers.

Stephen Kitay, the deputy assistant secretary of defense for space policy, said as much in response to a question in February. "Generally speaking, when you say 'do we need transparency there,' I think we do," he said, carefully steering clear of explicit budget matters outside his purview. "People need to understand that these are the air programs, these are the space programs, this is 'other.' I do think it's important that that comes through."

It is important. But as long as the pass-through remains, the truth is hard to see.

The birth of a new service presents a compelling case for righting these wrongs. Instead of prolonging this deception, Congress and the administration have the rare opportunity to clean up the budget and start anew. They can begin by relocating the pass-through to a more appropriate department, whether that is a particular agency or the Director of National Intelligence. Either one would be acceptable, because it's all intelligence spending, anyway. What it isn't, is Air Force or Space Force.

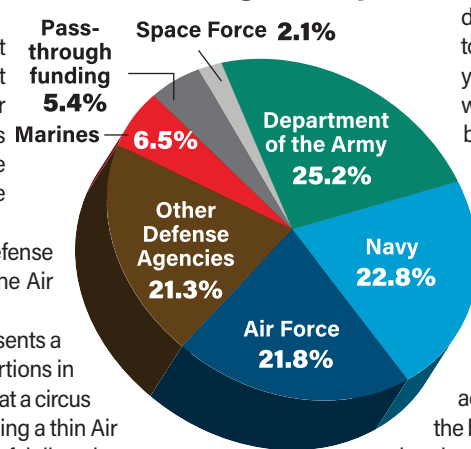
Next, review the roles, missions, responsibilities, and requirements for space in each of the military departments. This is not a matter of yanking out everything with "space" in its name and turning it over to the Space Force, but rather a necessary effort to rationalize what belongs in the centralized space service and what capabilities need to remain organic to effective operating units in the air, sea, and land domains. We should not see every service operating its own satellite constellations, for example. But it does make sense to have expert space consumers in every service.

Merging Navy and Army space capabilities into the new Space Force will help establish jointness as a core competency within the Space Force and pave the way to an integrated approach to space and its constituent customers. No one gains anything if the Space Force is little more than a renamed Air Force Space Command, as it is today. The nation only gains if the new service makes the other services better. And that will only happen if it has endemic connections to each of the other services.

Likewise, no one gains from budget games that obscure our true investments in national defense and leave our most critical offensive military assets—our combat air forces—handicapped by age and decay.

Today, the U.S. Air Force and Space Force find themselves locked in a great power competition for primacy in their respective domains, and they are also locked in a crucial competition for resources. While deception has its advantages in war, it undermines sound policy making. Leaders need to be frank about how they spend taxpayer money. It's one thing to try to fool the enemy. It's quite another to try to pull one over on those you are supposed to protect. ✪

The True Budget Request





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The Nuclear Powerhouse

There have been many articles about the mission, history, and future of the B-52, but none that describe what it is like to fly it. With six years experience flying it as a crew commander (pilot) and instructor pilot, let me say: "It is impressive" ["Strategy & Policy: The End to Nuclear 'Kick the Can,'" January/February, p. 12].

Oddly enough, despite its size, the B-52 is easy to fly. It is very stable. During air refueling, once in the refueling envelope, you can fly it with your fingertips. In my six years in it, even during combat crew training at Castle Air Force Base, California, I don't remember ever having an inadvertent disconnect. Likewise, landing is easy. In those same six years, I don't recall one bounce. Of course, the crosswind landing gear is unique and tricky, as is the bicycle landing gear. When you flare, you need to hold the plane off until you gently set the aft main landing gear, which is about 100 feet behind and 40 feet below you, gently on the runway. That crosswind landing gear can be set up to 15 degrees off the runway heading. And, you hold the crab all the way through touchdown. You really have to fight the urge to kick out the crab just before touchdown, as you would in any other aircraft. And, yes, I have landed while looking at the far end of the runway out of my left side window.

Having started my career as an F-80 Shooting Star fighter-bomber pilot, I always considered myself to be a fighter pilot. As such, I hated the idea of being a "BOMBER PILOT!" But, when I completed all of the requirements of the entire training program at Castle on my very first flight in the B-52, I realized that, like it or not, I was meant to fly the B-52. As much as I hated to admit it, I loved the airplane, and I loved flying it.

At the beginning of this letter, I referred to flying the B-52 as "impressive." Well, it is

impressive to get something as big as that off the ground and back down again without breaking something. And—it's fun.

Lt. Col. Alfred J. D'Amario,
(USAF) Ret.
Hudson, Fla.

More Ribbons, Not Fewer

The US Army uniform shows unit citation awards above the right pocket ["Letters: Trophy Culture," January/February, p. 4]. These citations are obtained mainly for being in the right place at the right time. But, if anything, they do balance out the uniform.

The Air Force uniform is basically bare over the right pocket, except for a commander's badge or very rare unique foreign badges. As a reflection of one's educational background, professional military education [PME] and civilian degrees could be shown by ribbons over the right pocket.

Each PME course should have its own ribbon. Devices could be used to reflect whether a course was completed by correspondence (C), seminar (S) or residence (R), and if an honor grad. Different ribbons could reflect civilian education for associate, bachelors, master's, or doctorate degrees with devices for business, arts, sciences, engineering, etc. Professional degrees, such as medical, law, etc., could have their own ribbons with devices as needed.

If the ribbons are uniquely colored and/or striped, promotion boards would have an easy time reviewing completion of PME requirements and noting civilian education just by looking at black and white official photos.

More importantly, these ribbons would reflect personal achievements and self-determination to excel.

Lt. Col. Russel A. Noguchi,
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—The Editors

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Star Wars Shy

The United States Space Force moved a step closer to reality recently with the passing of the Defense Authorization Bill ["Space Force is Here," January/February, p. 44]. As part of the laundry list of tasks required to stand up a new branch of the military will be the selection of uniforms. I would like to offer the new leadership a few suggestions.

First, the likelihood of the need for a jungle camouflage uniform is virtually nil. My suggestion would be to go with a dark blue or black utility uniform. USSF could pattern it after the uniform style worn by the ground crews for the F-22 demo team—they're functional, sharp, and with a coolness factor that's over the top (a quick Google search will give you the idea). And while they're at it, shelve the itchy-bitsy teeny-weeny grade insignia, and put it back on the sleeves (normal size) for the enlisted and on the collars for the officers (where God intended). "Good morning ur, uh, oh wait, let me put on my glasses; why good morning Chief, now let me get out of your personal space and we can exchange greetings properly." And those few threads that look like they might be out of place: That's not a stitching flaw, that's the micro insignia for the CMSAF.

For the service dress, they can also start with a clean slate and undo the fiasco of the 1990s (from which we still haven't fully re-

covered). With no effort whatsoever, the new Space Force could reinstate the pre-McPeak service dress (and from what I can tell, it is still being put to good use at USAFA). From what I've heard from current Airmen and potential future (Spacemen?—good God, that's a whole other discussion) it would meet with virtual instant widespread approval. But please, shy away from anything Star Wars-ish or Star Trek-ish; we're not there yet.

Gary Dahlke
Port Saint John, Fla.

Look-ee There

It is ironic that in the November 2019 article "Mosaic Warfare" [p. 51], the drone in the photo on p. 54 is manufactured by the Chinese company Da-Jiang Innovations, or DJI. Wonder how this purchase was approved?

David F. Zehr
Stafford, Va.

F-100's Dog Fight

The two letters in the January/February 2020 issue concerning former Editor-in-Chief John Correll's "Against the MiGs in Vietnam" article discussed several events of interest [p. 5]. The second letter, from Mike Dean, about the unconfirmed kill by F-100 pilot Capt. Don Kilgus on April 4, 1964, against a MiG-17, reminds me of examples of previous coverage in print of the F-100's only aerial engagement, although it saw

considerable action against ground targets as a Fast FAC and CAS/ground-attack type during the long war. Enthusiasts, and especially former Air Force Hun pilots who are not aware of them, might want to know about two publications that have highlighted this event.

Combat Aircraft No. 89 in the highly successful series published by the UK's Osprey Publishing, written by Peter E. Davies with David W. Menard, [including] the fine cover illustration by Scottish artist Gareth Hector of Captain Kilgus firing his 20 mm cannon at the distant MiG. He received credit for a "probable," perhaps because then-President Lyndon B. Johnson, who found himself in an unexpected and rapidly expanding involvement in a major conflict, somehow didn't want to publicize the destruction of a communist MiG.

The equally fine journal *The Intake*, of the F-100 Super Sabre Society, borrowed Hector's excellent illustration for its spring 2012 cover for a feature article about the engagement. Can't do any better than these two great sources on one of USAF's most historic combat aircraft, definitely for former F-100 pilots and maintainers, as well as aviation enthusiasts interested in the Vietnam War or the Super Sabre itself.

Cmdr. Peter B. Mersky
(USN) Ret.
Alexandria, Va.

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Forewarning



Photo: Shealah Craighead/WH

"Our message to the terrorists is clear: You will never escape American justice. If you attack our citizens, you forfeit your life."

President **Donald Trump**, Feb. 4, in his State of the Union Address, after explaining his reasoning for ordering the targeted killing of Iranian Quds Force Commander Qassem Soleimani.



Photo: Spc. Derek Mustard/USA

Uncategorically Speaking

"There are three categories of wounded in action that we've had for years: One is VSI, very serious—and you're probably all familiar with this—very serious injured; one is SI, serious injured; and one is NSI, not serious injured. And, in this case, the reporting to date indicates mild TBI [traumatic brain injury], which would be in the category of not serious injured. That doesn't mean they're not injured ... but in the categories that we categorize wounded in action, these individuals are in the NSI category at this time."

Joint Chiefs Chairman **Gen. Mark Milley** at a Pentagon briefing Jan. 30, on how the military characterizes traumatic brain injuries in combat, in the wake of Iran's attack on U.S. air bases in Iraq. At least 64 cases of TBI had been reported at the time.

Running in Place

"We have adversaries now that are going faster than we are. And it doesn't matter how far ahead you are in the race, if somebody's running faster than you are, they're eventually going to catch you."

Gen. John Hyten, Vice Chairman of the Joint Chiefs of Staff, on why he's focusing on speed as he takes up his new job.



Graphic: Mike Tsukamoto

Evolution

"Tradition alone should never be the sole justification for anything we do. ...There has to be an objective-based 'why' behind everything we do for cadets. If an activity doesn't add value or enhance the cadets' academic and training experience or ability to lead, we shouldn't do it."

Brig. Gen. Michele Edmondson, U.S. Air Force Academy Commandant, after a review showed a wide variance in the amount and type of training received across USAFA's 40 cadet squadrons [Jan. 13].

Don't Forget SOUTHCOM



Photo: Tech. Sgt. Angella Ruiz

"ISR is a key part of the intel picture, it is a global demand, and we're short in this hemisphere."

Adm. Craig Faller, commander of U.S. Southern Command, testifying to the Senate Armed Services Committee on Jan. 30. Military assets fulfill only about 8 percent of SOUTHCOM's ISR needs.



Photo: Senior Airman Skyler Combs

Mission Incapable

"We require your attention and improved focus on the KC-46. . . . The Air Force continues to accept deliveries of a tanker incapable of performing its primary operational mission!"

Air Force Chief of Staff **Gen. David Goldfein** in a letter to incoming Boeing CEO Dave Calhoun.

Tipping the Scale

"Yet no matter how much uncertainty there is across the straits, the fact that the Chinese mainland is getting increasingly stronger and the Taiwan island is getting weaker is an inevitable reality."

Editorial by the Chinese Communist Party's **Global Times newspaper**, reacting to the reelection of Taiwanese President Tsai Ing-wen [Associated Press, Jan. 20].

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Nukes, Space Force, and Change

Air Force Secretary Barbara Barrett with Airmen from the 332nd Air Expeditionary Wing. Recruiting, retention, and caring for people will make the service successful, she said.



Photo: Senior Master Sgt. Matthew Branson

Barbara Barrett was sworn in as the 25th Secretary of the Air Force in October 2019, only two months before the official stand-up of the U.S. Space Force as a part of the Department of the Air Force. In her first interview as Secretary, she spoke with Air Force Magazine Editorial Director John A. Tirpak and Editor-in-Chief Tobias Naegele about the challenges ahead for the two services she now leads; the flattening defense budget; and affording nuclear modernization. The conversation has been edited for clarity and length.

Q. Let's talk about the Space Force. How will the chain of authority work among you, Gen. David Goldfein, and Gen. John Raymond?

A. It's two separate services under one Department, not unlike what you see in the Navy and Marine Corps, but with some differences. In giving testimony, for example, they go in order of the precedence of the services, by the age of the service.

The Department of the Air Force has two components: the Air Force and the Space Force. One might think they'll be called the Department of the Air & Space Force, to have better evidence of the parity, but that's not what happened in the legislation. So they are peers, and that's also the practicality of it.

We're blessed that the two people starting this are Generals Goldfein and Raymond, because they are uniquely wise in how they've handled it. General Goldfein has been very supportive. I think he was the force behind Space Force's immediate participation on the Joint Chiefs, instead of delayed participation, which would have been permitted. He's been very supportive and even deferential beyond his due.

Our mission here is to have this be the textbook demonstration of how you would start something in a way to be led for success. I think we must have managed to clone General Raymond, because he seems to be on both sides of the country at once. He must never sleep, because I see him at 5 a.m. on video teleconferences. He's a remarkable leader, as is General Goldfein.

We are truly fortunate to have those two leaders applying that wisdom to setting up this new force.

Q. The Air Force has long struggled with the "pass-through" budget. It makes the Air Force's budget look bigger than it really is, but the Air Force doesn't actually control that money. Most of those funds go to space activities. With the creation of Space Force, would this be a good time to get rid of that budget idio-

syncrasy and give that budget money to Space Force to manage?

A. That's one of the ideas.

Standing up a new force is evidence that there is a nationally recognized need, and that the world has changed to where there is a new domain that is of paramount importance. There are old constructs that have become chiseled in granite: the 30-30-30-10 division of funds between the services and defense agencies, for example, and the Air Force covers the pass-through. Some of those constructs are no doubt reflective of a World War II mindset, or even a Civil War mindset. We wouldn't dream of trying to practice medicine without penicillin, we wouldn't dream of fighting without space. If we persisted with the same budget that we had "pre-penicillin," if you will, we would not only be wrong in medicine but wrong in leadership.

So what we are doing is, looking at how do we structure this. Budget is among the most important things, and the pass-through has been a thin disguise, but with a big penalty. We need to be looking at better solutions. Those solutions will all be fashioned buildingwide.

We need solutions that a former Army Secretary—who's now Defense Secretary [Mark Esper]—will find equitable. He needs to be persuaded on these. But all the services are beneficiaries of the space capabilities, and if no one else contributes, the space asset will be starved.

Q. Have you discussed the pass-through with Defense Secretary Esper?

A. Not since 10 o'clock this morning.

Q. Do you think the environment is sympathetic to doing something about this?

A. There are antibodies to any change. And I'm conscious that any change will receive pushback.

Q. You've run a lot of organizations and you can see what the antibodies to change are. How long do you think it's really going to take to get the Space Force to be fully accepted?

A. Users of space come to it right away, with a great deal of respect. Other people, they may be protecting their rice bowls.

When the whole idea of the Space Force came up, it was a subject of ridicule, as most new ideas are. But when people thought about it, as I said in my testimony, most people come around. We all use space, most of us before we have our cup of coffee in the morning. People awaken to an alarm clock that uses GPS. They look at their

iPhones or their electronics, and they see the weather, they look at the stock market, they look at news, the traffic report ... all those things use space.

It's ubiquitous, but it's invisible, so people don't think about it. But our way of life is entirely dependent on it. We don't have power unless we use space. Navigation, information, communication, all are dependent on it. And the GPS system that we rely on, worldwide, is run by the Air Force. And now, the Space Force.

By the way, seven staff members sitting in front of computer screens in Colorado Springs are running the world's GPS system, per shift. So, 40 people in total are running the world's GPS system. Now, this is probably the best deal in mankind. Nothing works without it. And the amount of traffic that goes through there is immense.

We don't have to bomb cities to fight a war. You just have to shoot down the space capabilities. My predecessor, Heather Wilson, said we built these capabilities as though we built a glass house before they invented stones. We have capabilities up there that we have to worry about: jamming, laser, capture, diversion. There are vulnerabilities. That's not news. It's not a secret that we depend on these systems and they are vulnerable.

The good thing, though, is that other societies are also increasingly dependent on space. We're not the only ones. And so, they have skin in the game. A debilitating action against America would almost certainly be debilitating against others.

We need to fortify the capabilities that we have. We need to replace these aging systems, some of which have outlived their design life, with less vulnerable capabilities—GPS satellites, for instance. And then, we need to build a capability so that we can be something other than a victim.

We need to make it so that if they take us on, we, too, can do damage in space. Our intent is, we are a peaceful nation. America's policies are peaceful policies, but we do not intend to be helpless victims.

We are in need of development of the capabilities that can defend the assets we rely on in space. We take it very seriously. Those who have thought about it, know this is right. At first it was treated with humor—we like humor—but with more humor than it's due. As people think about it, they understand with sobriety, this is a serious topic, and no less serious than defending our shores, borders, [or] skies. And now we need to be defending the capabilities we need in space.

So as to the question of "what do people in the rest of the [Pentagon] think," people eventually come around to realizing the urgency. They all are using space.

Q. Everyone is predicting flat budgets ahead. How do you protect the gains that have been made in readiness, and push for 386 squadrons, when budgets are flat, and when you have an enormous bill coming due for nuclear modernization?

A. Wasn't it Churchill in World War II who said, "We have run out of money. Now have to think?"

Flat budgets are a reality. It's what we project and anticipate in the future. So we have to get optimum use out of every dollar. Even as of this morning—and for that matter—most times I run into the Secretary of Defense, the question is, how can you do things faster, cheaper, better? How do we get better value for the dollar? Taxpayers should be proud of the Secretary of Defense because he is looking out for value for the money.

I don't think America wants defense on the cheap. I think America wants value for the expenditures. And I think the leadership in [DOD] is here to deliver value, to have the mission in mind, what is the threat, what is the desired outcome, and build a system, within constraints, that gives the best possible value and capabilities for the dollar.

The reality of flat budgets means we need top talent, we need them trained, we need to be recruiting the very best, we need to sharpen up our recruiting system, so it doesn't take months to get someone on board, or years. The best people will only be patient and tolerant for so long. So we need to improve our systems.

Q. Is the 386 combat squadron requirement still viable? The Space Force will take some of those, and the numbers will change. But is the general concept still in play? Or will it be something less than that?

A. It's still in play. What we need are the 386 squadrons. But at the same time, we need to be looking at how a squadron is built. We're looking at stripping it back to the studs. But the squadron, that's the building block. Squadrons are how we put together our force.

Q. One of your predecessors, Secretary Deborah James, suggested that Congress or DOD should break out nuclear modernization from the budget, because that's a once-every-40-years kind of thing, and because leaving it in the Air Force topline would crush funding for conventional programs. Do you think that's a viable idea?

A. Because nuclear modernization is 'up' right now, we really have to think about the best way of doing that. We'll look at the triad and see if there's anything we can do faster, cheaper, better; whether there are any improvements we can make. But carving that out of the budget, somebody's got to cover that. And two-thirds of it is Air Force. We'd need to assess whether others would pick that up. I can't imagine a rush of volunteers.

Q. Have you had that conversation with the Secretary, and with the Hill?

A. We have had conversations about nuclear modernization, how to get it done, and how to discipline the costs.

Q. Is it understood that such a large expenditure can't help but affect everything else the Air Force is trying to do?

A. There is complete understanding that nuclear modernization is a huge bill, coming due now, and is no longer deferrable. Creative solutions are welcome, and, unfortunately, missing.


Q. Looking ahead to the next year or so, maybe longer, what would you like to get accomplished in this job?

A. I guess you can't do everything, so you've got to focus on a few things. I've got the big three. We already talked about space. That's going to take getting it right, and you only get one chance to start something right. So, standing up Space Force is of course the unique and timely thing.

My swearing-in was at the [U.S.] Air Force Academy, not here. It was at the Polaris [Hall] building, symbolically about leadership and character-building. Our future depends on the people who are part of our Air Force and Space Force.

Recruitment of top talent, development of that talent, retention of that talent, and caring for them and their families and the communities in which they work, is how these forces will be successful.

And we've got to give them the right tools, not ancient tools. Any job can be done with the right tools.

During my life, I've been to a hundred different military installations around the world, and so I thought I knew the Air Force, to some extent. But I have only been overwhelmingly impressed with the caliber of men and women who devote their lives to this mission. This afternoon I'll be at a dignified transfer. That gives evidence of the level of commitment these men and women have, their willingness to make the ultimate sacrifice ... uniformed, civilian, [the] Total Force. 



Tech. Sgt. Ashley Yavorsky and Airman 1st Class Leah Weingartner, nondestructive inspection technicians with the 911th Maintenance Squadron, check for cracks on aircraft parts using magnetic particle testing at the Pittsburgh International Airport Air Reserve Station, Pennsylvania, on Jan. 28, 2020. Components are magnetized and then coated with small magnetic particles. Cracks and corrosion pits then can be discovered because they create a measurable flux leakage field around the magnetized component.



Staff Sgt. Jamila Lopez Daniel, a KC-10 Extender boom operator with the 78th Air Refueling Squadron, 514th Air Mobility Wing, guides a K-loader to her KC-10 at Joint Base Pearl Harbor-Hickam, Hawaii, on Jan. 4, 2020. Members from the 78th ARS flew somewhere over that rainbow from Travis Air Force Base, California, to Joint Base Pearl Harbor-Hickam, refueling the Navy's Blue Angels along the way.

Good morning, Alaska. The waning gibbous moon hangs above an ice-bound C-5 Galaxy transport on the flight line at Joint Base Elmendorf-Richardson, Alaska, on Jan 10, 2020. Airmen continued to work in minus 16 degrees Fahrenheit temperatures, some 23 degrees beneath typical average lows for the month.



By John A. Tirpak

Research Closes in on Reality

The X-60A, an air-launched rocket designed for hypersonic flight, is put through a hot-fire test.



Photo: USAF

When it comes to futuristic weapons, whether directed energy, or hypersonics, or robot troops, or whatever, the joke has long been that they are just “five years away ... and always will be.” Scientists overpromise, national leaders raise unrealistic expectations, and wonder weapons seem to take forever to find their way out of the lab.

That’s changing, said one of the Defense Department’s top technologists. Mark Lewis, director of research and engineering for modernization, said the Pentagon is ready to retire the “and always will be” gag for good.

“We always said hypersonics is the future and ‘always will be,’ but now it’s here,” said Lewis in his first interview since taking the job in November. “I think [directed energy] is in the same category.”

Lewis oversees 11 technical areas that Mike Griffin, under-secretary of defense for research and engineering, said offers the greatest potential for technology insertions and leap-ahead gains in capability. Griffin brought Lewis in last fall to oversee deputy directors in those 11 areas, each of whom is building a roadmap for how those technologies will make their way into operators’ hands. The 11 areas are:

- Hypersonics
- Directed Energy
- Artificial Intelligence/Machine Learning
- Biotechnology
- Autonomy
- Cyber
- Microelectronics
- Fully Networked Command, Control, and Communications (FNC3)
- Quantum Science
- Space
- 5G connectivity

The priorities came out of the National Defense Strategy. “It’s a really good list,” Lewis said. “We’re all really big fans of that strategy.” The roadmaps will incorporate “technology, milestones, metrics, and of course, policy issues.” A key aim is to “avoid buzzword science” and work through the ethical implications of the technologies being pursued.

Lewis’ charge to his area directors: “What state do we want to be in, in 2028, 2035, and 2040? And what are the steps that get us there?” Why 2028? Because that’s 10 years after the initiative’s launch in 2018, and it’s a “nice round number.”

