

Q&A  
With SECAF  
Heather Wilson 10

USAF AI Transformation 32 | A Better Bomber Vector 50 | Reaper Rewards 38

# AIR FORCE

MAGAZINE

# POWER UP

Block 4 adds brains and brawn to the F-35. 26



Published by the  
Air Force Association

March 2019

\$8



0 74470 29757 4

# THOSE BORN TO FLY LIVE TO WALK AWAY

## ACES 5<sup>®</sup>: Protects aircrew of all sizes

Protecting aircrew of all sizes is a mission that drives us relentlessly forward. It's why our ACES 5<sup>®</sup> ejection seat meets the exacting standards of MIL-HDBK-516C. It's why we've equipped it with advanced restraint systems, innovative technologies to stabilize the seat and better protect the head and neck, and an improved recovery parachute for safer descents. Learn more about the most advanced protection for your aircrew.

[collinsaerospace.com/aces5](http://collinsaerospace.com/aces5)



**Collins Aerospace**

## STAFF

### Publisher

Larry O. Spencer

### Editor in Chief

Tobias Naegele

### Managing Editor

Juliette Kelsey  
Chagnon

### Editorial Director

John A. Tirpak

### News Editor

Amy McCullough

### Assistant

### Managing Editor

Chequita Wood

### Senior Designer

Dashton Parham

### Pentagon Editor

Brian W. Everstine

### Digital Platforms

### Editor

Jennifer-Leigh

Oprihory

### Senior Editor

Rachel S. Cohen

### Production

### Manager

Eric Chang Lee

### Photo Editor

Mike Tsukamoto

### Contributors

Douglas A. Birkey,

John T. Correll,

David A. Deptula,

Robert S. Dudley,

Jennifer Hlad,

Shawn Waterman

### ADVERTISING:

### Kirk Brown

703.247.5829

kbrown@afa.org

### SUBSCRIBE

### & SAVE

Subscribe to  
*Air Force Magazine*  
and save big off  
the cover price,  
plus get a free  
membership  
to the Air Force  
Association.

1-800-727-3337

An MQ-9 in  
Southwest Asia.  
See p. 38.

### ON THE COVER



An F-35 Lightning  
II on the ramp.  
See "Keeping the  
F-35 Ahead of the  
Bad Guys," p. 26

Photo: SSgt. Jeremy Mosier

Photo: J.M. Eddins Jr./USAF

## DEPARTMENTS

### 2 Editorial: Delayed Gratification

By Tobias  
Naegele  
Does the  
argument for  
F-15X stand up  
to reality?

### 4 Letters

### 4 Index to Advertisers

### 6 Airframes

### 12 Aperture

What to expect  
from Shanahan;  
Nuclear force  
bill skyrockets;  
DOD and  
climate  
change ....

### 16 Verbatim

18 **World:** INF  
treaty out;  
Joe Jackson,  
MOH recipient;  
Afghanistan,  
China, and  
more ....

### 24 Faces of the Force

### 62 AFA Field Contacts

### 63 Airman For Life: AFA Chapter News

### 64 Namesakes: Bolling

## FEATURES

### 10 Q&A With the Secretary

An exclusive interview with Secretary of the Air Force  
Heather Wilson.

### 26 Keeping the F-35 Ahead of the Bad Guys

By John A. Tirpak

Operational testing is still underway, but the F-35 is  
already beginning its first major upgrade.

### 32 USAF's AI Transformation Takes Off

By Amy McCullough

AI cracks the code on better maintenance and  
faster training. Better and faster decision-making is  
next.

### 38 For MQ-9 Crews, 2019 is Time to Reap Just Rewards

By Brian Everstine

Fully manned crews and a focus on training means  
the RPA force is expected to reach new milestones  
in the coming year.

### 44 Halt, Who Goes There?

By Shawn Waterman

Today's Common Access Card won't disappear  
anytime soon—but the search for a better way to  
prove your digital identity is underway.

### 50 A Change in Vector

By Lt. Gen. David A. Deptula and Douglas A. Birkey

The Mitchell Institute on building America's future  
bomber force.

### 55 Peacekeeper by Fits and Starts

By John T. Correll

The Air Force explored more than 30 deployment  
options for MX, including air launch, a shell game in  
the desert, Dense Pack, and rail garrison.

### 60 The Air Force Chief of Staff Reading List

By Tobias Naegele

# Delayed Gratification

“The Air Force We Need,” which Air Force Secretary Heather Wilson outlined last fall, will continue to come into finer and finer focus this spring, as a series of follow-on studies near completion and the Air Force budget and modernization strategy is debated on Capitol Hill.

Encompassing 386 operational squadrons rather than today’s 312, the objective force was never intended to withstand a budget debate. Rather, it was designed free of budgetary constraints so leaders could understand the full extent of the mismatch between the 2018 National Defense Strategy and the force we have today. That force is too small, having been whittled and whacked over the past 15 years. The coming studies will provide alternative assessments regarding the service’s capacity demands and will consider force design alternatives that could potentially field greater combat power by means of new operational concepts and strategies.

Let’s hope so. The real world imposes budget constraints.

When the Trump administration unveils its budget the topline will be greater than 2019’s \$716 billion, a goodly sum that could approach \$750 billion. But with a cooling economy, rising interest rates, and a president indicating he’s had enough of “endless war,” another down cycle can’t be far off. Future defense budgets may not be able to keep up with inflation, let alone afford increases.

The Air Force, meanwhile, is behind the power curve. After failing for years to replace aging aircraft, it now must juggle multiple major acquisitions concurrently. Developing and acquiring the F-35 fighter, KC-46 tanker, B-21 bomber, T-X trainer, and UH-1 helicopter replacement at virtually the same time is already a perfect storm in budgetary terms. Every one of these programs is behind where it should be. And still, these are hardly the only priorities. The cost of modernizing nuclear forces is projected to rise 60 percent over the next decade (see Aperture, p. 12). Other priorities, from developing a more robust next-generation Global Positioning System and upgrading other space and cyber capabilities also add to the bill.

It’s like a family trying to buy two new cars, manage a whole-house renovation, take on a second home, and send the twins off to college—then repeating the feat every year for a decade. That’s a lot of risk to manage—no matter how much one scrimps and saves, such a load will put most families just one fiscal emergency from ruin.

And now comes a plan, in the midst of all this, to divert billions to buy a whole new fighter jet.

Air Force officials acknowledge the 2020 budget will include some \$1.2 billion for 12 new Boeing F-15X fighters. This new, more capable version of the F-15 does offer some advantages: It provides an upgrade to legacy F-15Cs that will need major upgrades to keep flying; it would help in air defense against cruise missiles, homeland security, and carry more missiles than smaller aircraft; and it could help keep another fighter house in business and share costs with allied foreign military customers already committed to the airframe. Finally, because at least one customer is willing to delay its acquisition, the airplanes could be delivered almost immediately.

That’s an attractive upside—until you look at the risks those benefits entail.

■ **No stealth.** Worldwide, air defenses are getting more capable and more dangerous. It’s not for vanity that the last five Air Force Chiefs and Secretaries have steadfastly maintained that the US not



Secretary of the Air Force Heather Wilson is strapped into an F-15D—the two-seat version of an F-15C—before a familiarization flight in 2018.

Photo: SSgt. Riley Johnson/ANG

buy any more 4th generation airplanes. It’s out of a robust desire to maintain air dominance and win. Were the US to find itself at war with Russia, China, or other allies of air defense customers, only stealth aircraft can expect to penetrate their modern air defenses. Until and unless those systems can be defeated, 4th gen aircraft will either get shot down or stay home. Ensuring the US has a full stable of stealth aircraft is the best way to ensure no such conflict ever arises.

■ **Costly.** At \$1.2 billion for 12 airplanes, even assuming a share for spares, these airplanes are at best comparably priced to new F-35As, and tens of millions more than the cost of a service-life extension for existing F-15Cs. It also adds another small fleet to the service, and all the added sustainment costs that go with that. To go back to our family budget example, why buy a new, bigger car just a year or two before the kids fly the coop? Maybe it makes more sense to fix that transmission after all.

■ **Overkill.** While the F-15X may not be well-suited to the high-end fight attacking deep into a peer competitor’s territory, it is being pitched instead as an answer to base and homeland defense missions. That’s fair. But existing F-15s, F-16s, and even B-1s modified to carry missiles could do the same job for less. And for attack missions where the Air Force has already achieved air dominance, it’s simply more jet than you need. There, a lower-cost armed variant of the T-X, or even propeller aircraft like the Super Tucano, Wolverine, or a remotely piloted aircraft could provide sufficient utility at a fraction of the cost.

■ **Deleterious.** The Air Force has a stated requirement for 1,763 F-35s. To date, it’s purchased fewer than 200, and current plans call for acquiring just 48 per year. If the Air Force can find another \$1 billion for fighters, investing that in more F-35s would accelerate procurement and drive down unit costs.

The F-15X is attractive, but its utility only fits into niche theoretical constructs. Unconstrained by budgetary reality, it seems like a great idea.

In the face of reality, however, this is a luxury the Air Force can ill afford. To achieve “The Air Force We Need,” the Air Force needs a force we can afford. Buying airplanes, even new updated versions, that date to the 1970s addresses only short-term risk.

If the United States Air Force must take on additional risk, the time to do so is now—when we can plan to solve the problem within a decade, not a decade or two from now, when we may not have time to recover.



**MQ-9B**

# THE FUTURE OF PERSISTENT ATTACK & RECONNAISSANCE

- 40,000 hours design service life
- Open architecture design for rapid integration of new payloads
- All weather operations with lightning protection, de-ice and anti-ice
- Dual redundant SATCOM data links
- Short runway operations with direct lift spoilers
- All airspace access with integrated Detect and Avoid suite
- Nine hardpoints

[ga-asi.com](http://ga-asi.com)

©2019 GENERAL ATOMICS AERONAUTICAL SYSTEMS, INC.



Leading The Situational Awareness Revolution



## Blasting Off

After reading your first editorial and letter in the December 2018 edition of *Air Force Magazine* ["The Air—and Space—Force We Need," p. 2, and "From the Editor in Chief," p. 3], I am wondering if you have had a chance to check in with most of your front-line Air Force Association members yet.

As a retired Air Force officer who spent her entire career in military space, and particularly space acquisition, I disagree with your and AFA's position on the lack of a need for a separate Space Force. As a result, I would like to cancel my life membership in the Air Force Association.

Even though the Deputy SECDEF cites Space as a warfighting domain in his report to Congress on Aug. 9, 2018, as per the US Air Force, the first Space War was actually fought in 1991 during Desert Storm. For those who think that the USAF has "got" the Space mission, and hence, no separate Space entity is actually required, there are decades of USAF personnel mismanagement examples since 1991 that demonstrate otherwise.

Here are some questions the Air Force Association (and Congress) may actually want to ask the USAF:

- 1) Why is it acceptable for an Air Force pilot, with no space experience, to lead a Space Wing, but it is not acceptable for a Space officer to lead an Air Wing?
- 2) Why do Air Force performance evaluations still have to be written so that any Air Force pilot on a promotion board can understand what a Space officer did, but the reverse is not true?
- 3) Why do Space officers have to change jobs every two years (just when they have learned their jobs) to be considered promotable in the Air Force?
- 4) Why does the Air Force send its best

and brightest Space personnel to NASA and the NRO?

5) Why are many junior Space officers, who are performing their wartime jobs in CONUS building and launching satellites, deployed overseas to non-space jobs, like protocol?

6) Why can't Space personnel be managed and promoted within their own career fields (similar to the Navy)—especially the engineers, program managers, and operators?

7) How can the Air Force be trusted to create any sort of Space cadre—especially when they created one in 2001 after the Space and Missile Systems Center moved into Air Force Space Command—and then let it atrophy?

8) Why are there more Space officers in the US Army than in the Air Force—especially since the Air Force has had Space responsibility for decades?

9) If the Air Force truly promotes what it values, why does the Air Force promote, at most, two Space officers to brigadier general at each brigadier general officer promotion board?

10) In light of the above, why should any Space entity fall under the Air Force's purview?

Space personnel in today's US Air Force remain second-class citizens, and I expect AFA to be more forward-thinking and forward-leaning than the US Army was during the creation of a separate Air Force.

If the US wants Space to be on equal footing with the rest of the warfighting domains, plus ensure seamless integration of these various domains in the future, the time for a separate Space entity is now.

Nancy R. Insprucker  
Manhattan Beach, Calif.

## INDEX TO ADVERTISERS

|                              |           |
|------------------------------|-----------|
| BAE Systems . . . . .        | Cover III |
| Collins Aerospace . . . . .  | Cover II  |
| GE Aviation . . . . .        | Cover IV  |
| General Atomics . . . . .    | 3         |
| Mercer . . . . .             | 17        |
| Pratt & Whitney . . . . .    | 15        |
| Rolls-Royce . . . . .        | 5         |
| USAF Charity Ball . . . . .  | 25        |
| USAA . . . . .               | 37        |
| -----                        |           |
| AFA Membership . . . . .     | 49        |
| AFA Monthly Giving . . . . . | 43        |

## WRITE TO US

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

—The Editors

## Air Force Association

1501 Lee Highway • Arlington, VA 22209-1198

[afa.org](http://afa.org)

Telephone: **703.247.5800**

Toll-free: **800.727.3337**

Fax: **703.247.5853**

## AFA's Mission

Our mission is to promote a dominant United States Air Force and a strong national defense and to honor airmen and our Air Force heritage.

### To accomplish this, we:

- **Educate** the public on the critical need for unmatched aerospace power and a technically superior workforce to ensure US national security.
- **Advocate** for aerospace power and STEM education.
- **Support** the Total Air Force family and promote aerospace education.

## Contacts

CyberPatriot . . . . . [info@uscypatriot.org](mailto:info@uscypatriot.org)  
 Field Services . . . . . [field@afa.org](mailto:field@afa.org)  
 Government Relations . . . . . [grl@afa.org](mailto:grl@afa.org)  
 Insurance . . . . . [afa.service@mercerc.com](mailto:afa.service@mercerc.com)  
 Membership . . . . . [membership@afa.org](mailto:membership@afa.org)  
 News Media . . . . . [communications@afa.org](mailto:communications@afa.org)

## Magazine

Advertising . . . . . [kbrown@afa.org](mailto:kbrown@afa.org)  
 Editorial Offices . . . . . [afmag@afa.org](mailto:afmag@afa.org)  
 Letters to Editor Column . . . . . [letters@afa.org](mailto:letters@afa.org)

## Change of Address/Email

In an effort to stay connected with AFA and your local chapter, please update your mailing and email addresses. Change of address requires four weeks' notice.

### To update your contact information:

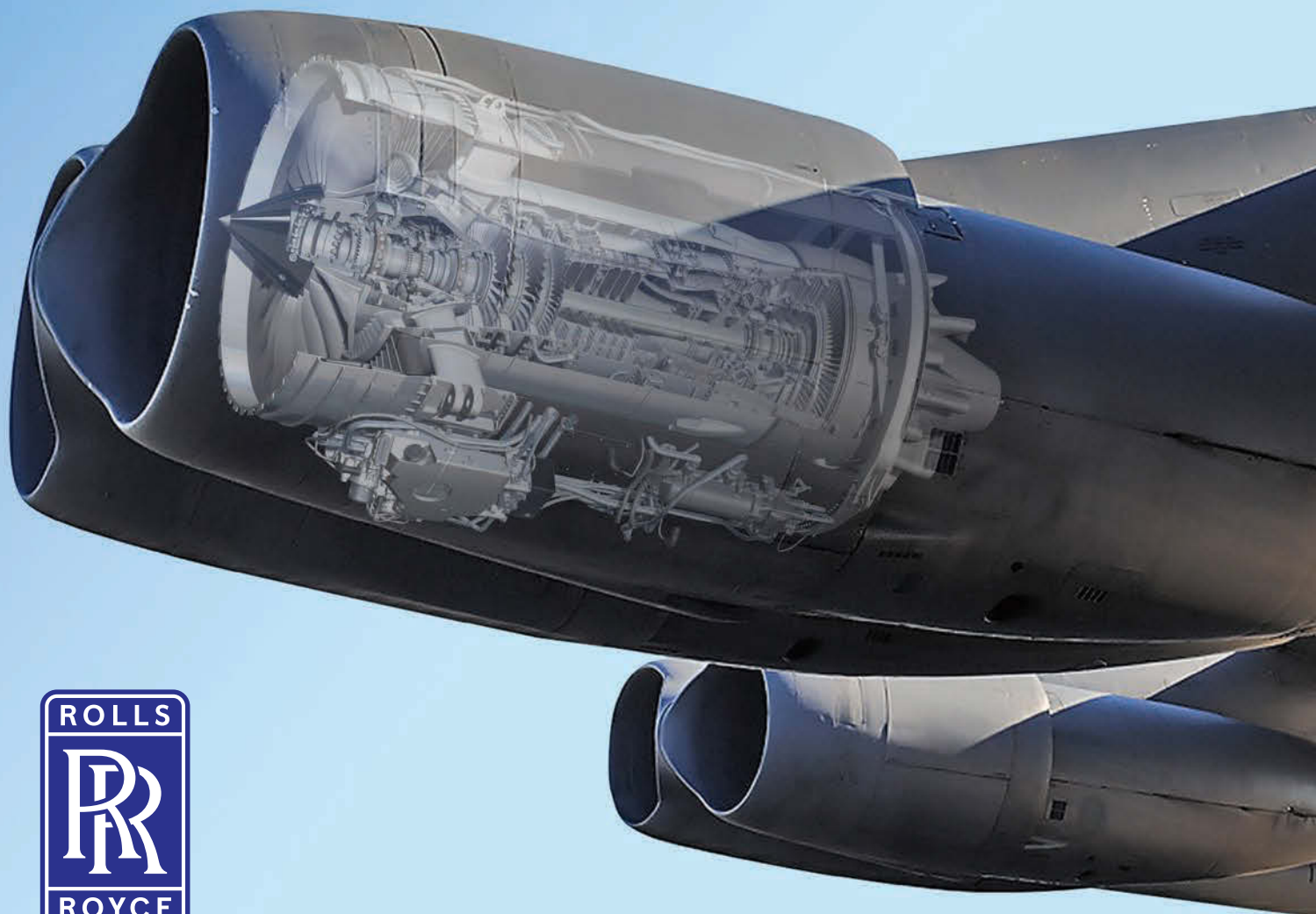
- **Email:** [membership@afa.org](mailto:membership@afa.org)
- **Visit:** The Members Only area of our website, [afa.org](http://afa.org)
- **Call:** Our Membership Department at 1-800-727-3337
- **Mail** your magazine label, including your first and last name, to our Membership Department at 1501 Lee Highway, Arlington, VA 22209-1198.



# F130 for B-52


## Proven. Efficient. Modern.

The Rolls-Royce F130 brings a reliable and combat-proven engine to the B-52 Engine Replacement Program. With over 22 million flight hours in the family of engines, the F130 is already in the US Air Force fleet with over 200,000 combat hours. F130 engines for the B-52 will be digitally engineered, manufactured, assembled and tested in the US, at Rolls-Royce North America. **American-made power for the B-52.**







A B-2 Spirit bomber is the central focus, shown from a low angle that emphasizes its sleek, stealthy design. The aircraft is on a runway at dusk, with the sky filled with soft, golden light and scattered clouds. The runway surface is wet, creating a clear reflection of the aircraft and the sky. In the background, another aircraft is visible on the tarmac, and a few lights are scattered across the horizon. The overall mood is serene and powerful.

A B-2 Spirit prepares for a training mission at JB Pearl-Harbor Hickam, Hawaii, in January. Some 200 airmen deployed from Whiteman AFB, Mo., to train with Hawaii-based F-22 Raptors, only the second time the bombers have deployed there. The stealth jet tandem demonstrated US resolve and power projection in the Pacific.

 **AIRFRAMES**





Cadet 2nd Class Eric Hembling peers into the US Air Force Academy's new Ludwig Tube, a compact Mach 6 wind tunnel that will aid in hypersonic research at the academy. USAFA stood up the Hypersonic Vehicle Simulation Institute in 2018, and cadets will participate in research this summer involving modeling and simulating the aerothermodynamic characteristics of hypersonic vehicles.

# The Secretary's SITREP

*Air Force Secretary Heather Wilson took time for an interview with Air Force Magazine editors Tobias Naegele and John Tirpak on Feb. 11 in her Pentagon office, where she offered updates on force structure, the Space Force, accelerating acquisition, and solving the challenges of sexual harassment at the Air Force Academy.*

**Q. You rolled out “The Air Force We Need” at AFA’s Air, Space & Cyber conference last September. Where are you now?**

A. The report that will go in on the first of March will ... provide all the analysis to the Hill in classified form. But there will also be an unclassified summary, and it will lay out in much greater and richer detail what we think we will need to support the National Defense Strategy. ... The presumption when we ... talked about it in September was not that we would fight the same old way, but that we will need to change the way we fight in the future. ... And that’s really driven by the threat. These kinds of things don’t stay static over time. We expect that they will develop. But for the first time, the Air Force will have a baseline that says, “this is the force we need to implement the National Defense Strategy.” And it’s really no surprise to anyone that the force we need is larger than the force we have.

**Q. Global Strike Command last year laid out its Bomber Vector, which said it would have to retire the B-1 and B-2 as B-21s come on board. Will that change?**

A. No. ... We need a minimum of 175 bombers ... a mix of B-21s and B-52s. We’re continuing to put money into the modernization of the B-52, re-engining and other kinds of systems. So, we’ll be driving that forward. The things that we said in September are still true, ... the stress on the force is in the ability to have long-range strike and the need for more bombers and tankers.

**Q. What if the B-21 isn’t ready as quickly as you hope?**

A. It’s on schedule at the moment, and we had the critical design review. We think that the program is being well-run at this point. So, there’s no change to the schedule.

**Q. By now the Air Force had expected to be buying 80-110 F-35s per year, but you’re still buying less than 60. That means you’ll have to keep F-15s and F-16s and maybe perform a service life extension program on them. Will you reach 80 or 100 F-35s in the next couple of years?**

A. Well, the reality is that our aircraft are aging. And we have been tasked to reorient ourselves to great power competition. The math ... suggests that we need to buy about 72 fighter aircraft a year, in order to restore the lethality of the force and to avoid a decline in the number of fighter squadrons that we have. There’s been some work this year on the mix that’s required on the 4th and 5th generation platforms, and what are we going to do with very old 4th generation



Photo: AIC Dalton Williams

**Air Force Secretary Heather Wilson**

aircraft. Does it make sense to extend them, or should they be replaced? And that’ll be one of the things we discuss in the context of the Fiscal 2020 budget.

We need to buy 72 aircraft a year to avoid a decline in the size of the fighter force. We’re actually going down to 54 fighter squadrons. ... That is not enough to be able to execute the National Defense Strategy at a reasonable level of confidence.

**Q. So, 72 aircraft a year of F-35s? Or could it be a mix of 60 F-35s and 12 of something else?**

A. It could be, yeah. But the real issue is ... we are not replacing aircraft fast enough, and they are aging out. Now, we are also ... restoring the readiness of the force. With the increases ... Congress approved and actually having a stable budget, ... we’re seeing an increase in our readiness. We’re about 15 percent more ready today than we were two years ago, and 90 percent of our operational squadrons are ready with their first force packages. ...

Readiness is about people, it’s about equipment and maintenance, and there’s a relationship between those. As an example, two years ago, we were 4,000 maintainers short.