HYPERSONICS

Griffin has publicly pegged hypersonics as his No. 1 priority, and Lewis, the former chief scientist of the Air Force, is a leading expert in the field. Lewis declined to detail how many hypersonics projects are underway in the U.S. military, but “the good news is, people are paying attention, now, right?” he noted.

After almost a decade of growing concern that China and Russia were advancing their hypersonic programs ahead of the United States, it’s now on every armed service’s priority list.

“They’re focused, they’re complementary, the services are doing what best fits their mission, and ... we have all the bases covered,” Lewis said. Hypersonics is “a suite of technologies,” he said: “It’s conventional prompt strike systems, it’s tactical systems, it cruise missiles,” and it’s defense against hypersonic weapons, most likely involving directed energy.

“We don’t want to simply duplicate what other people are doing, just because they’re doing it,” Lewis said of competitors such as Russia and China. “We want to do things that make sense for us. Which is almost certainly different from what other [countries] might pursue.”

Lewis declined to discuss the various U.S. military hypersonics programs in detail because they’re classified, but said “it is not a free-for-all.” One of his roles will be to “coordinate and make sure the services and agencies are talking to each other, and they’re spending their resources in ways that complement each other.” These will include the defense laboratories, the Defense Advanced Research Projects Agency, and, “at some point,” the Space Development Agency.

Lewis arrived wanting to see more investment in air-breathing hypersonics, like the DARPA Hypersonic Air-breathing Weapon Concept, or HAWC, because the Pentagon had already made a sizable investment in the successful X-51 program, which wasn’t being vigorously followed up. “I think there’s a lot to be gained from further pursuit of the air-breathing solutions,” he said.

China featured DF-17 hypersonic missiles at its 70th anniversary parade in the fall. Were they real or mock-ups? “I think we have to take them at face value,” Lewis said. “I didn’t see any evidence of cardboard.” He added, “There obviously was some strategic messaging, there.”

Lewis singled out the Army as particularly strong in hypersonics, saying the service “has a really well-thought-out plan, in my opinion, on how to get from the laboratory to operational systems; a really strong focus.” But the Navy also understands that “peer hypersonic systems hold the Navy at risk,” and is giving the technology the at-

CELEBRATING A CONTINUED PARTNERSHIP



Boeing is honored to have been selected as the C-17 sustainment partner through 2031. With an unwavering commitment to mission success, we've proudly reduced C-17 sustainment costs by 40% and provided the fleet with a mission readiness rate of 80%. When readiness matters most, Boeing is there to get the job done.

tention it deserves. The Air Force continues to move ahead “pretty aggressively, as well.” All the services are sharing, he reported. “For example, one of the things they’re sharing is designs for a common glide vehicle.”

There’s also opportunity for “engagement with allies,” such as Australia, which partnered with the U.S. in hypersonics on the HiFIRE program, and which developed the “Stalker Tube,” a wind tunnel used for testing hypersonic vehicle models in a particular regime.

“There is a genuine sense of urgency in our program,” he said, and while testing will begin this year, “we’re not just interested in delivering something quickly. We want to deliver a real capability.” He’s not interested in “onesies-twosies.”

Putting “three missiles in a tube doesn’t do anything for us,” Lewis asserted. “It’s putting tens, twenties, [dropping] hypersonic systems out a bomb bay ... having enough defensive systems so we’re effectively protecting our air bases. That’s what we need to be envisioning.”

What’s the timeline? Lewis won’t say, but “we definitely want to do it as quickly as possible.”

DIRECTED ENERGY

In directed energy—which includes lasers, high-powered microwaves, and other manipulations of the electromagnetic spectrum—“We’re on the threshold of being able to deploy practical ... systems,” Lewis said. Lasers have been brought up to “reasonable power levels ... in the multi-tens of kilowatts range,” and the concepts of operation have matured. During his previous stint in the Pentagon, a lot of laser concepts “basically substituted a laser for a kinetic weapon ... like, a laser as a gun,” he said. “Now I think we understand that we would use directed energy in different ways than you would use kinetic systems.”

There are certain things that “frankly, might be easier to shoot down with a laser than a gun.” Asked if that meant unmanned aircraft, he responded, “You said it, not I.” Does the military have the mobile computing power to make the concept work? “I think we do, yeah.”

It’s important to make such systems practical. If a tactical laser system requires a tractor-trailer size generator, that’s not very useful, he said. But “if we can get it down to reasonably compact form, fit, function,” the utility goes way up.

AI AND AUTONOMY

The future of electronic warfare is likely to be in artificial intelligence; machines sensing frequency changes and adapting in near-real time, much faster than a human being can do. Beyond such functions, “we would use autonomy to help us make decisions, not make decisions for us,” Lewis said. “We are not marching down the path of ‘The Terminator.’”

Are “loyal wingman” robotic aircraft flying with manned combat airplanes close at hand? “I think we’re pretty close,” Lewis said. “I think there’s tremendous value in it.”

Lewis worries that pervasive use of the term “AI” is rendering it meaningless. It’s better to think in terms of “machine learning,” he said, because that will “allow us to break through and understand information” in large volumes, at high speed.

Technology is “pointing us in the direction of ... swarms,” according to Lewis, but “we’re not completely removing humans from the loop. ... We don’t ever view a time when we’ve got, say, a fully autonomous ‘F-30-whatever’ making its own decisions about blowing things up. And that’s a really important distinction.”

BIOTECH

Although there have been some well-publicized examples of Defense dollars creating “power suits” and exoskeletons that enable

humans to lift extreme weights, there is no “Iron Man” in the near future, Lewis said. For one thing, “power suits are power-limited. ... Iron Man’s got that magical power source that we haven’t invented, yet.”

He also cautioned that no one should be worried about technology road maps that recommended “enhancing” people.

“Human beings have been enhanced by technology for centuries,” he said. Eyeglasses, hearing aids, night vision goggles, and prosthetic limbs are all human enhancements that did not involve reengineered human brains or flesh.

“We think about what technology tools we can bring to bear that will ... help human beings make decisions, provide them with the right sensors and information, the right way to process it and present it ... how to improve knowledge,” he said. “We are not talking about implants, or ... plugging people into computers with wires coming out the back of their skulls. ... We are not on a path to create Frankenstein.”

BLOCKCHAIN, QUANTUM, AND CYBER

The promise of blockchain and quantum computing is that information is stored in such small and discrete ways that any tampering would be immediately obvious. Are the days of hacking nearly over?

“No. At least, I don’t think so,” Lewis said. Blockchain will make it harder “for someone to break in, and we’re more likely to know about it,” he said, but hacking is likely to be “something we’ll always guard against.”

The Defense Department in late January released new cybersecurity policies for defense contractors. Lewis said the department will always discuss some kinds of security information “with our trusted partners and trusted vendors, [but] some things we won’t be able to discuss.” The emphasis will be on sharing in order to get the best ideas from industry, and so industry knows where the Pentagon wants to go.

“If we don’t discuss it at all, then what good is it?” he asked rhetorically.

SPACE

Space technology has tended to focus on miniaturization, better power sources and more reliable rockets over the years, and to that Lewis would like to add “making space more resilient.”

What was once a benign environment is now rife with potential threats. “Right now we’ve got some vulnerabilities if people start taking out our space assets,” Lewis said. “I want to be in a situation where, if people take out our space assets, all they do is make us angry, not hurt us. That’s my goal.”

One way to achieve resilience is to simply broaden the network so that an adversary is discouraged from even bothering to try to knock it out. “Having better ... and lower-cost access to space ... building-in redundancies and being able to replenish, that’s all part of where we’re going,” he said.

So is space resilience all about sheer numbers? “It’s how many, and how we use them, and how they interact with each other, and with other parts of our command and control network,” Lewis answered.

Lewis said he has an “amazing team of assistant directors” who are technical experts in their fields. He and they are well-engaged with Congress, which he said is willing to invest in long-term approaches where necessary.

“The folks on the Hill are our friends ... they understand what we’re trying to do,” Lewis said. He tells them, he added, that he believes “we’re the single most important office in the Pentagon because it’s worrying about the future. And while everyone thinks they’re the most important—that’s why they do it—I haven’t gotten a lot of pushback on that.”



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What's in the FY21 Budget Request

By Brian W. Everstine and John A. Tirpak

The Department of the Air Force's fiscal 2021 budget request includes \$153.62 billion for the Air Force and \$15.38 billion for the Space Force, all within an overall budget topline identical to what Congress passed for 2020.

That topline includes \$38.2 billion in pass-through funds neither controlled nor used by either service, but used by other defense agencies for secret, mostly space-related work. The pass-through is down slightly from \$39 billion in 2020. Air Force leaders have said in recent months that eliminating the pass-through has been the topic of high-level discussions, but is ultimately a matter for Congress to address.

The spending plan:

- Cuts USAF procurement by 5 percent to \$25.39 billion
- Cuts military construction funding by 74 percent to \$1.38 billion
- Increases operations and maintenance funding by \$3.26 billion (6.2 percent)

- And raises research and development investment by \$2.01 billion (5.9 percent)

The Air Force and Space Force budgets fit within an overall Defense Department funding request totaling \$705.4 billion (down from \$712.6 billion approved by Congress for 2020). It includes \$636.4 billion in base funding and \$53 billion to fund overseas contingency operations. Another \$35.1 billion for nuclear programs at the Department of Energy expands the total planned investment in national defense to \$740.5 billion.

USAF AND USSF

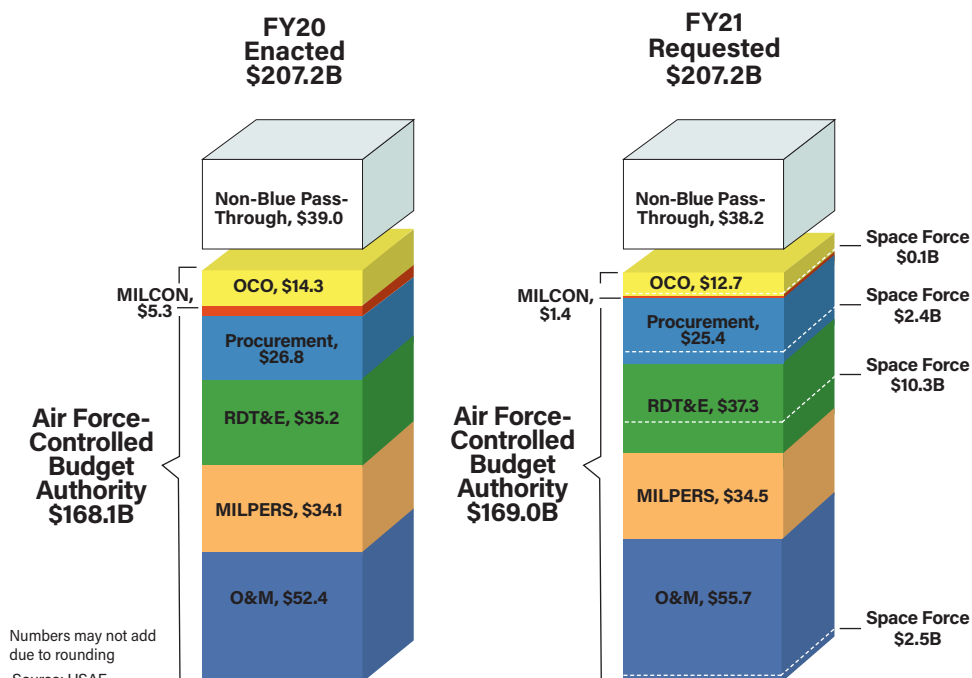
Air Force Department officials cited four priorities derived from the National Defense Strategy as driving their decisions:

- Connect the joint force
- Dominate space
- Generate combat power—defined as “blunt any attack against the U.S. or our allies”
- Sustain logistics while under attack

The budget request funds just 60 new fighters, including

Breaking Down the 2021 Budget

The fiscal 2021 budget request suggests an investment of \$207.2 billion for the Department of the Air Force. A closer look, however, shows that only \$154.62 billion (74.4 percent) funds Air Force programs and a slim \$15.38 billion (7.4 percent) funds the Space Force. The remaining \$38.2 billion (18.4 percent) is classified intelligence spending.



48 F-35As and 12 F-15EXs. That's a dozen short of the 72 fighters needed per year to staunch the aging of its fighter force. The Air Force had planned to add 60 F-35As per year by now.

In space, the budget buys two Global Positioning System III follow-on satellites and three National Security Space Launch vehicles.

Other planned purchases include 15 KC-46A tankers, 16 HH-60W combat search and rescue helicopters, the first MH-139 Grey Wolf VIP/ICBM support helicopters, and a variety of aircraft upgrades.

“The bottom line is: To ensure we have the capabilities we're going to need in the future, we're going to have to take some risk,” Maj. Gen. John Pletcher, the Air Force deputy assistant secretary for budget, said in a Feb. 10 briefing. “We can't continue to fund everything ... we have in our force today without eventually having to make some tough choices, so this budget does that.”

The increase in operations and maintenance comes from a substantial increase in operational contingency funds, with the total rising from \$14.3 billion enacted by Congress for '20 to \$21.5 billion in '21. OCO funds will help replenish JASSM-

ER stealth standoff missiles, JDAM bombs, Hellfire missiles, Small Diameter Bomb I, and Combat Rescue Helicopters used or lost in combat operations and support “six enduring locations” where USAF operates overseas, hand-launched RQ-20B Puma drones, general purpose bombs, and six European Defense Initiative military construction projects.

Air Force leaders had touted a planned \$30 billion realignment, which was projected to include wholesale retirements of major systems, but no such mass retirements materialized. Still, the plan seeks to retire the 17 least-capable B-1B bombers and 44 of the “least ready” National Guard A-10s, as well as 24 Block 20/30 Global Hawk ISR drones, 16 KC-10s,

and 13 KC-135 tankers. Losing the tankers is likely to raise questions since the new KC-46s are still years from being fully operationally capable.

Meanwhile, 24 C-130Hs would retire, but they would be replaced by 19 new C-130Js, which are more capable. Because no aircraft will be retired outright, the biggest potential savings did not materialize; as long as any aircraft remains in the inventory, so does its associated logistics chain.

Maj. Gen. John Pletcher said the '21 budget is not a blueprint for the “Air Force We Need” of 386 combat squadrons. That 386 goal “is not dead,” he said, but this budget merely begins the journey to that total. ✦

Space Force Launches with a \$15.4 Billion Budget Request

By Rachel S. Cohen

The Space Force is seeking \$15.4 billion in fiscal 2021 for its first full year of operations, up from \$40 million in seed money allotted by Congress in 2020.

The fledgling service was created under the Department of the Air Force in December by the fiscal 2020 National Defense Authorization Act, and will initially encompass most of the Air Force’s space enterprise. For the year, overall space funding would grow by \$900 million, said Maj. Gen. John Pletcher, the Air Force’s deputy assistant budget secretary.

Pletcher said Chief of Space Operations Gen. Jay Raymond has pressed hard to keep costs down. “Every time they’ve talked about how big a headquarters, how big of additional centers, anything that might look like added cost ... [he] pushed down on it,” Pletcher said. The future growth of the department, he added, “depends on how much we as a nation—and we as a department—invest in the capacity and the capabilities that are really the gain of standing up a separate Space Force.”

The bulk of the Space Force’s 2021 request is in research and development. At \$10.3 billion, it’s roughly two-thirds of the total planned spend. Among the major purchases: an improved control system for GPS satellites.

About one-third of that is for unspecified classified programs, according to budget watcher Todd Harrison, a defense analyst at the Center for Strategic and International Studies. “This is funding that was not previously identified as being for space,” he said via Twitter.

The service also wants \$2.5 billion to fund regular operations and maintenance of assets like satellites and launch ranges, and to build out its headquarters.

Another \$2.4 billion would go toward buying those systems, like two GPS III follow-on satellites from Lockheed Martin and three launches under the National Security Space Launch program. The Air Force requested the same amount of money for space procurement in 2020.

Two funding lines still resting within the Air Force are personnel and military construction. Pletcher said the Space Force will take control of its own military personnel money only once it’s certain those service members will be paid without hiccups. The Space Force’s workforce will still be small in 2021, growing from just 38 Active-Duty operators in 2020 to about 6,400 in 2021, according to Defense Department budget documents. That is expected to grow to about 8,100 Space Force members by 2025. In 2021, they would be joined

by 3,500 full-time civilians, up from more than 120 this year.

Other details in the Space Force budget:

- \$77 million for overseas contingency operations to fund “counter-space operations, satellite communications in support of overseas efforts, and the sustainment of the Space-Based Infrared System,” Air Force budget documents said.

- \$111 million to grow the number of Space Force employees, “including staff for centers for development of doctrine, testing, and training for the new service.”

- An unspecified sum for renaming some bases as Space Force installations. These name changes will not affect the base operating support and financial management relationships between the U.S. Space Force and the U.S. Air Force,” DOD said.

“The USSF is realigning existing space forces and materiel from the Air Force in the near-term and scaling up with other components over the next several years in order to address increasing threats and maintain strategic advantage,” the Office of Management and Budget wrote. “The budget also grows the Space Development Agency, which was established in 2019 to foster innovation by leveraging the thriving domestic commercial space sector, and the U.S. Space Command, which would employ the forces and capabilities of the USSF.”

DOD added that it still plans to bring the “preponderance” of space missions, units, resources, and personnel under the Space Force.

“Transfers are critical to unifying today’s disparate space-related research, development, acquisition, fielding, and operations into a single organization led by a single leader,” according to Pentagon comptroller documents. “Failing to consolidate the preponderance of military space activities and capabilities from across the DOD will fail to leverage the historic opportunity the establishment of the U.S. Space Force as a separate military service provides.”

The Pentagon says that, if allowed by Congress, it will take on the hefty task of determining which Army, Navy, and other space missions and resources will move into the Space Force in fiscal 2022.

“The department’s goal is to transfer the necessary space-related missions, units, resources, and personnel into the U.S. Space Force no later than FY22, consistent with law,” DOD wrote. “Missions, units, resources, and personnel will be transferred in a manner that minimizes disruption to current missions and acquisition programs and avoids adverse impact to military and civilian personnel.” ✦





Photo: Senior Airman Alexander Cook

Lockheed Mixed Up Structural Fasteners in F-35s

By John A. Tirpak

Hundreds of F-35s could have the wrong fasteners in “critical areas,” according to the Defense Contract Management Agency [DCMA]. But F-35 builder Lockheed Martin says the problem may not need to be fixed. “All aircraft produced prior to discovery of this [problem] have titanium fasteners incorrectly installed in locations where the design calls for Inconel,” the F-35 Joint Program Office [JPO] said in an email in response to a query from *Air Force Magazine*. “Because of this, the engineering safety analysis of the issue has assumed that each critical F-35 joint was assembled with the incorrect fasteners.”

Deliveries of the F-35 were halted briefly in November when the issue was discovered, but the JPO said analysis in January concluded “that no aircraft operating restrictions or inspections are necessary at this time.”

Inconel is an alloy of nickel and chromium. Inconel bolts are specified for uses where greater strength and corrosion resistance are required, while titanium bolts are used in areas where its lightness helps reduce weight. Titanium has a lower shear strength than Inconel.

The fasteners in this case are “eddie bolts” and are similar in appearance except for the numbers stamped on them. They are not the same, however: The titanium bolts cost about \$5 apiece, while the Inconel parts cost about \$20 each. A Lockheed spokeswoman said the two parts are “very difficult to distinguish visually.”

The Lockheed spokeswoman said an initial analysis concluded that “titanium has sufficient strength in locations that called for Inconel eddie bolts.” Another Lockheed official said components are built with “twice

The two parts are “very difficult to distinguish, visually.”

—Lockheed Martin spokeswoman

the strength specified,” but he did not specify whether this was the case with the titanium eddie bolts.

Ellen Lord, undersecretary of defense for acquisition and sustainment, said she had seen samples of the mixed-up fasteners and said, “right now we have assessed that there is no structural compromise of the aircraft.”

A Root Cause and Corrective Action [RCCA] analysis is now underway and the JPO said it will release a fleet guidance report when it is complete. Lockheed is doing the analysis under the supervision of both the DCMA and the JPO.

Noting that the JPO and Lockheed are working closely together, Lord said: “We will continue to assess if there are any issues, but we have confidence in the integrity of the aircraft at this point.”

Lord said she’s looking for “continuous improvement” in F-35 production, and reported seeing “incredible strides” in quality over the past 2 1/5 years. “I think this is a journey that we will be on for the entire life of the F-35,” she said, predicting that Lockheed will continue to improve, “month over month, quarter over quarter, and year over year.”

In addition to the F-35 production line at Fort Worth, Texas, the commingling of the two types of bolts was also discovered at the Italian F-35 Final Assembly and Checkout (FACO) facility, but not the one in Japan, the DCMA reported. Deliveries of the F-35 were halted briefly in November when the issue was discovered.

Lockheed plans to submit its report to the DCMA and JPO in February, and the company expects it “to be approved,” its spokeswoman said. As to how the issue occurred, she explained that “several fastener bins were found on the factory floor with commingled fasteners at Lockheed Martin locations and several

For F-35, ALIS Doesn't Live Here Anymore

By John A. Tirpak

The F-35's problematic Autonomic Logistics Information System, or ALIS, will be replaced by a new system starting later this year. The new system, dubbed ODIN, for Operational Data Integrated Network, is designed to be more user-friendly, more secure, and less prone to error.

ODIN "incorporates a new integrated data environment" and will be "a significant step forward to improve the F-35 fleet's sustainment and readiness performance," according to the F-35 Joint Program Office. The new system will also "allow software designers to rapidly develop and deploy updates in response" to operator needs.

The first "ODIN-enabled" hardware will be delivered in 2020, and the system is supposed to be fully capable by December 2022, "pending coordination with user deployment schedules," the JPO said. Some deployed ALIS systems may not get ODIN until they return.

ALIS was developed to gather vast quantities of F-35 flight data, relaying performance to maintainers on the ground in near-real time. It's meant to predict part failures and keep maintainers abreast of the health of each individual F-35. By amassing that data centrally for the worldwide F-35 fleet, prime contractor Lockheed Martin expected to better manage spare parts production, detect trends and performance glitches, and reduce operating costs. The system was plagued by troubles, from false alarms leading to unnecessary maintenance actions to laborious data entry requirements and clumsy interfaces. The system also was slow to boot up, updates were difficult, and the tablets used by maintainers were clunky.

ODIN development was led by the JPO, and leveraged USAF's Kessel Run software development unit, the 309th Software Engineering Group at Hill Air Force Base, Utah, the Naval Information Warfare Center, Lockheed Martin, and Pratt & Whitney, said Air Force Lt. Gen. Eric Fick, F-35 program executive officer. ODIN will "leverage the agile software development and delivery practices piloted by Kessel Run and investments by Lockheed Martin" to help improve mission readiness and meet operational requirements, he said.

The Air Force software shop charged with improving ALIS system software was nicknamed "Mad Hatter," a reference to a character by that name in Lewis Carroll's "Alice in Wonderland."

"Poor data quality is the top risk to the performance of the new and next-generation system," the JPO said. "That is why the F-35 JPO has prioritized building a new integrated-data environment first, using commercial best practice for data management, well-defined and simplified systems of record, and reliable data quality metrics and tracking."

ODIN will be a "cloud-native system that incorporates a



Photo: Senior Airman Caroline Burnett

Maintainers work on an F-35 at Luke Air Force Base, Arizona. Lightning II aircraft are getting a new, more user-friendly logistics and sustainment system.

new integrated-data environment and a new suite of user-centered applications."

Switching the enterprise to the new system will enable "real-time monitoring of system performance and automated collection of performance information, and seamless management of parts, technical orders, and program performance data."

The Government Accountability Office published a number of reports faulting ALIS for adding unnecessary man-hours and complexity to the F-35 enterprise, saying in a November 2019 report that USAF maintainers in just one unit reported "more than 45,000 hours per year performing additional tasks and manual workarounds because ALIS was not functioning" the way it was supposed to.

In early versions, ALIS also proved vulnerable to hacking and data theft, making security another reason to overhaul the system.

Ellen Lord, undersecretary of defense for acquisition and sustainment, has said driving down F-35 hourly operating costs is among her highest priorities. The Pentagon wants to reduce F-35 operating costs for the Air Force, Navy, and Marine Corps to \$25,000 per flight hour by 2025. Today's cost is about \$35,000 per flight hour.

Lockheed Martin has pitched a performance-based logistics program, which it says is the only way the \$25,000 goal can be met. The unofficial proposal would require Lockheed to invest more than \$1 billion in more efficient practices and hardware, a sum that would be paid back by the government at a later date. Lord said the Pentagon is reviewing the proposal. ★

supplier locations."

Inspections of some aircraft—Lockheed did not specify how many, or who had conducted the inspections—"indicated high levels of compliant fastener installations," and an engineering review "has been completed and is in review with the customer," the spokeswoman said.

The company believes that once its analysis is approved, "no rework will be required for aircraft in the fleet," she said, but did not identify other corrective actions.

Similar quality issues occurred with the F-16, where workers threw leftover fasteners into the wrong bin at the end of a shift. Such problems can often take months to be discovered.

According to the DCMA, there are more than 48,000 fasteners of the two types on an F-35 fighter. The Air Force's F-35As have 848 Inconel bolts out of 48,919 total fasteners, or about 1.7 percent of the total. The Marine Corps' F-35B model has 877 Inconel fasteners out of 50,603, also 1.7 percent. The Navy's F-35C carrier-capable model, though, which has to endure the shock

of repeated hard landings on an aircraft carrier, and is larger and heavier than the other two variants, has 51,353 fasteners, of which 1,813, or 3.5 percent, are made of Inconel.

The DCMA acknowledged that Lockheed had begun implementing a corrective plan in November and had “completed most action items in December 2019,” although it did not specify those actions.

It was not disclosed on which F-35 tail numbers the changes were implemented. Lockheed delivered 134 F-35s last year, so it’s likely that the last deliveries of 2019, or about 11 to 14 airplanes, as well as those delivered in January, are not suspected of having misapplied bolts.

The DCMA said it hasn’t calculated what it would take, in terms of man-hours, to check all the fasteners on all previous F-35s, or what that would cost, because this was “not part of the corrective action.”

The JPO will work with Lockheed to “examine the structural impacts of having titanium fasteners installed in locations where the design calls for Inconel.” It left open the possibility that there could still be “inspections or replacements ... required.”

The company and its suppliers “are validating correct fas-

tener installations and have taken actions to improve fastener segregation and control,” the Lockheed spokeswoman asserted.

The RCCA was to examine “all aspects of handling this part, including, but not limited to, the manufacture, shipping, receiving, production, line distribution, and production line work instruction,” the JPO said in an email. “The F-35 Joint Program Office and Lockheed Martin will use the findings to update these procedures as appropriate to prevent a similar escape from occurring in the future.”

It will be up to the JPO to decide what expense, if any, the bolt mix-up will entail, and who will bear that cost, the DCMA said.

Less than a year earlier, it was holes, rather than fasteners that found Lockheed under scrutiny, after USAF maintainers at Hill Air Force Base, Utah, discovered corroded fastener holes on some aircraft. The holes had either been improperly drilled or improperly treated to prevent corrosion.

Corrosion could become an issue in this case, as well. A Pentagon official familiar with aerospace structures said it’s possible the titanium or Inconel bolts could be incompatible with the materials they’re attached to. Left uncorrected, corrosion is one potential result. ★

The XQ-58A Valkyrie demonstrator, a long-range, high subsonic air vehicle, completed its inaugural flight March 5, 2019, at Yuma Proving Ground, Arizona.

Experiments Take Root Across the Air Force



Photo: Senior Airman Joshua Hoskins

By Rachel S. Cohen

When the Air Force Research Laboratory’s experimentation office was chartered in 2016, the idea of “try before you buy” hadn’t picked up much speed. Nearly four years later, the office is using momentum and top cover from leadership to institutionalize experiments as regular practice in the Air Force.

The Strategic Development Planning and Experimentation Office, or SDPE, was established to bring to life the ideas explored in the Air Force’s enterprise studies of big topics such as multi-domain command and control and electronic warfare.

SDPE has been a key piece of the Air Force’s push to shrink the time it takes to move from developing a technology to getting it out into the field, aiding efforts including the light attack experiment, and overseeing new pushes into directed energy and the “Skyborg” drone.

Now it’s looking for new ways to collaborate across the service, getting involved in the Pentagon’s joint all-domain command and control vision, funding side projects such as prototype landing strips, and

launching inquiries into electronic warfare and bulk munitions.

The office is evolving into more of a partner to the Air Force Warfighting Integration Capability—a headquarters-level group tasked with finding cross-functional solutions to the Air Force’s most widespread combat issues.

“The initial responsibility we had was to sort of provide the infrastructure and to execute these annual [Enterprise Capability Collaboration Teams] for the Chief of Staff of the Air Force,” SDPE Director Chris Ristich said in an interview. “Those have gone away now, and they’ve really been replaced by AFWIC. ... As they’re starting to reach critical mass, we’re working with AFWIC to establish where the priority focus is going to be in the future.”

That relationship is shaping where SDPE’s ongoing experimentation campaigns could go next. For example, Ristich said, an effort to protect bases from incoming threats such as cruise missiles is expanding from considering only directed energy to include kinetic defenses such as munitions as well.

AFWIC isn’t the only group that wants to tap into experiments, which proponents argue are a cost-effective way of narrowing down what industry has to offer and

“Experimentation can help us learn and frame the sort of ‘realm of the possible’ before we start turning them into specific requirements.”—

SDPE Director Chris Ristich

quickly seeing if they meet real-world needs. Major commands and combatant commands are advising SDPE more often now on how the office could help their large organizations, and some are launching their own experimentation groups.

"You see experimentation activities, in general, starting to pop up in more and more places," Ristich said. "I think all aspects of the Air Force are understanding that experimentation can help us learn and frame the sort of 'realm of the possible' before we start turning them into specific requirements for programs of record."

The office's flagship efforts haven't yet delivered any major weapons or networks that Airmen can use in everyday life, but officials are optimistic that those wins could be coming in the next year or so.

One area that could soon bear fruit is SDPE's program to find laser and microwave weapons that can protect bases from threatening drones. Three systems are heading to an undisclosed location overseas to spend a year downing unmanned aircraft that could be spying on U.S. troops or carrying explosives.

The demonstration "very much has the ability not just to be a 12-month operational overseas assessment, and [instead turn] into something that could be routine operations," Ristich said.

"Global Lightning," an experimentation campaign to hook up military aircraft to commercial Internet, is another good bet. Ristich said the office is eyeing a satellite communications lease contract within the next two years. SDPE believes that would take longer using a more traditional approach.

"We're not putting out contracts to buy satellites and launch satellites and design architectures. ... Instead we've been able to focus our resources on very quickly putting terminals in the field and testing with these different Internet services that are going up," said Global Lightning Program Manager Brian Beal. "We're working very closely with the ... Space Force commercial SATCOM office, who will put the business mechanisms in place to use that capability operationally."

SDPE's ideas can reach warfighters through other avenues as well. The office is partnering with similar experimentation campaigns—notably, the Advanced Battle Management System project championed by Air Force acquisition boss Will Roper.

The Global Lightning team lent one of its test sorties to the first ABMS experiment in December 2019, where it connected an AC-130 to the Internet using SpaceX's Starlink satellites. That enabled the plane to share data with other assets in the experiment in ways it couldn't before, and it gave researchers feedback on using government encryption on commercial systems.

"They have ongoing plans and we'll be testing different aspects quite frequently," Beal said of ABMS. "Where there's a good linkage between what we're doing on Global Lightning and what ABMS needs, I expect that we'll continue to test together."

SDPE researchers are also jumping into ABMS to figure out how to protect the U.S. from enemy cruise missiles. The December test worked with U.S. Northern Command on a scenario involving a cruise missile threat to the homeland, and SDPE will bring kinetic weapons, such as munitions, to an ABMS experiment this spring to address that problem.

The ABMS experiment could look at different ways of sending intelligence data to that counter-cruise missile system so a human operator knows when to fire.

Michael Jirjis, who runs SDPE's directed energy projects, said the Air Force is considering at least 10 kinetic and nonkinetic weapons to defend against cruise missiles. Some of those will be vetted as part of ABMS experimentation this year, while the

office will test others in a separate event in 2021.

"For the '21 experiment, ... we have both laser and high-power microwave [HPM] systems that we're looking at," Jirjis said. "They get at different mechanisms for addressing that threat that's actually coming in. ... The HPM system disrupts electronics that are in some of the cruise missiles, and then the laser system is very much a thermal burn, providing a kinetic-type kill, but it's a different mechanism than you would have with a kinetic munition blowing it up."

Ristich added that ABMS, envisioned as a faster, more connected way of doing command and control across the armed forces, is providing an opportunity for various military experimenters to help and learn from each other.

"ABMS is an example of where others that were doing this experimentation—including our office—kind of converged together to bring the different elements that we're experimenting on to provide broader capabilities to actually see ... more of an end-to-end kind of capability," he said.

Those kinds of partnerships are also popping up between SDPE and other Air Force groups, like bringing in Global Lightning to assist with Air Education and Training Command's "Squadron Next" plan to bring better connectivity to bases. Ristich indicated that's a good model for future collaboration, but that experimentation won't necessarily take root within program offices themselves.

Looking forward, SDPE is planning new campaigns and figuring out how to make the most of other efforts in AFRL.

Two pathfinders are helping hone their focus: one on rapid development of electronic warfare tools, and another on palletized munitions, or "the idea of exploring the ability to deliver a large volume of weapons at any given time," Ristich said. The office is sketching out possible experiments that could get underway in fiscal 2021.

He added that AFRL's "Vanguard" programs—major development efforts that will pull resources from across the lab—are a natural candidate for operational experiments so the Air Force makes sure the technology meets Airmen's needs.

The office can also learn from its struggles.


Transitioning technologies to full-fledged programs continues to be difficult, Ristich acknowledged, but bringing in program executive officers early can help smooth that path.

He also noted one effort, dubbed "opportunity capture," that ended up being too small for the vast task of identifying and reeling in emerging ideas for use in the Air Force—a mission now handled by AFWIC and AFWERX.

"The question was, how do you institutionalize something like that, where you're doing horizon scans, and understanding those evolving marketplaces and able to distill them into essentially operational concepts?" Ristich said. "That was an example of a small office really not able to absorb that fully."

Others have criticized experimentation for not following through on certain ideas. Though Air Force officials insisted their effort to vet light attack aircraft was just an experiment that wouldn't necessarily result in procurement, lawmakers and some in industry have criticized the service for what they saw as resistance to going all-in on a needed platform.

SDPE has to prove it can come through on its big promises while keeping a 30-person staff and a yearly budget of around \$120 million.

"It's very tempting, actually, to grow," Ristich said. "We try and execute as a flat organization where essentially everyone knows everyone and we work directly together. I think as we start to get too large, we'll start to stratify into a hierarchy. ... We don't want to do that." 

Planners Aim to Build Slim, Agile Space Force

By Brian W. Everstine

The U.S. Space Force will maintain a small and low-priced footprint, relying heavily on the existing USAF force structure, according to a 26-page document sent to Congress Feb. 3 that outlined the planned structure of the new service. That document will continue to evolve, however, with a finalized version expected in early May.

“DOD is focused on creating a structure that removes traditional layers of bureaucracy while maintaining clear lines of authority, responsibility, and accountability,” Air Force Secretary Barbara Barrett wrote. “The successful establishment of the Space Force is vital to the continued ability of the United States to compete, deter, and win in an era of great power competition.”

U.S. Space Force Vice Commander Lt. Gen. David Thompson, still a uniformed member of USAF, said there are about 6,000 Air Force personnel, previously assigned to Air Force Space Command, who are now assigned to the Space Force. The goal is to start transferring personnel in key career fields—space operations, intelligence, engineering, acquisition, science, and cyber—this year, with complete transfer of USAF personnel slated for 2021. After that, the Space Force will begin transferring Army and Navy personnel.

By keeping the personnel and infrastructure small, the Air Force expects the “additive cost” of the new service to be less than \$500 million per year, and less than \$2 billion total from fiscal 2020 to 2024, according to the planning document.

The Air Force does not yet have a name for Space Force personnel, but planners have reached out to the Air Force Academy’s language department, the Defense Language Institute, and other language centers for help in what to call those assigned to the new service, Thompson said.

One possibility can be ruled out: They will not be “space-men,” he said.

Officially bringing Airmen into the new service will take time. Changing the commissioning and enlistment process requires Congressional authorization, and the Pentagon wants to ensure bureaucratic processes such as pay and benefits are established before personnel join.

This means that for now, Chief of Space Operations Gen. Jay Raymond remains the only member of the new service, Thompson said.

Eventually, all of DOD’s space-specific career fields will make up the approximately 16,000 members of the Space Force. Non-space-specific jobs related to the service, such as medical, civil engineering, and finance, for example, will remain in the Air Force. This will reduce the overall size of the service by about 7,500 members, the Air Force told lawmakers in the document.

“There will be more people assigned to U.S. Space Force critical support than we’ll have in the U.S. Space Force because people in U.S. Space Force are a limited number of skill sets,” Maj. Gen. Clint Crosier, the director of the U.S. Space Force Planning Office, said.

The Air Force has not yet proposed how the National Guard and Reserve will fit into the Space Force. That will be outlined in a future report due to Congress in March.

Eventually, the Space Force will access officers in the same way as the Air Force, through Officer Training School, Reserve Officer Training Corps, or through the U.S. Air Force Academy,



Photo: Senior Airman Melody Howley

Gen. John Raymond signs the US Space Command sign at Cavalier AFS, North Dakota. Raymond toured the facility and spoke to Airmen stationed there.

in a similar way to how Marines go through the U.S. Naval Academy. There will be a Space Force detachment at the Air Force Academy in 2020, according to the document.

Enlisted personnel will still go through the Air Force Basic Military Training structure, with curriculum and programs to be modified in the future for some space-specific training.

A headquarters base has not yet been identified for the new service, but Air Force bases will potentially be renamed as Space Force installations, “To further cement the culture and identity of the Space Force,” according to the document.

There will eventually be a vice chief of space operations who will report directly to the CSO. That position will need Senate confirmation and Presidential appointment.

The Space Force will have subordinate commands, in the same way the Air Force has nine major commands. So far, only a few have been announced. Space Training and Readiness Command will be “devoted to growing a cadre of space warfighting professionals necessary to meet new mission demands,” while Space Operations Command provides Space Force and others with space resources, such as satellite communications or missile warning.

Another report, due to Congress by the end of March, will address space acquisition, including merging the acquisition functions of the Space and Missile Systems Center, the Space Development Agency, and the Space Rapid Capabilities Office into a single authority.

“We have plenty to do in the United States Space Force,” Thompson said. “In fact, we’ve been doing it for a long time.”✪

B-21 Illustrations Show New Details of Secret Bomber

By John A. Tirpak



Illustration: Northrop Grumman


An artist's rendering of a B-21 Raider concept at Ellsworth Air Force Base, South Dakota.

The Air Force released new artist's concept images of the classified B-21 Raider bomber Jan. 31, showing new details of the air intakes, landing gear, and mid-body shape.

The new Raider images, the first since the bomber's name was announced in September 2016, show the aircraft from ground level in the front right quarter, are actually three versions of the same picture, superimposed on a view out hangar doors at Whiteman, Ellsworth, and Dyess Air Force Bases in Missouri, South Dakota, and Texas, the planned future homes off the B-21, and the current homes of the B-2 Spirit and B-1 Lancer bombers, respectively.

The B-21 strongly resembles the B-2, but the new B-21 images show the cockpit windscreen further back from the nose, with a notable flat space in that location. The air intakes on either side of the cockpit are rendered as straight-edge triangular openings, unlike the B-2's scalloped air scoops, and the depth of the intake tunnel is clearly shallower and more blended into the upper surface.

The underside depth of the center body—the “keel” of the flying wing—is similar to that of the B-2, but the upper surface shows a shorter fairing into the rear of the aircraft behind the cockpit, perhaps indicating no accommodations for a third crew member. The B-2 featured an ejection seat opening for a third crew member, but a third station was never included, and the space is used instead by the pilot or mission commander for catnaps during 40-plus hour missions.

The landing gear in the images is akin to that on the B-2, with similar positioning and nose gear doors. The image suggests the aircraft crew compartment is accessed through the nose gear area, as on the B-2, though the nose gear is positioned further back from the nose than on the B-2. The picture also suggests that each of the main landing gear rests on two large wheels, instead of four on the B-2, perhaps owing to the B-21's smaller size and weight. The landing gear doors have more angles than on the B-2, and may fold like those on the F-22. No new information can be gleaned by the aircraft's “shadow” on the hangar floor, which confirms the kite-like shape of the aircraft as seen in the original artist's concept. 

Sexual Assault Prevention Problems Linger at Military Academies

By Amy McCullough

Reports of sexual assault at the Defense Department's three military academies rose 27 percent in the 2018-2019 academic year, despite a high-level call to action to eradicate the problem.

There were 149 reports of sexual assault involving a cadet or midshipman in 2018-2019, up from 117 the year before, according to a new Pentagon study. Some 122 of those reports were made by academy students for sexual assaults that occurred during military service; eight cases were reported by Active troops or civilians and involved a cadet or midshipmen currently enrolled at an academy or who was enrolled within the last four years. The Defense Department did not release details on the additional 19 cases.

“The Department recognizes the challenge of combating sexual assault in the Military Service Academies and the high cost of not succeeding,” said Elizabeth Van Winkle, executive director of the Office of Force Resiliency, in a press release. “Our academies produce our future leaders. At every turn, we must drive out misconduct in place of good order and discipline.”

The Defense Department assesses the prevalence of sexual assaults and misconduct at the academies as well as the number of reports made in two ways.

- Assessment reports for academic years beginning with even-numbered years—such as this report—look at academy actions and sexual assault reporting.

- Assessments conducted in odd-numbered years include an anonymous survey of cadets and midshipmen that covers both the prevalence of sexual assault and reports of assault.

The report released Jan. 30, outlines whether the academies are in compliance with Defense Department policies and includes feedback from focus groups conducted with cadets, midshipmen, faculty, and staff.

“Focus group participants favorably acknowledged senior academy leader efforts to address sexual harassment and sexual assault. However, there was little evidence that such efforts translated into greater interest to challenge disrespectful elements of academy culture,” the report states. “Students often cannot, or will not, identify disrespectful experiences as unacceptable behavior. Participants also noted the perception that sexual harassing behaviors either lack severity or are considered ‘normal’ at the academies.”



Photo: Joshua Armstrong/USAF

USAF's Class of 2023 at a March Back event in July 2019. A DOD report found that the Air Force Academy's Sexual Assault and Response office was deficient in 14 areas.

An inspection of the U.S. Air Force Academy's Sexual Assault Prevention and Response (SAPR) program, conducted by the USAFA inspector general from Dec. 10, 2018 to Jan. 25, 2019, found the program "does not comply with key elements of governing directives." It cited 14 significant deficiencies and one minor deficiency, of which two were repeat deficiencies, according to the report.

Deficiencies fall into three categories:

■ **Minor**—Requires corrective action.

■ **Significant**—Could negatively impact the mission.

■ **Critical**—Could result in widespread negative mission impact or mission failure.

The Air Force Academy replaced all staff in its SAPR office in the spring of 2018, including the sexual assault response coordinator and all full-time victim advocates, following the release of a scathing 2017 report that deemed the school's SAPR office "derelict" in its duties.

The Academy's SAPR office "is still suffering" from that changeover, the new report says, noting that new personnel do not understand USAFA operations and operating procedures and that inconsistent guidance has resulted in "frequent contradiction of each other's orders."

When the new staff came on board, they were essentially "starting from nothing because they found the office files to be missing, inaccurate, or inadequate," USAFA Inspector General Col. Gerald Szybist wrote in the report.

Continuing care of victims was the new team's "highest priority," according to Szybist, who acknowledges they were able to quickly make the office operational, but the team was "oversaturated and under-resourced" and too quickly diverted its attention to improving public perception. That left little time to codify processes or develop standard operating procedures, he said. A "lack of comprehensive onboarding/training ... further complicated" the problems.

Lt. Gen. Jay Silveria, superintendent of the Air Force Academy, said in a statement that it's clear the academy still has work to do. "The bottom line is that one sexual assault is too many, and a culture and climate that allows any prevalence of these harassing and assaultive behaviors is corrosive to our academy and our military's ability to accomplish its mission," he wrote. "Each and every person here deserves to live, work, learn, and serve in a safe environment free from sexual harassment, sexual assault, violence, and reprisal. I will accept nothing less."

The IG recommended that:

■ Headquarter-level SAPR personnel be co-located at the academy "to ensure unity of effort and clear communication to SAPR offices."

■ The academy's SAPR program manager develop a process to annually review program intent and develop curriculum.

■ Roles be more clearly defined for the SAPR program manager/lead sexual assault response coordinator, deputy program manager, program analyst, and deputy coordinator. ✪

KC-46 Delays Impact Readiness

By Brian W. Everstine

Boeing has incurred another \$148 million in losses for its KC-46 program due to higher than expected manufacturing costs, as the company works with the Air Force to address continued deficiencies in the tanker's capabilities.

The "reach-forward losses" of \$148 million follows \$736

million last year, and \$445 million the year before, according to a Jan. 31 filing with the Securities and Exchange Commission. Boeing has already absorbed more than \$3 billion in losses on the fixed-price KC-46 contract.

In the filing, the company says it expects the full contract value, for all 179 aircraft and options exercised, will be about \$30 billion. To date, 30 aircraft have been delivered.

The same day as the SEC filing, the Pentagon's Department of Operational Test and Evaluation released its 2019 annual report on the program, detailing the deficiencies still impacting the fleet.

The KC-46 still has problems with the lack of visual acuity in the remote vision system, there is no indication of a high boom radial load presented at the boom operator's station, boom stiffness in refueling lightweight aircraft, as well as issues with cargo locks. Air Mobility Command recently announced it has approved a fix for the cargo lock issue, but the other three deficiencies will linger. The service has said it does not expect the remote viewing system (RVS) issue to be fixed or the aircraft to be deployable for three-to-four years.

"Boeing and the Air Force offices are identifying solutions to remediate the deficiencies," the report states. "Until these deficiencies are resolved, the KC-46A will not be fully mission capable."

Aerial refueling tanker availability remains a major roadblock to readiness for U.S. Transportation Command, prompting the military to look at retaining even more aging tankers as well as the possibility of relying on private contractors to fill the gaps, U.S. Transportation Command boss Army Gen. Stephen Lyons said Jan. 28.

Problems with the KC-46 are causing ripple effects that could ultimately shrink the number of aircraft that are available for operations.

"We've got to figure out a way to mitigate the delayed fielding of the KC-46," Lyons said at an Atlantic Council event in Washington, D.C.

Lyons said TRANSCOM is working with the Air Force to keep older tankers around longer to "have continuous coverage for the joint force as we work through the issues" with the Pegasus. The command has previously said it wants to retain 28 additional KC-135s, and Air Mobility Command boss Gen. Maryanne Miller has said the command is looking at keeping even more of the tails in service.

Lyons also said he is open to the possibility of leasing tankers from private companies. He agreed with Miller's past comments that private tankers could help "take the pressure off the force" by flying certain missions within the continental United States. While those tankers wouldn't be allowed to fly in combat, they could be available for training sorties and test and evaluation missions.

AMC recently held an Industry Day with more than a dozen companies to explore the possibility of privatization, though no official program or plan has been developed.

The Air Force has said, in its "The Air Force We Need" plan that aerial refueling is its biggest shortfall in future plans, and Lyons said that tankers are within his command the most stressed and exceeding "deploy-to-dwell" red lines.