[We] put a real emphasis on recruiting and training more maintainers, and as of December, [we were] no maintainers short in the Active force. ... [Now] we have a very young force, and they have to be seasoned and moved from being apprentices to journeymen and being masters of their craft. There are a couple of bases that are trying different ways to accelerate the training of maintainers ... to help master their craft more quickly.

**Q. The Air Force will ask to buy the F-15X in the coming budget. How does that square with the service's consistent position that it won't buy any "new old aircraft," but instead focus only on 5th generation fighters?**

A. The Air Force chose to continue with its topline that we were given to buy the F-35. But in the next stage of the process, we were asked, "If there was more money available for tactical air, what should we do with it?" And we've jointly—with OSD staff and Air Force staff—looked at that—particularly the problem of the aging F-15Cs. ...

What are all the missions that we're required to do in the National Defense Strategy? We need to defend the homeland; provide a safe, secure, and effective nuclear deterrent; be able to defeat a near-peer while we deter a rogue state; and counter violent extremism at lower levels of effort. Many of those missions require a 5th generation capability—but ... some ... might need a mix of 4th and 5th generation aircraft.

So, can we use new 4th generation aircraft for some of our missions, and does it make sense from a cost point of view to do so? Particularly with F-15Cs, where ... we're having some significant structural issues with those aircraft? Do we want to try to extend their life? How long can you do that? Is that cost-effective, and then, if we had a mix of new 4th gen and 5th gen, is that a good plan, rather than try to extend the life of these old airplanes? So, [for F-15X,] that was the question and the analysis.

**Q. Let's talk about the Space Force. Where are we?**

A. The president gave us guidance to have Space as an independent service underneath the Air Force, with its own Chief of Staff and undersecretary for Space. That model will keep space integrated; it will probably also be less costly, and we are moving forward with the implementation. ...

There's a lot of planning ... a lot of difficult work [on] finances ... personnel issues, all those things. ... We expect to begin that detailed planning work that's required within the next 30 days and pull together a small team that will report directly to the Chief and me.

**Q. And assuming you get the go-ahead?**

A. We would expect that [Fiscal 2020] would be an initial stand-up year and then there would be significant growth after that.

**Q. Will all the personnel come from the Air Force or will some come from other services?**

A. Ninety percent of what the United States military does in space is done by the ... Air Force. We have about 80 satellites; the Navy has about 13, for some specialty communications.

This planning team that we're setting up ... will also have representatives and links and support from the other services, as well as the [Defense Department] offices, so, that we have a really good, robust planning effort.

**Q. You've had a goal to accelerate the pace of acquisition. How are you doing?**

We're doing a lot ... [to take] advantage of new authorities given to us by Congress. We've stripped about 71 years out of Air Force acquisition over the last nine months, and we've set a goal to take out 100 years of Air Force acquisition time. ... We're being very transparent about it; we're doing reports to the Hill every four months on all of our experiments and prototypes. ...

We're also using Other Transactional Authorities, which is a new authority to move things quickly. We have our first "pitch day" in March. We figured out, with small business innovative research grants ... how to significantly reduce the time and complexity of contracting. ... We're going down to days for contracting ... so our most innovative companies can supply and engage the Air Force. We have a space enterprise consortium that is working very well, we just passed the one-year mark with them. We have over 270 companies involved in that, and it's 90 days from solicitation to contract award. So, I'm pleased with some of the results that I'm seeing.


**Q. Those Other Transactional Authorities are ideal for nontraditional suppliers. But what are you doing to speed things up with traditional suppliers?**

A. We're not just tailoring the [Section] 804 authorities, but every program is tailored under the 5000 series. So, for example, ... [the F-15 EPAWSS electronic warfare system] program manager said he could do his program faster if he broke it into two sub-reviews, one for initial production and another for fielding. This enables the program to reduce hardware lead times by starting hardware procurement early while the software continues through development. ... It's faster, it's also a lot smarter. ...

We're teeing up our program managers to make smart, commonsense decisions. And that applies to Lockheed Martin just like it would apply to a small subcontractor.

**Q. A recent report showed no real reduction in sexual harassment and an increase in unwanted sexual contact at the Air Force Academy. Do you have confidence in the leadership there? What do you think is necessary to change the culture?**

A. The results were disheartening. And the results were even before this current leadership team was there. But it's ... the incidents of sexual assault or unwanted sexual contact and sexual harassment [that] were really disheartening, not only to the Chief and I, but also to the leadership of the academy. The Chief and I have asked the superintendent to do a review of the results and the data and also to look at all of the programs that we've put in place, including many of which were put in place after these data were taken ... 18 months ago. And so, [we're] trying to accelerate the data analysis so we get a much better real-time picture of where we are. ...

[This] is affecting every university campus across the country, which is why the Naval Academy will host the first National Summit on Sexual Assault Prevention and Response at America's colleges and universities, and all three services are supporting it. We're inviting leaders from universities across the country to come and ... focus on what works in prevention, what are the real evidence-based best practices to reduce assault and unwanted sexual contact. It's a national issue, and we think we have an obligation to lead. 

## What to Expect from Shanahan; Nuclear Forces Bill Skyrockets; Pentagon Copes With Climate Change



Photo: Sgt. Amber Smith/USA

Acting Defense Secretary Patrick Shanahan addresses a group of reporters off-camera at the Pentagon in January.

### THE SHANAHAN ERA

FEB. 4, 2019

Following the resignation/firing of James Mattis in December, Patrick M. Shanahan may be President Trump's extended-term choice to lead the Defense Department. Shanahan is likely to continue his technocratic focus, whether as acting secretary or as a confirmed nominee, rather than pursue a foreign policy parallel to that of the White House and State Department, as Mattis did.

Although Shanahan, at this writing, is still Acting Defense Secretary, Trump has endorsed him on several occasions, calling him "a wonderful man" during his December visit to Iraq. Trump suggested Shanahan may be in the top Pentagon job "a long time."

In fact, if Shanahan is still acting secretary Mar. 1, he will eclipse the record of William Howard Taft IV, who served 60 days in that capacity in 1989, during the George H.W. Bush administration.

The law is unsettled about how long Shanahan could serve in an "acting" capacity without being officially nominated for the job, and Trump said in early January that "I sorta like 'acting'" because that status gives me more "flexibility." Mick Mulvaney has been serving as "acting" chief of staff at the White House since the departure of Retired Marine Gen. John F. Kelly on Jan. 1, but that position is not subject to Senate confirmation. Trump said he's "in no hurry" to make either appointment permanent.

Shanahan was confirmed by the Senate as deputy, so his confirmation seems likely if Trump officially nominates him for the job.

Shanahan has been supportive of controversial Trump policies, particularly Trump's demand for a US Space Force, and he has echoed some of Trump's rhetoric regarding missile defenses and progress in reducing the nuclear threat from North Korea. He has not publicly differed with the president on any policy matters.

He told reporters his priority will continue to be to posture the US military for great power competition and to expedite the fielding of new equipment affordably. He said he'll be less active in diplomacy than Mattis, whose background as a former combatant commander gave him extensive experience with foreign militaries; experience Shanahan lacks.

In a late January press conference with NATO Secretary General Jens Stoltenberg, Shanahan repeated Trump's assertion that NATO partners haven't paid their fair share to the alliance, but are doing so now. He said NATO allies have increased defense spending by \$41 billion since 2016 and forecast that contribution will increase to \$100 billion by 2020. He went beyond Trump, though, in saying the US is with NATO "100 percent."

In his first press conference since being named Acting Defense Secretary, Shanahan said he wants to establish a separate Space

Force “under” the Air Force and to make it as small as possible to carry out the mission.

He told reporters in an off-camera Jan. 29 meeting that he has settled on the person “who would lead Space Command” but didn’t disclose who he has in mind.

Space Force will be a topic for discussion “over the next five, six months,” Shanahan said.

“The focus will be ... ‘How do we go faster with delivering capability?’” Shanahan said. Acknowledging concerns about bureaucracy, he said, the Pentagon must answer a key question: “How do we not generate unnecessary cost?”

“It’s going to be small—[to have] as small as possible footprint. That’s why it’s ... recommended it sits underneath the Air Force.” The main objective of delivering technology faster will be “leveraging commercially available technology,” he said.

Shanahan sought to clarify Trump’s assertion that ISIS is defeated in the Levant, saying that the terror group is more than 99.5 percent crippled—but is still able to plan attacks and worthy of attention and military action. While there’s “more work to be done,” ISIS is now “incapable of governing” the territory it once held in Syria, Shanahan said.

Asked if he’s willing to challenge Trump on military matters, Shanahan said, “I’m always prepared to give the president feedback. That’s what he asks me to do. That’s my job, okay?”

## BOEING MAN?

Shanahan worked for 30 years at Boeing and was credited with building and refining that company’s global supply network. That long-term relationship might be problematic if he’s seen as too sympathetic to his former employer. Boeing secured three major defense contracts in the fall—the Navy’s MQ-25 refueling drone, and the Air Force’s T-X advanced trainer and UH-1N helicopter replacement—and Shanahan has criticized the F-35 fighter, made by Boeing rival Lockheed Martin.

Asked about potential conflicts of interest, Shanahan said all DOD executives must sign “ethics agreements” and noted he has recused himself from involvement in any actions regarding Boeing. Paraphrasing the questions about his loyalties, he said, “Am I ... still wearing a Boeing hat? ... I think that’s just noise.”

Whether it is or not, the Air Force appears poised to include funding for a souped-up version of the Boeing F-15, called the F-15X, in its upcoming budget submission. That would mark a reversal of nearly two decades of Air Force policy that it will not buy any “new old” airplanes. Asked if he’s an enemy of the F-35—and by implication, a supporter of the F-15X—Shanahan said: “I am biased toward performance. I am biased toward giving the taxpayer[s] their money’s worth. And the F-35, unequivocally, I can say, has a lot of opportunity for more performance.”

## NUCLEAR INFLATION

Maintaining nuclear weapons to deter Russia, China, and others just got a lot more expensive. The cost of operating and modernizing the nation’s nuclear arsenal over the next 10 years has ballooned by 23 percent in just two years.

The Congressional Budget Office, a bipartisan agency, is required to calculate the 10-year costs of the nuclear enterprise every two years. The last estimate, in 2017, predicted costs for the nuclear enterprise from 2017-2026 at \$400 billion. The latest forecast, released in January, pegs the pricetag at \$494 billion from 2019-2028.

“The period now includes two later [and more expensive] years of development in nuclear modernization programs,” CBO reported, accounting for more than half the increase, or \$51 billion. Normal “economy wide” inflation is also higher, accounting

for “about one-fourth” of the rise. The balance comes from new modernization programs called for by the Nuclear Posture Review, which added another \$37 billion.

It’s important to note that these two-year reviews are separate from an October 2017 CBO report that pegged the cost of modernizing virtually every aspect of the nuclear enterprise at \$1.242 trillion through 2046. Those programs include a new ICBM (the Ground-Based Strategic Deterrent); a new stealth cruise missile; B-21 bombers and upgrade of the existing B-1, B-2, and B-52 bomber fleets; new ballistic-missile submarines, as well as a new sea-launched ballistic missile; updated nuclear command, control, and communications systems; and an overhaul of the nuclear weapons development, production and sustainment enterprise, mostly through the Department of Energy.

The difference between the two CBO reports is that the modernization estimate extends through the 2040s, but does not include all operations costs. The biennial estimate released in January, meanwhile, covers just 10 years and includes development and operations costs.

In the new estimate, the CBO said that \$432 billion of the \$494 billion estimate would “implement the administration’s 2019 plans as DOD and DOE have laid them out—provided those plans did not change or experience any cost growth or schedule delays.” The remaining \$62 billion is CBO’s estimate of cost overruns “incurred over the 2019-2028 period if the costs of nuclear programs exceeded planned amounts at roughly the same rates” as seen in the past.

Broken down, CBO’s new estimates are as follows:

- Strategic nuclear delivery systems and weapons: **\$234 billion**
- Tactical nuclear delivery systems and weapons: **\$15 billion**
- DOE labs and activities: **\$106 billion**
- The nuclear C3 and early warning system: **\$77 billion**

Over the 10-year period, annual costs rise steeply from \$33.6 billion to \$53.5 billion, CBO said, an increase of 60 percent through 2028. That works out to a compound annual growth rate of 4.76 percent—more than double the inflation rate.

What was the effect of the 2018 Nuclear Posture Review on these estimates? The CBO noted that three new capabilities called for in that review—a new low-yield warhead; a new sea-launched cruise missile (SLCM), and an increase in plutonium-production capability—added \$17 billion to the total over 10 years.

The new SLCM and its warhead would cost \$9 billion across the 10 years, assuming the SLCM’s design “would draw heavily” from that of the Air Force’s new Long-Range Standoff missile, or LRSO.

## FEET WET: CLIMATE CHANGE HITS BASES

The Pentagon is feeling the effects of climate change and is taking steps to become more resilient against its effects, according to a new Pentagon report released in January.

In “Report on Effects of a Changing Climate to the Department of Defense,” Ellen M. Lord, undersecretary for acquisition and sustainment, notes that climate change is having an acute impact on military bases. Rising sea levels threaten JB Langley-Eustis and nearby naval bases in Norfolk and Virginia Beach, wildfire risks are rising at Rocky Mountain bases, and desertification threatens Western states. Thawing permafrost is undermining facilities in Alaska, and droughts are hurting readiness across a wide swath of US and overseas facilities.

Of the 35 Air Force bases considered by the Pentagon for susceptibility to climate change effects, 32 were deemed vulnerable to wildfires; 20 to flooding; 20 to drought and four to desertification. The latter four are Creech AFB, Nev.; Hill AFB, Utah; Nellis AFB, Nev. and Kirtland AFB, N.M. These facilities are expected to become even drier than they already are, making



Photo: SMSgt. John Rohrer/ANG

**Climate change is expected to affect the schedules of future military exercises at bases across the country. An F-16 above participates in Green Flag exercises in November at Nellis AFB, Nev.**

them vulnerable to “erosion and increas[ing] soil fragility, possibly limiting future training and testing” activities.

Climate change is also heightening tensions, instability, and the risk of humanitarian disasters overseas, particularly in Africa, which is seeing a new cycle of “flooding and drought/desertification.” Melting ice in the Arctic is making that region more navigable for more of the year, requiring a greater naval presence and increased search and rescue capabilities, the report said. Forces must be ready to deal with each of these.

Of the 79 bases examined in the report, “about two-thirds” are vulnerable to recurrent floods, with Langley and Hampton Roads facing the greatest threat, according to the report. Built at sea level, those bases already have seen more than a foot of sea level rise, leading to recurrent floods that hurt the bases’ ability to perform their missions.

At Langley, for example, where flooding is becoming “more frequent and severe,” the Air Force has ordered that all new development be constructed at a minimum elevation of 10.5 feet above sea level, “with some projects planned for higher elevation due to high communication intensity and need for greater hardening.”

At the same time, Eglin and MacDill Air Force Bases in Florida are working with local communities to “address coastal erosion around their installations.” While the report did not blame the recent hurricane damage to Tyndall AFB, Fla., on climate change, it noted that coastal facilities in general are taking greater punishment from more frequent and powerful storms.

Rising temperatures drove the Defense Logistics Agency to increase cooling power in its data centers “to ensure provision of the cooling needed for processors and servers to operate efficiently in warmer temperatures.” DLA is also planning to relocate some facilities “from flood-prone areas to safer areas,” Lord’s report noted.

Fort Hood, Texas, has seen a sharp increase in flash floods.

During a 2016 exercise involving “a low river crossing,” flash floods “resulted in the death of several soldiers,” the report noted.

Drought is considered a hazard for virtually all US bases, increasing the potential for wildfires and impairing operations and training. This will lead to an increase in “the number of black flag day prohibitions for testing and training,” Lord’s report said. Drought increases the risk of “heat-related illnesses, including heat exhaustion and heat stroke.”

Prolonged drought also leads to “significant reduction in soil moisture at several Air Force bases, resulting in deep or wide cracks in the soil, at times leading to ruptured utility lines and cracked road surfaces.” At Edwards AFB, Calif., drought has caused large cracks to open up in the dry lakebeds used as runways, putting the value of the base itself—located there for its huge expanses of flat, concrete-hard surfaces—at risk.

Lord’s report said all departments are now preparing comprehensive plans for a response to climate-change effects and mitigation efforts. It did not forecast what the cost of these efforts will be. However, it did say that even where evaluated bases did not face a present problem with climate change, eventually, they will.

“In a few instances, locations considered not currently vulnerable were deemed to be vulnerable in the future,” the report said, positing that seven military bases not currently facing chronic flooding can expect to have that problem in the near future, while five bases not now subject to drought will face excessively dry conditions soon, as will “a number of installations” likely to face wildfires.

“It is relevant to point out that ‘future’ in this analysis means only 20 years in the future,” the report warned. “Projected changes will likely be more pronounced at the mid-century mark.” Absent new strategies to mitigate the risks, the report concluded, mission effectiveness will be degraded severely. ✦





GO BEYOND

MILITARY ENGINES

# A PROVEN ENGINE THAT'S COMBAT READY.

## FUELING THE FIGHT.

Pratt & Whitney is proud to power the United States Air Force's KC-46 tanker with the PW4062 engine. Proven in the commercial sector, this engine comes with a track record for safety, reliability and performance. With its low maintenance costs and global inventory of spare parts, the PW4062 is dependable in the air and on the ground.

SEE THE FUTURE OF MOBILITY AT [PW.UTC.COM](http://PW.UTC.COM)



**Interception**



Photo: DPRK Korea

"For certain regional geographies—North Korea comes to mind—we actually think it's entirely possible and cost-effective to deploy what I will loosely call air-to-air interceptors, although possibly of new design, on advanced aircraft [and] using the aircraft as either sensor or weapons platforms to affect a missile intercept."

**Michael Griffin**, undersecretary of defense for research and engineering on possible creation of a new F-35 ICBM-killing weapon

**Closer Look**

"The Trump White House .. proposed that all clearance activities be shifted to the Pentagon, and that the Defense Security Service get a new name highlighting its counterintelligence mission. An Executive Order is now pending that would shift all of OPM's personnel and resources involved in clearances to the new agency."

**Loren Thompson**, Lexington Institute [Forbes.com, Jan. 7]

**The Weaponization of Social Media**



Staff illustration

"We need to move beyond our 20th century approach to messaging and start looking at influence as an integral aspect of modern irregular warfare."

**Andrew Knaggs**, the Pentagon's deputy assistant secretary of defense for special operations and combating terrorism, speaking at a defense industry symposium Feb. 5



Photo: Joyce Boghosian/White House

**Enough**

"Great nations do not fight endless wars."

Remarks from **President Donald J. Trump** at his second State of the Union speech on Feb. 5 on concluding military operations in the Middle East

**Crowded Space**

"We assess that commercial space services will continue to expand; countries—including US adversaries and strategic competitors—will become more reliant on space services for civil and military needs, and China and Russia will field new counter-space weapons intended to target US and allied space capabilities."

Statement from National Intelligence Director **Daniel R. Coats**

**Out of Here**



Photo: Ron Pryzucha/State Department

"For years, Russia has violated the terms of the Intermediate-Range Nuclear Forces Treaty without remorse. ... Russia's violations put millions of Europeans and Americans at greater risk."

Secretary of State **Mike Pompeo** speaking from the State Department announcing US suspension of the INF Treaty [CNN, Feb. 1]



Photo: Kremlin

**Do svidaniya!**

[ Do svidaniya translates from Russian to interject: farewell, goodbye, see you later, until we meet again. ]

"Our response will be symmetrical. Our American partners announced that they are suspending their participation in the INF Treaty, and we are suspending it too. They said that they are engaged in research, development and design work, and we will do the same."

Russian President **Vladimir Putin's** response to US departure from INF Treaty

**Makeover**

"The current vetting process for security clearances and positions of trust is too complicated, takes too long, costs too much, and fails to capitalize on modern technology and processes. We are taking too many security risks and losing talented people who are not willing to endure a years-long process. Our current system is broken and needs a revolution."

Remarks by **Sen. Mark Warner** (D-Va.) who introduced a bill to overhaul DOD security clearances



## The AFA Group Term Life Insurance Plan



### Securing the present. Protecting their future.

You understand commitment to securing the lives of others, but would you feel confident about your family's financial future in the event that something happens to you and you're not around to fulfill that commitment?

Life insurance can offer peace of mind to help your loved ones with the burden of extra expenses, as well as with the taxes and debt you may leave behind.

At AFA, we mirror that sense of commitment. That's why we sponsor the AFA Group Term Life Insurance Plan to our members.

**Learn more\* about the AFA Group Term Life Insurance Plan.  
Call 1-800-291-8480 or visit [www.afainsure.com](http://www.afainsure.com)**



#### AFA GROUP TERM LIFE INSURANCE PLAN FEATURES:

- COMPETITIVE GROUP RATES
- "ACCELERATED BENEFIT" IF DIAGNOSED WITH A TERMINAL ILLNESS
- NO MILITARY EXCLUSIONS
- PROTECTION 24 HOURS A DAY, 365 DAYS A YEAR
- PREMIUMS WAIVED IF TOTALLY DISABLED
- FAMILY COVERAGE AVAILABLE FOR SPOUSE AND DEPENDENT CHILDREN



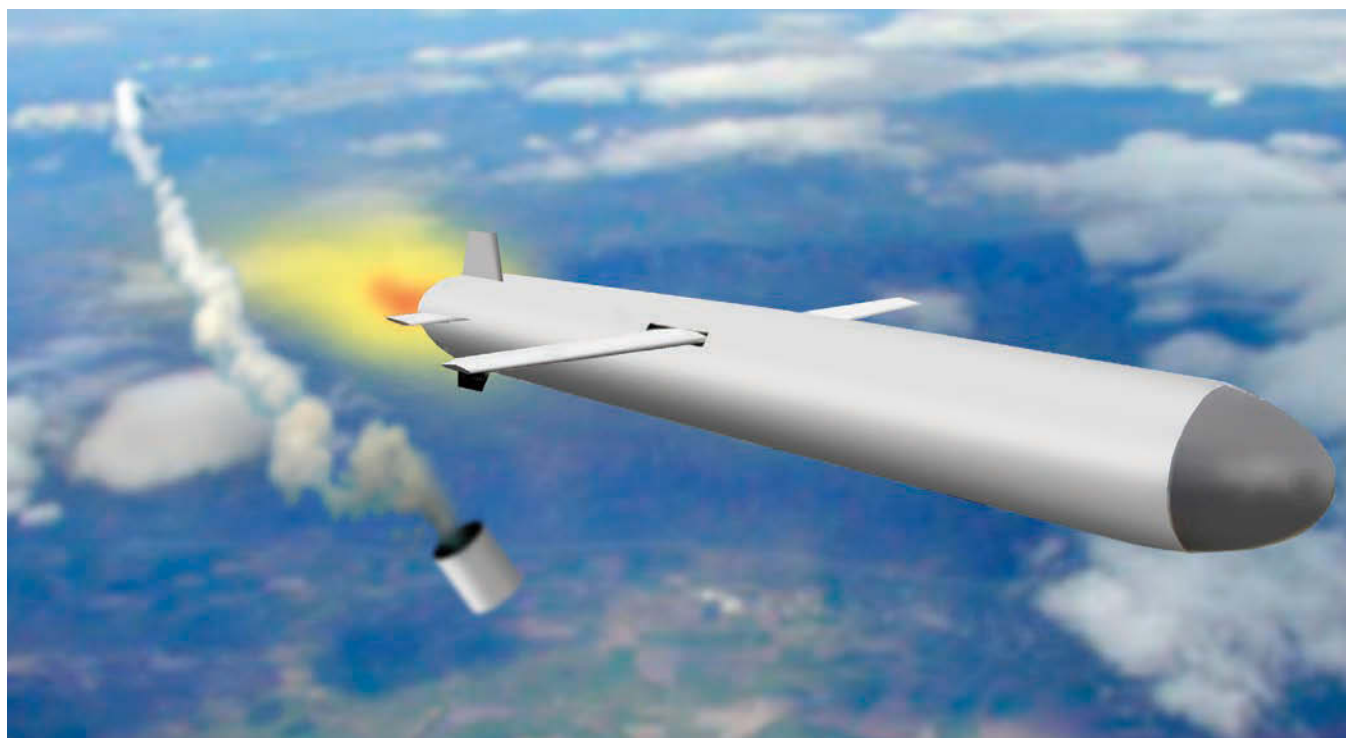
Underwritten by: New York Life Insurance Company, 51 Madison Avenue, New York, NY 10010 on Policy Form GMR-FACE/G-30290-0 Under Group Policy N. G-30290-0

\* Including features, costs, eligibility, renewability, limitations and exclusions.