USAF leaders have continued to express frustration with Boeing's pace of addressing flaws with the RVS. *Bloomberg* reported recently that Air Force Chief of Staff Gen. David Goldfein wrote to new Boeing CEO David Calhoun to demand the company focus more on the KC-46 because the service "continues to accept deliveries of a tanker incapable of performing its primary operational mission." ✪

USAF Signals Intent to Buy F-15-EX

By John A. Tirpak

The Air Force has launched the process of buying new F-15EX fighters with dual presolicitation notices from the Life Cycle Management Center at Wright-Patterson Air Force Base, Ohio.

The notices, dated Jan. 28, announce USAF's intention to purchase F-15EX jets from Boeing and F110-129 engines from General Electric Aviation, with both companies as sole source suppliers.

The indefinite delivery/indefinite quantity contracts are labeled as a "refresh to the F-15C/D fleet" as well as to "augment" the F-15C/D fleet with new airplanes. A contract is anticipated in May.

Although Pratt & Whitney also makes an engine that could power the F-15EX, its power plant is not certified for the airframes the EX model is based on, which Boeing is building for Qatar and Saudi Arabia. The Air Force's desire to obtain speedy delivery of the jets rules out a test program for the Pratt & Whitney engine, which has not been evaluated with the digital, fly-by-wire F-15EX, an Air Force acquisition official explained. Each F-15EX requires two engines, and USAF will also buy spares, for a package of up to 480 of the power plants. Some of those may power older F-15s.

The GE F110-129 powers more than half of Air Force F-16s and more than 80 percent of USAF's F-15E strike aircraft.

This first year of the program, the Air Force plans to buy eight F-15EX fighters, although future plans call for as many as 144 aircraft. Congress approved only two F-15EXs in the fiscal 2020 National Defense Authorization Act, with the proviso that USAF can buy the other six after submitting a report

on its acquisition strategy for the program. The eight aircraft, including initial engineering, hardware and software design, integration of subsystems, and parts production, would run about \$1.1 billion the first year.

The Air Force also plans to buy modernization kits for some of its existing F-15C/D airplanes, which would give them capability comparable to the F-15EX.

The new airplanes would have a substantially more powerful mission computer, new cockpit displays, a digital backbone, and the Eagle Passive Active Warning Survivability System (EPAWSS)—an electronic warfare and threat-identification system.

The F-15EX purchase was an initiative of the Pentagon's Cost Analysis and Program Evaluation shop, which said the Air Force could more rapidly refresh its fighter fleet by purchasing new examples of the F-15, even as it buys the stealthy F-35 fighter. Service leaders have said the F-35 remains their top priority, and they will only buy the F-15EX if additional funds are provided that don't require reducing the F-35 buy. ✪

■ The War on Terrorism Casualties:

As of Feb. 10, 2020, 91 Americans had died in Operation Freedom's Sentinel in Afghanistan, and 90 Americans had died in Operation Inherent Resolve in Iraq, Syria, and other locations.

The total includes 177 troops and four Defense Department civilians. Of these deaths, 83 were killed in action with the enemy, while 98 died in noncombat incidents.

There have been 570 troops wounded in action during OFS and 175 troops in OIR.



AMERICAN RHEINMETALL MUNITIONS

PGU-48/B 25 mm Frangible Armor Piercing (FAP) Ammunition

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FORCE PROTECTION IS OUR MISSION.





Photo: Jennifer Oprihory/staff



Photo: Tech Sgt. Armando Schwier-Morales



Photo: Cynthia Griggs/USAF



Photo: Senior Airman Stefan Alvarez

After earthquakes began rattling Puerto Rico in December, continuing with a 6.4-magnitude tremor Jan. 7 and a subsequent series of smaller temblors, Civil Air Patrol cadets from the U.S. Air Force auxiliary's Muñiz Air National Guard Base Cadet Squadron sprang into action to help document damage to the territory. In addition to photographing more than 50 damaged homes for Federal Emergency Management Agency analysis, the cadets helped at least one family to safety after another tremor struck while they were on the ground, according to **Cadet Lt. Col. Carlos Muñoz** and **Cadet 2nd Lt. Gabriel Fidalgo**. Fidalgo told *Air Force Magazine* "going to the place that was really affected while it was still active" was different than for Hurricane Maria. "It's like you're preparing during the danger," Muñoz said. **Cadet Capt. Angelymar Sanchez** said the earthquakes have unified the people of Puerto Rico and that they will "stand up stronger than before."

USAF 2nd Lt. Saleha Jabeen will become DOD's first female Muslim chaplain. The former Army Medical Corpsman received her Ecclesiastical Endorsement from the Islamic Society of North America, commissioned into the Air Force as a chaplain candidate on Dec. 18, 2019, and will get a duty station assignment once she finishes training. Jabeen said she wants to inspire people who hear her story to chase their destinies. "I want them to know that God has a plan for you," she said.

Thirteen-year-old Air Force family member **Brianna Heim**, who suffers from the genetic disorder glutaric acidemia type 1, teamed up with the Red Fred Foundation to publish a children's book entitled "Brave Betty & Her Besties." Brianna—whose dad, **Master Sgt. Scott Heim**, is assigned to the 388th Maintenance Squadron at Hill Air Force Base, Utah—decided to use her story to inspire people to be resilient in the face of bullying and to know that "it's okay for people to do things in different ways"

Airmen from Tyndall Air Force Base's 326th Comptroller Squadron received the Gen. Larry O. Spencer Special Acts and Services Award for assisting more than 1,000 people from the 325th Fighter Wing with finances as Hurricane Michael approached Florida, when it hit the base, and during the resulting process of recovery. The award, named for the former Air Force Vice Chief of Staff and Air Force Association president, honors troops and civilians who demonstrate "a selfless spirit of service to others," USAF said.



Photo: Antiques Roadshow/PBS

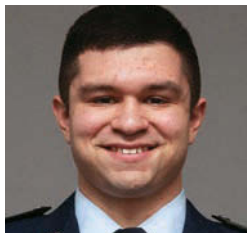


Photo: Airman 1st Class Joseph Barron

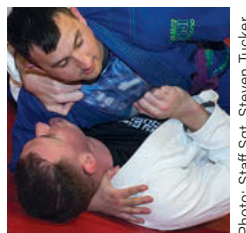


Photo: Staff Sgt. Steven Tucker

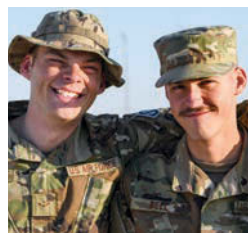


Photo: Senior Airman Giovanni Sims



Photo: USAF

A former EOD Airman identified only as "**David**" fell over on "Antiques Roadshow" after an appraiser said the Rolex Oyster Cosmograph watch he ordered from a base exchange in Thailand in 1974 for \$345.97 is worth far more now. He initially bought it to wear for scuba diving, but deemed it too fine a timepiece to risk saltwater damage, so he hid it in a safety-deposit box for decades. The watch and its paperwork can allegedly fetch up to \$700,000 at auction. "You've gotta be s***ing me," he said.

Civil Air Patrol Cadet Col. Zane Fockler of the Mildenhall Cadet Squadron was granted an F-15 familiarization flight with the 493rd Fighter Squadron at RAF Lakenheath, U.K., on Jan. 10 as a reward for his achievements with CAP. The aspiring fighter pilot recently received CAP's Gen. Carl A. Spaatz Award—the foremost honor bestowed upon qualifying cadets. "This has been my home my entire life, and it was an honor to fly in my home base F-15," he said.

Airmen from the Connecticut ANG's 103rd Security Forces Squadron are using jiu-jitsu to combat stress and foster rapport within their unit. **Master Sgt. Ian McMahon**, the squadron's flight chief and combatives instructor, informally teaches classes in the martial art a few times per month. "I always ... say it's pretty primal—just a bunch of people getting together and roughhousing, but with strategy," McMahon said. "The stress relief of getting on the mat and fighting with your friends is a blast."

Last December marked the first time in years that 378th ELRS vehicle maintainer **Senior Airman Jared Bell** and his brother, 378th ESFS defender **Airman 1st Class Joel Bell**, were able to spend Christmas together. They surprisingly ended up at the same base—Prince Sultan Air Base, Saudi Arabia—for their first-ever deployments. The two had gotten used to having a long-distance brotherly bond, being stationed around the world and chiefly keeping in touch via FaceTime.

Becoming full-time foster parents wasn't possible for Air Force Band of the West pianist **Airman 1st Class Ed Knoeckel** and his wife, so instead, they got certified to provide home respite care to foster children. They take in kids on a short-term basis to give caregivers time to breathe. He also hangs out with hospitalized foster children. "A lot of these kids come out of abusive homes ... and they just need someone to be there to hold them and sing to them," he said.

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



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Leading The Situational Awareness Revolution

Getting Serious About Interoperability



USAF and the Japan Air Self-Defense Force are taking bilateral interoperability to the next level with joint F-35 training.

A JASDF F-35 in the air over the Pacific. Japan is the single largest international customer for the fifth-generation jet aircraft.

Photo: JASDF

By Jennifer Hlad

Misawa AIR BASE, JAPAN—

acific Air Forces doesn't have many F-35s. Yet.

However, within five years, there will be more than 200 Joint Strike Fighters in the region—70 percent of them owned and operated not by the U.S. Air Force, but by its allies. Japan is acquiring 147 F-35s—105 A models and 42 B models—making it the single biggest international customer for the fifth-generation jets.

Ensuring all those aircraft are truly interoperable is a critical challenge, and there's no time like the present to get that ball rolling, said Chief Master Sgt. Brian Kruzelnick, command chief master sergeant for 5th Air Force.

"We're always looking for ways for the U.S. Air Force and the Japan Air Self-Defense Force to become more interoperable," Kruzelnick said. Japan released its annual Defense of Japan white paper, which outlines its defense policy, strategy, and priorities. "They really

"The overarching reason we're here is to support the [Air Force] Chief of Staff's vision of strengthening our alliances!"

—Col. Michael Miles, commander of the 388th Maintenance Group

highlighted the fact that the U.S. and Japan alliance is the cornerstone for any multilayered, multifaceted security cooperation between allied partners in the region."

So when the Japan Air Self-Defense Force (JASDF) approached 5th Air Force about an F-35 maintenance exchange, it seemed like the "perfect opportunity to come in on the ground level and grow our interoperability together," he said. Except that 5th Air Force doesn't have any F-35s of its own.

Enter the 388th Fighter Wing from Hill Air Force Base, Utah—the only USAF combat unit with F-35s.

"The overarching reason we're here is to support the [Air Force] Chief of Staff's vision of strengthening our alliances," said Col. Michael Miles, commander of the 388th Maintenance Group, speaking louder as Japanese F-35s roared overhead. "This endeavor fits right into that priority. And the joint strike fighter, F-35, really enables a different level of cooperation than any other platform we have."

All F-35 units share training, technical data, tools, and a common program support infrastructure, he said. But by "cooperating and sharing lessons learned, we can

actually raise everybody's performance within the program."

Miles and seven of his Airmen flew to Misawa Air Base, Japan, in December for a two-day F-35 maintenance symposium, featuring briefings and lessons-learned discussions as well as hands-on training on specific maintenance tasks.

"My Airmen, the U.S. Air Force Airmen that I brought with me, always take back lessons learned from who we're talking to within the program, so the value to us back at Hill Air Force Base is a greater understanding of the F-35 from the Japanese perspective that we'll see and hear about," he said.

The group from Hill included low observable and analysis specialists, as well as a crew chief and a maintenance officer, and their hosts were grateful to tap their expertise.

"The 388th Maintenance Group has great experience and great knowledge," said a JASDF ammunition maintainer who declined to give his name. "We learned many things," he said, adding that he was looking forward to hands-on training on weapons loading. "This maintenance day will contribute to our interoperability."

Hill Airmen have previously hosted JASDF maintenance delegations in the U.S., and in 2018 the maintenance group sent a training team here for weapons loading and aircraft gun training.

The continued collaboration has helped establish a "recurring battle rhythm of mutual support," Miles said.

"The idea would be to continue this engagement as we both learn more about the F-35 and the way they capitalize on its capabilities," he said.

The airplane was designed to be interoperable between users, "whether you're a pilot flying it or a ground maintainer handling it," Miles explained. "So we're trying to break through policy and force the program to design some common ways that we can be interoperable on the ground" as well. "There are multiple levels to that beyond just flying."

Lt. Gen. Kevin Schneider, commander of U.S. Forces Japan and 5th Air Force, said joint training such as this "supports our strategic objectives to seamlessly integrate during conflict and rapidly reconstitute aircraft, providing overwhelming air power against any adversary."

Eventually, he said, "I envision Koku Jieitai airmen ... generating U.S. Air Force F-35 sorties and vice versa. A projection of our integrated capabilities can deter threats; but, if deterrence fails, we must be ready to win in conflict."

Kruzelnick envisions building a "fifth-generation fighter ecosystem" throughout the region, "where potentially at



Photo: Staff Sgt. Deana Heitzman

USAF, U.S. Navy, and JASDF leadership watch the arrival of the first JASDF F-35A at Misawa Air Base, Japan. JASDF is on track to acquire nearly 150 F-35s—most of them A models.

some point, any aircraft can land in the Pacific, regardless of tail flash, and any maintainer, regardless of nationality, can come out and generate that aircraft.”

As Kruzelnick put it, the objective is “really to build toward our ability to increase deterrence and then win if deterrence happens to fail.”

FRONT LINE

Misawa is at the front line of deterrence: China, North Korea, and Russia are all within an hour’s flight of the base, and JASDF jets based here are on alert whenever there’s an incursion into Japanese air space.

JASDF fighters scrambled to intercept foreign military aircraft 246 times in the three months from April through June 2019, or nearly three times per day. Three-quarters of those incursions were by Chinese airplanes, with Russia accounting for the vast majority of the rest, according to the Japanese Ministry of Defense.

The frequency of foreign military aircraft nearing or entering Japanese air space is on the rise, according to the U.S. military newspaper *Stars and Stripes*. It said intercepts of Chinese aircraft rose 27.6 percent from fiscal 2017 to fiscal 2018.

Former Japanese Minister of Defense Takeshi Iwaya, in the annual Defense of Japan report, said the security environment around Japan “is becoming more testing and uncertain at a remarkably faster speed than we expected.”

He added: “China is expanding and stepping up its activities in the seas and airspace neighboring Japan, with more and more fighters and bombers advancing to the Sea of Japan and the Pacific Ocean.”

A Russian military airplane taking part in joint patrols with

China entered Japanese airspace in late July in an action Japanese officials viewed as a test of Japan’s relationships with the U.S. and South Korea, according to *The Japan Times*.

At the time, Pacific Air Forces Commander Gen. Charles Q. Brown Jr. called it “a potential harbinger of things that could happen in the future.”

JASDF leaders also reached out to the 35th Fighter Wing’s munitions section last year for training in building GBU-12s and loading them onto Japanese F-35s.

Building GBU-12s is “something we do all the time, every single exercise,” explained Senior Master Sgt. Edgar Ulrich, the 35th Maintenance Squadron’s munitions production section chief.

The American munitions Airmen put together a team, led by Staff Sgt. Kyle Horvat, the conventional maintenance production supervisor, to train their Japanese counterparts on how to build them safely.

Horvat said the team trained 20 Japanese airmen to build GBU-12s, then helped them test the weapons over a four-day training event. Prior to that, the munitions section provided four different bomb variants, he said, “so they could practice loading different munitions onto the F-35, since it’s a new platform for them.”

The munitions Airmen expect to train JASDF weapons crews on GBU-31s and small diameter bombs in the next few months, said Chief Master Sgt. Plez Glenn, the munitions flight chief.

Each of these activities contributes to the larger goal of bilateral cooperation and interoperability—a concept this base takes seriously.

“We’re the only truly bilateral flying operation here in Japan,” so there is plenty of day-to-day interaction between U.S. Airmen

Lightning Tech Training

USAF is working to get the most out of its F-35 maintainers through its Lightning Technician Programs. Luke and Hill Air Force bases in Arizona and Utah have “partnered to explore the capabilities of U.S. Air Force Airmen to do multiple things for the F-35,” and the maintainers shared those experiences during the symposium through a comprehensive brief, Col. Michael Miles said.

LTP “is by no means a final product, and it’s not necessarily the way the Air Force is going, but we’re trying to explore the possibilities. What is the art of the possible with F-35 maintenance, given the design of the airplane? The way the prognostic health management system works on the aircraft really opens the door for a new way of doing sustainment, and that’s really what we’re trying to get to and share with other users,” he added.

The program is one way they are looking to build the “next-generation Airman.” Miles said he envisions a next-generation Airman to be multifaceted and able to “use the technology the world offers right now. ... There’s so many great electronic devices to enable aircraft maintenance that are not in use. So I think coupling the Airmen we have in the Air Force ... giving them the technology to really get the most out of what they can do on the F-35 ... the technology that they can use to make them better maintainers.”

He offered an analogy: “We’ve outfitted the pilot of the F-35 with an amazing helmet with everything on the glass. Where is that for the maintainer? Where’s my Google glasses, where I can see the tech data in my glasses while I’m doing a job? ... That’s where an F-35 maintainer is really making the Air Force a profit from a human-capital standpoint.”

and JASDF members, explained Col. Kristopher Struve, commander of the 35th Fighter Wing.

Social functions and festivals also help “close the gap between our cultures,” he said. There are “some great opportunities back and forth for U.S. to just bridge the seams and really work on that interoperability piece, which is going to be critical if we have to go to war together.”

These engagements are at all levels, he noted, from the “logistical to tactical level.”

“We may need to be able to shoot and scoot, but we also need to be able to operate together, be it maybe in a shared strike or in shared air defense,” Struve said. “Maybe they’re manning a [combat air patrol], or manning a CAP next to us, or we’re working together, and CAP is swapping out with them. Us working together to increase interoperability, increase our tactical proficiency together, and learn from each other is really invaluable, and since we are here on the yard together, we can do that on a routine basis.”

Misawa is “a unique location to provide deterrence and help maintain the free and open Pacific,” he said. “We’re prepared all the time, ready for any aggression from North Korea, Russia, [or] China.”

WIDE EXPANSE

The Pacific is a very big place, Miles said, and because of the “time-space problems” in the theater, “you’ve got to have—in my mind—the capability to have airplanes dispersed throughout the theater and supported by our allies. And that’s [what] we’re getting at, with common tech data for launch and recovery, and then, eventually, grow to where we can repair each other’s airplanes, load each other’s airplanes with ammunition and weapons. We’re really on the first stage of that ... so we need to continue to push toward that goal. ‘How do we get the most out of our alliances, and how do we get the most out of this weapons system in a short time span?’ ... We got delivered what we asked for as a DOD and program office. Now, ‘how do we get the most out of it?’ That’s on us.”

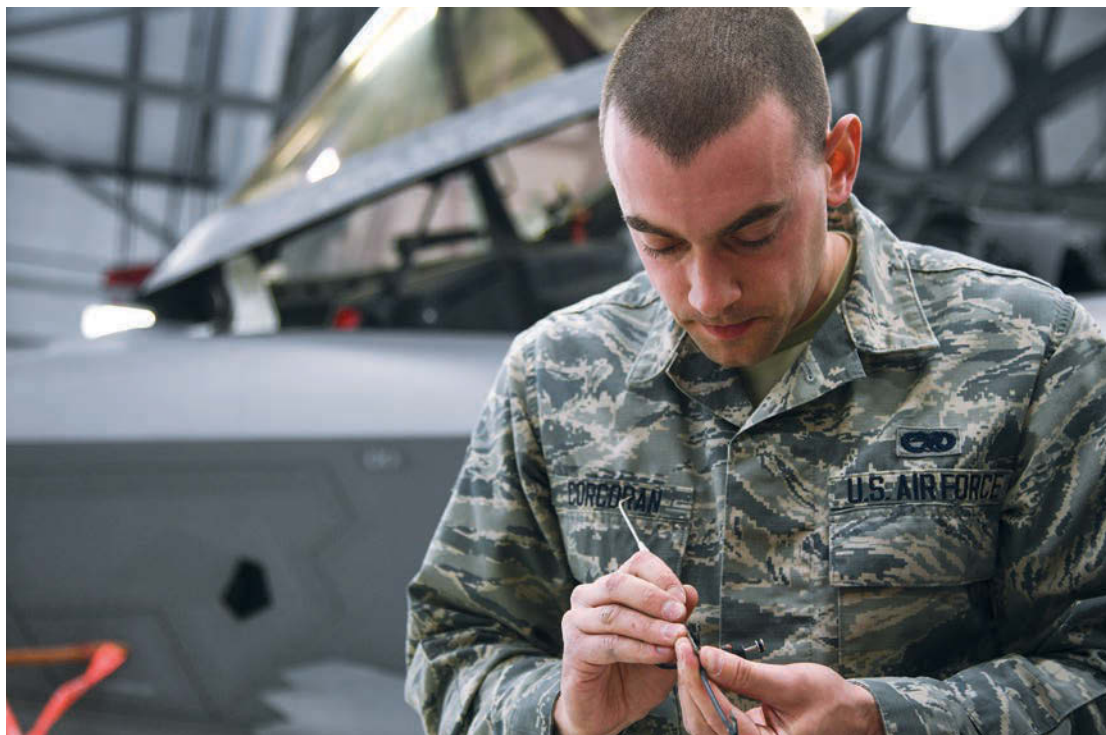


Photo: R. Nial Bradshaw/USAF

Senior Airman Matthew Corcoran prepares to install canopy egress components at Hill Air Force Base, Utah. Both Hill and Luke Air Force Base, Arizona, have introduced Lightning Technician Programs to get the most out of F-35 maintainers.

Creating a Culture of Fitness

An Airman performs one of 10 parts of an occupationally specific and operationally relevant physical training assessment at a North Carolina Air National Guard base.

Photo: Airman 1st Class Juan Paz

USAF launches no-risk, trial fitness tests.

By Amy McCullough

You start work at zero-dark-30, and mission demands keep you at your desk long after dark. Then it's time to get the kids, make dinner, clean up, and finish up whatever unfinished business is still awaiting your attention. Maybe you can workout tomorrow—you think—but that next PT test is less than six weeks away, and you're beginning to wonder if you can even pass.

Don't sweat it.

Starting now, Airmen can take as many as three no-risk PT tests before their official testing deadline. If they perform well, they can forgo further tests and accept the score for their official record. If they don't, they can take it again.

"One of the things we noticed is that regardless of fitness level, you can get anxiety," said Larry Anderson, chief of Air Force physical fitness policy. As of March, units can hold mock tests to alleviate some of that anxiety and allow Airmen to choose when they take the PT test.

The move is part of an Air Force-wide effort to make fitness more deeply rooted in Air Force culture and to ensure Airmen are ready to deploy anywhere, anytime across the globe, without

"One of the things we noticed is that regardless of fitness level, you can get anxiety."

—Larry Anderson, chief of Air Force physical fitness policy

placing too much emphasis on punitive actions for those who fall short of expectations.

Service leaders also want to know if the current fitness assessment matches the intent of the National Defense Strategy, Anderson told *Air Force Magazine*. The Air Force has enlisted the help of outside experts to help figure that out.

"We got these questions from our senior leadership, so we asked [the] RAND Corp. to come in and look at our program and identify areas that we're strong in, and weak in, and to identify areas where we need to fix gaps," Anderson said. "That's coming to a conclusion pretty soon."

The Air Force considers three factors in assessing the health of its Airmen:

■ Body composition—measuring individuals' waists.

■ Aerobic fitness—measuring the time it takes to complete a 1.5-mile run.

■ Muscular fitness—measuring how many push-ups and situps, respectively, can be completed in one minute.

Airmen who exceed minimums in each category for their age and gender, and receive a composite score greater than 90—are rated as



Photo: Airman 1st Class Benjamin Ingold

Airmen on a timed run at Shaw Air Force Base, S.C. The 1.5-mile run carries the most weight in computing the overall fitness score.

“excellent”—and are not required to take another PT test for 12 months. Meeting all the minimums and achieving a composite score of 75 to 89.99 merits a “satisfactory” rating, but those individuals must take the test every six months. Less than 75 is an “unsatisfactory” score, according to the Air Force Instruction.

Failing the test completely could negatively impact an Airman’s career, and it might even lead to an administrative separation from the service if the individual fails too many times, said Tech. Sgt. Hung Thai, a physical training leader and the noncommissioned officer in charge of Air Force manpower, personnel, and services.

THINK POSITIVE

Chief Master Sgt. of the Air Force Kaleth Wright, who first floated the idea of a no-fail PT test in August, called the concept a “bad day” PT policy, saying the current system was “too heavily weighted on the negative side.”

On Jan. 20, Air Force Materiel Command started to allow Airmen who had kept current on their testing to take up to three “mock tests” prior to their test date. The diagnostic tests can be taken as far out as 45 days before their official assessment month and up to 15 days before their PT test is due.

Airmen can take a mock test for any or all of the test’s components, but the score cannot count unless the entire test is completed. Once a score is recorded, Airmen can’t take another diagnostic test until 45 days before their next testing cycle begins, according to an AFMC release.

“Physical fitness is crucial to our ability to meet mission requirements,” AFMC boss Gen. Arnold Bunch Jr. said in the release. “The diagnostic assessments will give Airmen an idea of their current fitness level and where they may need to improve prior to their test due date. This is part of an overall effort to continue to encourage a culture of fitness among all of our Airmen that includes year-round physical conditioning and healthy eating habits.”

Thai, who has worked as a physical training leader for 17 years and has conducted PT assessments at almost every unit he’s been assigned to, said the new system will help units foster healthier lifestyles, which will help Airmen prepare for the test, instead of just waiting for it to be due.

“We should, as a unit, understand their fitness level and what they are about to walk into as well,” said Thai, who has seen plenty of Airmen stress over the test. He thinks the new program will help reduce some of that tension.

“It also gives us a better understanding of their fitness

level, because, as stress mounts, people tend to perform better or worse sometimes,” he said. “It doesn’t give us a good reading” of their true fitness levels.

At the Air Force Association’s 2019 Air, Space & Cyber Conference, Wright said the service was considering separating the waist-measurement portion of the test, which counts as 20 percent of the overall score. At the time, he said there are some Airmen who “go to great lengths to get a good score on the abdominal circumference,” taking diuretics that dehydrate the body or even starving themselves. “Then they try to run or do the other components, and we’ve had Airmen that have lost their lives and Airmen that have become injured or gotten sick.”

Initially, the idea was to take the waist measurement seven or more days before the rest of the test, but Anderson said after getting feedback from the major commands the service decided to “shelve” the idea.

“They are all tied together,” said Anderson, questioning whether the service would get a more accurate picture of an Airman’s health by separating the measurement and physical portions of the test. Some argued that spacing out the components might drive some test takers to harm themselves through extreme measures.

The problem was particularly acute for Guard and Reserve members. “Just playing with the numbers, it looked like there could be a possibility of up to 60 days between getting the abdominal circumference and physical fitness test,” he said. “Imagine getting taped in October, and, come January, doing your test. We know there are other, bigger topics to tackle, and we wanted to put our full efforts into other things.”

LIFE OR DEATH

At least three Airmen suffered PT-related deaths in 2019, including two within a single week at Shaw Air Force Base, South Carolina. The Air Force briefly suspended PT testing to investigate. While the service has not said what exactly caused those deaths, it did add two questions to its fitness screening questionnaire in August 2019, both related to the sickle cell trait—an inherited red blood cell condition that can cause significant physical distress or even death during intense exercise.

Thai said if Airmen say they have the sickle cell trait on the questionnaire, the test cannot be administered without clearance from the local medical treatment facility. Anderson said the Air Force provides videos and other educational material explaining sickle cell and precau-

Job-Specific PT Tests Coming Soon for 10 AFSCs

By Amy McCullough

Two years after the Air Force officially rolled out a more rigorous, gender-neutral physical fitness test for its most elite warriors, more and more career fields are looking to do the same.

While the regular physical fitness assessment, known as Tier I, is intended to promote a culture of fitness and reduce health risks for Airmen, Tier II tests are tailored to more physically demanding Air Force Specialty Codes [AFSC]. Each of the Tier II tests are unique and are designed to simulate what Airmen in those career fields will be asked to do on a deployment.

For example, air liaison officers and tactical air control party members still do the 1.5-mile run, but they must complete it in a much faster time than most other Airmen. Instead of the pushups and situps most Airmen are required to do to assess muscular strength, the test for ALOs and TACPs includes a medicine-ball toss, two-cone drill, a trap bar, pullups with a weighted extension, cross-knee crunch, a 4x25 yard farmer's carry, and a 1,000-meter row.

The Air Force Exercise Science Unit uses a five-step process to study and develop each of the job-specific physical fitness tests and standards.

They include:

1. **Conduct** an analysis of the physical demands for that career field and develop AFSC-specific physical tasks.
2. **Develop** the job-specific PT test and physical task simulations.
3. **Validate** and set physical tests and standards.
4. **Implement**, verify, and refine prototype tests and standards; train units.
5. **Deliver** after an appropriate adaptation period.

Once a career field has completed all five steps, Airmen assigned to that AFSC are exempt from three of the four portions of the original fitness assessment. They must still complete the waist measurement portion of the test, according to officials.

Larry Anderson, chief of Air Force physical fitness policy, said, "After talking with the A1 [Lt. Gen. Brian Kelly, deputy chief of staff for manpower, personnel, and services], I asked him, as more and more careers come on board, if they come on board, do we want to give them the exemption? He said, 'Yes, absolutely.' Moving forward, we may tweak it a little bit. First, we have to know you are legitimately going through the process to get that exemption."

tions affected people can take prior to doing maximum exertion exercises.

Getting Airmen to provide an honest assessment of their own health on the questionnaire is a critical piece of the equation and starts with leadership, according to Anderson.

"We need to make sure we are great wingmen," he said. "Leadership is coming around to that."

Air Force Chief of Staff Gen. David Goldfein himself has taken this task to heart. Whether talking with Airmen at remote locations such as Thule Air Base, Greenland, where temperatures can dip significantly below zero, or here in the United States, he rarely misses a chance to tout the importance of physical and mental health.

"We're the service that deploys globally, and I don't know when I'm going to ask you to deploy to a place where it's 120 degrees on the ramp or 30 below [zero] on the flight

Higher Standards

Air liaison officers and tactical air control party members are already using a job-specific PT assessment. ALOs and TACP must score at least 46 total points on the test's 10 events to pass. A perfect score is 100.

ALO-TACP Points	Grip Strength PSI	Med Ball Toss ft	Two-Cone Drill secs	Trap Bar DL 5RM lbs	Pullup reps	Lunges Wid reps	Ext Cross-Knee Crunch reps	Farmer's Carry 4x25yd secs	Row 1000 m min: secs	Run 1.5 mile min: secs
10	198	50.5	8.6	417	32	199	107	21.2	3:15	7:51
9	166	47.5	8.9	387	28	161	94	22.5	3:22	8:03
8	153	44.5	9.3	355	24	148	79	23.5	3:30	8:50
7	144	42.0	9.5	334	22	123	69	24.8	3:36	9:21
6	137	40.5	9.8	316	20	104	62	25.9	3:40	9:47
5	130	39.0	10.0	300	18	88	57	26.8	3:44	10:10
4	124	37.5	10.2	284	16	73	52	27.8	3:48	10:33
3	117	35.5	10.4	267	13	58	46	28.8	3:52	10:59
2	108	33.5	10.7	245	11	43	39	30.1	3:57	11:31
1	95	30.0	11.1	213	7	24	31	32.0	4:05	12:17

Component minimums

A total of 10 career fields are at some point in the five-step process and will likely adopt the new tests within the next few years.

TACPs and TACP officers have already completed all five steps, as have explosive ordnance disposal Airmen. EOD Airmen already are using Tier II as their official test, but "it's not been updated in policy yet," said Air Force spokeswoman Capt. Carrie Volpe.

Combat rescue officers, pararescue, special tactics officers, combat control, and special reconnaissance fields have completed the third step, and USAF expects the career fields to wrap up all five steps some time in 2020.

Security Forces and fire emergency services have been approved to begin the process and are slated to complete it in 2021, Volpe said. Survival, evasion, resistance, and escape (SERE) specialists and civil engineers also have been approved to start the process, but Volpe said it's too early to determine when the process might be complete for those career fields because the study has not yet begun.

"Other career fields have shown interest, but have not made official requests," she added.

line," Goldfein said in September 2019 after completing a half-marathon at Wright-Patterson Air Force Base, Ohio. "I just know that when you arrive is not the time to start a fitness program."

Goldfein has often told USAF leaders they need to practice what they preach. During a 2019 meeting with wing commanders, Goldfein tied physical fitness to mental fitness.

"What's tough about your job isn't physical, it's mental," he said in a release. "That's the challenge of the Chief of Staff of the Air Force, keeping everybody mentally in the game. To have that kind of mental clarity requires physical fitness. There's a direct tie. ... If I get to work in the morning and I didn't work out that morning, I feel it. ... I feel it in terms of how clear my head is working on these tough issues. My best days are when I start with a good workout. Always." ✪



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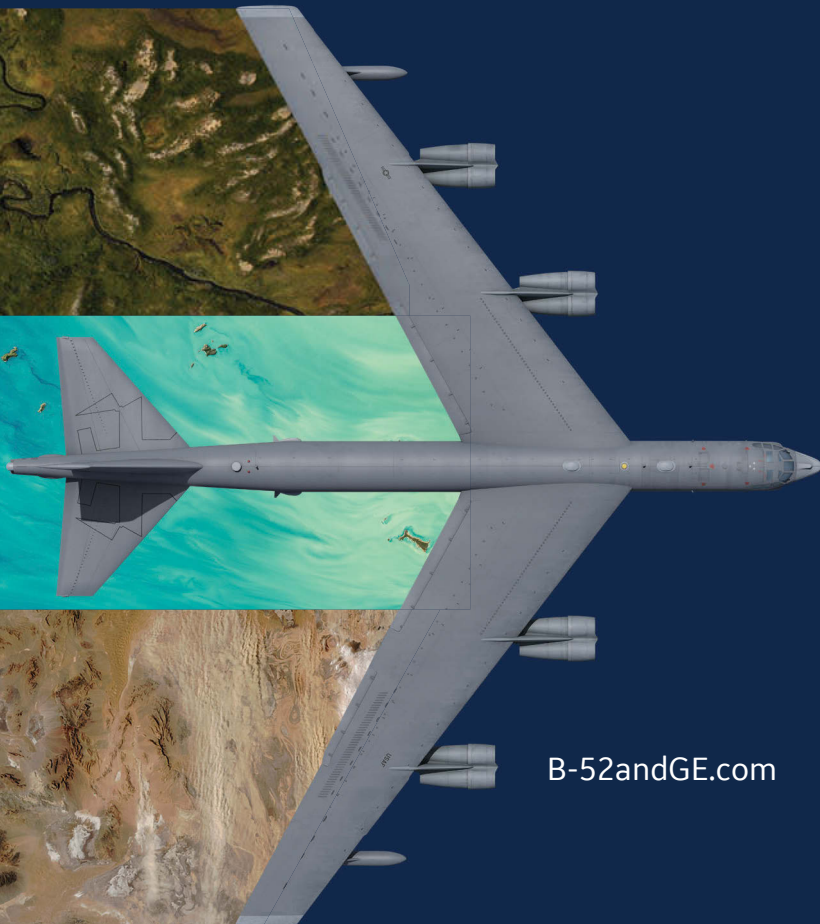
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Acquisition Accelerators

With a dozen-plus initiatives, the Air Force is cutting decades from the acquisition process.

By John A. Tirpak

"Must go faster," urges Ian Malcolm to the driver of his speeding jeep in the movie "Jurassic Park," as a ravenous T-Rex pursues them through the jungle. The dinosaur looms in the rear-view mirror just above the warning, "Objects in mirror are closer than they appear."

With China and Russia snapping at America's military heels, the Air Force knows it, too, "must go faster," as those and other

"Speed matters in an era of reemerged great power competition."

—Former Air Force Secretary Heather Wilson

adversaries advance their military capabilities with often astonishing speed. Competitors now deploy stealth aircraft, precision munitions, and sophisticated satellites—all once exclusive to USAF and, broadly, to the American military—and China and Russia have taken the lead in hypersonic missile technology and modern nuclear weapons.

To keep its edge, the Air Force can no longer settle for a long and risk-averse acquisition process. It has to cut out unneeded steps, sharply shrink timelines, accelerate development, testing, and the writing of new software, take risks, and bring in new vendors

who may offer novel approaches to military problems.

To do it, USAF is employing a dozen or so major acquisition initiatives to speed the introduction of new technology.

CENTURY CHALLENGE

Former Air Force Secretary Heather Wilson, along with service acquisition chief Will Roper, set an early and ambitious speed goal in 2017: Take 100 years of process out of program schedules, because time is money, and delay is intolerable. By stripping away reviews and intermediate milestones, they aimed to accelerate results.

By April 2018, they had succeeded. Roper chalked it up to "remaining exceptionally disciplined" about schedules, and the application of new congressional authorities to eliminate statutory requirements that add little besides delay. Now USAF is aiming to find another 50 years, at least.

"Speed matters in an era of reemerged great power competition," Wilson told Congress last May. Excess reviews only cause "delays getting capability to the war fighter."

The Air Force embraced new authorities granted it by Congress known as Section 804, which allow the Air Force to undertake more rapid prototyping, among

other changes. Section 804 allows the Air Force to "Begin prototyping ... nearly a year and a half earlier than under the old system," Roper and then-Undersecretary Matt Donovan wrote in *Defense News* in August 2019. The new authorities also "give engineers more time for testing and troubleshooting; and keep flawed concepts from entering production and operations—a whopping 70 percent of a program's total cost."

The Air Force said it had taken three years out of a program to reengineer the B-52 bomber and two years out of an F-22 upgrade plan. Service leaders also claimed a five-year reduction in two hypersonic missile programs: the Hypersonic Conventional Strike Weapon [HCSW] and Advanced Rapid Response Weapon [ARRW].

In another shift, the Air Force is buying new engines for the B-52 the same way commercial airlines buy their engines. Finalists in the competition will compete in a "digital flyoff" rather than provide mounds of paper proposals.

Prototyping "is the safe place to fail," Roper said. If flaws make their way into the final product, it will be a perpetual headache in operations and sustainment.

The Advanced Battle Management System, or ABMS, is an example of a program where USAF is pulling together a number of speed initiatives all at once. The ABMS is meant to substitute for the E-8 Joint STARS ground moving target radar plane, which also serves as an air battle manager. Such a "big wing" intelligence, surveillance, and reconnaissance platform makes for an inviting target in a fight, given the limited number of aircraft in the JSTARS fleet. The Air Force has decided instead to shift the functions per-

A maintainer works on an F-35. After almost 20 years, the jets are technically still in the development stage. USAF wants to drastically speed up development and acquisition of new aircraft by using digital prototyping.

Photo: Airman 1st Class Bryan Guthrie

The Air Force is planning to buy new engines for its B-52 fleet by using a “digital flyoff.” In the past, competing engines would have been mounted on the aircraft for flight tests.



Photo: Airmen 1st Class Duncan Bevan

formed by JSTARS to a network and “cloud” format, the better to move information around and allow the network to heal itself if some nodes are lost.

“We wanted to show we could do this very rapidly,” Roper said of a late fall 2019 experiment in which information was passed from an Air Force F-22 to a Navy F-35, with inputs from a Starlink satellite, an AC-130 gunship, and other nodes. The experiment will be followed up in April with more elaborate tests, such as using an unmanned “cyborg” aircraft to operate as a flying communications hub that translates signals from all the involved systems so others can receive and understand them.

The experiment demonstrated that “mesh, ad hoc networking” could work in a contested environment and “does not take years to set up,” Roper said in January. With each experiment, Roper said he’s looking for 10 to 15 percent more capability, learning at each step, and thus achieving “velocity” of improvement.

“The technology changes that quickly,” he said. “The CON-OPS [concept of operations] and the warfighting approaches are going to have to adapt at a speed that’s equivalent.” He added that ABMS will “emerge, slice by slice,” rather than all at once. Numerous subprograms will contribute to ABMS, each with its own demonstration schedule, but by running experimentation every four months, the Air Force will seek to ensure that “they work together.”

ACCEPT FAILURES, AND GIVE PEOPLE TOP COVER

Although Section 804 has helped—for many programs—acquisition pros already have the tools they need to go fast, Roper said in April 2019. Rather than new laws or relief from old ones, he suggested, one of the best ways to speed up acquisition is to shield contracting officers when things don’t pan out.

“You can do almost anything with the FAR [Federal Acquisition Regulation] if you have top cover,” Roper said. Acquisition managers would go faster if they did not fear losing their jobs—or worse—if they make occasional mistakes. Indeed, Roper said if there aren’t any failures or missteps, there isn’t enough risk-taking and “there won’t be any big successes, either.”

In the ABMS experiment, Roper said, the level of success

might actually suggest the experiment was too conservative.

“I think 26 of 28 things worked, and that is too high of a success rate this first time,” he said. “But I’ll take it. We should be taking more risks than that.” Roper has also said he would reward “glorious failures” if they produce solid learning that can later accelerate programs.

AFWERX

The Air Force launched “AFWERX” in 2017 as an umbrella organization that would engage industry, small business, academia, and Airmen to seek out new technologies, mainly those already in commercial service, that could be adapted to provide new combat power. One of its objectives is to “quickly identify, validate, acquire, and integrate” new technologies, products, and solutions. Among its activities are “Spark Tank” competitions in which Airmen compete to offer low-cost/high-return improvements to help them accomplish their missions. Other efforts pair entrepreneurs with Airmen and/or academics to explore new solutions to operational challenges.

Among the AFWERX enterprises is “Air Force Ventures,” which seeks private capital to invest in technical solutions, placing bets on ideas’ potential. Each year AFWERX funds about 1,000 small projects valued at \$50,000 or less; about 300 mid-sized projects with investments under \$1 million each; and a couple of dozen strategic projects valued in the tens of millions per year. While many of these programs will not yield operational results, the intent is to identify opportunities, explore them, and determine their viability as fast as possible.

RAPID SUSTAINMENT

Roughly 70 percent of the cost of any program covers sustainment, versus acquisition costs. Streamlining sustainment, therefore, offers substantial savings if the Air Force can find ways to squeeze out costs, and operate more quickly and efficiently.

The service established a Rapid Sustainment Office in its Life Cycle Management Center at Wright-Patterson Air Force Base, Ohio, in 2018 to exploit 3D printing, artificial intelligence, and predictive maintenance technologies in the hopes that unscheduled maintenance will someday be a thing of the past.

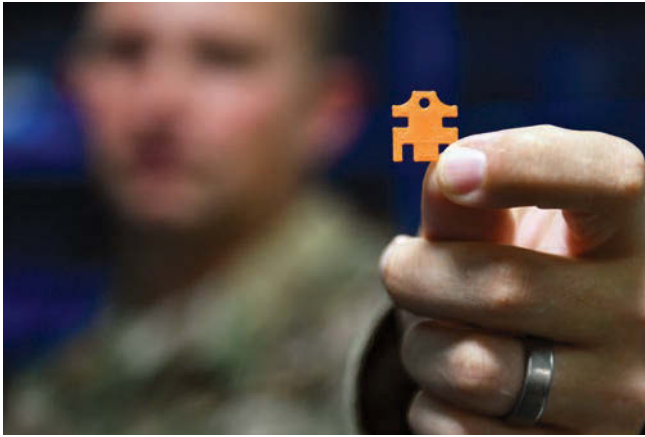


Photo: Senior Airman Kevin Sommer Giron

Tech. Sgt. Keith Boudreau, from the 31st Maintenance Group, created a 3D-printed spacer to repair phones as part of the Air Force Repair Enhancement Program.

By tracking what each airplane does during flight and conducting maintenance based on actual usage, as opposed to following a rigid, one-size-fits-all schedule, the center aims to squeeze out savings and increase readiness. Aircraft that simply fly from one part of the country to another need less attention than those pulling maximum G forces and engaging in heavy air combat maneuvering, for example.

Applying condition-based maintenance to the KC-135 tanker enabled the fleet to improve from 255 cancellation days in a single year “to 300 straight days with no maintenance cancellation,” Lt. Gen. Robert McMurry Jr. told *Air Force Magazine* in an interview.

DIGITAL CENTURY SERIES

The traditional method of introducing new airplanes into Air Force service has grown longer over the years; prototypes for what would become the F-22 flew in 1990, and that jet’s initial operational capability [IOC] occurred some 15 years later. With the F-35, it was 16 years from prototype to IOC, and now, 20 years after program go-ahead, the jets are technically still in the development phase.

Twenty-year development cycles won’t work anymore, and Roper has said what USAF needs is a return to the idea of the “Century Series” airplanes of the 1950s and 1960s, in which the Air Force designed and fielded nine types of fighters in almost as many years. Not all were successful, and some were withdrawn fairly quickly, but the exercise rapidly built understanding of engines, materials, aerodynamics, and the interplay of the aircraft with their sensors and weapon systems. It also forced the Soviet Union to devise ways to cope with a bewildering array of U.S. aircraft.

Roper wants to follow a similar approach using digital prototyping to generate virtual designs that can be tweaked and revised before a physical airplane is actually built. Roper foresees building 50 to 100 of a promising design, then either improving on it before building more, or pressing on with some other new aircraft already in the works. The aim is to go from design to flyable jet in five years, he said.

The payoff to this approach would be rapid technology refreshes and the means for new firms to emerge and compete in the aircraft design world. Because these planes would not be designed for long service life, the Air Force would not have to sustain them over thousands of flight hours. Instead of engineering airframes to last 12,000 hours, designers would engineer for perhaps 5,000. That could cure “vanishing vendor syndrome,” where whole fleets are held hostage as components are discontinued by parts suppliers.

PITCH DAYS AND CREDIT CARDS

The Air Force has long held Industry Days, where contractors discuss the technological art of the possible on new programs and upgrades. Traditionally, service officials provided the outlines of their objectives at these events, which were followed by a series of meetings, draft requests for proposals, comments, and revisions, often lasting years before bids and selection.

Now the Air Force is sponsoring “pitch days,” where companies make short presentations and the most promising ideas can generate a contract the same day. Although pitch days tend to focus on software and small businesses, Roper sees no reason why the concept can’t be expanded to more complex programs. The first one was held in March 2019, and after at a



Photo: Kyle Fetter/USAF

AFWERX allows companies to pitch their off-the-shelf ideas firsthand, as in this Phase 1 Small Business Innovation Research event. Success here could lead to a government contract in under 30 days.

Air Force Chief ABMS Architect Preston Dunlap uses real-time data-sharing tools to show how the Advanced Battle Management System works in a simulated scenario at Eglin Air Force Base, Florida.



Photo: Tech Sgt. Joshua Garcia

two-day, space-oriented pitch event in November, the Air Force awarded contracts worth \$22.5 million, in some cases paying the bill with a government credit card.

Small businesses “can’t wait” for the wheels of the acquisition system to produce a check, Roper said. Credit card payments mean contractors can get right to work.

Air Force Secretary Barbara Barrett said pitch days demonstrate USAF will do what it takes to address contractor needs and make it as easy as possible to do government work. “The bottom line is, we need you and the creativity you bring,” she said.

Ellen Lord, undersecretary of defense for acquisition and sustainment, said in January that she is “encouraging a high level of engagement” with industry to clear away misunderstandings and make sure the Pentagon isn’t setting unrealistic goals.

“We are trying to decompose acquisition so it’s very intuitive to anybody who wants to do business with the Department of Defense,” she said. The Pentagon wants to understand from industry “what we’re doing that’s driving cost, what’s good for markets, [and] what’s not.”

TRUSTED CAPITAL

The Pentagon has become keenly aware that China, particularly, has been either buying up promising technology companies or, by investing in them, gaining access to their secrets. In response, the Pentagon has launched the “Trusted Capital Marketplace” concept, wherein companies that have verified American provenance and security put up the money for new commercial ventures that could benefit the military. In November, the first such TCM event was held, seeking finance for companies working in unmanned aerial systems, as well as counter-drone systems.