Program Administered by Mercer Health & Benefits Administration LLC  
AR Insurance License #100102691  
CA Insurance License #0G39709  
In CA d/b/a Mercer Health & Benefits Insurance Services LLC

86647 (3/19), 87328 (10/19) Copyright 2019 Mercer LLC. All rights reserved.

# For US and Russia, It's Off to the (Cruise Missile) Races



Air Force Magazine staff illustration

An illustration of what the Russian Novator 9M729 cruise missile might look like after it ejects its booster and begins flight to its target. The US claims it violates the ban on producing, testing, or deploying any land-based or ballistic missile with a range of 310 to more than 3,400 miles.

By Rachel S. Cohen

**T**he United States and Russia each pledged to invest in research and development of short- and intermediate-range, land-based missiles in the wake of the Trump administration's formal announcement to leave the Intermediate-Range Nuclear Forces Treaty this summer.

In a move backed by NATO, the Trump administration said it is strategically unwise to remain in a pact Russia flouts.

Meanwhile, China—an increasingly close Russian ally and the Pentagon's top geopolitical adversary—urged the feuding countries to uphold the existing treaty.

The US and Soviet Union signed the INF Treaty in 1987, banning all land-based ballistic and cruise missiles, nuclear or conventional, that can strike targets between 500 and 5,500 kilometers away. After reviewing the treaty in 2017, the president announced last year he would pull out of the Reagan-era agreement.

**“We cannot be the only country in the world unilaterally bound by this treaty, or any other.”**

—the White House

Secretary of State Mike Pompeo confirmed on Feb. 2 that the US delivered written documents to the Russians and other former Soviet states notifying them of the withdrawal. The US stated Russia must eliminate all 9M729 land-based cruise missiles, including launchers and associated equipment, by August for the treaty to remain intact, Pompeo said.

“We cannot be the only country in the world unilaterally bound by this treaty, or any other,” the White House said Feb. 1. “We will move forward with developing our own military response options and will work with NATO and our other allies and partners to deny Russia any military advantage from its unlawful conduct. ... We stand ready to engage with Russia on arms control negotiations that meet these criteria.”

In response, Russian Defense Minister Sergei Shoigu proposed modifying submarine-based cruise missiles for use on land, as well as a plan to create land-based launchers for hypersonic missiles that fall in the range banned by the INF Treaty, according to a transcript published Feb. 2.

Russian officials also called for a halt to disarm-

ment talks, for an inspection of denuclearized American submarine-based missile launchers and bomber aircraft to ensure they cannot be returned to the nuclear arsenal, and for a plan to neutralize other countries' space weapons.

"Russia will not deploy intermediate-range or shorter-range weapons, if we develop weapons of this kind—neither in Europe nor anywhere else until US weapons of this kind are deployed to the corresponding regions of the world," President Vladimir Putin said.

Russian Foreign Minister Sergei Lavrov accused the US of violating the three-decade-old pact since 1999 by testing combat drones and claimed Russia had done "everything we could to save the treaty."

Critics of US withdrawal argue leaving the pact will spur a new arms race. But US Strategic Command chief Gen. John E. Hyten said new "credible, flexible" nuclear weapons will deter other countries from launching their own.

In the Nuclear Posture Review unveiled last year, the Trump administration recommended research on a ground-launched cruise missile and developing a sea-launched cruise missile in response to Russia's deployment of 9M729 weapons, also known as the SSC-8.

"Research and development is not prohibited by the INF Treaty," Hyten said a year ago. "If they [Russia] don't come back into the fold on INF, then we'll be prepared to respond accordingly as we go forward. That's going to be a very complicated discussion. ... But the capabilities we propose are to respond to the threat and hopefully give our diplomats room to move."

US administration officials stressed that while Russia would be at fault for starting any potential arms race, leaving the treaty has a second benefit: It allows the US to address nuclear threats posed by China and Iran as well.

"It will take us time to make decisions about what kind of capability would we deploy, what kind of capability would we test," one official said in a background call with reporters. "We are some time away from a flight test. We are certainly time away from an acquisition decision and from an eventual deployment decision. What we do know is that we are only looking at conventional options at this time."

That holds true for the conventional, ground-launched cruise missile under consideration, although the Nuclear Posture Review also specifically notes a nuclear-armed, sea-launched cruise missile "will provide a needed nonstrategic regional presence, an assured response capability, and an INF-Treaty compliant response to Russia's continuing treaty violation."

Sea- and air-launched weapons are allowed under the agreement.

"We are some time away from having a system that we would produce, that we would train soldiers or airmen or Marines to deploy, and then, certainly, before we would be in a position to talk about basing, potentially in allied countries," a senior official said.

Congress allocated \$48 million in Fiscal 2019 toward research on systems that would violate the treaty if deployed.

Ian Williams, a fellow at the Center for Strategic and International Studies, wrote in October 2018 that developing American intermediate-range missiles could actually be the most promising path toward further nonproliferation efforts.

"History shows that Russia is most interested in arms control when it feels like it is falling behind," Williams said. "Walking away from the treaty now will, in the long run,



Photo: Erik Luntang/NATO

### NATO Secretary General Jens Stoltenberg at the World War II Memorial in Washington D.C., on Jan. 27, 2019.

enable the United States to more affordably strengthen the defense of its allies and overseas forces and demonstrate that it takes arms control obligations seriously."

During his Feb. 5 State of the Union address, President Donald J. Trump said the US may be able to hash out a replacement treaty that brings in China and other new signatories. If not, he promised, America will "outspend and out-innovate all others by far."

But a spokesman for China's Ministry of Foreign Affairs dismissed the idea of a multilateral pact.

"As an important bilateral treaty in arms control and disarmament, this treaty plays a significant role in easing major-country relations, promoting international and regional peace, and safeguarding global strategic balance and stability," said spokesman Geng Shuang. "China is opposed to the US withdrawal and urges the US and Russia to properly resolve differences through constructive dialogue. ... Multilateralization of the INF Treaty involves a series of complex issues covering political, military and legal fields, which draws concerns from many countries."

On Capitol Hill, Senate Armed Services Committee leaders clashed in their responses to the news. Chairman Jim Inhofe (R-Okla.) praised the end of the INF Treaty as Ranking Member Jack Reed (D-R.I.) called for an extension of the New START Treaty until 2026 to bolster what he sees as weakened arms control.

While House Armed Services Committee Chairman Adam Smith (D-Wash.) tried to make the case that America's European allies see withdrawal as a betrayal, and NATO Secretary General Jens Stoltenberg said Feb. 1 the coalition backs the US's decision.

NATO worries Russia could use cruise missiles to destabilize its command and control, logistics, and air bases.


"For over five years, allies and the United States in particular, have repeatedly raised their concerns with the Russian Federation, both bilaterally and multilaterally," NATO's foreign ministers said. "Russia has responded to our concerns with denials and obfuscation. ... Allies have emphasized that the situation, whereby the United States and other parties fully abide by the treaty and Russia does not, is not sustainable." 



Photo: U.S. Air Force photo/AFA Library

A C-123 piloted by Lt. Col. Joe Jackson (circled) prepares to evacuate the last three men from Kham Duc airfield, South Vietnam, during a battle with North Vietnamese forces on May 12, 1968.



Photo: USAF/AFA Library

## Joe M. Jackson 1923-2019

By John A. Tirpak

Joe M. Jackson, a 33-year Air Force veteran who served in WWII, Korea and Vietnam, and who received the Medal of Honor for action during the latter conflict, died Jan. 12, at the age of 95.

Jackson was born in Newman, Ga., and enlisted in the Army at age 18, becoming a crew chief on B-25 Mitchell bombers. He applied to become an aviation cadet and won his wings, receiving his commission and becoming a fighter pilot in P-40 Thunderbolt and P-63 King Cobras, serving as a gunnery instructor. Toward the end of WWII, he transitioned to the B-24 Liberator.

He returned to combat during the Korean War, amassing 107 combat missions in the F-84 Thunderstreak fighter-bomber with the 524th Fighter Squadron. After the war, he was among the first Air Force pilots to fly the super-secret U-2 spyplane, supervised detachments of the aircraft worldwide, and developed a campaign of aerial reconnaissance over Cuba during the Cuban Missile Crisis. Jackson got his bachelor's and master's degrees in political science in the early 1960s, at night school.

He went to Vietnam in 1967, flying the C-123 Provider with a Special Operations Squadron, building up to 298 combat missions.

On May 12, 1968, he volunteered to attempt the rescue of three airmen; a C-130 navigator and two combat controllers that had been left behind at Kham Duc, an airfield near the Laos border being used by Army Special Forces. It was about to fall to North Vietnamese regulars and Viet Cong, and was taking heavy ground fire from mortars, rockets, .50 cal. machine guns and small-arms fire.

The evacuation of troops from the airfield was largely complete, but the operation had already or would claim seven

aircraft lost to enemy fire, including a CH-47 wrecked halfway down the runway.

A previous C-123 attempting the rescue had nearly been shot down, as well. It had to leave because of low fuel, but was able to spot the three airmen needing evacuation. Jackson made an extremely steep approach to the field, evading heavy fire from the edge of the airfield, avoiding the wrecked helicopter and an unexploded rocket on the runway. He slowed to pick up the three men, escaping the field and returning to base without suffering any hits on his aircraft.

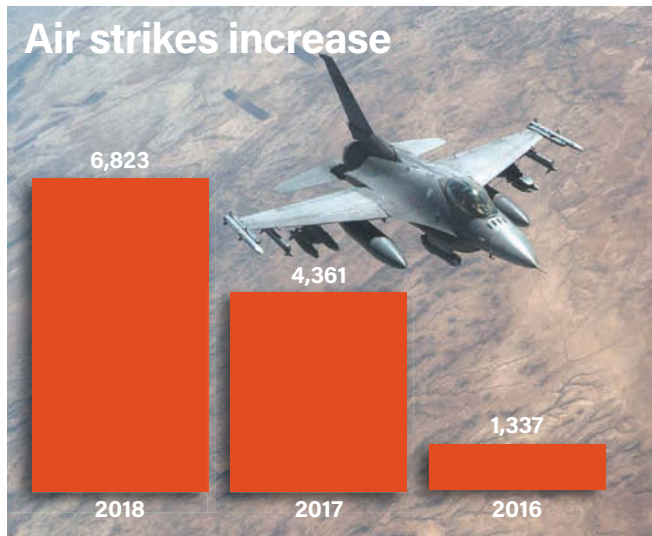
For his heroism in pressing the rescue despite tremendous enemy fire, his skill in landing the aircraft and taking it off under difficult conditions, and rescuing the three troops, Jackson was decorated by President Lyndon B. Johnson Jan. 16, 1969—nearly 50 years to the day before Jackson's death. The other members of Jackson's crew were also decorated by Johnson.

After Vietnam, Jackson worked as a planner in the Pentagon and taught strategic studies at the Air War College. He retired in 1971 with the rank of colonel.

In addition to the Medal of Honor, Jackson also received the Distinguished Flying Cross, Legion of Merit, and three air medals among his decorations. He was also credited with a number of aeronautical innovations. These included developing formulaic methods for returning to base in bad weather; landing jets under conditions of low visibility and low ceilings; organizing large movements of aircraft across oceans, and a bomb-tossing technique used in the delivery of nuclear weapons.

In 1997, Jackson was inducted into the Tanker/Airlift Association's Hall of Fame.

More on Jackson's Medal of Honor can be found in "Rescue at Kham Duc," by John T. Correll, in the October 2005 issue of *Air Force Magazine*.



Source: AFCENT data

## ■ Air Strikes Increase in Afghanistan, Syria, Despite Talks of Withdrawal

US aircraft conducted more strikes in Afghanistan in the first 11 months of 2018 than in the previous three years combined—and exceeded every year for the past decade.

American aircraft dropped 6,823 weapons in Afghanistan in 2018, up from 4,361 in 2017 and 1,337 in 2016, according to the AFCENT data.

US planes also air-dropped vastly more supplies in 2018 than prior years, dropping 602,980 pounds of supplies in 2018, versus just 33,423 in 2017, and none in 2015 or 2016.

The increased activity comes at a time when about 10.8 percent of the Afghan population continues to live in areas under Taliban control and roughly a quarter of the population lives in contested areas, according to the Special Inspector General for Afghan Reconstruction. The report questioned the strength and ability of the Afghan National Defense Security Forces, which shrank to 308,693 total personnel in October 2018, the fewest in the past four years.

The report also said the Taliban's strength has increased during that time, while attacks claimed by a rival group, ISIS-Khorasan, decreased.

US officials are negotiating directly with the Taliban in peace talks. Acting Defense Secretary Patrick M. Shanahan called progress "encouraging" and US news reports suggested the Taliban would agree to help keep al Qaeda and ISIS out of Afghanistan should a deal be struck.

Encouraged, NATO Secretary General Jens Stoltenberg told reporters at the Pentagon that NATO's mission in Afghanistan was always to create the conditions for a "peaceful solution" and to ensure "that Afghanistan never again becomes a safe haven for international terrorists."

## ■ DIA: China Building Stealth Bombers, Improving Jointness, Has a Cyber Service

By John A. Tirpak

China is accelerating the improvement of its military, drawing closer to parity with the US in a number of key technologies, and building a smaller but far more professional force of troops, according to a new Defense Intelligence Agency assessment.

"China is building a robust, lethal force with capabilities spanning the air, maritime, space, and information domains which will enable China to impose its will in the region," writes

DIA Director Army Lt. Gen. Robert P. Ashley in a foreword to the new report. The People's Republic has transformed its military from "a defensive, inflexible, ground-based force charged with domestic and peripheral security ... to a joint, highly agile, expeditionary, and power-projecting arm of Chinese foreign policy."

The encyclopedic, 125-page white paper, titled "China Military Power: Modernizing a Force to Fight and Win," is patterned "in the spirit of Soviet Military Power," DIA said, referring to a document produced throughout the 1980s and '90s. The unclassified report—DIA said there is not a classified version—is distinct from the Pentagon's annual report on Chinese military power mandated by Congress, which critics have complained has been ambivalent about China's military capabilities.

Ashley said China is growing "in strength and confidence" and will demand "a greater voice in global interactions, which at times may be antithetical to US interests." The report aims to give US leaders "a deeper understanding of the military might behind Chinese economic and diplomatic efforts," so American leaders can develop "the widest range of options for choosing when to counter, when to encourage, and when to join with China in actions around the world."

Though the document doesn't forecast an imminent conflict between the US and China, it notes that Chinese military publications unstintingly call for China to defend its claims on sea lanes, lines of communication, fisheries, and fossil fuel deposits hundreds of miles off its coast, projecting its power well beyond the "island chain" lines in the Pacific. Those publications advise stern resistance to "third parties"—that is, the United States—backing up allied countries in the region whose goals conflict with China's, and they reject any consideration of Taiwan as anything other than Chinese territory. Indeed, DIA asserts that China's top military priority is to "deter any attempt by Taiwan to declare independence," and it organized and equipped to "deter and deny foreign regional force projection."

DIA said it now spends about \$170 billion a year on its military, or about 1.3 percent of its Gross Domestic Product. It gets more for its money than the US does, however, benefitting from a "latecomer advantage." DIA said: Rather than invest in costly research and development, "China has routinely adopted the best and most effective platforms found in foreign militaries through direct purchases, retrofits, or theft of intellectual property."

The net result: China expedited its military modernization "at a small fraction of the original cost," according to DIA. Robust investment has yielded precision, long-range tactical missiles; a series of new mobile intercontinental ballistic missiles; a new indigenous aircraft carrier; hypersonic, directed-energy and laser weapons; and stealth and artificial intelligence technologies. DIA noted China plans to be world-class or world-leading in most of these by 2030-2035.

In terms of airpower, DIA said, the People's Liberation Army Air Force (PLAAF) is seeking to build both medium- and long-range stealth bombers "to strike regional and global targets," anticipating initial operational capability around 2025. That's about the same time frame the US Air Force anticipates its next-generation B-21 bomber would enter service.

Photo: MSgt. Burt Traynor

**"China is building a robust, lethal force with capabilities spanning air, maritime, space, and information domains, which will enable China to impose its will in the region,"**

—DIA Director Army Lt. Gen. Robert Ashley

China's new aircraft will have "full-spectrum upgrades compared with current operational bomber fleets and will employ many fifth generation fighter technologies in their design," DIA predicted, noting that the long-range bomber means China will match the US and Russia in deploying a true nuclear triad.

China's existing H-6 bombers, based on the Russian "Badger" series, already are capable of carrying land-attack cruise missiles, providing a "long-range, standoff, precision-strike capability that can reach Guam," DIA reported.

On the defensive front, China is developing an "increased ability to detect low-observable targets," DIA said, diminishing the US advantage in stealth. Equipping its airborne early warning and control aircraft with active electronically scanned array (AESA) radars will give China "instantaneous target updates, electronic beam steering, advanced/specialized radar modes, very large search volumes, and the ability to stare at a target or track thousands of targets simultaneously."

China's air defenses, already formidable, will be improved by the addition of the Russian S400 Triumf system, and the upgrade of the Chinese copy, the HQ-19, in the next couple of years. The latter will likely have a ballistic missile defense capability.

The country will have "a majority fourth generation [fighter] force within the next several years," DIA predicted, and the country is also developing fifth generation fighters to compete with the US-made F-22 and F-35. Its J-10B/C and J-11B/J-16 Flanker-derived jets are already comparable to the most up-to-date American F-16 and F-15, respectively, according to the report.

China has also advanced tremendously with unmanned aircraft that emulate the US Predator and Reaper, offering both a strike and reconnaissance capability. "China has sold armed UAVs to customers such as Iraq." China claims its UAVs can attain speeds of 170 mph, stay aloft for 20 hours, and carry two guided air-to-surface missiles.

The DIA estimated that China will have "an ISR capability to effectively support traditional air missions, including ground support and air superiority, along with the PLA's emerging capabilities in space" by 2020.

For airlift, China is developing the Y-20, a C-17-lookalike powered by the same engines as China's other main transport, the Russian IL-76. Derivatives for aerial refueling and paratroop, among other missions, are expected. China is also investing in new production of the world's largest airlifter, the An-225.

DIA also noted that China is stepping up its training capabilities, investing in an air combat maneuvering instrumentation (ACMI) system to debrief pilots in major exercises patterned on USAF's Red Flag series. It seeks to "replicate real-world combat environments as closely as possible," has multiplied its joint-service exercises for that purpose, and increased exercises with others, such as Thailand, to gain experience in "foreign operational concepts and tactics."

China has vastly multiplied the number of military attachés it deploys among its worldwide embassies, to observe, engage with, and report on foreign militaries.

The DIA noted that China has taken firm steps to replace the Army-centric command structure with a joint system that elevates the other services and improves their interoperability.

In 2015, China established the Strategic Support Force, an entire branch of the military dedicated to "cyber, aerospace, and electronic warfare capabilities." This service reports directly to the Central Military Commission of the Chinese Communist Party. According to a Chinese strategy document, the SSF "will integrate reconnaissance, early warning, communications, command, control, [and] navigation, ... and will provide strong support for joint operations for each military service branch.

## ■ Lt. Gen. Bruce Wright Named AFA's New President

Retired Lt. Gen. Bruce A. Wright has been named AFA's new president, effective March 1. Wright, a fighter pilot with more than 3,200 flying hours, spent 34 years in the Air Force, having last served as commander of 5th Air Force and US Forces Japan. He will relieve retired Gen. Larry Spencer, who has led the association since 2015, AFA Chairman Whit Peters announced in a news release. After the Air Force, Wright was vice president of cyber and S&T at Lockheed Martin Government Affairs, where he worked on a range of joint forces, intelligence, advanced technology, and cyber programs. "General Wright has had a distinguished career and his success in the Air Force and in industry will serve AFA very well," said Peters, a former Secretary of the Air Force. "As a great AFA supporter and member of our board, we have seen the dedication that he brings to AFA."



Photo: Mike Tsukamoto/AFA

Lt. Gen. Bruce Wright, USAF (Ret.)

Spencer will turn over the reins to Wright at the conclusion of AFA's Air Warfare Symposium in Orlando, Fla. "The Board is very sad to be losing the highly successful leadership of Gen. Larry Spencer," Peters said. In his new role, Wright will direct the association's professional staff, be responsible for the management and operations of the association, and serve as publisher of *Air Force Magazine*. "I am excited to lead the Air Force Association and absolutely dedicated to supporting AFA's mission of promoting a dominant Air Force and a strong national defense," Wright said. "General Spencer has made a terrific, positive impact on AFA, and I cannot thank him enough for all he has done to lead AFA."

## ■ New Evaluations for Enlisted Airmen By Jennifer-Leigh Oprihory

New enlisted evaluations will give commanders more flexibility and recognize associate's degrees from any nationally or regionally accredited academic institution for those seeking "promotion and senior rater stratification or endorsement." Previously, only degrees from the Community College of the Air Force counted.

Other changes include:

■ Performance evaluations are now optional for individuals reaching high year of tenure.

■ Senior enlisted leader will now be "a voting member of the Enlisted Forced Distribution Panel," rather than a mere advisor.

■ Letting commanders designate as many nonrated days as they deem necessary in cases where they deem airmen have gone through "personal hardships during the reporting period." This allows commanders to acknowledge "extenuating circumstances" affecting airmen without ding them for it.

■ Eliminating mandatory referral evaluations for those rated as meeting "some, but not all expectations."

CMSAF Kaleth O. Wright said eliminating mandatory referral evals will let raters give airmen "more honest, realistic" performance feedback and more "room to improve."

"Under the previous policy, if we set 100 expectations for an airman and they met or exceeded 99 of them, but fell short on one, in essence we were saying they should be removed from promotion consideration," Wright said. "That doesn't align with our vision of talent management."



## ■ GBSD Will Not Rely on Refurbished Warheads

By Rachel S. Cohen

The National Nuclear Security Administration has canceled its previous plan to refurbish a warhead for use on future land and submarine-launched ballistic missiles, according to a December 2018 report to Congress that *Air Force Magazine* viewed Jan. 29.

The agency "is no longer planning for an interoperable warhead program as previously conceived," the report states. "NNSA has no plans to pursue a W78 life-extension program using the existing aeroshell."

Instead, NNSA will develop a safer but slightly more expensive warhead for the future Ground-Based Strategic Deterrent, the W87-1, which is expected to cost between \$8.6 billion and \$14.8 billion before accounting for the fissile pit inside. The program began in November 2018, according to the Government Accountability Office.

Pit production could add \$300 million to \$750 million to the program's overall price tag. Pursuing a life-extension program for the W78 warhead was projected to cost \$8.5 billion to \$14.2 billion, according to NNSA. The W78s are in use today on Minuteman III missiles deployed in silos in Montana, North Dakota, and Wyoming. The replacement warhead is planned for deployment in 2030.

The updated price tag followed release of a Congressional Budget Office report that concluded modernizing America's nuclear triad is projected to cost nearly \$500 billion through Fiscal 2028, figures likely to attract criticism from those opposed to today's plans, most notably new House Armed Services Committee Chair Adam Smith (D-Wash.).

A newly developed W87-1 would be an "insensitive high explosive," which experts believe are safer because they are less likely than current existing warheads to detonate in an accident, such as a fire or unexpected impact. Insensitive high explosives would have improved controls to ensure proper launches and can be more efficiently produced, because of the reduced risk of accidental triggers.

"The probability of high-explosive detonation or high-explosive violent reaction during weapons operations is essentially zero," NNSA wrote.

**"The probability of high-explosive detonation or high-explosive violent reaction during weapons operations is essentially zero."**

—NNSA

However, insensitive explosives are larger and heavier, and fitting one inside the Minuteman III's Mk12A aeroshell could pose "significant technical problems," the report said. "Fortunately, for the W87-1, conditions allow trade space in terms of mass and volume for an IHE-based primary [fission explosive]."

Congress invested \$53 million in the W87-1 for 2019. A chart included in the document, which projects costs

through 2037, shows annual spending on W87-1 would peak at between \$700 million in 2030 under a low estimate, or at about \$1.2 billion in Fiscal 2031 under a high estimate.

"Previous [NNSA Stockpile Stewardship and Management Plan] estimates, which reflect the [Interoperable Warhead 1] program, underestimated the complexity of addressing challenges of newly manufactured warhead components including development of IHE, enhanced classification anticipated with GBSD, surety features in ballistic missiles, new capability needed for secondary and nuclear explosive package work, increased program management control, and integration with [the] GBSD and Air Force aeroshell acquisition program," the

report states. "These complexities have been adjusted based on experiences and lessons learned from the W80-4, B61-12, and W88 Alt 370 programs. This projection more accurately reflects programmatic funding needs than previous estimates for IW-1."

Kingston Reif, director for disarmament and threat reduction policy at the Arms Control Association, praised the IW-1 plan's cancellation, calling it unnecessary and almost certainly financially infeasible.

"The lessened commitment to interoperable warheads does not appear to have reduced the projected cost of replacing the W78," Reif said in a Jan. 30 email. "Indeed, the report notes that previous NNSA estimates underestimated the complexity and cost of the IW-1! Which should cause us to be skeptical about the estimated cost of the W87-1!"

GAO showed NNSA spent \$114.5 million on the W78 replacement program—later known as IW-1 before becoming W87-1—between 2011 and 2014. From Fiscal 2015 to 2017, another \$4.3 million was carried over from past years to close out life-extension programs for the W78 and W88 warheads.

## ■ August 2017 MQ-1 Crash Caused by Electrical Failure

The Air Force MQ-1B Predator that crashed during a combat mission at an undisclosed location in the Middle East on Aug. 17, 2017, experienced an electrical failure before it fell from the sky, according to an investigation released by the Air Force.

The forward-deployed Predator was being flown by a crew from the 432rd Wing at Creech AFB, Nev., when the incident occurred. It had just taken off in a forward operating location in the US Central Command area of responsibility, and the crew was taking control from the launch crew when the aircraft experienced an internal electrical failure.

## ■ MDC2 Career Field to Offer First Training Course This Summer

The Air Force will launch its first course to train multi-domain command and control officers this summer, open to those with seven to 12 years of service who want to work across the air, space, and cyber domains to schedule missions and employ forces at an air operations center. A 20-week course will be held at Hurlburt Field, Fla., followed by more training at Maxwell AFB, Ala. "Officers who complete the course will have the opportunity to be stationed at AOCs at a variety of US military bases in the United States, Europe, Southwest Asia, and Southeast Asia," the service said in a press release. "After officers gain a general understanding of the operations of an AOC, they will be stationed at combatant commands." Launching the 130 career field—open to officers in any specialty—is one of the Air Force's first steps toward creating a more integrated force that can react to threats faster. —By Rachel S. Cohen

## ■ The War on Terrorism Casualties:

As of Feb. 7, a total of 64 Americans had died in Operation Freedom's Sentinel in Afghanistan, and 74 Americans had died in Operation Inherent Resolve in Iraq and Syria.

The total includes 133 troops and five Department of Defense civilians. Of these deaths, 64 were killed in action with the enemy while 74 died in noncombat incidents.

There have been 369 troops wounded in action during OFS and 77 troops in OIR.

# FACES OF THE FORCE



Photo: USAF

**Capt. Zoe Kotnik** became the F-16 Viper Demonstration Team's first female commander and pilot on Jan. 29 and also the service's first female single-ship aerial demonstration pilot. Kotnik, an Air Force Academy grad and eight-year veteran, has more than 1,000 flying hours in the F-16 and trainers.

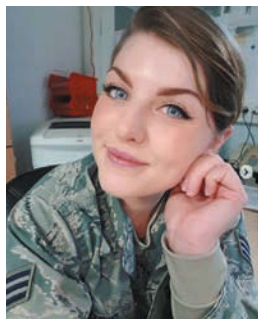


Photo: Kelly Davis via Instagram

**SrA. Kelly An Davis**, a security forces airman at Ramstein AB, Germany, has become an unofficial Air Force ambassador. *The Aviationist* blog called her Instagram account, where she documents her professional and personal activities, "a value-added recruiting asset for" USAF. And no wonder: At press time, her account had over 13.6 million followers.



Photo: USAFA

**Tucker Bone**, a midfielder on the Air Force Academy soccer team, was drafted by the Seattle Sounders in Round 1 of the MLS SuperDraft, after a season in which he scored 13 goals, had six assists, and made the 2018 NCAA Division I Men's All-America soccer team in December. Graduating in June, Tucker will have to report for duty 60 days later—unless the Air Force grants a waiver to let him pursue both soccer and a military career.



Photo: Marketh Horace/USA

Atlanta Falcons Offensive Guard and Colorado Air National Guard **Capt. Ben Garland** received the National Football League and USAA's 2018 Salute to Service Award created to acknowledge exceptional efforts by members of the NFL community who honor and support the military. In his honor, USAA will donate \$5,000 to each of the five military-service aid societies, and the NFL will give \$25,000 to a military charity of Garland's choosing.



Photo: Kenji Thulowert/USAF

**Maj. Rachael Winiacki**, from the 461st Flight Test Squadron, completed her flight test mission last month to become the first female F-35 developmental test pilot. The number of women in the test community is increasing, Winiacki said, noting several female test directors, conductors, discipline engineers, and flight test engineers within the 461st FLT.



Photo: All Faiths Funeral Services

A Texas newspaper's story about an unattached Air Force veteran's funeral triggered a domino effect of epic proportions. When the *Killeen Daily Herald* reported that **Joseph Walker**, 72, was slated to be buried with full military honors and no relatives present, details about the funeral went viral on social media and over 2,000 people reportedly showed up in support.



Photo: Mauricio Campino

**MSgt. Trevor Derr**, 736th Maintenance Squadron's Airframes Powerplant General Section Chief at Dover AFB, Del., runs three to five miles daily while holding an American flag to honor a fallen comrade. Derr first planned to run 1,000 miles with the flag between January 2018 and January 2019, but he plans to continue to run to raise awareness for PTSD (post-traumatic stress disorder) victims.

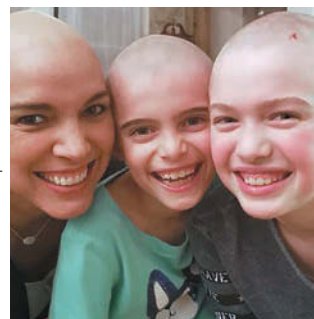


Photo: ABC News/GMA Brightly

When USAF **Col. Joanna McPherson** (I) of Shreveport, La., was diagnosed with breast cancer and faced chemotherapy, she decided to shave her head. Then her two young daughters, 10-year-old **Kayla** and seven-year-old **Sophia**, said they wanted their heads shaved, too—in solidarity with their mom. Says McPherson on her blog at her2positivelife.com, "Watch the video and you'll see why I love my life."

Know of someone we should recognize? Send nominees to [afmag@afa.org](mailto:afmag@afa.org)

# *The* United States Air Force *Charity Ball*

Benefiting the Air Force Aid Society  
*The Official Charity of the U.S. Air Force*

TICKETS ON  
SALE NOW!

[airforcecharityball.org](http://airforcecharityball.org)

APRIL 27, 2019 • THE RITZ-CARLTON, TYSONS CORNER, VA



## SPONSORS

**LEAD SPONSOR** - USAA Bank

**DIAMOND PLUS PATRONS** - The Boeing Company  
Lockheed Martin Corporation • The Raytheon Company

**DIAMOND PATRONS** - Northrop Grumman Corporation

**PLATINUM PLUS PATRONS** - Leidos • Textron

**PLATINUM PATRONS** - Air Force Association • GE Aviation • Harris Corporation  
L3 Technologies • Rolls-Royce North America • United Technologies (UTC Aerospace  
Systems, UTC Pratt & Whitney)

**NEW PATRONS** - Advanced Concepts and Technologies International  
The Aerospace Corporation • SES Government Solutions



TO BECOME A SPONSOR  
[CORPORATESPONSORS@AIRFORCECHARITYBALL.ORG](mailto:CORPORATESPONSORS@AIRFORCECHARITYBALL.ORG)

TO PURCHASE TICKETS OR FOR MORE INFORMATION  
[AIRFORCECHARITYBALL.ORG](http://AIRFORCECHARITYBALL.ORG)



# Keeping the F-35 Ahead of the **BAD GUYS**

*Operational testing is still underway, but the F-35 is already beginning its first major upgrade.*

By John A. Tirpak

**T**he F-35 is expected to complete initial operational test and evaluation late this year, certifying the Block 3F version is fully combat-ready. By that time, work will be well underway for dozens of planned upgrades, collectively known as Block 4.

Block 4 comprises some 53 improvements to counter both air- and ground-based threats emerging from China and Russia. None of these upgrades will change the aircraft's outer appearance, or "mold line." Instead, they are primarily new or enhanced features executed in software, which will be rolled out in stages, with updates every April and October starting in 2019 and continuing through at least 2024.

"Instead of doing two-year deliveries ... we decided to go to a more continuous capability framework," said Vice Adm. Mathias W. Winter, F-35 Program Executive Officer, in a December interview.

**"Instead of doing two-year deliveries ... we decided to go to a more continuous capability framework."**

—Vice Adm. Mat Winter, F-35 Program Executive Officer

Now that Block 3F has been "verified and validated," the Lightning II is a "mature" system, Winter said, and ready to accept "modernization, enhancement, and improvements." Exactly how many early production F-35s will be upgraded to the 3F configuration may be revealed in the 2020 budget submission to Congress.

Most existing F-35s are getting the Technology Refresh 3 package. Known as TR3, Winter said it includes "updated cockpit displays, updated memory system capacity, and updated core processing and computer power." Together, these "ensure that we have growth [capacity] well into the 2030 time frame."

In fact, TR3 makes the Block 4 improvements possible, Winter said.

"Think of TR3 [as] your brand-new ... laptop that has a new cool display with better graphics. It has a new processor inside so it can go faster, and it's got terabytes of storage and memory system in there." The Block 4 upgrades are like "the programs; the applications and outcomes that fill your computer."

A pilot and crew chief ready an F-35 for taxi at Luke AFB, Ariz.



Photo ATC Jacob Wongwai

Handled at the squadron level, TR3 upgrades can be completed “in a couple of days,” Winter said. That’s in contrast to TR2 modifications that require depot-level installation of structural and component improvements.

The Block 4 upgrades will be “80 percent” software, Winter said, and delivered more rapidly than in the past.

Block 3F “allowed us to ... do software faster,” according to Winter. “We can [now] go to a more agile, relevant, and flexible code-verify-test-deliver cadence, based on the warfighter’s direction to us [and] based on what capabilities they need, [and] when, to pace the threat. So, that’s the philosophy.”

Winter calls this Continuous Capability Development and Delivery, or C2D2.

### **RISK vs. THREAT**

The Government Accountability Office recommended last June that Block 4 be delayed until initial operational testing was complete, but Winter certified that the rapid advance of threat systems posed an urgent risk, and the Pentagon proceeded with a Block 4 contract award in November.

Block 4 includes 53 new capabilities “mapped ... to six-month delivery cycles over the next six years, to 2024,” Winter said.

Updating every six months instead of every two years marks a cultural shift from “the traditional waterfall acquisition to an agile, rapid capability/continuous delivery” model, Winter noted. The new model is more akin to commercial product cycles, where rapid, iterative software releases are now the norm.

Indeed, the last Block 3F software was delivered in December and the first Block 4 update is planned for April 2019.

Combat operators, rather than program managers, will decide how to prioritize the updates, Winter said. If the combat operator wants to “wait, for whatever operational reason, we have the flexibility to be able to do that.”

The specific content of the Block 4 upgrade remains closely held, but breaks down broadly into six categories:

- Integration of seven new weapons, including the Small Diameter Bomb II, British weapons such as the ASRAAM and Meteor air-to-air missiles; Turkey’s Standoff Missile and Norway’s Joint Strike Missile;

An F-35 fires an AIM-9X missile during a test over the Gulf of Mexico in June 2018 near Eglin AFB, Fla. Block 4 upgrades will enable the Lightning II to fire up to seven additional weapons.



Capt. Dayna Grant briefs then-Deputy Secretary of Defense Patrick Shanahan at Hill AFB, Utah. Hill is host to three F-35 fighter squadrons.



Photo: Todd Cromar/USAF



## F-35 Lightning II

### Basic Missions:

- Air superiority
- Close air support
- Destruction of air defenses
- Strategic attack

### New in Block 4:

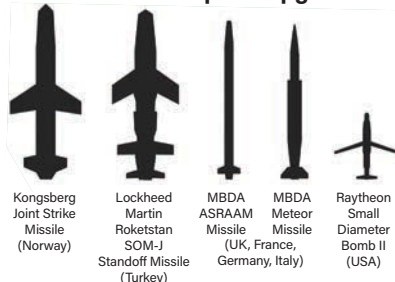
- Extended surface warfare



### Block 4 upgrades include new or improved capabilities:

- 13** Electronic warfare updates
- 11** Radar and electro-optical system enhancements
- 8** Logistic and support changes
- 7** Interoperability and networking changes
- 7** Cockpit and navigation upgrades
- 7** New weapons systems

### Some Block 4 Weapons Upgrades



Sources: Joint Strike Fighter Program; Kongsberg; MBDA; Raytheon; Lockheed Martin

Photo: SSgt. Brandt Hansen

- Eight logistics and support changes;
- 13 electronic warfare updates;
- Seven interoperability and networking changes;
- Seven cockpit and navigation upgrades; and
- 11 radar and electro-optical system enhancements.

In addition to those improvements, which will be common to all variants, some updates will answer unique service requirements. For example, Winter mentioned, only the Navy wants its F-35Cs to be able to launch the Joint Standoff Weapon (JSOW) C1 version.

The F-35 has four basic missions: air superiority, or offensive and defensive counterair; suppression or destruction of enemy air defenses (known as SEAD and DEAD); close air support; and strategic attack against high-value strategic and mobile targets.

“The Block 3F can service all four of those,” said Winter. Block 4 “brings on advanced capabilities and enhancements” to counter adversaries as their “capabilities increase against those mission sets.”

Block 4 also adds a fifth basic mission, Winter said: “extended surface warfare.” Upgrades will enhance radar “for maritime surveillance, identification and targeting,” he explained, “because ‘maritime surface’ and ‘land surface’ are two different problems.” Search patterns on the open ocean will be improved, as will “being able to sense the order of battle in the maritime world.”

Although the F-35 can carry the new Long-Range Anti-Ship Missile, or LRASM, externally, Winter said the principal new anti-ship missiles coming in Block 4 are the JSOW C1 for the Navy and the Norwegian JSM. The program has “not been asked” about whether the stealthy LRASM can fit inside the F-35’s weapon bays, he said, nor has the Navy asked to integrate the SLAM-ER (Standoff Land Attack

Missile-Extended Range) version of the Harpoon anti-ship missile.

The Block 4 updates identified thus far have a completion point in the mid-2020s. A program official said “there will certainly be other Block updates” to follow. If current production schedules hold, the F-35 will remain in production through at least 2040. A “Block 5” will “probably kick in around 2028-2030,” one Pentagon official suggested, and feature “what we think of today as really ‘out there’ stuff, like lasers.”

### ‘TECHNICALLY FEASIBLE’

The “tagline” for Block 4 is “technically feasible while operationally relevant,” Winter said. That term is essential because, “we don’t want to overcommit. It’s got to be technically feasible.”

Besides improvements to the aircraft themselves, Block 4 updates must also be applied simultaneously to ALIS (Autonomic Logistics Information System), the Mission Data Files and training systems, such as simulators.

ALIS maintains an automatic, aircraft-specific logbook of maintenance actions, parts consumption, and noteworthy events (such as overstressing a landing gear door or an accident affecting stealth surfaces), then maps these data points across the entire fleet. The system can track trends regarding the actual use and consumption of parts and maintenance man-hours, and thus anticipate future demand.

Mission Data Files have been one of the most laborious projects attending the F-35. A software center at Eglin AFB, Fla., staffed by a small army of computer coders, constantly

F-35s refuel from a KC-135 over the Utah Test and Training Range during a combat power exercise in November 2018.



updates the threats F-35s could encounter in specific regions, and these files are downloaded into the aircraft before operational missions.

The level of detail in the MDFs is extremely fine-grained and includes every fighter, radar, surface-to-air missile battery, airborne sensor aircraft, and other knowable threat. The Israeli Air Force Chief of Staff told an industry source last year that, waiting to take off in the F-35, he already had a “full picture of the entire Middle East” on his displays, including everything airborne and all potential threats.

The MDFs have to be constantly validated and verified to account for even small changes in adversaries’ order of battle.

“The certification/validation philosophy right now is 100 percent,” Winter said. However, it still takes eight months to compile an MDF “because we’re using engineering/manufacturing tool suites that were used to just determine how to do this.”

Winter said the program is set to migrate by April 2019 to new tools that will speed up the process.

Air Force leaders have allowed that they’ve been going slow in buying F-35s. They prefer to wait for the Block 4 version to start coming off the production line, with all the bells and whistles they want for the bulk of the force. Doing so would reduce the cost of upgrading the fleet.

In order to get there, though, the F-35 must survive as a program. Undersecretary of the Air Force Matthew P. Donovan said in January that F-35 sustainment costs remain too high.

“F-35 sustainment costs are going to have to come down,” according to Donovan. Compared to 4th-generation

fighters such as the F-15, he acknowledged, there is a “tax for LO,” or low observability. However, to be affordable in large numbers, F-35 sustainment costs “have got to be comparable” to those of the aircraft—the F-16, A-10, and F-117—it replaces. The Air Force has a goal to reduce F-35 sustainment costs by 38 percent, and Donovan said “we are trying to pull that to the left” and accomplish it sooner than predicted.

Last October, then-Defense Secretary Jim Mattis directed the Air Force to increase mission capable rates for the F-22, F-16, and F-35 to at least 80 percent. At the time, the F-35 rate was 54 percent overall, but for 3F aircraft recently off the production line, the rate was better than 80 percent.

Winter agreed that spare parts are the “long pole in the tent” for getting the F-35 fleet up to the 80 percent standard.

“We have initiatives underway to increase spare parts production,” he said, including accelerating the rate at which parts can be repaired by the F-35 depot at Hill AFB, Utah. This will allow industry to concentrate on making more new parts, rather than fixing older ones, he said.

The Air Force has until Sept. 30 to achieve the 80 percent mission capable rate, assuming the order stands under Acting Defense Secretary Patrick M. Shanahan or his successor.

Winter confessed that “supply chain performance” is his greatest concern with regard to readiness, and he also recognizes that sustainment costs are key to keeping the F-35 viable.

“We are getting after that supply chain performance and their ability to meet [our] capacity demands, he said. “So, that’s working.”





Photo: SSgt. Andrew Lee



Photo: A1C Caleb Worpel

A1C Eric Ruiz-Garcia inspects a Lightning II at Luke AFB, Ariz., in December 2017.

## Future Engine Upgrades

The F-35 is slated to remain in the inventory for decades—and with propulsion technology always advancing, will likely receive a new engine at some point in the future. A switchover to a new power plant, however, is still years away and is not envisioned within the timelines of Block 4.

The Air Force is deep into development of a new propulsion system that could fit in the F-35. It promises more thrust, 30 percent less fuel consumption, and the ability to generate greater excess power for things like directed-energy weapons than the current F135 engine.

“Right now, we have margin in our propulsion system for the near future,” Program Executive Officer Vice Adm. Mathias W. Winter said. The existing engine can produce enough electricity “at least for the anticipated current and new capabilities” that operators are demanding or planning, he said. Meanwhile, the engine Component Improvement Program is “providing us the technical feasibility, the reality, the solutions base, so that we can see what the art of the possible is.”

The earliest a new engine might be available would be the early 2030s, Winter conjectured. At that point, assuming no big spur to USAF’s production plans, the service will be a little more than halfway toward its production goal of 1,763 F-35s.

# USAF's AI Transformation *Takes Off*



AI cracks the code on better maintenance and faster training. Better and faster decision-making is next.

By Amy McCullough

**T**he National Defense Strategy predicts artificial intelligence could transform the battlefield of the future, changing the “character of war” in ways not yet imagined.

Explosive growth in commercial AI technologies, fueled by advances in microprocessors, cloud computing, and their combined ability to rapidly assemble and analyze vast data sets, has set off a revolution in commercial markets. AI now directs traffic, routes packages, answers customer queries, and anticipates consumer demand. Its military applications are also endless.

“Structurally, we know AI has the potential to be an enabling layer across nearly everything,” Dana Deasy, the Defense Department’s chief information officer, told the House Armed Services emerging threats and capabilities panel in December. “It means the opportunity to positively transform every corner of the department, from innovative concepts that change the way we fight, to improvements in

**“Structurally, we know AI has the potential to be an enabling layer across nearly everything.”**

—Dana Deasy, the Defense Department’s chief information officer

the way we maintain our equipment, perceive our environment, train our men and women, defend our networks, operate our back office, provide humanitarian aid, and respond to natural disasters.”

Federal investment in unclassified AI research and development is already growing rapidly, up more than 40 percent since 2015, according to the White House. More increases may be ahead. The Trump administration plans to update the 2016 National Artificial Intelligence Research and Development Strategic Plan this spring.

The Defense Advanced Research Projects Agency (DARPA) has been driving AI technology research since the 1960s. Of DARPA’s 250 programs today, 80 involve AI in one form or another, and 25 are focused on breakthrough AI technologies that are yet to emerge from the lab. Currently, DARPA plans to invest \$2 billion over the next five years in AI Next, a new campaign focused on three tenets:

■ **Third-wave AI:** Technologies that incorporate contextual reasoning;

■ **Solving the most vexing problems:** As DARPA Director Steven H. Walker said in September, DARPA



2nd Lt. Brett Bultsma, Pilot Training Next student, and Capt. Jeffery Kelley, PTN instructor pilot, prepare to take off in a T-6 Texan at Austin-Bergstrom Int. Apt., Austin, Texas.

Photo: Sean Worrrell/USAF

is seeking to “identify and apply emerging AI technologies to solve today’s toughest security challenges;” and

■ **Performance Assurance:** Walker seeks to “create the deep analysis and understanding of how and why today’s AI technologies work” and ensure “the robust performance guarantees essential for military- and safety-critical systems.”