“This is a public-private partnership that will convene trusted sources of private capital with innovative companies critical to the defense industrial base and national security,” Lord said at a Pentagon press conference.

The need for such secure funding is particularly felt in the manufacture of integrated circuits, computer motherboards, and the like. The concern is that China may be manufacturing chips and other components with “back doors” that could be used to disable the end product or spy on its use. The Defense

Department is also investing in “trusted foundries” to produce chips without foreign content.

AGILE SOFTWARE DEVELOPMENT AND DEV OPS

Agile software development traces its roots to the Agile Manifesto, a set of principles detailed in February 2001. But the concept took nearly a decade before it would become standard practice in the commercial software world, and nearly a decade more before the military would also embrace the concept. It breaks down software development into pieces that can be developed and released incrementally, rather than waiting for the whole project to be complete. By integrating development, testing, fielding, feedback, and refinement with frequent releases of new software, agile development allows designers and users to share a constant feedback loop. USAF has adopted Agile by launching development labs such as Kessel Run, a USAF software shop whose motto is “continuous delivery, continuous feedback, continuous learning.” (It’s named after a fictional route traveled by Han Solo’s Millennium Falcon in the original “Star Wars.”)

One of the big drivers in adopting Agile—and the standup of Kessel Run—was the failed Air Operations Center Increment 10.2 program to automate information flow in the AOC. After a decade of effort without results, the project was scrapped in 2017, and the Air Force opted for rapid, incremental improvements instead of waiting for an all-encompassing final capability.

Speaking to reporters in January about the way ahead on ABMS and about rapid acquisition in general, Roper said going fast does “great things” for a program because it allows the service to “demonstrate and retire risk quickly, learn quickly, and energizes your team.” They can see the results of their efforts almost immediately, without waiting years for the results. On ABMS, the four-month cycle allows USAF to “put industry in the design-and-build seat very early on, working with an engineer, an operator, where the fun is getting to see their system demonstrated,” according to Roper. The program will have a “pot of money” that will allow for “continual opportunity for innovation. I think that alone is going to help us get really interesting ideas from industry and ensure the ... A-team ... is working on this program.”

The new MH-139A Grey Wolf was unveiled at Eglin Air Force Base, Florida, on Dec. 19, 2019.



Photo: Samuel King Jr./USAF

The Grey Wolf Arrives

Patrolling USAF's missile fields is job one for the Air Force's new helicopter.

By Brian W. Everstine

When the first MH-139 “Grey Wolf” helicopter touched down at Eglin Air Force Base, Florida, it marked two surprising firsts: Based on an AgustaWestland AW139 civilian helicopter, it is the first helicopter procured directly by the Air Force, and the first major acquisition by Air Force Global Strike Command.

The MH-139 will replace the aging UH-1N Huey and will primarily be used to patrol AFGSC's sprawling missile fields.

“We’re going to do more things with this aircraft than we could ever do with the Huey,” AFGSC Commander Gen. Timothy Ray said when the first MH-139 was delivered in mid-December. “It even has the new car smell.”

The Eglin ceremony came just over one year after a team of Boeing and Leonardo won the competition and began a developmental and operational test cycle intended to achieve initial operating capability by 2021.

The Air Force first set the requirements for the

“We’re going to do more things with this aircraft than we could ever do with the Huey.”

—Air Force Global Strike Command Commander Gen. Timothy Ray

Huey replacement as part of the Common Vertical Lift Support Program in 2007, even before AFGSC was established. At the time, most of the Huey fleet was almost 40 years old, with limits placed on its range and speed, hampering mission performance both in the missile fields and shuttling VIPs around the Washington area.

Back then, initial operating capability was to come around 2015, but changing priorities and budget cuts forced the Air Force to first delay, then cancel, the program in 2013. Officials started over in 2015 and released a formal request for proposals in July 2017. Boeing and Leonardo teamed up to offer this variant of the AW139, while Sikorsky offered a variant of its H-60. Then Sikorsky filed a pre-award protest in 2018 with the Government Accountability Office over how intellectual property rights would be handled. GAO rejected the complaint.

Still the program lagged. Gen. John Hyten, then-commander of U.S. Strategic Command, told lawmakers in 2017, “It’s a helicopter, for gosh sakes. We’ve been building helicopters for decades. ... I don’t understand why the heck it is so difficult.”

One year later Hyten was back before Congress,

Comparing Birds

These characteristics will play a large part in how the MH-139 can protect convoys and respond when needed at the Air Force's expansive missile ranges.



	MH-139
Cruising Speed	130-140 knots
Max Speed	167 mph
Range	778 nm
Length	54.63 ft (16.65 m)
Ceiling	20,000+ ft
Max takeoff weight	14,330 lbs

	UH-1N
Cruising Speed	90-100 knots
Max Speed	149 mph
Range	300 nm
Length	57.25 ft (17.44 m)
Ceiling	15,000 ft
Max takeoff weight	10,500 lbs



Source: USAF

saying, “We’re going to get a new helicopter, if I’m going to die trying or kill somebody to do it.”

In September 2018, the Air Force finally pulled the trigger and awarded Boeing-Leonardo a \$2.38 billion contract for up to 84 MH-139, some 41 percent less than the original cost estimate for the program.

“Strong competition drove down costs for the program, resulting in \$1.7 billion in savings to the taxpayer,” then-Air Force Secretary Heather Wilson said when the award was announced.

Finally, 14 months after the contract was awarded, the first MH-139 for the Air Force touched down at Eglin in December, and the Air Force announced the helicopter’s new name—Grey Wolf.

AFGSC chose the name from among suggestions submitted by the units and aircrews that will operate the aircraft. The choice honors a species native to the western plains where the helicopters will operate.

Grey wolves strike “fear in the hearts of many,” Ray said. “Its range is absolutely inherent to the intercontinental ballistic missile [ICBM] fields we have.

“As they hunt as a pack, they attack as one, they bring the force of many,” he said. “That’s exactly how you need to approach the nuclear security mission.”

At Eglin, a small number of Airmen and a few aircraft are starting up developmental testing. Five pilots and six special mission aviators will put four helicopters through the ringer in the Florida panhandle before the helicopters and crews move north to Malmstrom Air Force Base, Montana, for operational testing next year.

The crews assigned to Eglin come from all of the areas and mission sets the UH-1Ns serve. “We’re really focused on mission representation for all our customers—Global Strike, Air Force District of Washington, Air Education and Training

Command,” said Lt. Col. Mary Clark, commander of detachment 7 at Eglin, which is overseeing the developmental testing along with Eglin’s 413th Flight Test Squadron.

The 413th FLTS is also overseeing developmental testing of the HH-60W combat rescue helicopter, which is replacing the HH-60G Pave Hawk, meaning the squadron will be involved with the development of the Air Force’s entire future helicopter force. That’s a “blessing and a curse,” Clark said, because it means the MH-139 and HH-60W crews will have to share airspace and resources.

Airmen working with the MH-139 must ensure that the Grey Wolf meets all the requirements the Air Force contracted for, including speed, handling, payload, and more.

Given the operational history of the AW139, the helicopter has already proven to be leaps and bounds ahead of the Huey. “It goes further, faster, flies longer, and carries a lot more people,” Clark said.

The AW139 is rated for a cruising speed of 130-140 knots with a max speed of 167, compared to 90-100 knots for the aged Huey. Range is about 778 miles vs. just over 300 miles for the Huey, according to the Air Force. These characteristics will play a large part in how the MH-139 can protect convoys and respond when needed at the Air Force’s expansive missile ranges.

The Grey Wolf is armored and has countermeasures on board, along with a pintle-mounted machine gun capability. Its modern avionics enable flying in poor weather, and an improved four-axis autopilot and improved automation that “helps a pilot in a high-workload situation,” Clark said. “It’s almost like having a third pilot with you.”

The MH-139 is also outfitted with a forward-looking infrared camera system, which will be used both to help crews find survivors for possible rescue missions and help target “bad guys,” Clark said.

Photos: Samuel King Jr./USAF, Devin Doskey/USAF
Graphic: Mike Tsukamoto, Dash Parham, and Brian W. Everstine/Staff

There are hundreds of test points to accomplish, and each one requires “days and days of work behind the scenes” in addition to just the flying hours, with pre-briefing and post-briefing, test plan development, etc.

This first test plan is linear and will focus on “really binary” characteristics of the aircraft.

Does it “fly as fast as Boeing said it can fly? Does it carry as many people as they say it carries? Black and white things,” Clark said. Then, as tests progress, “we’ll start getting really into the meat of it, its handling qualities, how the aircraft performs with different inputs, conditions, power settings.”

“While we’ve militarized it, the basic platform has been known for so long,” Clark said. This part of the testing should be relatively brief. But after the move to Malmstrom, tentatively scheduled for 2021, crews will develop the tactics, techniques, and procedures [TTPs] for the aircraft. This is where the background of the crews becomes integral to the future of the MH-139, according to Clark. For example, determining how best to operate in poor weather, or to operate with close overwatch of a convoy, requires having flown that mission in the past. For the continuity of government missions in the Air Force District of Washington, speed, responsiveness, and range for “getting away from the threat” will be important, as will the aircraft’s secure radios and advanced avionics. Similarly, a small unit at Yokota Air Base, Japan, which flies UH-1Ns in a comparable role over the Tokyo region, must also be supported. Crews in the test unit will have this background to apply to the test process, as well.

The Huey also has a big role for Air Education and Training

Command, flying for survival, evasion, resistant, and escape training for aircrews. To be ready for this mission, crews need to establish TTPs for parachuting out of the aircraft and using its rescue hoist.

This test process will play out as production of the aircraft ramps up. Full-rate production is expected in 2023, with deliveries anticipated at a rate of 10 per year into the early 2030s.

“We’re going as fast as we can, but we’re going to do it right,” Clark said. “We’re going to get it to the warfighter as soon as possible. That’s what we’re really trying to do, but we’re not going to do that at the expense of safety and compromising requirements. We’re going to do it right, and we’re really excited.”

In the meantime, Hueys will continue to roam the missile fields and serve other current missions. Global Strike has upgraded the aircraft, including fuel and armament upgrades, to keep it relevant to ensure there is no “lapse in any mission,” Clark said. Airmen at the missile bases have deployed fuel bladders so crews can land and refuel themselves in the middle of a mission if needed. Airmen have been forced to fly longer patrols and work longer hours to ensure the missile security mission is accomplished with the old helicopter.

“We know the Huey has been humping it,” Clark said “We’ve known it for a while, and had to get by with fixes, Band-Aids, I guess, to make sure we’re doing our mission as prescribed, in response to the threat. We’re doing it on the backs of Airmen, working longer shifts, security forces doing longer patrols. ... We’ve been doing [this mission], but it’s so much better to do that smarter.”



Photo: Matt Biden/USAF

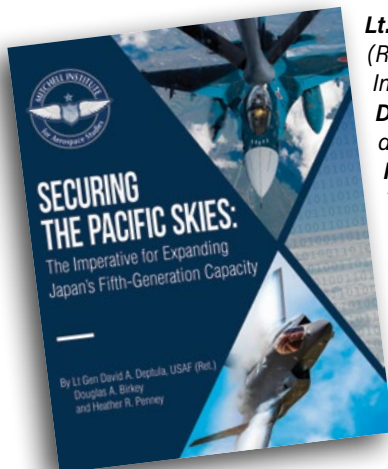
A USAF UH-1N escorts a payload transporter convoy. The aging UH-1N, in service for about 50 years, is slated to be replaced by the MH-139, whose mission will be centered on AFGSC’s missile fields.

Japan Needs More Fifth-Generation Jets

Japan can gain strategic advantage by modernizing its F-2 fighter force.

By Lt. Gen. David A. Deptula, USAF (Ret.), Douglas A. Birkey, and Heather R. Penney

Lt. Gen. David A. Deptula, USAF (Ret.) is the dean of the Mitchell Institute for Aerospace Studies. **Douglas A. Birkey** is the executive director of Mitchell, and **Heather R. Penney** is a resident senior fellow. This article is adapted from the Mitchell Institute's research study, "Securing the Pacific Skies: The Imperative for Expanding Japan's Fifth Generation Capacity," which can be downloaded in its entirety at: www.mitchellaerospace-power.org



Japan is grappling with a serious military modernization challenge that has broad operational and strategic implications for the balance of power in the Asia-Pacific theater. The Japan Air Self-Defense Force (JASDF) must soon decide how to replace its aging F-2 multirole fighter aircraft and how much it's willing to pay to develop a replacement.

Derived from the F-16, the F-2 entered active service in 2000 as the JASDF's mainline multi-role aircraft. Today, 20 years later, the F-2 is approaching obsolescence just as China is becoming more aggressive in the region about its own air force modernization. Whatever aircraft Japan settles on will arrive roughly a decade from now to face off against Chinese fifth-generation aircraft.

The Japanese government recently authorized \$102 million for fiscal 2020 to formally begin "Japan-led development of a new aircraft with international collaboration." The intent is to reduce cost and risk, potentially through the reuse or

adaptation of existing or emerging systems and technologies. Among the options: leverage or merge the attributes of the F-22 and F-35, while also fielding custom features to address specific JASDF mission demands. This would harness the latest stealth technology to survive threats, advanced sensors for situational awareness, cutting-edge data-processing to manage all that sensor data, and data links to support the ability to collaborate with other combat partners in real-time. Such advances are exceedingly important given China's indigenous pursuit of fifth-generation aircraft; its sophisticated anti-access and area denial (A2/AD) technologies; and its advanced power-projection systems.

An F-2 replacement based on the F-22 and F-35 would buy down risk, development time, and cost, equating to tens of billions of dollars. In any event, the case for a fifth-generation successor to the F-2 is clear—and Japan does not have the time (or the defense budget) to reinvent proven and available U.S. technologies.

An artist's concept of an FB-22. The proposed aircraft, which would replace Japan's F-2, would blend the best of USAF's F-35 and F-22 into a hybrid fifth-generation aircraft.

Photo: USAF; Illustration: Mike Tsukamoto/staff

While other options exist to replace the F-2, none are as compelling as the approach that leverages the proven F-22 and F-35. Alternatively, Japan could continue procuring new-build, fourth-generation aircraft, such as a Eurofighter Typhoon or a modernized F-15 tailored to Japanese requirements. But without organic stealth designs and built-in, fifth-generation information systems, these aircraft would lack the attributes necessary for future Japanese pilots to survive in an A2/AD environment.

Another option under consideration is to partner with a European consortium to develop a new-build advanced fighter. While this approach could yield a promising aircraft, time is a significant factor—neither the Franco-German nor the United Kingdom's advanced aircraft efforts have yet to move past the concept phase. This contrasts with both the Chinese J-20 and FC-31, which are well on their way to being operational. Workshare factors and political equities are problematic when thinking about any European defense project. It is likely Japan would be a minority stakeholder in any agreement.

Given China's aggressive fifth-generation development and modernization drive, a partnership with a European firm might not deliver the capability Japan needs in the time frame and at the price it wants. The last option is for Japan to develop an all-new fighter on its own. However, given the potential high cost and risk, this option could potentially weaken the posture of the U.S.-Japan alliance by fielding capability later than needed, or diverting budget away from other defense priorities.

Looking back throughout the annals of air combat, much has changed as technology has progressed. But the mission still relies on a foundation of enduring tenets. First and foremost, air superiority is a crucial mission and a condition necessary for military victory. Second, the ability to gather, process, and act upon high quality information will significantly enhance a pilot's ability to net desired effects, while minimizing undue projection of vulnerability. Third, survival is paramount, for aircraft losses will impede the attainment of desired effects and rapidly erode the ability to sustain a military campaign over time. A nation that fails to abide by these time-proven realities risks defeat.

In past eras, achieving these goals involved a disparate force of mission-specific aircraft—air superiority fighters; command and control, intelligence, surveillance, and reconnaissance (C2ISR) airplanes; and, more recently, tailored stealth aircraft. Today, modern technology merges these federated mission areas into a single airplane in the form of a fifth-generation fighter. F-22 Raptors and F-35 Lightning IIs are highly lethal kinetic platforms able to strike targets in the sky or on the ground. They are loaded with sensors, processing power, and advanced pilot interfaces. Their stealth designs, situational awareness, and ability to process real-time threat information, —while sharing key data with mission partners—ensures tactical advantage and survivability. While many legacy aircraft possess one or two of these attributes, only fifth-generation airplanes offer the complete package.

FIFTH-GENERATION STANDARDS

On the night of Sept. 22, 2014, F-22s executed their first combat mission as part of the opening phase of Operation Inherent Resolve (OIR) against the Islamic State (ISIS) over Syria. Pilots had to overcome advanced air defenses, multifaceted international dynamics, and the risk of unintended escalation at the state-on-state level. As one of the F-22 pilots recalled, "We're essentially going after and targeting a nonstate actor within the sovereign state borders of another country that we



Photo: Xie Zhongwu and Zhou Yongheng/Chinese Ministry of Defense

A Chinese pilot in a J-10 fighter during joint training with the Royal Thai Air Force at Udorn Royal Thai Air Force Base, Thailand, in August 2019. On his wing are two more J-10s.

are not technically at war with, and we're not friends with. ... Part of the coalition's objective ... is to not do anything that's going to escalate the situation." The arrival of Russian combat forces in Syria in 2015 raised the stakes further.

On that first night of OIR, and well into the campaign, F-22s focused on understanding the battlespace and communicating with coalition aircraft to ensure they were in the right place at the right time, out of harm's way, and deconflicted from adversary forces. "We have more information at our fingertips than other aircraft," recalled one F-22 pilot. "We have an easier time making big decisions." Aircraft like the E-3 AWACS and E-8 JSTARS have been gathering, processing, and disseminating battlespace intelligence for decades.

Yet as derivatives of commercial airliners, these aircraft require air superiority to execute their missions and return home safely. This was not possible over Syria, where the brutal execution of a Jordanian fighter pilot by ISIS a few months into the campaign left no ambiguity about the need to ensure the safety of all coalition actors. Upward of 100 aircraft have been shot down during the Syrian Civil War, including an F-16 flown by the Turkish Air Force. Stealth-enabled survivability, paired with situational awareness, set the F-22 apart.

Combat commanders recognize these distinct attributes and have kept the F-22 in the OIR fight since that first combat mission in 2014. "The F-22's low observable characteristics, combined with its integrated avionics, in the hands of our outstanding aviators, provided us the ability to project power and freedom to maneuver," said Gen. Jeffery Harrigan, then-commander of U.S. Air Forces Central Command and now-commander of U.S. Air Forces in Europe-Air Forces Africa. "Importantly, the Raptors drove down strategic risk to our people in a very complex and dynamic environment with significant threats."

In one 2018 deployment, F-22s flying defensive counterair missions deterred 587 aircraft during 590 sorties over Syria and in the Middle East. The deployment included flying offensive counterair missions deep into Syria, deterring Syrian fighters and air defenses during the April 2018 U.S.-led military strike

responding to the Assad regime's use of chemical weapons. The fact that these F-22s achieved this air superiority objective without kinetic action speaks to the respect commanded by the airplane—by friend and foe alike.

This is exactly why nations like Russia and China are focused on developing their own fifth-generation fighters and why allied sales for the F-35 continue picking up pace. Whether signaling for deterrence, defending personnel on the ground, executing limited operations, or guaranteeing sovereignty, fifth-generation aircraft are now an essential tool underpinning statecraft.

THE CHINA THREAT

The threat posed by China is not abstract. The Asian superpower has already militarized much of the South China Sea by constructing 3,000-plus acres of manmade islands that are now outfitted with military airstrips, sensors, and surface-to-air missiles (SAMs). To the north, it has forcefully challenged claims over disputed areas in the East China Sea, such as the Japan-administered Senkaku Islands. In 2013, China unilaterally extended an air defense identification zone (ADIZ) into Japan's internationally recognized ADIZ in the East China Sea. Japanese intercepts of Chinese aircraft have grown significantly from around 300 a year in 2012, to 1,200 in 2016, and today's rates also remain high. Of these intercepts, 55 percent are Chinese intruders, while the remainder are typically identified by the JASDF as Russian intelligence-collection aircraft.

Beijing's aggressive actions are backed up by its investment in robust military capabilities. The People's Liberation Army Air Force (PLAAF) now possesses 1,700 fighter aircraft, 400 bombers, 475 transports, and 115 special-mission aircraft. The PLAAF has also invested in modernizing its fighter inventory with fourth-generation variants based on Russian designs such as the Su-27 and the Su-30, along with its indigenous J-10 fighter. It also developed and fielded two new fifth-generation fighter aircraft in rapid succession, the J-20 and FC-31, the second of which is understood to be available to China's arms customers. Several analyses also suggest the



Japan Air Self-Defense Force J-2s on the line at Eielson Air Force Base, Alaska, prep for a Red Flag flight in June 2019.

Photo: Senior Airman Kristen Heller

Chinese are seeking to arm their new fifth-generation fighters with hypersonic weapons. DOD's annual China report notes that Chinese engineers announced they successfully tested a solid-fuel ramjet missile engine and have suggested this capability could enable the J-20 to carry future hypersonic air-to-air missiles with a range of 300 kilometers (180 miles).

These new capabilities will pose critical challenges to most JASDF, U.S. Air Force, and U.S. Navy aircraft, which are predominantly fourth-generation fighters such as the F-15, F-16, F/A-18, and the F-2.

China's growing arsenal goes well beyond aircraft. The PLA has 150 to 450 medium-range ballistic missiles, 750 to 1,500 short-range ballistic missiles, and 270 to 540 ground-launched land attack cruise missiles for standoff precision strikes. Its Navy boasts the region's largest fleet, with more than 300 surface ships, submarines, amphibious ships, patrol craft, and other specialized vessels. China's first domestically built aircraft carrier will soon join its fleet, and a second, larger carrier is under construction.

China has also enhanced the reach of its SAMs, air-to-air missiles, and standoff strike missiles and declared its intention to develop a new long-range stealth bomber. According to DOD estimates, this aircraft could become operational by 2025 with a range of 5,000 miles, enough to hold all of Japan's territory at risk. The sum effect of these investments transforms China from a regional actor with robust defensive capabilities to a global superpower with significant power-projection capability. This ability to shape circumstances beyond its borders through military means will grow with further investments.

According to the Department of Defense (DOD) *Annual Report to Congress, Military and Security Developments Involving the People's Republic of China 2019* (hereafter referred to as the DOD China Report), "China's continuing improvements of air and ground-based missile strike capabilities within and, increasingly, beyond the first island chain enable other military assets to operate farther from China. These assets can conduct a variety of missions to include presence and sovereignty enforcement, as well as offensive missions such as blockades. China also focuses on enhancing the PLA's ISR capabilities, extending the reach of the PLA's situational awareness, as well as enabling improved targeting and timely responses to perceived threats."

These operations have included long-range bomber flights

over the Sea of Japan, and more exercising of long-range power-projection capabilities. In 2016, two Chinese H-6 bombers were accompanied by Y-8 airborne early warning and control aircraft on a sortie through the region. This was expanded in January of the following year, with six bombers and two reconnaissance aircraft in the same area. Eight months later, a formation of H-6 bombers flew through the Miyako Strait toward Okinawa, and then to the Kii Peninsula of Honshu. In May 2018, the PLAAF flew fighter aircraft and long-range cruise missile-capable bombers around Taiwan and employed an early warning aircraft to support Su-35 and J-11 fighter flights to the Miyako Strait near Okinawa and the Bashi Channel between the Philippines and Taiwan. Such operations represent deliberate actions to demonstrate Chinese power, normalize military presence in international regions, and project power operationally.

Chinese investment decisions are also aligned with these activities and increasingly aggressive military stance. PLAAF Deputy Commander Lt. Gen. Xu Anxiang recently said, "The building of a modern Air Force will essentially be achieved by 2035." Manned fighters and sophisticated SAMs, long-range strike via manned bombers and guided missiles, logistics functions like aerial refueling and cargo aircraft capacity, and capabilities through the Chinese concept of "informationized warfare"—gathering data, processing it, and fusing it into actionable information—are all underway.