While DARPA focuses on future developments, the Defense Department is working to field AI more rapidly. Last June, DOD established the Joint Artificial Intelligence Center. Led by Deasy, JAIC (pronounced Jake) aims to accelerate AI deployment to the operational force. As of December, JAIC had a staff of 30—a mix of DOD civilians and military personnel from across the services—and Deasy told House legislators in December he is actively recruiting AI experts to expand the team.

At AFWERX—the Air Force’s innovation hub—AI is a clear focus.

“We think AI will fundamentally change the way the Air Force operates in kind of unseen ways, and that’s why we take this iterative, experimental approach to it,” said Lt. Col. Dave Harden, AFWERX chief operating officer.

Harden said AFWERX looks at AI in four buckets:

■ **Autonomous deep learning:** Analyzing vast data sets to assist with predictive analysis or early warning.

■ **Human-machine collaboration:** Using AI to help human operators make better decisions more quickly.

■ **Assisted human operations:** Streamlining and automating processes so that machines can help humans operate more efficiently.

■ **Advanced human-machine teaming:** Humans working with unmanned systems.

■ In one recently completed deep-learning project, AFWERX researchers studied 10 years of supply data and five years of maintenance reports for the E-3 fleet and ultimately identified 29 percent savings in unplanned scheduled maintenance. The study also revealed 48 parts “that were highly likely over maintained,” Harden said. In other words, the analysis concluded those parts were swapped out more frequently than necessary.

Using AI to better predict maintenance needs has long been on the Air Force’s radar. But the technology to enable the concepts hasn’t been readily available until recently. This project came about after an AFWERX innovator witnessed USAF maintainers deployed downrange using spreadsheets to track maintenance. Aware that AFWERX was already working

Lt. Col. Justin Elliott, 59th Test and Evaluation Squadron director of operations, runs through a presentation. Elliott wants to use new, cheaper, lightweight data-collection boxes in every aircraft flown by USAF instead of just those assigned to test units.



Photo: AIC Andrew Sarver

on other strategic AI projects, he called back to the States and, within six months, AFWERX had secured funding and USAF leadership support for the project. AFWERX partnered with the Pentagon's Defense Innovation Unit (formerly known as DIUx) on the project, Harden said.

"This was the toughest AI project because it was all unstructured data and text," said Harden. Structured data is information organized in tabular form, such as the data in a spreadsheet. Unstructured data is everything else and can include photographs and handwritten documents, PDFs, and more.

Now AFWERX is working to expand the project to other aircraft. "With the other structures we're adding on, like the F-16 and C-5, we're working hard to integrate sensor data in real-time, [which] heightens or improves your algorithm capability," Harden said.

## MAN AND MACHINE

Human-machine collaboration tries to find innovative ways to help operators make decisions. USAF's Pilot Training Next program, a collaborative effort with Air Education and Training Command, leverages AI to augment instructors in training student pilots.

In the initial test, an "AI coach" observed what students did, how they learned, and offered real-time advice. For example, if a student pilot learning to fly a loop pulled too hard on the stick, the AI coach could tell them to ease up. Also, if a student is more of a visual learner or prefers reading about a task first, the AI coach could personalize the training syllabus for that student.

"It's an artificial intelligence that's actually adapting the environment in which you learn," explained AETC boss Lt. Gen. Steven L. Kwast at AFA's Air, Space & Cyber Conference in September 2018. "It's coaching you along the way, so you're reminded of what you're doing right and what you're doing wrong."

Twenty students—15 officers and five enlisted airmen—participated in the first Pilot Training Next class, which

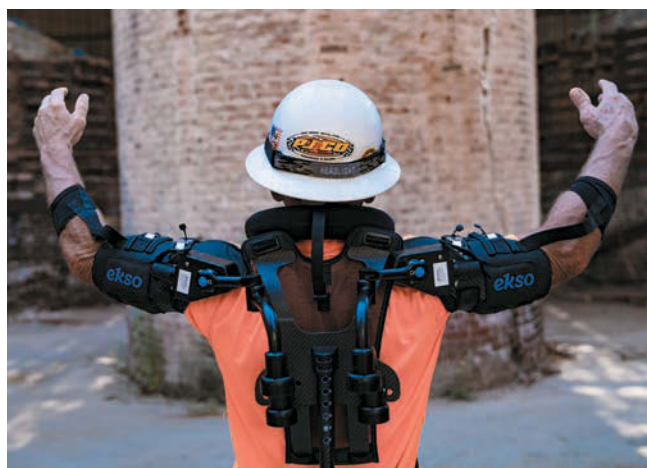


Photo: EksoVest

Exoskeletons support the weight of limbs to reduce strain on shoulders and arms. The vest provides 5 to 15 pounds of lift assistance and would help with overhead work such as aircraft maintenance.

graduated 13 pilots in half the time it normally takes to complete USAF's Specialized Undergraduate Pilot Training course. The second class, which kicked off in January, will have 24 students.

AFWERX launched an open challenge for the second phase of the program in October, promising to spend up to \$300,000 "for the right set of upgrades and solution trials." It also noted the possible scale of the program, saying it "has the potential to reach \$100 million or more in contracts over time."

In this phase, officials want the AI tutor to "rapidly adapt to accomplished learning objectives," according to the October challenge. While the initial AI coach "provided game-changing elements of individualized training," it "could not keep pace with student progress."

AFWERX Mission Lead, Brian "Beam" Maue, said the next phase aims to better structure data to tailor simula-



2nd Lt. Charles Keller and A1C Tyler Haselden, Pilot Training Next students, maneuver on a virtual reality flight simulator at the Armed Forces Reserve Center in Austin, Texas.

Photo: Sean Worrell/USAF

tor scenarios to each student's needs and to improve the biometric sensors used to monitor students' performance during training.

The first phase utilized eye-tracking sensors embedded in virtual reality goggles, which traced students' eye movements, providing an indication of whether students were focused on the right things in order to have truly mastered a maneuver. Now, Maue said, AFWERX wants to track even more, perhaps adding headbands that could track body temperature, perspiration level, and heart rate as indicators of students' stress levels.

"AFWERX engages in experiments, and AETC has been a forward-leaning command with this experimental mindset as well," Maue said. "So, going forward into any of these experiments we wouldn't expect we would have 100 percent of the technology identified for something that's never been tried before."

Industry interest is intense. AFWERX received 150 responses to its October challenge and selected 15 to pitch their concepts at its Austin, Texas, storefront. Of those, five were awarded \$50,000 each to further refine their concept. "When they come back with their results, they will be re-evaluated to see whether or not we can do some form of other transaction authority [or] prototyping contracts to further advance that type of technology," Maue said.

## INTELLIGENT ASSISTANCE

Further off—but still within reach—is what AFWERX calls assisted human operations.

"Think of this as kind of like the Iron Man suit," Harden said. "You know that Iron Man suit is not about the physical metal material that's flying around. It's about all the algorithms and software necessary to interpret in real-time all the external sensor data, integrate it, and then create a response that assists the human."

Say, for example, there are five airmen on the flight line tasked with moving munitions. If you gave one of those airmen an exoskeleton suit, he might be able to accomplish

the work all by himself, freeing up the other four airmen for another task, said Harden.

AFWERX is also looking for opportunities to investigate advanced human-machine teaming. For instance, how might a pilot work seamlessly with an unmanned platform in a multi-domain operation?

The ability to operate concurrently in multiple domains is one of USAF Chief of Staff Gen. David L. Goldfein's top three priorities, and AFWERX has an open MDO Fusion challenge intended to identify innovative concepts that could advance the concept. Harden said his team expects AI to feature prominently in the resulting proposals.

In science fiction, AI is typically seen as autonomous robots or computers with a mind of their own. In reality, it's a natural extension of the Information Age: It is what becomes possible when enough data can be captured and enough computer power can be applied to calculate in a timely way things that, before now, were simply unimaginable. AFWERX sees at least part of its role as working to "demystify" the technology—to make the concepts accessible to the people who stand to benefit from what they can offer.

"I think artificial intelligence is much more nuanced than what we see maybe in the headlines," Harden said. "It's not about killer robots. ... We can help humans find targets in landscapes. We can cut maintenance. We can do communication validation. We can use artificial intelligence for financial data. It's really taking all those use cases, doing a short experiment, and then maybe you start to see people who maybe aren't as familiar with tech ... say, 'Oh, I get it.'"

The applications are endless. But the most effective use cases are the ones where the subject matter experts themselves see the possibilities.

"As soon as you have that aha! moment," Harden said, "you're able to move the needle on artificial intelligence: the way we do business and fight in the future."

Finding those ideal-use cases and proving their value is the challenge right now, Harden acknowledged. "Our only path forward is to rapidly experiment." ✦

# DARPA's Quest for Faster, Better AI

By Amy McCullough

Artificial intelligence uses computers and software algorithms to do jobs that otherwise require a human brain—things such as identifying the contents of photographs, translating documents, or even teaching specific skills.

The explosion of interest in AI over the past few years is focused largely on machine learning, which uses large data sets and computer algorithms to train a system to perform a given task, such as image recognition.

“Algorithms have become remarkably good at classification and prediction tasks when they can be trained on very large amounts of data,” said Lisa Porter, deputy undersecretary of defense for research and engineering, testifying before the House Armed Services emerging threats and capabilities panel in December. “Today’s AI capabilities offer potential solutions to many defense-specific problems. Examples include object identification in drone video or satellite imagery and detection of cyber threats on networks.”

Machine learning is only the tip of the AI iceberg. The Defense Advanced Research Projects Agency (DARPA) plans to invest \$2 billion over the next five years to spark advanced work in what it’s calling AI Next.

“What we’d like to do is go beyond these machine-learning applications,” said John Everett, deputy director of DARPA’s Information Innovation Office, in an *Air Force Magazine* interview.

Basic machine-learning algorithms are great at identifying objects in an image. For example, a system can be trained to identify a cat and a suitcase in a photograph and then write a caption that says, “Cat sitting on suitcase.”

Everett wants to develop systems that could determine what would happen if you put the cat in the suitcase, or even let you know if the cat would fit inside.

Machine learning can teach computers to significantly narrow tasks very well. But it does not teach machines to reason. “We have millions of pictures online, which has been a huge boon for these exceptionally data hungry, woefully inefficient methods we’re using now,” Everett said. “But pictures don’t capture common sense.”

AI Next seeks to find ways to help enable machines to put information in context.

To do this, DARPA will invest in “high-value applications” focused on understanding the engineering process for current state-of-the-art AI technology and integrating it into Defense Department requirements, such as how to conduct continuous clearance reviews for personnel

(instead of periodic reviews, as is done today) or continuous software accreditation, said Valerie Browning, director of DARPA’s Defense Sciences Office.

But AI Next also will look at “very opportunistic, short-term efforts” that lead to prototyping development of potentially game-changing AI technology, Browning added. The Artificial Intelligence Exploration initiative (AIE), a key component of DARPA’s AI Next campaign, will fund a series of high-risk, high-payoff 18-month projects to establish the feasibility of new AI concepts, using streamlined contracting to accelerate progress.

For example, DARPA wants to investigate whether understanding tiny bug brains could help develop more efficient AI computational frameworks. In a Jan. 4 post announcing the Microscale Bio-mimetic Robust Artificial Intelligence Networks program, DARPA offered to pay up to \$1 million to selected competitors to create computational models inspired by insects.

“The past decade has seen explosive growth in development and training of AI systems, which are now embodied in digital computing processes spanning several key industries,” the solicitation said. “However, as AI has taken on progressively more complex problems, the amount of computation required to train the largest AI systems has been increasing tenfold annually.”

DARPA wants to find a more efficient processing solution to achieve better results faster. The solicitation notes some miniature insects have neurosystems based on just a few hundred neurons, yet are still able to use “low-power, and fast integrated sense-control-actuate systems” for “higher-level behaviors, such as feeding, reproduction, and survival.” DARPA wants to know how they do it—and more importantly—how that can then be applied to military AI systems.

DARPA plans an AI Colloquium March 6-7 in Alexandria, Va., which will bring scientists, researchers, and technologists together with defense stakeholders to “find the people with the best ideas” and then incorporate those ideas into the next wave of artificial intelligence, Everett said.

“The problem they’re tackling is, ‘Can we bring some physics into machine learning so that we don’t need as much data and we don’t have to worry so much about these fragile and brittle things,’” Porter told House legislators. “AI is all about speed. It really is. This is one of those domains where things are just going very, very quickly.”

**“Today’s AI capabilities offer potential solutions to many defense-specific problems. Examples include object identification in drone video or satellite imagery and detection of cyber threats on networks.”**

—Lisa Porter, deputy undersecretary of defense for research and engineering



# I SERVED FOR *his future*

With USAA, you've earned access to a membership that can be passed down from generation to generation. So no matter what reasons you served for, the best reasons are yet to come.

**JOIN USAA AND BEGIN YOUR LEGACY.**  
CALL 877-618-2473 OR VISIT [USAA.COM/AFA](https://www.usaa.com/AFA)



USAA is proud to be the  
**Preferred Provider**  
of Financial Services  
for the Air Force Association

USAA means United Services Automobile Association and its affiliates. Air Force Association receives financial support from USAA for this sponsorship. Use of the term "member" or "membership" refers to membership in USAA Membership Services and does not convey any legal or ownership rights in USAA. Restrictions apply and are subject to change. To join USAA, separated military personnel must have received a discharge type of "Honorable." Eligible former dependents of USAA members may join USAA. © 2019 USAA. 250717-0119-AFA



# For MQ-9 Crews, 2019 is Time to Reap Just Rewards

Fully manned crews and a focus on training means the RPA force is expected to reach new milestones in the coming year.

By Brian W. Everstine

**T**his is the year the Air Force's remotely piloted aircraft community comes of age. New aircraft, new squadrons, a new independent operating base, and greater recognition for pilots and sensor operators are all coming into view at the same time.

For the first time, Air Force RPA pilot crews are nearing 100 percent manning. Operating tempo remains intense, however. Unlike manned aircraft pilots—who may spend years preparing for their first combat flights—RPA crews go almost instantly from training into combat.

**“You come in today and fly in this part of the world, tomorrow in [another] ...”**

—Col. Julian Cheater

Lt. Col. Eric Bissonette, who oversees RPA training as commander of the 558th Flying Training Squadron at JBSA-Randolph, Texas, said one pilot he trained received a “nine-line” request for weapons from a joint terminal attack controller in combat as soon as he sat down in the control station. Less than 10 minutes later, the 23-year-old had fired his first shot.

Similarly, Bissonette described a sensor operator who was tasked with tracking and providing intelligence on the second highest-ranking target in an undisclosed theater—on the operator's first day of duty.

“The responsibility and strategic impact they have



Airmen run a preflight check on an MQ-9 Reaper in Southwest Asia in January.



Photo: SSgt. Jeremy L. Mosier

is unbelievable,” Bissonette said. “The responsibility on them at a very, very young age is unbelievable.”

Currently, half of all RPA pilots are lieutenants and half of the sensor operators are junior airmen. Second lieutenants routinely conduct air strikes; first lieutenants are veterans of repeated combat deployments.

“I don’t know of any other airframe where you’ve got second lieutenants routinely conducting air strikes in combat,” said Col. Julian Cheater, commander of the 432nd Wing at Creech AFB, Nev.

Within the first two-and-a-half years, pilots become aircraft commanders, and within about four years, some have as many as 4,000 combat hours.

**“The responsibility on them at a very, very young age is unbelievable.”**

—Lt. Col. Eric Bissonette

All told, the aircrews at Creech recently surpassed 2 million hours, he said.

#### GETTING WELL

The Air Force is more than two years removed from completing a “get-well” program aimed at bolstering the RPA community. With the older MQ-1 Predators retired, MQ-9 Reapers now make up the full complement of armed RPAs. The 2016 Culture and Process Improvement Program, based on more than 3,300 surveys at 12 bases, provided a flight plan to help RPA crews reach a point of stasis, where the Air Force could finally take one squadron at a time out of combat operations to focus on reset and training.

A 558th Flying Training Squadron student trains on a T-6 simulator while an instructor monitors the instrument computer panel at JBSA-Randolph, Texas.



"I think the earliest opportunity we have is the end of 2019 to make that a reality," Cheater said in a recent interview with *Air Force Magazine*. "That will improve our readiness rate considerably because I can take [aircrews] out of combat to train, ... [and] put [them] up against threats that are more representative of near-peer adversaries."

The Air Force plans to stand up two more RPA squadrons in the near future, and expects units to begin flying combat sorties before they approach full manning. There are 18 Total Force squadrons flying the aircraft.

The RPA training community doubled its pilot output in 2017 and since then has been focused on developing tactics and capabilities to equip RPA pilots with more experience before they go to graduate-level training, Bissonette said.

Today, RPA pilots get about two-and-a-half months of

qualification training and about a month of fundamentals training. In addition to T-6 flights and academics, the 558th has simulators to give RPA pilots more practice in the basics of flying and the foundational tactics for employing weapons, along with getting used to the onslaught of information they must manage while flying, which includes multiple screens and audio inputs.

In initial training, RPA students deal with challenges in situational awareness and basic airmanship, as they have a limited amount of time actually flying, Bissonette stated during a December conference on military flight training.

Trainers talk regularly to units and change the syllabus bimonthly to address issues as quickly as they arise, according to Bissonette.

Despite the operations tempo, Cheater said the RPA



Photo: Joel Martinez/USAF

community embraces the challenge of supporting the fight and defending US troops and American interests every day.

Because of the nature of current operations, RPA crews are highly proficient at close air support, reconnaissance, and attacking time-sensitive targets, but less proficient in the skills needed to operate in denied environments.

"If there's a near-peer fight, we will be there," he said. "There's no doubt in my mind. The questions are: Are we going to go Day One? Are we going to go before Day One? Are we going to go Day Three?"

With the increase in operations, the Air Force is standing up more units to fly MQ-9s, locating crews at multiple bases nationwide. Air Combat Command activated the 25th Attack Group at Shaw AFB, S.C., in October 2018, the latest in a series of activations.



Photo: ATC Joel Miller

The new 65th Special Operations Squadron patch features the Latin "Scientia Fortuna Iuvat," which means "Fortune Favors the Bold."

"We won't just have RPA operations from Creech Air Force Base," said 1st Lt. Anne, an MQ-9 Reaper pilot at Shaw, in a release announcing the group. (The Air Force does not release the full names of its RPA operators.) "We will have operations on the East Coast at Shaw, as well as at Ellsworth AFB, S.D., and Whiteman AFB, Mo. We are having more units across the country to help us do what we do."

Air Force Special Operations Command has also increased operating locations. In December, AFSOC stood up the 65th Special Operations Squadron, part of the 1st Special Operations Group at Hurlburt Field, Fla. Most of AFSOCs other MQ-9 units operate from Cannon AFB, N.M.

Creech, meanwhile, is growing. It will change from an auxiliary to Nellis AFB, Nev., to an independent base in 2019, with the 432nd Wing taking over command of the installation, a shift with major implications for the MQ-9 aircrews.

Air Combat Command boss Gen. James M. Holmes, during a January visit to the base, said the change will bring a "more sustainable lifestyle for airmen and their families."

While the infrastructure is expanding, the pilots and sensor operators themselves are still facing hurdles to their progression in training because of the constant need for combat operations. Today, the "vast majority" of upgrade training for RPA crews happens on "combat lines," Cheater said, meaning a crew flying over a combat zone en route to a possible air strike takes the time to fly upgrade training, which usually would happen at home bases over local airspace. If an aircrew is not qualified to conduct an actual air strike, a qualified pilot will take over once weapons must be fired, Cheater said.

Reaper missions can last more than 20 hours, and RPA crews work in three shifts throughout the day to fly, at the most, eight hours. To manage demand, RPA pilots and sensor operators must be qualified in at least two combatant command theaters. Typically, however, they will fly in only one part of the world on any given day, Cheater said.

"You come in today and fly in this part of the world, tomorrow in [another] part of the world," he said. Each has its own rules of engagement and operating instructions, so switching back and forth can be complicated.

"I really want you to specialize," Cheater said. "That's a



Weapons load crew member Amn. Alissa Bien (far left) operates a jammer while TSgt. Christopher Shamburger and A1C Deion Giron align a munition on an MQ-9 Reaper at Cannon AFB, N.M.

Photo: SrA. Luke Kitterman

An airman runs a postflight check on an MQ-1 Predator at Creech AFB, Nev. The Predators were retired last year.



Photo: SrA. James Thompson

restriction I place on the squadrons: Be really good at two places.”

Despite the pace of operations—or perhaps because of it—Cheater said crews have full license to stop flying if a pilot becomes too tired. The decision is between the squadron and the supported combatant command, leaving the wing command out of the decision process.

## RECOGNITION

More often than not, however, RPA pilots are all in, and the Air Force is looking for ways to better recognize their contribution to the fight. For the first time, the service is considering awarding the Legion of Merit, historically reserved for senior officers and enlisted leaders, to the more junior RPA pilots and sensor operators.

Longer term, Cheater said, the service may consider awarding the revered Distinguished Flying Cross to RPA aircrews.

“In the future, it may evolve to that point, but right now we are operating within the regulations available to us,” he said.

In 2016, the service created the “R” device for RPA actions. The first awards of this device were presented with Meritorious Service Medals and Air Force Commendation Medals to aircrews last July and served as a “big morale boost” to the community, Cheater said.

RPA group commanders and chiefs formed a “decoration board” where they reviewed extraordinary air strikes, specifically ones with strategic significance and higher degrees of difficulty. A few cases were referred to the Combined Forces Air Component Commander for the possible award of Legions of Merit.

“The ones in my mind that may be worthy [involved] an extremely time-sensitive moving target, where significant friendlies are at risk, or the level of difficulty is extreme,” Cheater said. ✪



# Become a **FLIGHT LEADER** in AFA's Operation Enduring Support!

Sign up for a  
**MONTHLY GIFT** today  
and qualify for the  
special gifts below!

## RECURRING DONATION TIER

## GIFT

Hap Arnold Flight  
**\$15**

**Operation Enduring Support Blanket**



Doolittle Squadron  
**\$25**

Above Gift + **Decal**



Airpower Defenders Group  
**\$50**

Above Gifts + **Airpower Classics Book**



Patriots Wing  
**\$75**

Above Gifts + **Trifold Flag (flown over the Air Force Memorial)**



AFA Leadership Command  
**\$100**

Above Gifts + **President's Coin**



[www.AFA.org/OperationEnduringSupport](http://www.AFA.org/OperationEnduringSupport)



We are YOUR Air Force Association  
We are AIRMEN for LIFE



Graphic: SrA, Ericha Vuyota

# Halt, Who Goes There?

**Today's Common Access Card won't disappear anytime soon—but the search for a better way to prove your digital identity is underway.**

By Shaun Waterman

**"O**n the Internet, no one knows you're a dog!" Twenty-five years ago, when *The New Yorker* published its iconic cartoon depicting a dog seated at a screen using a keyboard and mouse, it was good for a chuckle. Now that the entire economy, not to mention command and control of the nation's armed forces, has moved online, it's not so funny anymore.

**"It's a matter of how fast you can incorporate technologies!"**

—USAF Chief Technology Officer Frank Konieczny

The challenges of proving identity in a digital world have been weaponized by America's enemies, used to worm into military and contractor networks, and to siphon out secrets by the truckload, threaten vital infrastructure such as the power grid, and spread fake news on social networks.

Like a lot of large, global enterprises, the Air Force has been grappling with how to enable the on-the-go access people want and need while protecting the confidentiality, security, and integrity of its data.

USAF Chief Technology Officer Frank Konieczny described a recent technology pilot program where



Photo: J.M. Eddins Jr./USAF

TSgt. Kyle Hanslovan, a cyber warrior with the Maryland ANG, works at Warfield ANGB, Middle River, Md.

officials sought to tackle complicated and sensitive issues of network and data access by working with lawyers in the military justice system.

It was one of the “more difficult” test cases, Konieczny said. “That’s why we did it there.” Lawyers move on or off cases on short notice—and who is entitled to access files also changes depending on the case’s disposition.

The program successfully demonstrated the transformative power of a new, more agile, and automated approach to identity management, he said. Later this year, when the DOD’s chief information office publishes its long-awaited, departmentwide Identity Credentialing and Access Management (ICAM) strategy, observers hope such approaches will propagate through the entire department, allowing the military to play catch-up.

“It’s a matter of how fast you can incorporate new technologies,” said Konieczny.

Traditionally, computer network security operates like a castle and moat. Data is protected behind a firewall (or moat), and users are admitted over a “drawbridge” only after proving their identities. But as *The New Yorker* cartoon highlights, that last part is the weak link. Spoofing identity by co-opting someone else’s credentials turns out to be relatively

easy, especially when identity is defined by a username and password combination that can often be stolen using malware hidden in carefully crafted emails. Almost all the major breaches suffered by the US government and military began with a phishing attack designed to fool users into giving up their digital identity credentials.

But the Air Force, like the other military services and, indeed, the whole federal government, has access to a very strong identity credential—the Common Access Card. The CACs are issued only after a rigorous in-person identity-proving session. They use a system of encryption that can be traced back to the origins of online security.

To make online computer communications secure, they must be encrypted, which means using a special mathematical code to scramble the message. In classical encryption, the code to scramble the message is the same as the one that unscrambles it. Here’s the problem: To send an encrypted message, I need a key that can let me eavesdrop on all your communications.

Ron Rivest, Adi Shamir, and Leonard Adleman—the three scientists who gave their initials (RSA) to global corporate security—solved this problem in 1977 using something called asymmetric encryption, in which messages are

# Access Control Beyond the Common Access Card (CAC)

Securing a network is a lot like securing a building: Both need doors, locks, and keys. But, because anyone with a key can gain access—including hackers and imposters—closely tying keys to trusted identities is critical.

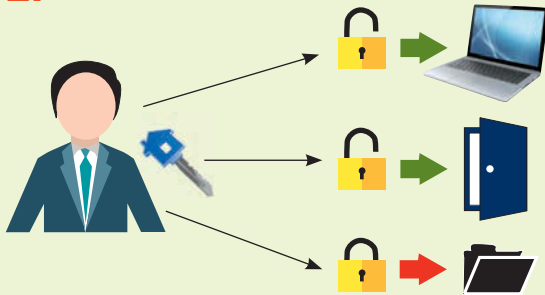
## 1. The Defense Department breaks this down into three components:

- **Identity**—a trusted digital identity based on an individual's defining attributes, which can include a photo, fingerprints, date of birth and more
- **Credential**—a digital identity with authoritative proof of that claimed identity, such as the Common Access Card (CAC)



- **Access**—allows an organization to leverage a trusted digital identity and the CAC to control what files and systems a user can access

## 2.



Think of your identity and CAC as **keys to the front door**. They get you into the building. But what you are allowed to access once inside is defined by access controls. Today, DoD manages access with **Role-Based Access Controls**, which:

- Groups users by their role or roles within an organization
- Has policies or rules about what access is allowed for users in a given role
- Are implemented using directory-type tools, like Windows Groups
- In the future, **Attribute-Based Access Controls** will allow more granular access control and better security. The Air Force recently demonstrated such a system

## 3. ABAC can use multiple types of attributes to grant or deny access, including:

- **Subject attributes**—Things that are true about the user: Such as citizenship, job title, and clearance level
- **Action attributes**—Things that describe the action the user wants to do: Read, edit or share, for example
- **Object attributes**—Things that describe the computer resources (apps, data, etc.) being accessed: Such as what kind of data is it, who owns it, the level of classification, and so on
- **Contextual or environment attributes**—Things that are true about the circumstances of the access: What time of day is it? What IP address is the user logged on from?

Sources: DoD, CompTIA; Illinois Security Lab

scrambled using a public key that anyone can access, but requiring a private key that the receiver alone possesses to unscramble the message at the other end.

In the CAC, the private key is stored on a secure chip that never leaves the card. Validated by a PIN, the CAC is as secure a cryptographic credential as we can make. Because the card has to be physically present in the reader to present the key, it renders credential theft attacks using stolen usernames and passwords useless.

"It's as close to the gold standard as I've seen out there," said Dan Conrad, Federal Chief Technology Officer of One Identity. His company, which has contracts with many DOD agencies, including Air Force elements, has spent a lot of time researching emerging new cryptographic technology such as the open-standard Fast Identity Online (FIDO), but has yet to find anything as secure as the CAC. "Its assurance level has yet to be beaten," he said.

Even so, Chinese hackers were still able to steal the Office of Personnel Management database just by acquiring a username and password. Even though federal policy required the use of personal identity verification cards for system administrators and other privileged users, that policy wasn't strictly enforced.

"Leaders simply hadn't enforced the policy," said retired USAF Brig. Gen. Greg J. Touhill, who helped lead the Obama

administration's cybersecurity sprint after the massive OPM hack in 2015 and became the nation's first federal chief information security officer, or CISO, in 2016. Information security is "a leadership and management issue, as much as it is a technology issue," said Touhill, now president of cybersecurity contractor Cyxtera Federal Group.

According to agencies' self-reporting in 2015, fewer than 40 percent of privileged users were using CAC/PIV cards to log on, Touhill said. By the end of 2016, that number was above 90 percent, thanks to leadership buy-in at the White House. "We got top cover all the way up," he explained.

Yet even today, such problems persist. The Air Force enforces CAC log-on for 96 percent of privileged users, according to Konieczny, and has a plan to reach 100 percent. The holdup? Some network equipment isn't designed to work with a CAC or other cryptographic credentials.

Longer term, however, there's a bigger problem with the CAC as an identity credential. To go back to the castle analogy, the drawbridge has become more like a highway toll plaza with a dozen lanes of traffic whizzing through at high speed than a one-lane gateway where each user must prove himself to the guard. The growing use of mobile and wireless devices, whether on the flight line or out in the field, is changing the requirement for identifying technologies.



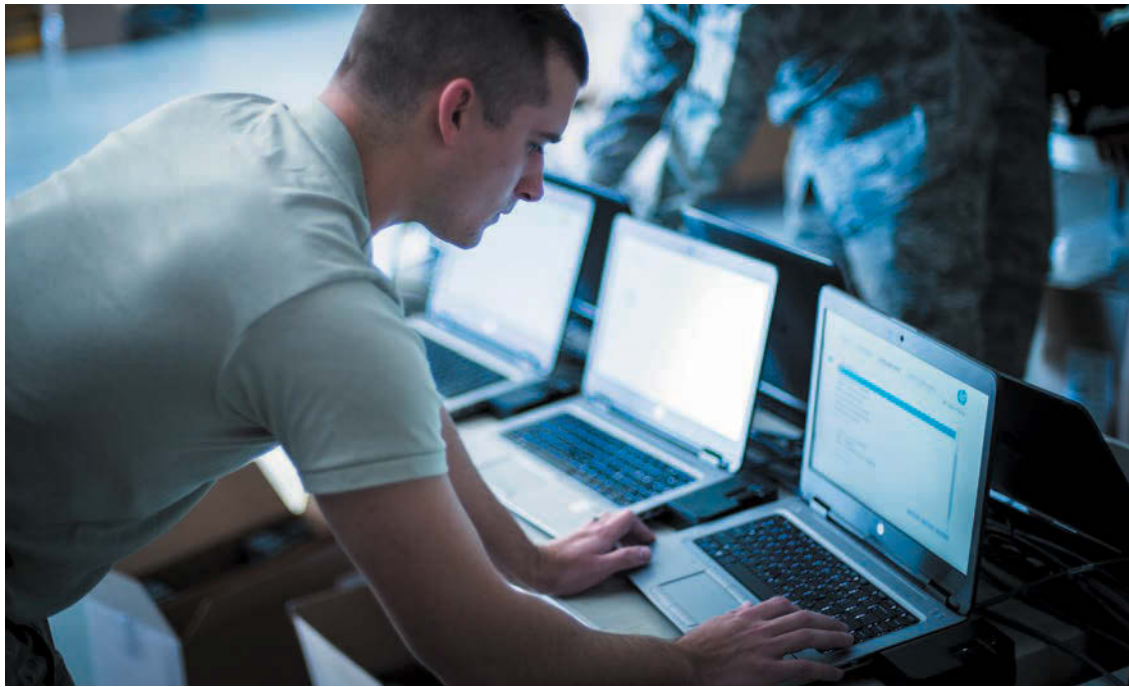


Photo: AIC Alexis Docherty

SrA. Zach Wilt installs Microsoft Windows 10 onto a laptop at Holloman AFB, N.M., in 2017.



Photo: Amn. Frankie Moore

Cyber security airmen at Davis-Montham AFB, Ariz., are tasked with safeguarding operational and communications security for installation of computer and telephone systems.

“Traditional identity technologies don’t scale well across a mobile environment,” said Touhill. “The technology has overrun the policy.”

There’s no way for a typical smartphone or tablet to read a CAC. Hardware solutions, similar to a built-in card reader, are impractically bulky and expensive—not to mention annoyingly slow.

Software alternatives, dubbed derived credentials, leverage the security features in modern smartphones. Users enroll their devices at a terminal where they can use their CAC to log on, deriving a cryptographic certificate from the private key stored on the CAC. Validated by a PIN or a biometric identifier, such as a fingerprint or iris scan, a derived credential is theoretically as secure as the CAC itself.

But derived credentials haven’t taken off. “Managing those credentials isn’t easy,” Touhill said, and there are still only a few applications that accept them.

DOD’s solution is called Purebred. It’s a management system that issues derived credentials and manages the cryptographic infrastructure they need. Konieczny said DOD was aiming to increase its use throughout the military services. “There’s a big push to get more Purebred out there,” he said.

Meanwhile, any notion that the CAC will disappear in the foreseeable future is probably sheer fantasy. CAC infrastructure investment was \$154.7 million in DOD’s FY18 IT budget, roughly comparable to prior years’ spending, according to Stephanie Meloni, manager of market intelligence for IT consultancy immixGroup. That’s a “significant investment, both in time and money,” and is more than 500 times as much as the \$300,000 DOD invested researching alternatives.

“There are a lot of alternative solutions being talked about, piloted, and prototyped,” she said. But the “CAC is not going anywhere anytime soon—these new solutions will be in addition to CAC, for the near-term, at least.”



Photo: Kimberly Grouse/USAF

Jeff Parks, a Microsoft Premier field engineer, leads a course on cybersecurity tools for airmen at Keesler AFB, Miss.

## WHOSE MOAT?

Meanwhile, the moat-and-drawbridge model of security is rapidly going the way of, well, castles and moats. In the emerging era of cloud computing, the concept of a perimeter protecting all your vital data is disappearing. Increasingly, vital data is stored on someone else's computers.

"The perimeter as we knew it is gone," said Touhill. In its place is a model where the moat is only one security layer of many. In this model, every room in the castle is locked. When users gain permission to cross the drawbridge, they are given keys to only those rooms to which they need access.

As Konieczny puts it, "You need to separate authentication from authorization." Authentication is proving you are who you claim to be; authorization determines what access you get on the network.

"The CAC tells me who you are," Konieczny said. It lets you over the drawbridge. But it doesn't define what data or applications you need to do your job; it doesn't entitle you to keys for any particular rooms. That's the authorization piece.

"I have to map—within my system—what access you should have, based on your role," Konieczny said. This Role-Based Access Control, or RBAC, ties your identity to your job.

Today, most military systems rely on a manual process to define those roles. It's a time-consuming, paper-based, and inherently inefficient process, sometimes taking days to grant access to the necessary files and systems. Removing someone can take just as long—raising potentially serious insider-threat concerns when access for an individual should be quickly denied, such as when they are fired or disciplined.

The pilot program the Air Force ran for military

lawyers sought to automate that whole process, Konieczny said. "To automatically assign authorization to particular people dynamically ... based on a data or application owner coming in and saying, 'Yes, this person needs access to that.'" Based, in other words, on attributes associated with identity and that would be discoverable in an automated fashion from a range of authoritative databases.

Rather than based on a role or job, this approach is based on attributes identified in the system. The advantage: "If those attributes change, the system automatically deletes their system access" right away, Konieczny said.

"The goal is to do that [authorization piece] faster and eliminate the [system administrator] piece of it and eliminate the paper-based aspect," he said.

That pilot program successfully dealt with a dynamic environment where access requirements change quickly. Documents had to be tagged so that access could be authorized correctly.

Now follow-up research is focused on automating the tagging process, so when documents are created, it's already clear who is entitled to see them.

But wider implementation must wait on the new, DOD-wide ICAM strategy.

Konieczny pointed out that the new strategy is replacing a 2014 document titled *Identity and Access Management*. Bringing credentialing into the title is emphasizing the PKI, he said. "It's brought [cryptographic] certification into a higher level of visibility."

Touhill said he hoped the new strategy would be proscriptive only about capabilities. Prescribing specific technologies, he said, was a recipe for being "outdated by the time the policy is out." ❏

**"The perimeter as we knew it is gone."**

—Brig. Gen. Gregory Touhill, USAF (Ret.)



# We are YOUR Air Force Association We are AIRMEN for LIFE

For a \$50/year Membership or a \$35/year E-Membership, you too can be part of an organization that believes whether you are Active Duty, Guard, Reserve, or Civil Air Patrol; in uniform or civilian; students, cadets, or family members – we are all **Airmen for Life**.

The Air Force Association exists so we can all be **Airmen for Life**. It is the very foundation on which General Jimmy Doolittle built AFA.

Of course, the world and the Air Force have changed a lot since 1946. However, one fact remains unchanged: We are all Airmen who believe deeply in a dominant Air Force for our nation.



Join today at [www.AFA.org](http://www.AFA.org)

# Building America's Future Bomber Force:

# A Change in Vector

A B-2 takes on fuel near JB Pearl Harbor-Hickam, Hawaii. The B-2 is scheduled for retirement before the B-21 bomber's initial production allotment is completed.

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



*Lt. Gen. David A. Deptula is the dean of the Mitchell Institute for Aerospace Studies. Douglas A. Birkey is the executive director of the Mitchell Institute. This article is adapted from the Mitchell research study, Building the Future Bomber Force America Needs: The Bomber Re-Vector, which can be downloaded in its entirety at: [www.mitchellaerospacepower.org](http://www.mitchellaerospacepower.org).*

**T**he United States faces an inflection point regarding how it projects power in an environment defined by burgeoning threats and a complex set of security imperatives. Since the end of the Cold War, Americans have rightfully assumed their nation possessed military superiority, no matter the situation. Today, however, that assumption is radically changing.

We are now in an era where multiple competing nations are concurrently developing strategies and fielding advanced capabilities specifically designed to counter US combat power. As the Senate Armed Services Committee declared in 2018:

“The array of national security threats facing the United States is more complex and diverse than at any time since World War II. The strategic environment has not been this competitive since the Cold War. Simply put, America no longer enjoys the comparative edge it once had over its competitors and adversaries.”

Opponents have observed America's long-established pattern of operations and are developing methods to negate our strategies. The 2001 Quadrennial Defense Review predicted as much 18 years ago: “Future adver-



Photo: MSgt. Russ Scaif



Photo: TSgt. Ted Nichols

**B-1Bs on the flight line at al Udeid AB, Qatar. Older, nonstealthy bombers such as the B-1B complicate an enemy's defense calculus with standoff missile capabilities.**

saries could have the means to render ineffective much of our current ability to project power overseas. Saturation attacks with ballistic and cruise missiles could deny or delay US military access to overseas bases, airfields, and ports." That "future" is now.

It is necessary to reassess long-held assumptions regarding the capability and capacity of US military force structure, in particular the size of the Air Force's bomber

fleet—which is now the smallest it has been since the founding of the service in 1947.

America ended the Cold War with over 400 bombers arrayed to fight one enemy—the Soviet Union. Countering multiple adversaries demands a more capable hybrid force comprised of new B-21s, as well as modernized legacy bombers—the B-1B, B-2, and B-52.

Bombers are the most cost-effective option to deliver long-range, rapid power projection capacity and capability to combatant commanders around the globe. In the Mitchell Institute's recently released study, *Building the Future Bomber Force America Needs: The Bomber Re-Vector*, we make the case to grow the Air Force inventory to a force of 270 bombers: 180 B-21s, plus 90 legacy bomber aircraft. This approach departs from the Air Force's current plan to retire the B-1B and B-2 before the B-21's initial production allotment is completed, a budget- and personnel- driven decision that preceded the release of the new National Defense Strategy in 2018. The Air Force plan would yield a force of 175 bombers, inadequate to meet the requirements of the National Defense Strategy. Premature divestiture of legacy bombers risks an even greater shortage in the event of B-21 production delays or a curtailed buy. History teaches it is unwise to divest a capability until the replacement is guaranteed.

## FORK IN THE ROAD

The new National Security Strategy, the growing near-peer threats of China and Russia, and continued instability in regions like the Middle East mandate that the nation close the gap between real-world demand and available force structure. Failing to pursue this path will see valuable strategic, operational, and tactical options fall off the table. The Department of Defense has few options when it comes to long-range power projection on a global level. A good “Plan B” does not exist without bombers. The new B-21—if procured in sufficient numbers—paired with a modernized B-52, B-1B, and B-2 force can avert the current shortfall and ensure security requirements are met years into the future.

The high end of the conflict spectrum is more dangerous than ever. As the 2018 National Defense Strategy explains: “Deterring or defeating long-term strategic competitors is a fundamentally different challenge than the regional adversaries that were the focus of previous strategies.” Nations around the globe are turning to overtly aggressive actions to advance their interests. China is harnessing attributes of hard power to expand its territorial claims in the South China Sea and beyond. Russia is willing to engage in blatant acts of hostility in places like eastern Ukraine and Syria. North Korea is aggressively pursuing nuclear weapons, and Iran is continuing its adversarial actions across the Persian Gulf. All the while, the threat posed by nonstate actors continues to evolve in new, challenging ways. The globe is increasingly unstable, and highly predictable regions are now buffeted by significant change. US interests and priorities are at risk with both military capabilities and capacity stretched thin.

The burgeoning threat environment is also of increasing concern because adversaries now have the means to execute their strategies due to concerted investment in a new generation of advanced military capabilities. This list includes advanced air defense systems; long-range precision strike; deployed, decentralized airborne command and control; robust ISR functions; and enhanced computing capacity. Enemy commanders will be able to target American and allied forces with an incredibly lethal combination of range, precision, and mass.

These threats have not existed since the Cold War. Strategies, operational practices, and hardware of the last century can no longer be assumed to be “good enough.” Factors like wartime attrition and reserve must be seriously considered once again. Mass, concurrent, and survivable power projection becomes increasingly important given the scale and scope of these new challenges.

With adversaries aggressively pushing forward, the Air Force must act fast to realign its capabilities and capacity with a requirements-driven force, not one shaped by arbitrary budget targets. It is not just about buying more of what the service already has; it is about generating the right balance of capabilities.

## BOMBER TOOL KIT

Looking to the future, attributes of the right force balance include:

**Range.** The bomber force must be able to strike nearly any target, no matter its distance. Many key facilities lie deep within adversary territory, and bombers are one of the few assets capable of reaching these targets early in a conflict. Range also enhances survivability. It permits the bomber force to operate from bases beyond the reach of



Staff illustration

An artist's concept of the B-21 bomber. The B-21 must be procured in sufficient numbers to avert a coming bomber shortfall.

our adversaries' anti-access capabilities and lessens our reliance on tankers.

■ **Responsiveness.** The bomber force must react quickly to emerging crises around the globe. Unlike other elements of the joint force, bomber response time is measured in hours—not days, weeks, or months. Further, bombers can move easily from one theater to another, potentially from the same base. This strategic flexibility is particularly critical in a multipolar world.

■ **Payload.** This gives the bomber force the ability to bring a large number of weapons and highly specialized capabilities into the fight. This includes swarms of cheap munitions to swamp adversary air defenses, specialized penetrators to defeat deeply buried targets, powerful sensors to better understand the battlespace, and potentially nonkinetic payloads that support integrated systems destruction warfare.

■ **Survivability.** Aircraft that feature stealth technology like the B-2 and the B-21 can strike targets anytime, anywhere. Older nonstealthy bombers, such as the B-1B and B-52, can also complicate an enemy's defensive calculus at the high end of the threat spectrum by using standoff missile capabilities and ISR to locate targets. The combination imposes steep costs on an enemy and radically complicates defense strategy.

■ **Versatility.** Regardless of type, all bombers now execute missions that extend beyond their historic roles as long-range, air-to-ground strategic attack and interdiction strike aircraft. Additional mission areas include counter-sea attack; ISR; persistent direct attack; close air support; and electronic warfare. Future growth areas include deployed, airborne decentralized command and control capability as integral elements of the combat cloud, and new technologies like hypersonic munitions, directed-energy weapons, and cyber-attack tools.

From an airpower perspective, these essential attributes point to a common capability: long-range sensor-shooters. Operating across long distances, carrying large loads, fielding sensor and processing capabilities, and transiting anywhere on the globe in a matter of hours, the defining virtues of the bomber force speak directly to the attributes required for this new threat environment. These aircraft will radically complicate an enemy's defensive calculus and yield valuable options for US commanders.



Airmen prepare to load a Quickstrike-Extended Range mine onto B-52s at Andersen AFB, Guam. BUFFs are expected to remain in service through 2050, completing some 100 years of service.

Photo: SrA Zachary Bumpus

## BIGGER AND YOUNGER FORCE

Bombers' strengths are not reflected elsewhere in the current defense inventory. Naval vessels are slow and increasingly vulnerable to modern weapons. Land forces require significant deployment time, are vulnerable to attack once employed, and lack extended power-projection capabilities. The majority of the nation's airpower portfolio consists of short-range aircraft, with limited payload carriage. Thus, the argument for long-range sensor-shooters is simple—maximize the capability to rapidly project power. Viewed from a cost-per-effect perspective, it may also be termed “mission-based affordability,” because desired combat effects are realized so efficiently.

Force size also matters. In the years after the Cold War, US forces faced comparatively mild anti-air threats, which resulted in relatively few losses compared to earlier conflicts. Future threats point to higher attrition risks, which must be factored into the force structure. Additionally, unlike the limited regional conflicts of the post-Cold War era, future wars will likely encompass larger operating areas—increasing demand for a greater number of bomber aircraft.

America's present bomber force is too small to meet the tenets of the nation's defense strategy. The “peace dividend” paid out following the Cold War radically reduced USAF long-range strike capacity from 661 airframes when the Berlin Wall fell to 157 aircraft in 2018—a 76 percent reduction in bomber aircraft. The B-2 acquisition was slashed by 85 percent, and the B-1B and B-52 force was cut by half. While resources were focused on making the remaining bombers more effective through introduction of precision-strike capabilities and a range of other upgrades, a small force, no matter how capable, can only be stretched so thin on the global stage in an era where threats are on the rise.

The backdrop to this was the combined impact of downsizing, combat operations in Afghanistan and Iraq, and the

Budget Control Act of 2011—which cut several vital force modernization efforts. Multiple continuing resolutions further eroded finite investment and contributed to today's compromised airpower capabilities. As Secretary of the Air Force Heather Wilson remarked: “We have an Air Force that is the oldest Air Force and the smallest Air Force in its history.” Former Senate Armed Services Committee Chairman John S. McCain declared, “This is a full-blown crisis, and if left unresolved, it will call into question the Air Force's ability to accomplish its mission.”