To protect itself, China relies on advanced SAMs that can be based on ships, on land, or on its man-made islands in the South China Sea. The PLAAF, Pentagon officials believe, possesses "one of the largest forces of advanced long-range SAM systems in the world," with both Russian SA-20 and SA-21 designs, as well as indigenous types such as the HQ-9. These systems are linked to airborne early warning and control aircraft in order to target threats in varying conditions, in larger volumes, and at greater distances.

China's inventory of ballistic and cruise missiles are also cause for concern as are China's manned bomber aircraft, the legacy Soviet H-6, which is equipped with an estimated six land-attack cruise missiles per aircraft, and a new long-range stealthy bomber now in development. That new aircraft (likely designated the H-20) could debut in the next decade, featuring both a conventional and nuclear weapons carriage, a payload of at least 10 metric tons, and a range greater than 5,200 miles.

Congested and Contested

China's People's Liberation Army Air Force and Navy increasingly fly training routes over the Yellow Sea and the East China Sea that challenge Japan's long-standing territorial claims and air-defense identification systems.



Drawing these disparate tools together is China's continued focus on "informationized" war. At a macro level, this concept refers to a combat cloud-type enterprise, whereby a broad net of distributed sensors continually gather data, process it into actionable knowledge, and operationalize it through a robust, agile command and control system. Chinese President Xi Jinping has touted the need to accelerate "informationization" efforts, and endorsed a range of national development plans that focus on improving not only information and communications technology, but also "disruptive technologies" to give China a competitive advantage over the United States.

RIGHTING THE AIR SUPERIORITY IMBALANCE

To ensure Japanese security, the F-2 replacement should be the most capable fifth-generation aircraft possible, empowered with superior range and payload capacity.

Fifth-generation aircraft share four basic attributes: all-aspect stealth; superior aerodynamic performance; advanced automated sensors; and information fusion. The synergy of these capabilities is what makes fifth-generation aircraft so survivable and so lethal, projecting unprecedented lethal power at the right time and place to maximize desired effects, minimize vulnerabilities, and team with friendly assets in real time.

From an operational perspective, the value of a fifth-generation solution based on the F-22 and F-35 combines the proven strengths of each aircraft with enough room for novel modifications specifically designed to address Japan's unique threat environment. Conceptually, this approach would likely combine the prime advantages of both aircraft. For Japan's purposes, though, the attributes from the F-22 would include high-altitude operations, high-performance fighter maneuverability with the use of thrust vectoring, and high Mach speeds to sustain supersonic flight without the need to use high fuel consuming afterburners.

But Japan's security environment demands an aircraft with greater range to patrol the airspace over areas such as the Senkaku Islands, requiring increased internal fuel capacity that could be provided by fitting the F-22 with

larger wings. While this would be a major modification, it would not be unprecedented. Lockheed Martin studied a fighter-bomber variant of the F-22 as far back as 2002—but it was never built. In that design, the large delta-like wing decreased the maximum G-force limits of the airframe, but the wing design reduced the need for aerial refueling while retaining the fuselage mold lines, thereby enhancing the aircraft's stealth. That "FB-22" design concept, while originally conceived as a regional bomber for the U.S. Air Force, could now be adapted for Japan's long-range air-dominance mission as the F-2 replacement aircraft. Another benefit would be the opportunity to redesign the internal structure of the mid- and aft-fuselage to extend the side bays. This would allow the new aircraft to carry up to eight, rather than six, medium-range guided missiles internally. An F-2 replacement aircraft utilizing a modified F-22 fuselage, a larger delta wing, and F-35 skin and coatings would provide unprecedented survivability in the threat environment Japan faces. At the same time, the advanced, integrated sensors and fused processing from today's F-35 would significantly surpass the F-22's informational capabilities in sensors, avionics, data links, fusion processing, and presentation. Likewise, an advanced active electronically scanned array radar would offer passive and active modes, and more powerful and effective electronic attack and electronic protection capabilities than are available on any legacy aircraft, while the F-35's infrared sensor and display system could help pilots with dynamic targeting and managing their signature presentation.

IN CONTEXT WITH THE THREAT

Japan lies within China's A2/AD threat ranges, and Chinese military power continues to grow. In addition to Chinese power, regional threats still loom next to Japan, such as the unpredictable North Korean regime and Russia, which holds the Kuril Islands north of Hokkaido in a territorial dispute dating back to World War II. Even advanced fourth-generation variants, such as the F-15J, will not be able to meet mission requirements as they are increasingly threatened by adversary fifth-generation aircraft, modern SAMs, and advanced air-to-air weapons. Unless Japan invests in fifth-generation capabilities, the JASDF will forfeit air superiority to China.

Whatever solution Japan chooses should leverage the F-22 and F-35. Rather than risking schedule delays, cost growth, and technological unknowns as the result of a clean-sheet approach, Japan can capitalize on proven technology. This approach could leverage much of the F-22 airframe and its favorable performance at high altitude, ample speed, and excellent maneuverability, while adding a larger wing for enhanced range. These attributes would be paired with the information superiority of the F-35—cutting-edge sensors, robust processing power, fusion, and ability to collaborate



Photo: Danny Yu

A People's Liberation Army Air Force Shenyang J-31 fifth-generation jet at a Zhuhai Air Show in China.

in real-time with other combat assets. The F-35 program could also contribute other technological advances, such as newer radar absorbing coatings and stealth “skins.” All of this adds up to unprecedented survivability and performance in an A2/AD threat environment. Importantly, harnessing proven technologies would assure interoperability with other allied fifth-generation aircraft in such environments.

A fifth-generation F-2 replacement aircraft can become a critical node in building toward a “combat cloud”-capable force. Just as F-22s and F-35s share information through advanced data links and networks, expanding these connections across a battlespace increases situational awareness for all combat aircraft and assets. Instead of flying as isolated platforms, the combat cloud enables a highly integrated enterprise where informationized collaboration determines mission success or failure. In combat cloud operations, the kill chain becomes a “kill web,” where finding, fixing, tracking, targeting, engaging, and assessing targets is weapon- and platform-agnostic, a constantly updating process that cannot be broken by a single point of failure.

Fifth-generation connectivity and processing power are critical to this new concept of operation. However, this is only possible in a fully matured fifth-generation force. In fact, the presence of fourth-generation aircraft will degrade this potential, restraining operations because these older systems do not feature modern stealth, battlespace awareness, and decision superiority enabled by advanced sensors and avionics key to fifth-generation aircraft.

While there are other options to replace the F-2, none are as compelling as this fifth-generation approach that leverages the F-22 and F-35. For example, Japan could continue to acquire new-build fourth-generation aircraft, such as a Eurofighter Typhoon tailored to Japanese requirements, but without organic stealth and built-in fifth-generation


information systems, these aircraft would lack the attributes necessary to survive in an A2/AD environment.

Leveraging the F-22 and F-35 would likely prove the most cost-effective and timely way to field an F-2 successor Japan requires to respond to the Chinese military challenge. Paired with Japan’s own growing F-35 force, the F-2 replacement would be unique to Japan and would take advantage of the advances in low observability, sensors, processing power, and maneuverability achieved in the field of fifth-generation combat aircraft since the F-22 line closed in 2010.

THE FIFTH-GENERATION IMPERATIVE FOR JAPAN

As a core U.S. treaty ally, Japan has the opportunity to fully leverage this significant technological and operational advantage. fifth-generation attributes must be integrated into a single aircraft. Doing otherwise risks expending resources on aircraft that will fall short in modern combat and fail to survive in the modern threat environment. A war of attrition against China, with its more abundant resources, is unsustainable.

Investing in proven fifth-generation fighter technology will be critical to Japan’s airpower modernization. Leveraging proven F-22 and F-35 technologies would help Japan put new fighters on ramps faster and avoid the trap of costly, time-intensive, and risky developmental programs.

For Japan, the chance to build its own fifth-generation solution and shorten technological development and cost risks is a significant strategic advantage, especially given China’s clear military buildup. This approach promises the added benefit of seamless integration with U.S. fifth-generation aircraft and similarly equipped allies and partners. Choosing such a course for F-2 replacement would secure a significant strategic advantage for Japan, and it would set a high bar for air power in the Asia-Pacific for decades into the future. 

Hitler's Buzz Bombs

A V-1 makes it through London's air defenses. The first phase of the Vengeance Weapon attacks by Nazi Germany on Britain and Belgium lasted only three months in 1944 before Allies overran the launch sites in Europe, but there was more to come.

The priority target for Germany's V-1 "Vengeance" weapon was London.

Photo: USAF

By John T. Correll

Just before sunrise on June 13, 1944, the Royal Observer Corps in Kent sighted several small aircraft with loud engines and bright exhaust plumes trailing behind. Shortly thereafter, one of them crashed to the ground in the east end of London, causing a large explosion in Bethnal Green.

Six people were killed, 266 left homeless. Remains of the little airplane were found in the enormous bomb crater. Newspaper accounts attributed the damage to German Luftwaffe "raiders," but British officials knew better.

Pressed by boastful claims from Germany about strikes by new weapons, the British home secretary disclosed that Britain was being bombarded by "pilotless aircraft," also described as "robot planes."

The Bethnal Green attack was the first by the V-1 flying bomb, designated Vengeance Weapon 1 (Vergeltungswaffen 1) by the Germans. The British called it the "doodlebug" or "buzz bomb," because of the distinctive sound of its pulsejet engine.

The V-1 was not the technological marvel initially imagined. That description applied better to the V-2—Vengeance Weapon 2—a ballistic missile introduced later. Whereas the V-2 was technically

The V-1 was constructed mainly of sheet metal, cheaply produced, and quickly assembled. It resembled a small airplane with short, stubby wings. It was propelled by a simple jet engine that ran on 80-octane gasoline.

advanced, the V-1 was constructed mainly of sheet metal, cheaply produced, and quickly assembled. It resembled a small airplane with short, stubby wings. It was propelled by a simple jet engine that ran on 80-octane gasoline.

With a limited range of 148 miles, the buzz bomb had to be based forward on the French side of the English Channel. From there, it was fired from a slanted ramp pointed toward London. That determined its direction in flight.

Over the next three months, the Germans launched more than 8,000 V-1 strikes, nearly all of them against London, killing 5,500 people, injuring 16,000, and forcing the evacuation of more than a million.

The British had considerable success in fighting the V-1s with anti-aircraft guns, fighter interceptors, and barrage balloons. The first phase of the V-1 assault on Britain ended in September 1944 when Allied armies in Europe overran the launch sites.

The attack on Britain continued for a while with an air-launched version of the V-1, carried aloft by He-111 bombers, but the main targeting for the buzz bombs shifted to Belgium, principally the port of Antwerp. An improved ground-based variant, introduced late in the war, could reach Britain, but only about a dozen got that far.

About 30,000 V-1s of all kinds were manufactured.

Between June 1944 and March 1945, almost 25,000 were launched against targets in England and Belgium. Of these, 7,000 managed to hit somewhere in England, with fewer than 4,000 landing in the greater London area.

V-WEAPONS

The Germans had been working on flying bombs and rockets since the 1930s. The program was concentrated at Peenemünde, a sprawling complex of laboratories and test facilities on a remote section of the Baltic coast near the Polish border. The technical director at Peenemünde was Werner von Braun, who was the driving force behind the V-2.

Development moved into high gear in 1942 because of the interest of Führer Adolf Hitler, who wanted new weapons to strike back at Britain for the bombing of German cities. The Vengeance weapons, with their potential for spreading terror, suited his wishes.

The A-4 rocket—later the V-2—was a project of the ordnance branch of the German army. The Luftwaffe, unwilling to concede the bombardment mission to the army, devised its own program, the FZG-76 pilotless bomb, which became the V-1.

The V-2 was flight-tested in June 1942. First flight of the V-1 was in December 1942. Operation Eisbar ("Polar Bear") was supposed to begin in December 1943, devastating London with a combination of V-1s and V-2s.

Hitler would not listen to proposals to use the vengeance weapons against other targets, such as the ports in southern

Britain where the armada for the D-Day invasion was gathering. He was obsessed with retribution against London, although he also hoped that the V-weapons might help reverse the course of the war.

In the German plan, London was "Target 42," with the Tower Bridge on the River Thames as the specific aim point. As it turned out, no V-1 ever hit the Tower Bridge.

CROSSBOW

British intelligence had been aware since 1939 of the experimental station at Peenemünde but they did not know its full purpose. In May 1943, a skillful Royal Air Force photo interpreter determined that a curving shadow on an aerial photo was an elevated ramp, and that a T-shaped blot on the ramp was an airplane without a cockpit.

The British had seen and recognized the V-1 for the first time. Reconnaissance in July discovered a V-2 prototype on a transport trailer near its test stand.

The attempt to eliminate the V-weapons was "Operation Crossbow." In August 1943, hundreds of RAF bombers destroyed Peenemünde, but the essential research work was done. The Germans moved the production work elsewhere.

Crossbow turned to the "ski sites"—so called because the launch ramps looked like ski jumps—on the French coast. Between August 1943 and August 1944, 14 percent of Allied heavy bomber sorties and 15 percent of the medium bomber missions were allocated to Crossbow targets.

Combatting the V-1

Germany launched more than 24,000 V-1 buzz bombs at Britain and Belgium from June 1944 to March 1945. Thousands crashed after takeoff and up to half were shot down. In a few instances, pilots chose to tip the bombs off course, rather than risk shooting them and flying into a blast of debris. This tactic was used successfully at least three times.

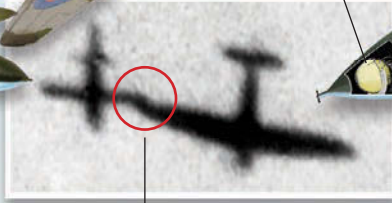
1 Pilot maneuvers plane to place one wingtip beneath the V-1 wing.



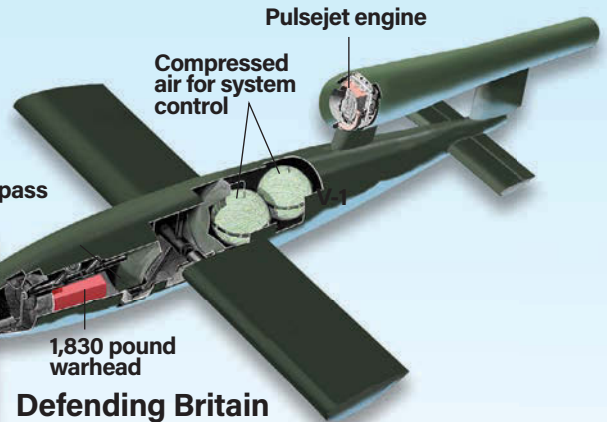
Hawker Tempest

V-1

2 Steering away from the V-1, the pilot's wing would rise, tipping the V-1 out of control.



3 This actual image shows a Spitfire engaging the technique, but the fastest British defender was the Hawker Tempest.



Defending Britain

Britain used an active defense in four layers: A fighter belt at sea, a coastal belt of anti-aircraft guns, an inland fighter belt, and, closest to London, a belt of barrage balloons.



● British four-layer defense

■ V-1 launch sites in Nazi-occupied France and Belgium

Measuring Up

The V-1 buzz bombs flew a swift 400 mph, faster than most aircraft in the Allied inventory:



Source: *Airpower Classics*

Scattered reports of German “secret weapons” found their way into the news. In February 1944, British Prime Minister Winston Churchill acknowledged the existence of installations in France for rockets or robot planes (or both). The erroneous public assumption, often repeated, was that the weapons were radio-controlled.

The bombers succeeded in destroying most of the ski sites, approximately 100 of them, and about 2,400 V-1 missiles in the production and delivery pipeline. The Germans replaced the ski sites with simpler, modified sites. There were few outbuildings and little construction other than the launch facility itself. Modified sites could be built in eight days each, and were much easier to camouflage and hide. It was several months before the Allies identified the first one of them.

Crossbow did not stop the V-1 program, but it did slow it down. Hitler missed his goal of starting Operation Eisbar in December 1943. It was not ready to go until June 1944, a week after the D-Day landings began in Normandy.

It would not have mattered much to the invasion if the V-1s had been used. They were so inaccurate that they would have been as likely to hit the German defenders as the Allied soldiers on the beaches.

V-1 Launches, June 1944-March 1945

Target	Launch	
	Ground	Air
England		
London	8,839	1,440
Other areas	53	163
Total	8,892	1,603
Belgium	11,988	
Totals	20,880	1,603

Sources: Kirk Kloppel; Dieter Holsken

FLYING BOMB

The V-1's wings had no ailerons or other control surfaces. The missile was placed on the inclined ramp and launched toward London. The takeoff was assisted by a piston catapult, after which the pulsejet engine took over. At its cruising speed of 400 mph, the buzz bomb was across the English Channel in five minutes.

The pulsating sound—described as “similar to a Model T Ford going uphill”—could be heard from 10 miles away. It was generated by the opening and closing of the combustion chamber as the jet engine fired at 50 cycles or “pulses” per second.

Distance was measured by counting the revolutions of a propeller in the nose of the bomb. When the propeller had spun a predetermined number of times, the ignition stopped, and the nose of the bomb tipped downward into a steep dive.

In theory, the ignition cutout happened when the V-1 was above the target. In fact, there was considerable variation from the intended flight path. Of the four buzz bombs launched in the first attack on June 13, one landed on the periphery of London. None of the others came closer than 22 miles.

Residents of London and the surrounding territory learned

Graphic: Mike Tsukamoto, and Dash Parham/staff; Photos: Imperial War Museum; USAF

quickly that when the noise of the buzz bomb quit, they had about 12 seconds to take cover before the missile exploded on impact with the ground.

The V-1 was not that powerful in an absolute sense. Its 1,830-pound warhead was equivalent to less than two of the general-purpose bombs carried by aircraft. However, the random nature of the attacks created great fear. Nobody knew when or where the next buzz bomb might fall.

UNDER ATTACK

Following the explosion at Bethnal Green, the V-1 attacks on London continued for seven weeks. "Between 100 and 150 flying bombs, each weighing about a ton, are being discharged daily," Churchill said in July. The casualties were running at "almost exactly one person per bomb," he said.

The damage was extensive. "Soon not a pane of glass remained in the city buses," said historian Rick Atkinson. "Tens of thousands of houses were smashed."

The peak of the assault came Aug. 3, when 316 missiles were launched, about 220 of them getting to London. One of the buzz bombs narrowly missed Buckingham Palace. It struck a tall ash tree on the grounds and exploded before reaching the ground, blowing out a number of windows in the royal residence.

The only information the Germans had on where the buzz bombs struck was what they could glean from the British, who used double agents to send back false reports. Deceived, the Germans retargeted with the result that the bombs were more likely to fall on less-populated places. "The subterfuge had to be kept secret of course—not only to fool the Germans but also to keep from the population of the southeast suburbs and countryside that their lives were being endangered to make central London safer," said Nigel Blundell in a *Daily Express* look back.

V-1 launches declined in the middle of August as the Germans retreated from launch sites in northern France to avoid capture by the advancing Allied invasion forces. The last buzz bomb fired from France was on Sept. 7.

Between June and September, the total of V-1s launched was 8,617. More than 1,000 crashed on takeoff and almost half were shot down by the British defenses. Many landed far afield and only a quarter of them struck anywhere in London. The Germans began relocating the launch sites to eastern Germany for use against continental targets.

The British government announced on Sept. 7 that, "Except possibly for the last few shots, the Battle of London is over."

Within 24 hours, the first of the V-2s fell on the city. They kept coming intermittently for the next six months, although not in numbers comparable to the V-1s.

THE DEFENSE BELTS

The Operation Crossbow attacks on the V-1 sites, never all that effective, were abandoned. What worked was an active defense in four layers: a fighter belt at sea, a coastal belt of anti-aircraft guns, an inland fighter belt, and, closest to London, a belt of barrage balloons.

The best of the RAF interceptors was the new Hawker Tempest V, fast and maneuverable at low altitudes, but available only in limited numbers. Between June and August, Tempest pilots shot down 638 flying bombs. Other fighters, the Mosquito, Spitfire XIV, and Mustang, were also effective.

A shell from a 20 mm cannon could blow a hole through the steel covering of the buzz bomb, but the pilots dared not get too close. When a V-1 exploded in the air, it threw metal in all directions. A few pilots discovered that they could slide a wing under the V-1 wing and tip it over and out of control. Three V-1s were destroyed this way.

In good weather, the fighter-interceptors were more successful than the guns, and the Germans concentrated their main efforts on days when bad weather kept the fighters out of action. Results from the guns improved markedly with the arrival of proximity-fuzed shells from the United States.

The barrage balloons caught a few of those making it through, accounting for about eight percent of the V-1s intercepted. As a countermeasure, some of V-1s were equipped with balloon cable cutters on the leading edges of their wings.

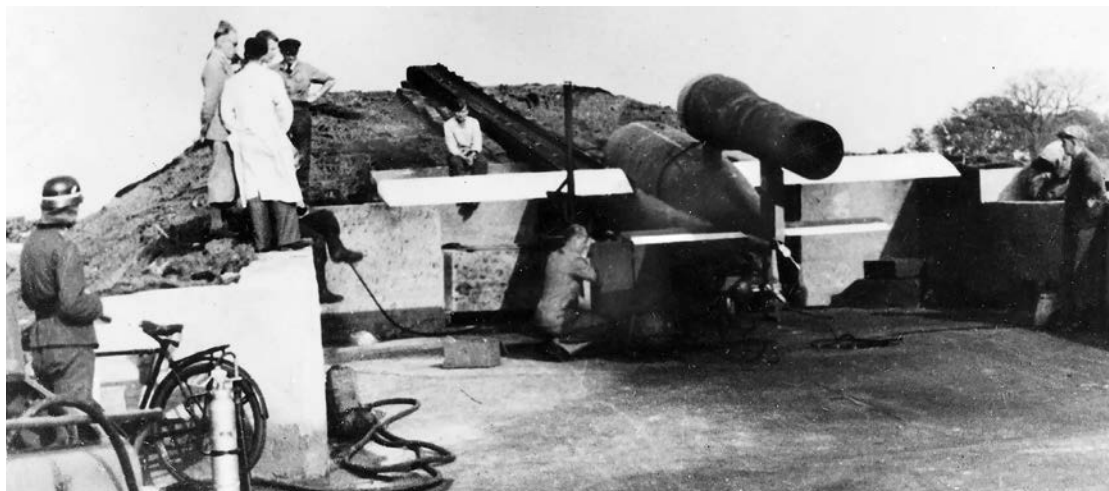
"By the end of August, not more than one bomb in seven got through to the London area," Churchill said.

MORE V-1s

As the war progressed, the Germans developed several more variants of the V-1. On July 9, a Heinkel He-111 bomber approached within 60 miles of England and fired a buzz bomb it carried under the port wing, inboard of the engine.

Between July and January 1945, some 1,600 air-launched V-1s were employed against Britain, nearly all of them aimed at London. The accuracy was even worse than the ground-launched weapons. In September, half of those dropped from He-111s missed London by 24 miles.

In October, the V-1 threat shifted to Belgium, especially the key port of Antwerp. Between then and March 1945, the Germans rained 11,988 V-1s against Belgium—more than



Crews ready a V-1 for launch at an unidentified location in Europe. Of one variety or another, 10,500 V-1s were launched against Britain during the war. They were useful as a weapon of terror, but had little operational impact.

Photo: USAF

Firemen and civil defense workers look for survivors in a cavity formed by a large pile of rubble following a V-1 attack in Upper Norwood, London. Although the V-1 and V-2 weapons were largely ineffective in a military sense, they were clear precursors to modern day cruise missiles.



Photo: Imperial War Museum

were sent against England. Accuracy was still poor. Only 211 buzz bombs ever fell into Antwerp.

V-2 rockets struck Belgium as well. The most deadly day was Dec. 16, when a V-2 hit a movie theater in Antwerp, killing 567.

Meanwhile, the Germans were working intensively on a longer-range version of the V-1 that could target Britain from launch sites in Holland. The result was the F-1 variant, which had a larger fuel tank and smaller warhead. It achieved greater range but at the sacrifice of explosive impact. Only 275 of these variants were fired at England, all in March 1945, with just 13 of them reaching London.

The last V-1 development was a piloted version, intended for attack against high-value targets. Supposedly the pilot could bail out at the last moment. Several test flights were conducted before the Luftwaffe canceled the whole thing in 1945 as a bad idea.

About 10,500 V-1s of all kinds were fired against England. Two thousand crashed on takeoff or shortly after. The defenses shot down 52.8 percent. Some got through, but they had no real effect on the outcome of the war.

LEGACIES

“The average error of both weapons [the V-1 and V-2] amounted to more than 9.3 miles,” Churchill said. “Even if the Germans had launched 120 weapons per day and had we not shot down any of them, their effect would not have exceeded the dropping of two or three one-ton bombs per square mile per week.”

The Germans paid a substantial opportunity cost for the V-weapons. “The resources that went to build them could, according to the American bombing survey, have produced an additional 24,000 aircraft,” said historian Richard Overy.

The Americans shipped a supply of V-1 parts to Wright Field in 1944 and built their own copy of the buzz bomb, the JB-2 “Thunderbug,” but the program dwindled away with the end of the war.

Hanson Baldwin of *The New York Times* was among the first to perceive the legacy of the V-weapons. “The flying bomb will not win this war,” he wrote in August 1944. “And unless its cousin, the giant rocket the Germans are preparing for use against London, has undreamed of potentialities, neither will the rocket. But both of them are weapons of the future. Both have had and will

Big Brother

The V-2 rocket, much larger than the V-1, was a ballistic missile rather than a pilotless airplane. It was fired from a mobile transporter-erector-launcher called a Meillerwagen.

Although the technology was more advanced, the explosive yield of the V-2 warhead was no greater than that of the V-1. Since there were fewer of them—a total of 3,170 launched against England, Belgium, and other countries—the damage inflicted was limited.

A little more than a third of the V-2s aimed at London and Antwerp hit the cities. And since the V-2 could not normally be intercepted in flight, it did not tie down defensive fighters and antiaircraft guns the way the V-1 did.

An exception occurred when by coincidence a V-2 overtook and passed through a formation of B-24 bombers returning to England after a mission. One of the machine gunners opened up on the rocket and demolished it.

“The cost of the development and manufacture of the V-2 was staggering, estimated by a postwar US study as about \$2 billion, or about the same amount as was spent on the Allied atomic bomb program,” said historian Steven Zaloga. “Yet the entire seven-month V-2 missile campaign delivered less high explosives on all the targeted cities than a single large RAF raid on Germany.”

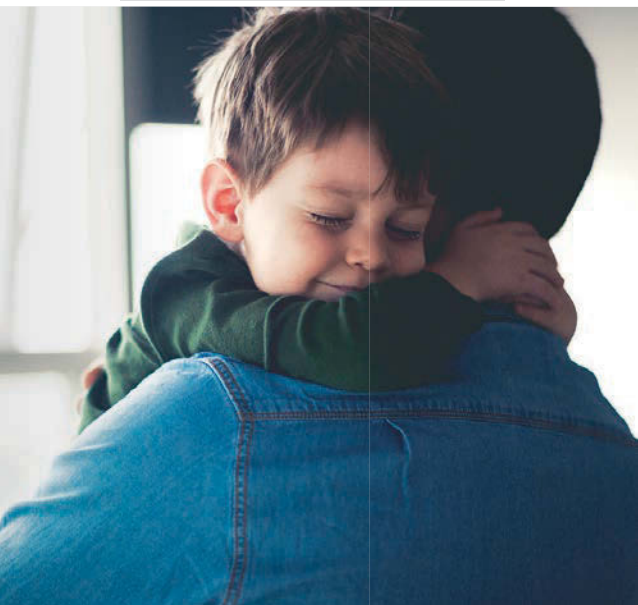
continue to have considerable effect upon military operations.”

A major role for ballistic missiles and space boosters was not long in arriving. Peenemunde research chief von Braun went on to become director of NASA’s Marshall Space Flight Center in Huntsville, Ala. And the V-1 is clearly recognizable as the forerunner of the cruise missile, which has been pervasive in modern military operations. ❄

John T. Correll was editor in chief of *Air Force Magazine* for 18 years and is a frequent contributor. His most recent article, “The Euromissile Showdown,” appeared in the January/February issue.



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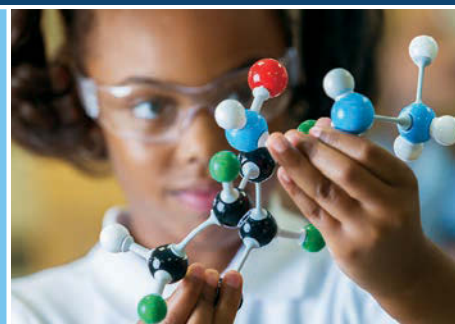
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RPA Building Dedicated to Ollie Crawford

By Jennifer-Leigh Oprihory

The Air Force's sole center for undergraduate remotely piloted aircraft training, located at Joint Base San Antonio-Randolph, Texas, was renamed "Crawford Hall" on Nov. 13, 2019, in honor of the late Ollie Crawford, a World War II pilot and Air Force Association charter member who went on to lead the organization as national president and chairman of the board.

Crawford was instrumental in the formation of the Air Force Memorial Foundation and his efforts led to the dedication of the Air Force Memorial in Washington, D.C., in October 2006.

Among other accomplishments, Crawford was also known for encouraging the Air Force to formally recognize the efforts of the Flying Tigers, the American Volunteer Group in China, in the lead-up to World War II; for helping to get the Commemorative Air Force's P-40 Warhawk restored; and for becoming the oldest recipient of a U-2 Dragon Lady orientation flight at age 84. Crawford died on July 21, 2019, in Texas. He was 94.

James Clark, director of Air Force warfighting integration capability, who said he led the charge to memorialize Crawford at Randolph, called him "one of the most gracious, giving gentlemen I've had the honor to know," in an interview with *Air Force Magazine*.

"He always concentrated on the warfighter, on the Airman, ...and, you know, he loved aviation, but [he had] a true and abiding passion for our Airmen and taking care of those Airmen, and I saw that firsthand on many, many occasions," said Clark, who also spoke at the ceremony.

Retired Maj. Gen. Douglas Raaberg, AFA's executive vice president, was among the ceremony's keynote speakers.

Ollie Crawford symbolized passion for the Air Force and service to the nation, he said. "If every Airman could have just a thimbleful of the passion that he had," it would make for an even more powerful Air Force, joint forces, and nation.

Raaberg said that honoring Crawford in this way also pays homage to AFA.

"Personally and professionally, it's a dedication to the Air Force Association—and Ollie would want it that way—as well as to his Air Force and to all the allied partners that he flew with and worked so closely with," Raaberg said.

According to Air Education and Training Command, the 558th Flying Training Squadron, which heads up all undergraduate RPA pilot and sensor operator training for USAF and the Marine Corps—including three courses taught in the newly dedicated building—produces 440 pilots and 440 operators each year.

"We at the 558th are honored that our one-of-a-kind mission




Photo: Sean Worrell/USAF

Maj. Gen. Craig Wills, 19th Air Force commander, speaks with Nancy Crawford, widow of Ollie Crawford, at the dedication of Crawford Hall at Joint Base San Antonio-Randolph, Texas, on Nov. 13, 2019.

can be represented by a one-of-a-kind hero like Col. Ollie Crawford," wrote 558th FTS Commander Lt. Col. Eric Bissonette in an email.

Clark said the Airmen who pass through Crawford Hall have its namesake to thank for it.

"They're there because of the legacy of great Airmen like Ollie Crawford that made our Air Force possible today, and they are part of a very proud legacy that we hope they will continue," he said. "I know that Ollie would be proud of those young RPA operatives coming out of Crawford Hall." 

USAFA Alumni Transition Center Seeks Volunteers



Photos: Bill Evans/USAF

Cadets in the Class of 2019 stand at attention in Falcon Stadium at the U.S. Air Force Academy, prepared to cross the stage and become USAF's newest second lieutenants.

By Jennifer-Leigh Oprihory

Air Force Association member and 2006 U.S. Air Force Academy alumna Liz McLean is putting out a call for individuals and organizations to get involved with the USAFA Association of Graduates' AOG Transition Center.

Rather than being a jobs board or matchmaking service between Academy graduates and specific companies, the center—which launched last September—is a centralized resource to help these Airmen discern the best careers for them.

"The concept is it's a one-stop shop, and it's for people that are getting out [of the military] or making the transition between their civilian careers that are looking for everything from sources to specific career links to mentorship to networking help, all in one location," she told *Air Force Magazine* in a recent interview.

The center's website—located at www.usafa.org/CareerCenter—says its current support-service offerings include resources related to education, employment, self-employment, resume support, mentorship, and transitioning from military aviation to commercial aviation.

"Mentorship is one of the most important pieces, so Northrop Grumman sponsored a mentorship platform by Veterati that allows graduates the ability to be partnered with a mentor in industry, and help to figure out and talk through what they ideally would like to do in their next chapter," McLean said.

USAFA alumni who've successfully transitioned out of the military and into civilian careers are needed to serve

"Mentorship is one of the most important pieces, so Northrop Grumman sponsored a mentorship platform ... [so graduates can get] a mentor in industry!"

—2006 U.S. Air Force Academy alumna Liz McLean

as mentors, she noted. Interested individuals can visit the AOG's Veterati page at www.veterati.com/AOG/ to sign up.

In the longer term, the center plans to also offer support resources specifically designed for female graduates, Reserve and Guard Airmen, and military spouses. It also hopes to create a forum for general officers and senior leaders.

According to McLean, current corporate partners include:

- BRKT
- Military.com
- Milkeep
- Northrop Grumman
- Orion International
- Southwest Airlines
- USAA
- Veterati

The center is on the hunt for an organization to partner with for its military spouse program, which will support USAFA alumni's partners.

"Right now the problem is, you can't pick a job for a spouse," she said, noting that these individuals "are people themselves with incredible backgrounds [and] diversity." One major goal of the spouse program will be to equip spouses with "relocatable and ... transferable skills," she said.

Interested parties should reach out directly to Corrie Grubbs at corrie.grubbs@aogusafa.org, McLean said. ✪

THUNDERBIRD CHAPTER SPONSORS ROBOTICS TEAM

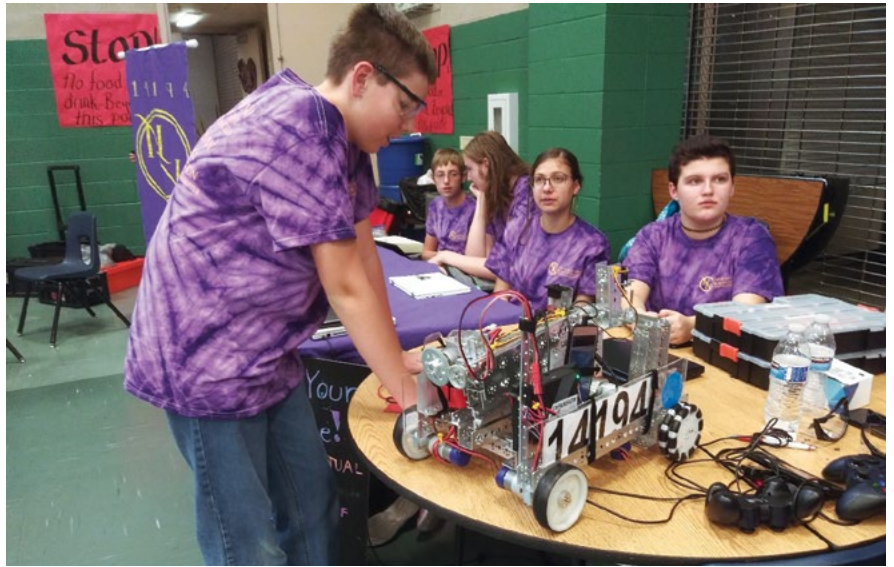
The Air Force Association's Thunderbird Chapter (Nev.) is sponsoring a robotics team made up of nine students from various schools throughout Las Vegas. The "Neocratic Nerds" come from Cadwallader Middle School; Betsy Rhodes Elementary School; Anthony Saville Middle School; Lee Antonello Elementary School; Arbor View High School; Northwest Career Tech Academy; and Cram Middle School.

After competing as the Super 7 in the FIRST (For Inspiration and Recognition of Science and Technology) Lego League robotics competition, the team moved up to the FIRST Tech Challenge when team members aged out of the previous competition. Half of the team members went on to the same magnet school, Advanced Technologies Academy [A-TECH].

FIRST was founded in 1989 to peak young students' interest and participation in science and technology and to encourage the pursuit of STEM careers.

This is the second year AFA has sponsored the team. In 2019, the Neocratic Nerds won the Inspire Award at the Regional competition and took the second-place Promote Award at the FIRST Tech Challenge Nevada State Championship.

A representative from the Thunderbird Chapter has accompanied the students to all competitions.



The Neocratic Nerds with their 2019-2020 robot (above). President of the Thunderbird Chapter, Bobi Oates (below, far left), joins members of the robotics team at a competition at Rancho High School in Las Vegas where they placed second.



STEEL VALLEY CHAPTER HOSTS JROTC DRILL COMPETITION

The Air Force Association's Steel Valley Chapter (Ohio) hosted its second annual JROTC drill competition October 2019 in Youngstown, Ohio. It featured an inspection, an academic quiz bowl, drills, color guard, and exhibitions. Forty-one cadets represented their schools from Trumbull Career and Technical Center, Ohio; Pine-Richland, Pa.; and Plum Borough, Pa.

Precision was the name of the game. The inspection teams of nine cadets plus one commander checked uniforms and appearance, and quizzed cadets on chain of command, current events, and general military knowledge. Poise and confidence were also judged. Proper military courtesies were in place, and all cellphones were turned off.



JROTC cadets from the Trumbull Career and Technical Center compete in an individual drill routine at the Youngstown Air Reserve Station in Ohio.

Photos: courtesy



1

1 George Putnam Moody. 2 A-10 attack aircraft at Moody, 2017. 3 Production AT-10 Wichita aircraft, 1943.



2



3

Photos: togetherweserved.com; Senior Airman, Erick Requardt; USAF

MOODY

Still Unexplained

George Moody was one of those rare individuals upon which good fortune seemed always to shine, right up to the very end.

This officer, whose name graces Moody Air Force Base, Georgia, succeeded in everything—school, sports, military career, marriage. However, his death stands out as a still-unexplained piece of bad luck.

George Putnam Moody was born in 1908, in Manila, into a prominent military family. The son of Col. Lucien Moody (West Point Class of 1904), George grew up immersed in Army culture.

He was an academic and athletic standout and one of the youngest-ever Eagle Scouts. He entered West Point in 1925, aged 17, and graduated in June 1929 as a second lieutenant of infantry.

Moody wanted wings. In September 1929, he was detailed as a student officer to the Air Corps Primary Flying School at Brooks Field, Texas. He received pilot wings and entered Advanced Flying School at Kelly Field, Texas, completing the pursuit course in October 1930 and officially transferring into the Air Corps.

Moody deployed to Panama, where he joined the 24th Pursuit Squadron. He made a name for himself as a top pilot, was promoted, and was sent to Mitchel Field, N.Y. In 1935, he met and married Dorothy Perkins, the daughter of a congressman.

Despite his youth, Moody was named Operations Officer of the 9th Bomb Group at Mitchel. By 1938, with war looming, the expansion of the Air Corps was underway, and Moody was in the midst of it.

First, he became a flight commander of training units in Texas. In 1940, he was sent to Maxwell Field, Alabama,

where he helped plan new facilities and schools at the Southeast Training Center.

Now a major, Moody boasted extensive experience both in training pilots and in flying multi-engine aircraft. As a result, the Air Corps named him test pilot for a new twin-engine trainer.

On April 29, 1941, Moody came to Wichita, Kansas for the first flight of the Beech Model 25, a prototype. On May 5, 1941, he took off, got into trouble, and crashed in flames, dying instantly.

What happened? No one knows for sure. Oddly enough, the Air Corps never prepared or issued an official accident report.

Explanations varied. Beech speculated Moody lost control. Others said the airplane stalled and entered an uncontrolled spin. Witnesses told news

reporters that the Model 25 side-slipped on takeoff and plunged to the ground from 100 feet altitude.

Beech pointed out the Model 25 was not a complex machine. On the other hand, Air Corps officers insisted Moody was too good a pilot to have simply lost control.

Beech and the Air Corps proceeded with a modified Model 26, which became the AT-10 Wichita and was bought in the thousands. AT-10s were used extensively at what became Moody Field, Georgia.

Today, Moody Air Force Base is the home of Air Combat Command's 23rd Wing—the "Flying Tigers"—the mission of which is to train air crew for and employ USAF's A-10 and OA-10 Thunderbolt II, HC-130 Combat King II, and the HH-60G Pave Hawk helicopter.



GEORGE PUTNAM MOODY

Born: March 13, 1908, Manila, Philippines
Died: May 5, 1941, Wichita, Kan.
College: U.S. Military Academy, West Point, N.Y.
Occupation: U.S. military officer
Services: U.S. Army—Infantry, Air Corps
Main Era: Interwar period
Years Active: 1929-41
Combat: N/A
Final Grade: Major
Honors: American Defense Service Medal
Resting Place: West Point Cemetery

MOODY AIR FORCE BASE

State: Georgia
Nearest City: Valdosta
Area: 178 sq mi / 11,403 acres
Status: Open, operational
Opened as Valdosta Airfield: June 1941
Renamed Moody Army Air Field: Dec. 6, 1941
Inactivated: February 1946
Reactivated as Moody Air Force Base: May 1951
Current owner: Air Combat Command
Former owners: Flying Training Command, Training Command, Air Training Command, Tactical Air Command

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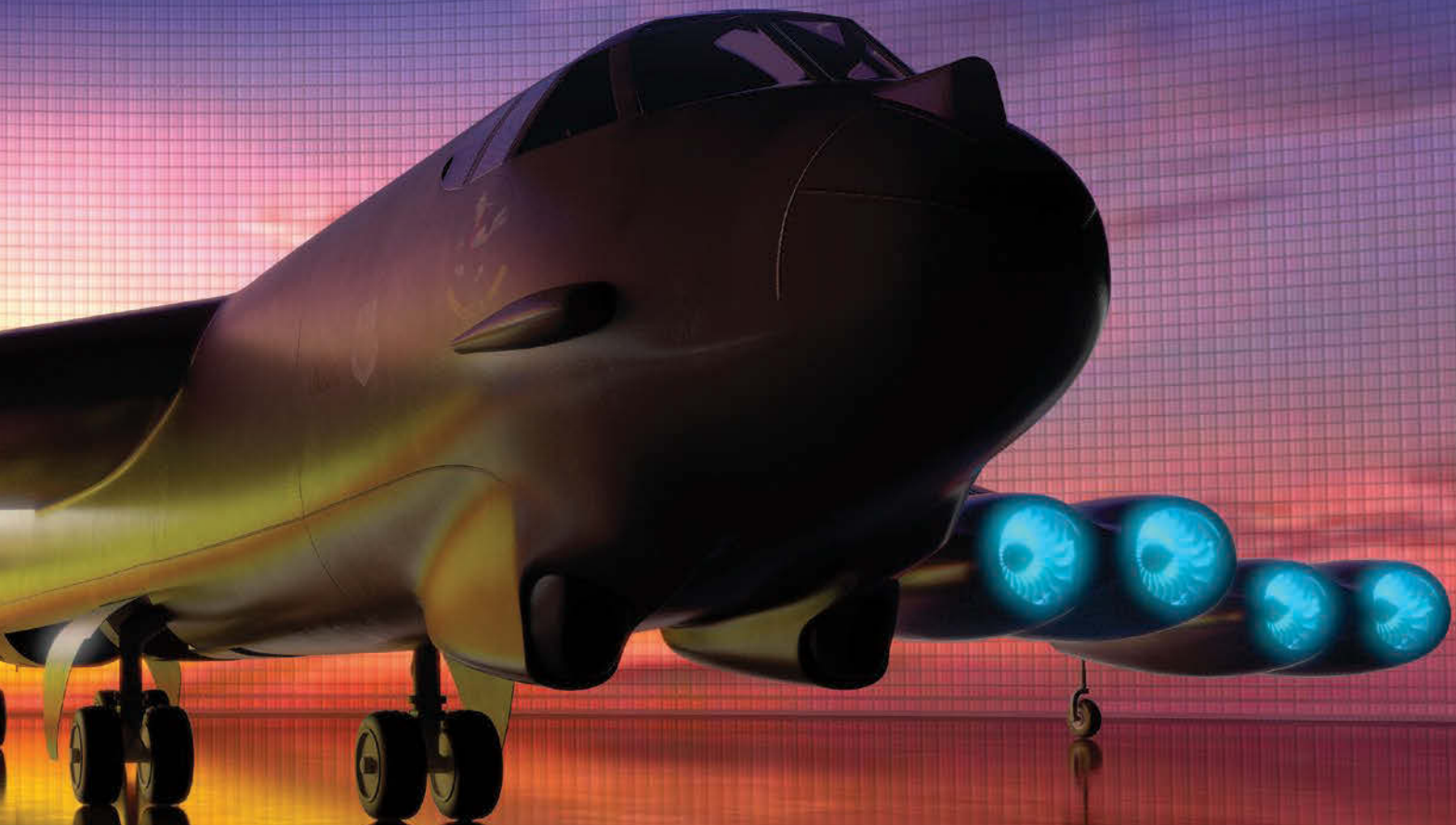
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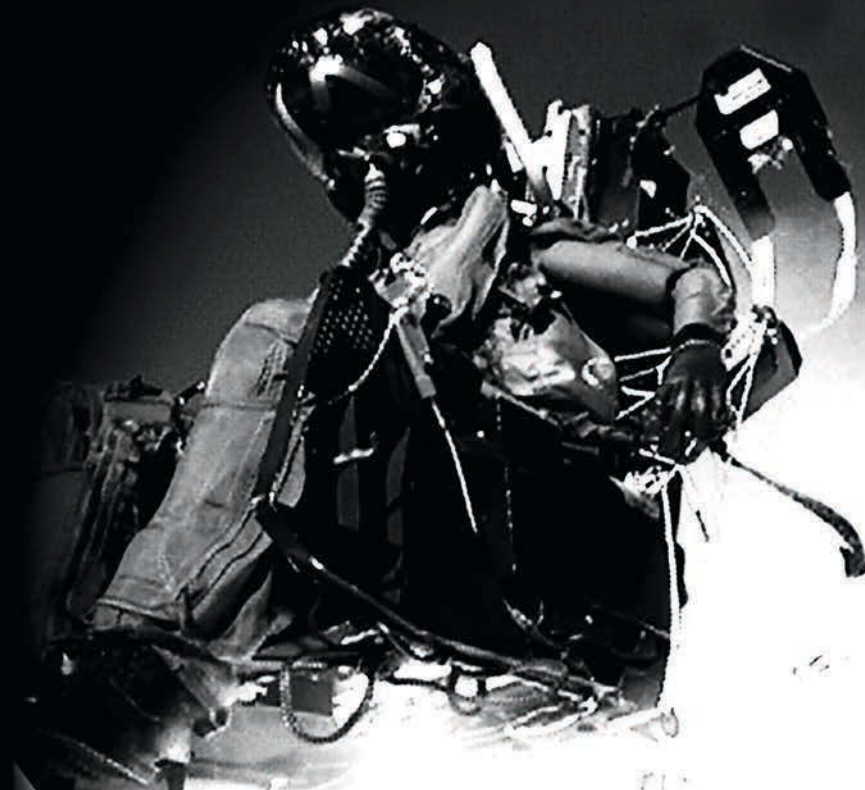
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