While the acquisition of the B-21 certainly stands as a crucially important decision in reshaping America's military defense portfolio, the current Air Force “bomber vector” suggests that the service is planning an inventory of only 175 bombers—B-21s and B-52s, with B-1Bs and B-2s retired in the 2030s. This risks retiring aircraft before their replacements are fully fielded and fully capable and is simply inadequate for today's security environment. Decisions must focus on mission requirements, not just up-front cost.

To build the force structure needed for the 21st century, the Air Force should consider retaining and modernizing its B-1Bs and B-2s until it can procure B-21s in larger numbers. This additive approach—in combination with the stated intent to retain and modernize the B-52—builds the bomber inventory and closes the gap between demand and available assets. It also answers the demonstrated requirement to meet both high-end mission demands in increasingly complex threat environments, while also allowing efficient power projection against long-standing nonstate actors and other persistent adversaries. The Air Force must advocate for greater resources to fund this need.

Potential adversaries are well aware of the capacity challenges facing the US military and are emboldened to press forward aggressively because they believe the US will be self-deterred from engaging. An inadequate set of

A Chinese S-300 air defense missile system fires at an aerial target. The new National Defense Strategy identifies China as a near-peer threat.



Photo: Fu Kaichun, Wang Haijun, and Chenlei via chinamil.com.cn

tools will result in lost lives, ceded mission objectives, and the risk of defeat in war. A larger long-range, sensor-shooter force, however, will deter enemy action and stabilize the world against aggression. Preventing war is always cheaper than fighting one.

## BACK TO THE FUTURE

The Mitchell Institute recommends a nine-step course of action to increase the capability and capacity of America's long-range bomber force:

**1 B-21 acquisition.** The Air Force should aim to procure at least 180 B-21s and increase the production rate to meet growing demand for penetrating strike capability and provide highly survivable long-range sensor-shooter platforms for a variety of emerging missions.

**2 Bomber retirements.** To build the force structure needed for the 21st century, the Air Force should consider retaining and modernizing its legacy force of B-1Bs and B-2s. Retiring the Air Force's legacy bomber aircraft should be postponed until sufficient fully mission-capable B-21s have been produced and delivered to equip a significantly expanded bomber force.

**3 Modernization.** All legacy bomber types should be modernized to afford continued operational relevance for several more decades, and to take advantage of the considerable life span remaining in the B-1Bs, B-2s, and B-52s.

**4 Fleet management.** To make retirement pronouncements today about decisions that will not be final until the 2030s is counterproductive. Once an aircraft is labeled for retirement, modernization dollars disappear. The surge of funding necessary to turn back the clock on that decision may not be possible later. The bomber plan's overly prescriptive approach to fleet management is not only expensive but also highly inefficient.

**5 Networking.** Every bomber must be connected as critical elements of the combat cloud to facilitate rapid and seamless data gathering, processing, and dissemination across platforms and domains. With readily available size, weight, and power, bombers have enormous potential for operating as key nodes in the distributed, decentralized future combat cloud architecture.

**6 New missions.** The extraordinary versatility of the bomber force allows for the expansion of bomber missions beyond long-range, air-to-ground strategic attack and interdiction. The payload and range of these platforms offers important advantages for a diverse range of missions such as maritime

strike, ISR, close air support, air defense, and electronic warfare, while also affording size, weight, and power for the integration of new technologies like hypersonic munitions and directed-energy systems. Upgrade priorities, funding levels, and general force-management decisions must appreciate all these strengths, not just the traditional bomber air-to-ground strike function.

**7 Weapons.** Future weapons development, especially with hypersonic and directed-energy weapons, will likely gain significant operational advantage if they are paired with the bomber's ability to carry large numbers of weapons, transit long distances, persist in areas of interest, and penetrate defended regions. Distinct advantages can also be leveraged by further integrating existing weapons into the bomber portfolio.

**8 New metrics.** The Department of Defense must establish a new set of metrics to determine mission system value on a normalized "cost-per-effect" basis. It should measure mission cost per output delivered relative to total enterprise costs.

**9 Readiness.** While funding can and should be directed to airframe enhancements that improve the mission capable rate of a given platform, there is no greater determinant of aircraft readiness than sustained, constant, and predictable operations and sustainment funding. Operations in Southwest Asia have established that with proper manpower and spare parts, even legacy bombers are sustainable at mission capable rates similar to other Air Force combat aircraft.

## NEED TO PREPARE

Secretary Wilson recently said, "We must see the world as it is. That is why the National Defense Strategy explicitly recognizes that we have returned to an era of great power competition. We must prepare."

Modern conflict emerges quickly, is unpredictable, and requires decisive force. Drawn-out wars of attrition caused by military parity or poor strategy are not in America's interest. Over the past 17 years, the US military has overwhelmingly focused on counterinsurgencies. Today, world dynamics are driving us back toward a different kind of conflict—struggles where the nation's most crucial interests will be on the line. The Air Force must seize the initiative now to grow its long-range, sensor-shooter capabilities and capacity. Our national security depends on it. ★





Photo: AFA library

# Peacekeeper by Fits and Starts

**The Air Force explored more than 30 deployment options for MX, including air launch, a shell game in the desert, Dense Pack, and rail garrison.**

By John T. Correll

**T**he Minuteman intercontinental ballistic missile—backbone of the US strategic deterrent throughout the Cold War—entered service in 1962, deployed in underground silos across the Great Plains and along the northern tier of the United States.

Even then, it was understood that silo basing was less than optimal. The original plan was that part of the Minuteman force would be mobile, with missiles moving around the countryside on railroad cars. Funding for three mobile squadrons

**A Peacekeeper ICBM in a modified Minuteman site at Vandenberg AFB, Calif. Development of the Peacekeeper missile began in 1972.**

was canceled in 1961 for reasons of cost and doubts about its necessity.

That decision took on a different cast in 1966 when the Soviet Union introduced the SS-9, a huge ICBM with extraordinary accuracy and high destructive yield. The obvious target for such a weapon was the silo-based Minuteman. By the early 1970s, the Soviets had fielded the SS-18, an improved version of the SS-9, and was testing several more new ICBMs.

The consensus of defense planners was that instead of an improved Minuteman, what was needed was a new missile, more powerful and less vulner-

The buried trench concept featured a missile on an unmanned vehicle moving back and forth along an underground trench. The option was costly, and would have had significant environmental impact.



Illustration: AFA library

able. Advanced development on Missile System X—or MX, later known as Peacekeeper—began in 1972.

The driving objective of the MX/Peacekeeper program was survivability under attack, to be achieved by some combination of mobility and hardening of missile sites. Initially, the Air Force favored launching the MX by dropping it from an airplane, but that soon gave way to other concepts.

Eventually, more than 30 different basing modes were considered. They included shuttling the missiles around by road or rail, hiding them in underground tunnels, and situating the silos on the southern side of steep mountains, where they would be more difficult targets for Soviet missiles arriving from the north.

This constant jumping from one operational concept to another—often with conflicting claims about what would work and what wouldn't—undercut credibility. MX/Peacekeeper was further bogged down by partisan opposition, which regarded any new US strategic weapons as destabilizing.

The program was repeatedly redefined and reorganized for 20 years with the result that when the Cold War ended, the operational Peacekeeper had never gotten beyond deployment in old Minuteman silos.

The quest for a mobile MX Peacekeeper was abandoned in 1991, and the missile was deactivated altogether in 2005.

## EMERGING RISK

The SS-9, almost twice the size of Minuteman, entered flight testing in 1963. The earliest models were not accurate enough to knock out US silos, but the launch control centers were at risk. A number of improvements reduced

the immediate danger to the LCCs, but in the long term, the SS-9 was clearly a potential threat to Minuteman.

US planners had not forgotten about ICBM mobility. From 1966-1967, STRAT-X, a Pentagon study on the future of strategic weapons, reviewed ways to make missiles more survivable, including launch from airplanes and deployment on trucks moving around a winding system of roads.

In 1969, Secretary of Defense Melvin Laird declared that the SS-9 was a bid by the Soviet Union to achieve a “first strike” capability, a devastating blow to the US strategic forces. His deputy secretary, David Packard, said—disputed by arms control advocates and others—that the SS-9 had attained sufficient accuracy to destroy a Minuteman silo.

A new generation of Soviet ICBMs appeared in 1973, replacing the SS-9 with the massive SS-18 and including upgraded variants of two smaller missiles. At least one more missile was in testing, with across-the-board gains in guidance and payloads.

The Pentagon gave assurance that enough Minuteman missiles could still ride out a Soviet strike to deliver a punishing counterattack. However, future improvements in Soviet accuracy and delivery systems might chip away at that capability.

The Air Force regarded Minuteman technology as obsolete, though, and wanted the eventual replacement to have the capability for a US strike on Soviet ICBMs—not possible with the existing Minuteman.

“Air Force and Defense Department planners appear to be moving toward the conclusion that the Air Force’s next ballistic missile system should be mobile, and most likely air mobile,” *Air Force Magazine* reported in 1973.

In a test in October 1974, a Minuteman I missile was dropped from high over the Pacific by a C-5A transport.

The multiple shelter concept was essentially a “shell game” in the desert. Each missile could be hidden in any one of 23 shelters.

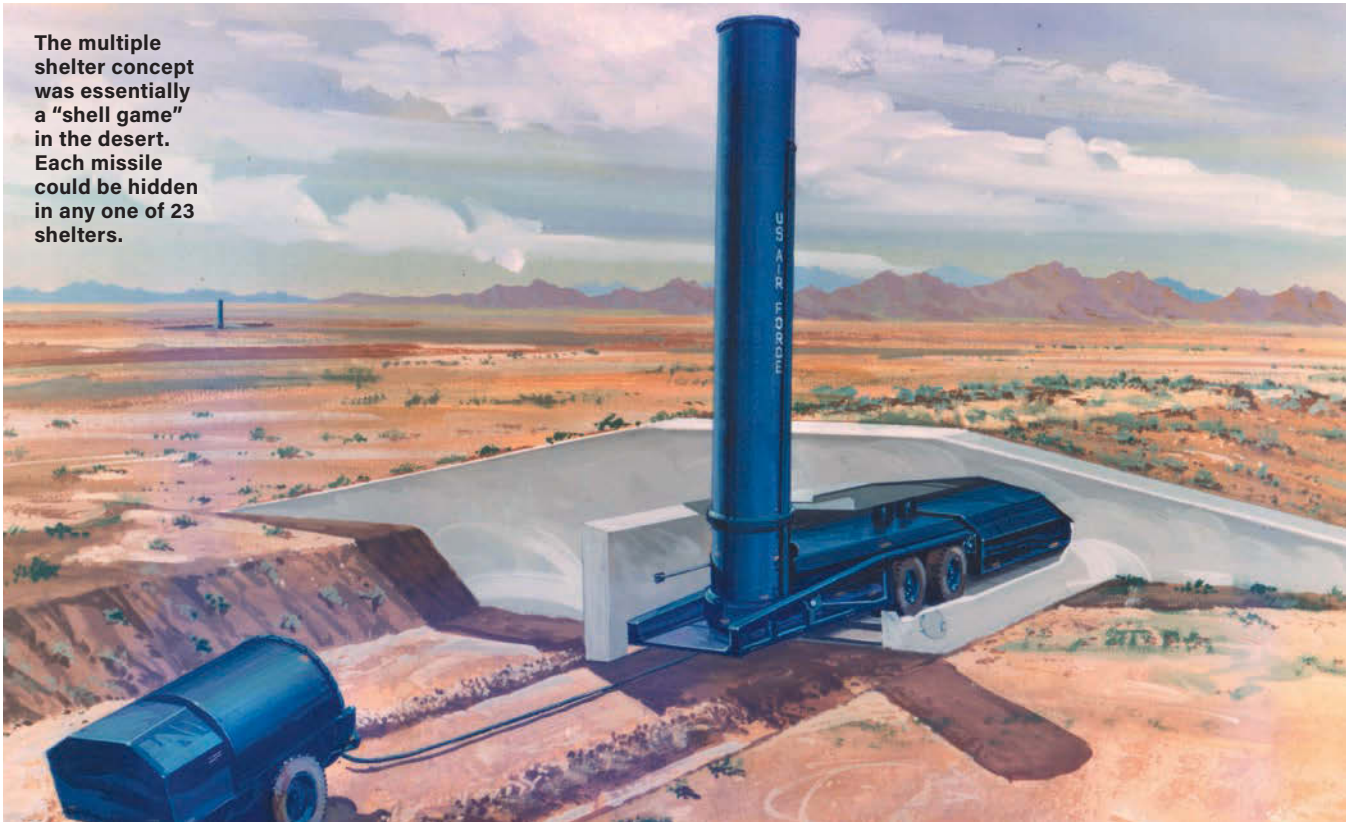


Illustration AFA library

The missile, mounted on a carriage, was pulled out the rear door by drogue parachutes and held upright until it fell to 8,000 feet, where the engines ignited. The air launch was a complete success.

## MULTIPLE OPTIONS

During the 1970s, the Air Force explored a wide range of basing options for MX, with numerous variations spun off from the principal concepts. Among the proposals actively considered were these:

- Deep underground basing in hardened silos buried at depths of 1,000 to 2,000 feet.

- Locating the silos on the southern side of steep mountains or mesas, creating a targeting problem for Soviet missiles fired across the polar regions to the north. As it turned out, relatively few sites could be found that were both suitable and available. Also, the Soviets might be able to shoot the tops off the mesas and bury the missile sites in radioactive rubble.

- The “spoked wheel,” with a high-speed missile transporter at the hub, dashing out on warning to hardened shelters at the end of the spokes. This was somewhat akin to the Multiple Protective Shelter solution later in effect from 1979 to 1981.

- The “buried trench,” with the missile on an unmanned vehicle moving back and forth along an underground trench, five feet below the surface and 20 miles long. This option was costly, and had significant environmental impact.

In 1976, Secretary of Defense James R. Schlesinger proposed deploying MX in existing Minuteman silos as a temporary expedient, but Congress would not fund it, directing validation of either a buried trench or shelter basing plan. Congress also turned down air-mobile basing.

Meanwhile, both Minuteman (in 1970) and the SS-18 (in 1975) had gained multiple independently targetable re-entry vehicles or MIRVs and could deliver between three and 10 warheads per missile.

Drew Middleton of *The New York Times* was among those pointing out that the US Air Force was still “talking in conceptual terms about the MX,” whereas “the Russians have developed and produced four new ICBMs,” referring to the SS-17, SS-18, SS-19, and the SSX-16-X, then under development.

## CARTER AND THE RACE TRACK

Ironically, it fell to President Jimmy Carter—who wanted passionately to cut the defense budget and reach a SALT II arms control agreement with the Russians—to revive the lagging MX program. In the opinion of *The New York Times*, “Approval of the MX was the price President Carter thought he had to pay for Air Force support of the SALT II treaty, and he paid it.”

In 1979, Carter acknowledged that fixed-based missiles were “becoming vulnerable to attack” and authorized full-scale development of MX to be deployed in Multiple Protective Shelters, a “shell-game” arrangement in the deserts of Nevada and Utah.

It provided for 200 “racetracks” or long oval roadways. Each of them was a 15-mile closed loop with 23 spur roads leading off of it to concrete and steel shelters. One MX would be assigned to each racetrack, able to take cover in any of the 23 shelters. For arms control verification, the shelters would have a removable “plug” in the roof, to be opened at specific intervals to allow the Soviets to see that there was only one MX per racetrack.

“The system consists of a missile, a transporter or fancy truck, a shelter or concrete bunker, a launcher decoy, and some cheap roads,” said Deputy Undersecretary of Defense Seymour Zeiberg. “For security reasons, a two-and-one-half-acre plot around the shelters will be fenced off. ... The fenced area is the same as we use in the Minuteman bases. We expect that farming and grazing can be right up to the

The rail garrison concept consisted of 25 missile trains, each carrying two Peacekeepers. Specially designed rail cars would transport the missiles and serve as launchers.



Illustration: Convair/General Dynamics

fence. ... The roads connecting the shelters will be as simple as we can get away with.”

The footprint of the project was significantly greater than that, said local ranchers and farmers who were opposed to it. True, the total “public exclusion zone” was 33 square miles, but the clusters were not bunched together into a single space. The total deployment area took in about 15,000 square miles, some of which might be closed off in times of increased security.

That, along with more than 10,000 miles of connecting and service roads, would change the character of the desert region. Furthermore, the project would use large amounts of water, especially during construction, and deplete scarce ground water reserves. The governors of Nevada and Utah did not want the missiles in their states.

Speaking for those with more fundamental objections, *The New York Times* declared that, “The MX would threaten Soviet missiles in underground silos and thus provide Soviet generals with a compelling argument for shooting first in a crisis.”

During the 1980 election campaign, Republican Ronald Reagan was critical of Carter’s Multiple Protective Shelters plan and canceled it when he became president, even though he was convinced of the need for the missile. That left him in search of an alternative basing option.

*Soviet Military Power*, a major report from the Pentagon published in October 1981, said that upgrades to the SS-18 had reached the point where each of its 10 warheads “has a better than 50 percent chance of destroying a Minuteman silo.”

## REAGAN AND DENSE PACK

In November 1982, Reagan gave the MX a name—Peacekeeper—and proposed a deployment mode called Closely

Spaced Basing, or “Dense Pack.” The array would have 100 Peacekeeper silos, spaced about 2,000 feet apart and all grouped onto a single site no larger than 15 square miles.

The first incoming Russian missiles would detonate and wipe out some of the Peacekeepers. However, the attack would also leave behind lingering heat and radiation, setting up “fratricide” that would disable or destroy the following waves of Soviet missiles as they arrived.

Carter said that Dense Pack sounded “ridiculous.” Critics ridiculed it as “Dunce Pack,” but Pentagon officials said it would work, and that about half of the Peacekeepers would survive a Soviet strike. The nuclear effects would persist long enough for the remaining Peacekeepers, carrying 250 to 500 warheads, to launch a retaliatory counterattack.

Rep. Barney Frank (D-Mass.) said the string of odd-sounding proposals for MX were “like critics of the Three Stooges debating the right way to squirt seltzer up your nose.”

Congress would not buy the Dense Pack idea and refused to fund it. Reagan then fell back on a commission on strategic forces, headed by Brent Scowcroft, to suggest the next steps. Scowcroft, reporting in April 1983, proposed a two-part program, to which Reagan agreed.

To fill the hard-target capability gap, 100 Peacekeeper missiles would be deployed in existing Minuteman silos. Concurrently, a small single-warhead ICBM would be developed for deployment in a mobile mode for survivability. The small missile was promptly dubbed “Midgetman.” To some extent, the particular capabilities of each missile system would offset the shortcomings of the other.

The plan represented a political compromise, sufficient to keep the program going, although it suffered somewhat in credibility. After years of hearing about the vulnerability of Minuteman in silos, the public did not understand

The Boeing version (r) and the Martin Marietta version of the small ICBM hard mobile launcher during mobility testing at the Yuma Proving Ground in Arizona in 1986.



Photo: Garfield Jones/DOD via National Archives

why, all at once, Peacekeeper in those same silos was acceptable.

The first flight test of Peacekeeper took place in June 1983. Production began in February 1984. The first 10 Peacekeepers went on alert in modified Minuteman silos at Francis E. Warren Air Force Base near Cheyenne, Wyo., in December 1986.

Midgetman, projected to be operational in 1992, would be stationed at Air Force installations from which it could fan out on 15 minutes warning to roadways in hardened mobile launch vehicles. It would have the capability to retarget quickly and launch from a dispersed location.

## RAIL GARRISON

There would be one last shot at a mobile Peacekeeper. In 1985, Congress set a ceiling of 50 missiles on the program until the administration came up with a more survivable basing plan. In December 1986, Reagan proposed Peacekeeper Rail Garrison. It was a variation on an approach the Air Force had worked up for the early Minuteman two decades before.

The rail garrison system consisted of 25 missile trains, each of them carrying two Peacekeepers. Specially designed rail cars would transport the missiles and serve as launchers. Day to day, the trains would be parked in special “igloos” on military bases. Each “garrison” would consist of about 50 acres of land and use several igloos to house the trains. In time of crisis, the trains would move out onto the 200,000 miles of commercial rail track.

Gen. Larry D. Welch, Air Force Chief of Staff, said in 1987 that “survivability has been overplayed. The real issue is capability.” ICBMs, he said, “are at present our only prompt hard-target capability for the foreseeable future.” Welch pointed out that of all the preparatory steps possible in response to crisis, “the least provocative is putting Peacekeeper on the rails.” This could be done on the softest of warning indications.

Opponents disagreed. Sen. Albert D. Gore Jr. (D-Tenn.) said that rolling out Peacekeeper would change the equation of

power and confront the Soviet Union with a limited window of time to strike without losing advantage. Midgetman, he said, could be ready with less warning and without the risk of destabilizing the crisis.

Rail garrison edged forward slowly, and a prototype rail garrison car was delivered in October 1990. Design work continued on Midgetman.

## BACK TO THE BEGINNING

Neither program had reached completion when the Cold War ended. Development of the Peacekeeper rail garrison system was terminated in 1991. The prototype rail garrison car was sent to the US Air Force museum in 1994. Midgetman was never built, and the program was canceled in 1992.

The Peacekeeper missiles intended for rail garrison deployment were installed instead in Minuteman silos. Then in 2005, Peacekeeper was deactivated, replaced in the silos by Minuteman III missiles refitted with the newer and more powerful warheads from the now-retired MX Peacekeepers. In accordance with arms control agreements, all of the Minuteman IIIs were downgraded to single-warhead status in 2014.

The search for deployment options had come full circle. The technology had improved, of course, but the configuration and the basing mode for the ICBM force today—single-warhead Minuteman missiles in hardened silos—are the same as they were in the beginning, 60 years ago.

At long last, Minuteman today is approaching the end of its run. In 2017, the Air Force awarded contracts to explore the next generation of ICBMs, called the Ground-Based Strategic Deterrent. Specific proposals for building the system are expected in 2020. ❖

**John T. Correll** was editor-in-chief of Air Force Magazine for 18 years and is a frequent contributor. His most recent article, “U-2 Down,” appeared in the January/February issue.

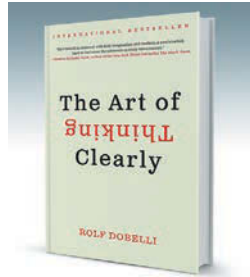


# CSAF READING LIST

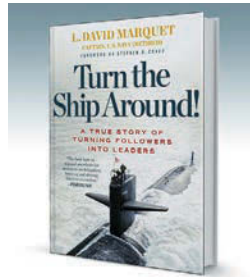
Gen. Ronald R. Fogleman created the CSAF Professional Reading Program in 1996 to develop a common frame of reference among airmen, including officers, the enlisted force, and civilians. Each Air Force Chief of Staff since then has enhanced and continued the reading program. The current list, developed by Gen. David L. Goldfein, includes videos, TED Talks, podcasts, and blogs as well as books. The list is constantly evolving, and now includes recommendations from CMSAF Kalet O. Wright.

Here is a non-exhaustive list of the Chief of Staff of the US Air Force's recommendations. For the full list and an archive of past lists, go to <https://static.dma.mil/usaf/csafreadinglist/>

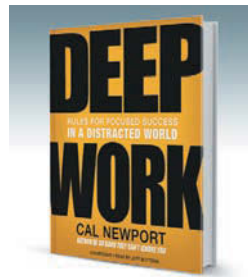
## Leadership and Decision Making



**The Art of Thinking Clearly**  
by Rolf Dobelli  
A practical examination of how to be more aware of your own cognitive biases—and to use that knowledge in your favor.

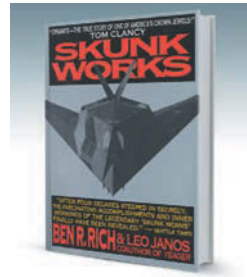


**Turn the Ship Around!**  
by L. David Marquet  
How the *Santa Fe* skyrocketed from worst to first in the fleet by challenging the US Navy's traditional leader-follower approach.

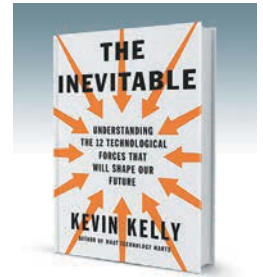


**Deep Work**  
by Cal Newport  
Develop the ability to focus without distraction on a cognitively demanding task. It's a skill that allows you to quickly master complicated information and produce better results in less time.

## Technology & Innovation



**Skunk Works**  
by Ben R. Rich & Leo Janos  
We must get comfortable thinking outside the box and innovating daily ... [and] this book sets the tone.



**The Inevitable**  
Kevin Kelly  
An optimistic road map for the future, showing how the coming changes in our lives—from virtual reality in the home to an on-demand economy, to artificial intelligence embedded in everything we manufacture—can be understood.

## Message From the Chief

"Our new Reading List provides a range of professional development opportunities to refocus our thinking on the challenges that this new era brings. We must sharpen our understanding of nuclear weapons, deterrence, great power diplomacy, and future warfighting technologies. Airmen are the strength of the Air Force. I challenge each of you to take deliberate steps toward expanding your understanding of this new national security environment, the threats we will face, and the tools we will need to prevail. Your dedication and commitment to expand your understanding ensures we remain the best Air Force the world has ever seen. FIGHT'S ON!"

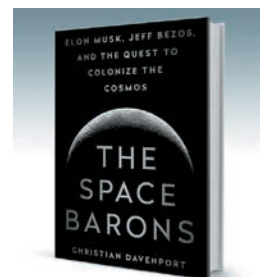


Staff photo by Mike Tsukamoto

David L. Goldfein  
General, USAF  
Chief of Staff

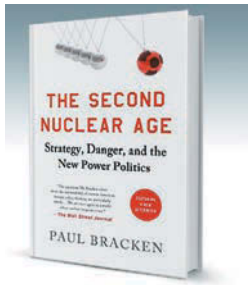


**The Difference**  
by Scott E. Page  
Progress and innovation may depend less on lone thinkers with enormous IQs than on diverse people working together and capitalizing on their individuality. Diversity yields superior outcomes, and Page proves it using his own cutting-edge research.



**Space Barons**  
by Christian Davenport  
A compelling narrative that leaves the reader both entertained and well-informed about what the commercial sector is doing in space and how the "Space Barons" are setting the pace for space activities today.

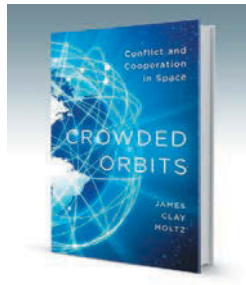
## Warfighting



### The Second Nuclear Age

by Paul Bracken

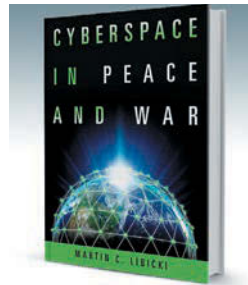
As we face rising powers and unstable regimes, understanding and advocacy for our nuclear force by all airmen has never been more important.



### Crowded Orbits

by James Moltz

A valuable primer on space policy from an international perspective.

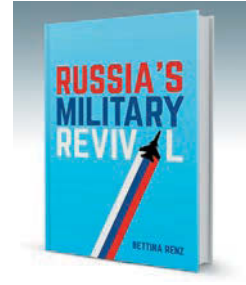


### Cyberspace in Peace and War

by Martin C. Libicke

America's adversaries—from individual actors to nations—will continue to grow new and dangerous cyber capabilities for the foreseeable future as they pursue asymmetric advantages.

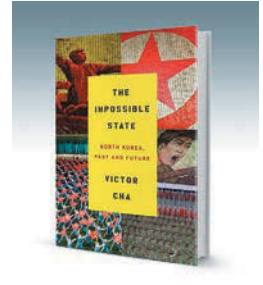
## Strategic Environment



### Russia's Military Revival

by Bettina Renz

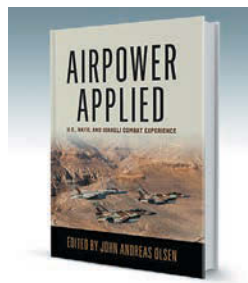
An in-depth and comprehensive analysis of Russia's military revival under Putin's leadership.



### The Impossible State

by Victor Cha

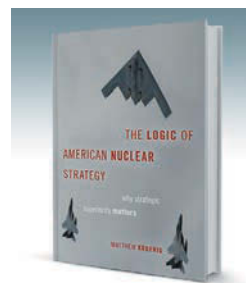
The definitive account of North Korea, its veiled past and uncertain future, from the former director for Asian affairs at the National Security Council.



### Airpower Applied

John A. Olsen, ed.

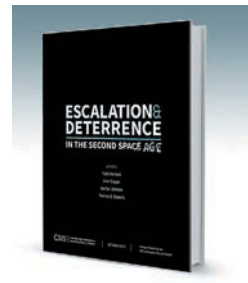
The evolution of airpower and its impact on the history of warfare. A critical examination of 29 case studies in which various US-led coalitions and Israeli airpower played significant roles.



### The Logic of American Nuclear Strategy

by Matthew Kroenig

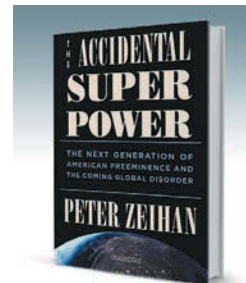
US policy has held that possessing more nuclear weapons than necessary for a second-strike capability is illogical. Is it?



### Escalation and Deterrence

CSIS Report

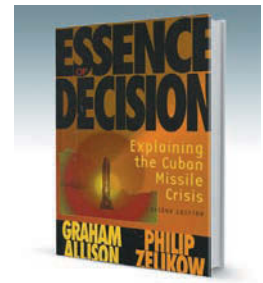
Evolution of space as a contested domain, the changing threats to US space systems, deterrence theory and its applications to the space domain, and results from an 2016 exercise.



### The Accidental Super Power

by Peter Zeihan

In the coming century, America will be challenged across the spectrum of conflict in ways we cannot imagine. We need airmen who can quickly and deliberately synthesize a number of competing theories.

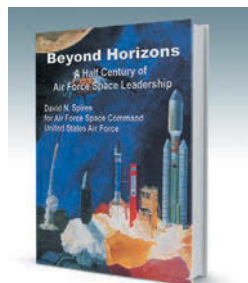


### Essence of Decision

by Graham Allison & Phillip Zelikow

One of the most influential political science works written in the post World War II era, the original edition is a unique and fascinating examination of the pivotal event of the Cold War.

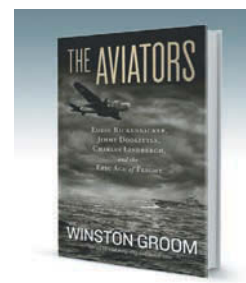
## Heritage



### Beyond Horizons

by David N. Spires

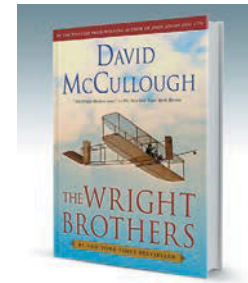
Space is now a contested warfighting domain. Every airman should understand our rich heritage in space.



### The Aviators

by Winston Groom

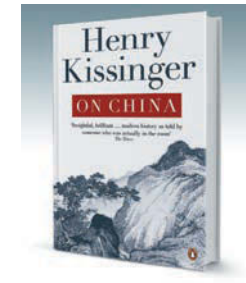
The saga of three extraordinary aviators—Charles Lindbergh, Eddie Rickenbacker, and Jimmy Doolittle—who redefined heroism.



### The Wright Brothers

by David McCullough

The two original airmen who relentlessly pursued flight and overcame countless obstacles and naysayers to realize their dreams.



### On China

by Henry Kissinger

A deep, nuanced understanding of China's history in foreign affairs, its leaders on the global stage, and its ever-growing role on the global security environment.

## CENTRAL EAST REGION

### REGION PRESIDENT

**Peter Jones**  
(202) 430-5190 (CentralEast.president@afa.org).

### STATE CONTACT

**DELAWARE:** William Oldham, (302) 653-6592 (DE.President@afa.org).  
**MARYLAND:** Tanisha Crosby, (575) 415-5784 (MD.President@afa.org).  
**VIRGINIA:** Kenneth Spencer, (757) 208-0768 (VA.President@afa.org).

## FAR WEST REGION

### REGION PRESIDENT

**Wayne Kauffman**  
(818) 706-0936 (FarWest.President@afa.org).

### STATE CONTACT

**CALIFORNIA:** Wayne Kauffman, (818) 706-0936 (CA.President@afa.org).

## FLORIDA REGION

### REGION PRESIDENT

**Sharon Branch**  
(407) 432-8504 (Florida.President@afa.org).

### STATE CONTACT

**FLORIDA:** Sharon Branch, (407) 432-8504 (FL.President@afa.org).

## GREAT LAKES REGION

### REGION PRESIDENT

**Tom Koogler**  
(937) 427-7612 (GreatLake.President@afa.org).

### STATE CONTACT

**INDIANA:** Craig Spansburg, (812) 323-7649 (IN.President@afa.org).  
**KENTUCKY:** R. Troy Kenning, (859) 466-5501 (KY.President@afa.org).  
**MICHIGAN:** Randolph Whitmire, (248) 930-6420 (MI.President@afa.org).  
**OHIO:** Kent Owsley, (937) 671-8932 (OH.President@afa.org).

## MIDWEST REGION

### REGION PRESIDENT

**Chris Canada**  
(402) 212-7136 (MidWest.President@afa.org).

### STATE CONTACT

**ILLINOIS:** Thomas O'Shea, (847) 659-1055 (IL.President@afa.org).  
**IOWA:** Jerry Thorius, (319) 622-3074 (IA.President@afa.org).  
**KANSAS:** Todd Hunter, (316) 619-4096 (KS.President@afa.org).  
**MISSOURI:** Paul Bekebrede, (816) 847-7376 (MO.President@afa.org).  
**NEBRASKA:** Richard Holdcroft, (402) 933-1352 (NE.President@afa.org).

## NEW ENGLAND REGION

### REGION PRESIDENT

**Kevin Grady**  
(603) 268-0942 (NewEngland.President@afa.org).

### STATE CONTACT

**MASSACHUSETTS:** Yvonne Thurston, (978) 454-1626 (MA.President@afa.org).  
**RHODE ISLAND:** Dean Plowman, (401) 413-9978 (RI.President@afa.org).

## NORTH CENTRAL REGION

### REGION PRESIDENT

**Larry Sagstetter**  
(612) 695-8700 (NorthCentral.President@afa.org).

### STATE CONTACT

**MINNESOTA:** Daniel Murphy, (952) 942-5487 (MN.President@afa.org).  
**NORTH DAKOTA:** Nathan Wages, (770) 365-3554 (ND.President@afa.org).  
**SOUTH DAKOTA:** Ronald Mielke, (605) 334-7421 (SD.President@afa.org).

## NORTHEAST REGION

### REGION PRESIDENT

**Bill Fosina**  
(908) 803-4949 (NorthEast.President@afa.org).

### STATE CONTACT

**NEW JERSEY:** Kevin Webster, (973) 903-1939 (NJ.President@afa.org).  
**NEW YORK:** Maxine Rauch, (516) 826-9844 (NY.President@afa.org).  
**PENNSYLVANIA:** Patrick Kon, (814) 516-4019 (PA.President@afa.org).

## NORTHWEST REGION

### REGION PRESIDENT

**William Striegel**  
(253) 906-7369 (NorthWest.President@afa.org).

### STATE CONTACT

**ALASKA:** Jeff Putnam, (907) 452-1241 (AK.President@afa.org).  
**OREGON:** Mary Mayer, (310) 897-1902 (OR.President@afa.org).  
**WASHINGTON:** Lance Bleakley, (253) 737-5593 (WA.President@afa.org).

## ROCKY MOUNTAIN REGION

### REGION PRESIDENT

**Don Kidd**  
(719) 282-6022 (RockyMountain.President@afa.org).

### STATE CONTACT

**COLORADO:** Linda Aldrich, (719) 694-8719 (CO.President@afa.org).  
**UTAH:** Alex Dubovik, (801) 841-7801 (UT.President@afa.org).

## SOUTH CENTRAL REGION

### REGION PRESIDENT

**Russell Lewey**  
(256) 425-8791 (SouthCentral.President@afa.org).

### STATE CONTACT

**ALABAMA:** Ken Philippart, (256) 489-3144 (AL.President@afa.org).  
**ARKANSAS:** Jerry Reichenbach, (501) 837-7092 (AR.President@afa.org).  
**LOUISIANA:** C. Ben Quintana, (318) 349-8552 (LA.President@afa.org).  
**MISSISSIPPI:** Teresa Anderson, (228) 547-4448 (MS.President@afa.org).  
**TENNESSEE:** Derick Seaton, (731) 438-3240 (TN.President@afa.org).

## SOUTHEAST REGION

### REGION PRESIDENT

**Jackie Trotter**  
(478) 954-1282 (SouthEast.President@afa.org).

### STATE CONTACT

**GEORGIA:** Sam Grizzle, (770) 607-7585 (GA.President@afa.org).  
**NORTH CAROLINA:** Larry Wells, (919) 762-0184 (NC.President@afa.org).  
**SOUTH CAROLINA:** Franklyn Kreighbaum, (714) 421-3479 (SC.President@afa.org).

## SOUTHWEST REGION

### REGION PRESIDENT

**Roberta Oates**  
(702) 498-3045 (SouthWest.President@afa.org).

### STATE CONTACT

**ARIZONA:** Stu Carter, (520) 678-4418 (AZ.President@afa.org).  
**NEW MEXICO:** Frederick Harsany, (505) 846-0840 (NM.President@afa.org).

## TEXOMA REGION

### REGION PRESIDENT

**Kelly Jones**  
(325) 280-6059 (Texoma.President@afa.org).

### STATE CONTACT

**OKLAHOMA:** Dan Ohnesorge, (580) 213-7226 (OK.President@afa.org).  
**TEXAS:** Michael Winslow, (940) 873-4663 (TX.President@afa.org).

## SPECIAL ASSISTANT EUROPE

**Dustin Lawrence**  
(EU.President@afa.org)

For more information on the Air Force Association, visit [afa.org](http://afa.org) or call the AFA representative in your area.



Civil Air Patrol cadet Emma Herrington became the first graduate of the new Cadet Wings Program, earning her private pilot's certificate after passing the Federal Aviation Administration's practical test.



Photo: courtesy of Emma Herrington

## CAP ANSWERS PILOT SHORTAGE CALL

Emma Herrington, a cadet chief master sergeant with the Texas Wings Sulphur Springs Composite Squadron, was one of the first cadets to benefit from CAP's new **"Cadet Wings Program."** As part of USAF's Youth Aviation Initiative, funded at more than \$1 million by the Air Force, Cadet Wings helps CAP cadets obtain their private pilot licenses. The funds cover fuel and aircraft rental through CAP's existing flight training program and may be used at the cadet's home squadron, at an approved flight school, or (starting in June 2019) at a one-month training program.

"I knew CAP flew missions, but I didn't know you could train out of CAP aircraft, so when orientation flights were first mentioned, I was ecstatic, ... I had no idea my first flight with CAP would lead to many more. O-flights are the most important part of a cadet's journey through CAP, and most importantly, they are free," Herrington told CAP.

After completing five orientation flights, Herrington attended week-long training at the Shirley Martin Powered Flight Academy (PFA) in Texas, where she soloed and completed 10 hours of close-pattern and cross-country training.

While there, the Cadet Wings Program awarded Herrington a flight scholarship, and the **Air Force Association's Northeast Texas Chapter**—which contributes more than \$5,000 annually to CAP—stepped in to help by awarding Herrington a \$1,000 fuel- and maintenance-cost scholarship, allowing her to complete all training requirements and obtain her license. Herrington is a senior in high school and has applied to the US Air Force Academy, bringing her that much closer to a career in aviation.

**Correction:** Laurence Gulick, featured in *Airman for Life* (p. 62) in the January/February issue, retired as a major, not a major general.

The **Utah Air Force Association** and Weber State University's Engineering, Applied Science & Technology hosted the 6th Rube Goldberg Machine Competition in January. The event was held on campus in Weber State's Shepherd Union Ballroom with support from the Utah AFA Aerospace Education Foundation, Weber State Center for Technology Outreach, Utah STEM Action Center, Hill Air Force Base STEM Program, and Sectorium Systems.

The challenge was to design the best "automated" machine to deposit coins into a piggy bank. Teams from Northern Utah Academy for Math, Engineering, and Science (NUAMES), Quest Academy, Capstone Classical Academy, New Bridge Elementary, and Odyssey Elementary participated in one of three divisions: elementary school—ages eight to 11, middle school—ages 11 to 14, and high school—ages 14 to 18.

Volunteers served as judges and referees by inspecting and evaluating each team and machine.

The referees' job was to make sure the designs met requirements and filled the piggy banks properly for 40 percent of their score, and the judges scored the remaining 60 percent on teamwork, ingenuity, and whimsical aspects. Said one elementary school teacher: "It is good to see the young students observe the other machines and ask why they operate that way."

NUAMES won in the high school division, and Quest Academy won for the middle school division. Both teams will represent Utah at the Rube Goldberg National Finals in Lawrenceburg, Ind., on April 6, 2019.

The New Bridge Elementary team won trophies for Rube Goldberg Spirit of Hilarious Inventions and Helping Hand Teamwork, while Odyssey Elementary won the Professor Butt's Creative Spark Award.



NUAMES students put the final touches on their Rube Goldberg entry, which won in their division.



Students from Quest Academy, winner in the middle school division, complete the project.

Photos: courtesy of Alex Dubovik



1/Col. Raynal C. Bolling. 2/Aerial view of Bolling Field, 1924. 3/Gen. Stephen Wilson, Vice Chief of Staff of the Air Force, at the 100th anniversary of Bolling Field.

# BOLLING

## Present at the Creation

For airmen, the word “Bolling” stands out, it being the name of a famous air base in Washington, D.C. This title pays tribute to a World War I aviator of truly great vision and skill.

Raynal Cawthorne Bolling (given name rhymes with canal) was a New York superlawyer who, at age 38, chucked aside an easy civilian existence for a military career. It was brief but illustrious.

In a scant 30 months, he became a military pilot, organized the first Guard and Reserve flying units, helped conceptualize long-range airpower operations, and received a combat command.

Bolling, born in Arkansas, moved frequently in his early life, completing high school in Philadelphia. He graduated from Harvard College in 1900 and Harvard Law School in 1902.

Bolling rose to fame as general counsel for US Steel, a high position he attained at the age of 36. For a while, he lived the high life in an English-style mansion near New York City.

Then came World War I. The May 7, 1915, sinking of the ocean liner Lusitania by a U-boat convinced him the US would soon be at war. Bolling foresaw a key role for military aircraft and took private flying lessons, acquiring his pilot license in summer 1915.

Bolling pushed for and received authorization to create an aviation unit in the New York National Guard. On Nov. 1, 1915, he was commissioned a first lieutenant and was ordered to organize an aviation detachment. His “1st Aero Company” is recognized as the first flying unit in what became the Air National Guard.

Bolling was mustered into federal service and became a Reserve Military Aviator. On May 26, 1917, he stood up the 1st Reserve Aero Squadron—the first-ever in the Army Reserve. It was renamed the 26th Aero Squadron when it reached France in summer 1917.

Before Bolling could take command, however, he was detached for staff duty and sent to Europe as head of a



Photos: DOD; AFA Library; 2nd Lt. Jessica Cicchetti

“Bolling Mission” to study Allied air forces and plan the creation of a wartime air force.

Bolling, impressed by what he saw as the great promise of strategic bombing, strongly recommended buying “fighting airplanes and bombers,” not just support-type aircraft. He and a close friend, Col. William L. “Billy” Mitchell, pushed hard for this concept in US circles.

Gen. John J. Pershing, American Expeditionary Force chief, promoted Bolling to colonel and made him head of the Air Service’s supply and training, but Bolling grew tired of political infighting at headquarters and sought a combat command.

He was picked to run Air Service, US II Corps. On March 26, 1918, Bolling and his driver were inspecting his zone of operation at the front when they were attacked by German soldiers. Bolling was shot and killed. His remains were never recovered.

He was the most senior US air officer to die in the Great War.

On July 1, 1918, the Army honored the fallen aviator by bestowing the name “Bolling Field” on a new aviation facility south of the US Capitol. Renamed Bolling Air Force Base in 1948, it has been operational for 100 years. In 2010, Bolling merged with Naval Support Facility Anacostia to form JB Anacostia-Bolling.



### RAYNAL CAWTHORNE BOLLING

**Born:** Sept. 1, 1877, Hot Springs, Ark.  
**Died:** March 26, 1918, near Amiens, France  
**College:** Harvard (College and Law School), Cambridge, Mass.  
**Occupation:** Attorney, US military officer  
**Services:** New York National Guard; US Army Signal Corps  
**Main Era:** World War I  
**Years of Service:** 1915-18  
**Combat:** Western Front, Europe 1917-18  
**Final Grade:** Colonel  
**Honors:** Distinguished Service Medal, Legion d’Honneur, Croix de Guerre (all awarded posthumously)  
**Famous Friends:** Billy Mitchell, Hober Baker

### BOLLING AIR FORCE BASE

**Site:** District of Columbia  
**Nearest City:** Washington  
**Area:** Approx. 1 sq mi / 607 acres  
**Status:** Open, operational  
**Opened as Flying Field Anacostia:** October 1917  
**Renamed Anacostia Experimental FF:** June 1918  
**Renamed Bolling Field:** July 1, 1918  
**Renamed (new site) Bolling AFB:** June 24, 1948  
**Merged/Renamed JB Anacostia-Bolling:** Oct. 1, 2010  
**Current owner (Bolling):** AF District of Washington  
**Former owners:** Director-Military Aeronautics, 3rd Service Command, Chief of Air Corps, GHQ Air Force, Air Force Combat Command, Second Air Force, Hq USAAF, Continental Air Forces, Strategic Air Command, Bolling Field Command, Military Air Transport Service, Hq Command USAF, Military Airlift Command, HQ US Air Force



# Game changer

With a multi-million dollar expansion in support of electronic warfare, BAE Systems is delivering unparalleled advancement to the F-35 Lightning II. We are fully trained, staffed, and equipped for full-rate production. Unprecedented capability is available now.

[baesystems.com/EW](http://baesystems.com/EW)

**BAE SYSTEMS**

# Timeless Warrior

Time to re-engine

Battle-tested during more than 60 years of service, the B-52 fleet has earned a re-engineing to sustain its service well into the future.

This critical mission needs the company that can deliver proven performance and flawless system integration.

Trust GE to do it right. We're the only ones who've done it for the US Air Force three times before.



[geaviation.com](http://geaviation.com)

