AIR FORCE MAGAZINE

AIR MOBILITY NEVER RESTS

p. 26

Also: Transporting the President
p. 18

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August 2018. Vol. 101, No. 8

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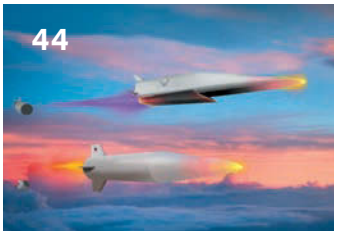

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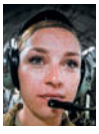

A1C Georgia Clyde, a C-17 loadmaster. See "Mobility Boom," p. 26. Photo by SSgt. Michael Battles

Air Force Magazine (ISSN 0730-6784) August 2018 (Vol. 101, No.8) is published monthly, except for two double issues in April/May and October/November, by the Air Force Association, 1501 Lee Highway, Arlington, VA 22209-1198. Phone (703) 247-5800. Periodical postage paid at Arlington, Va., and additional mailing offices. **Membership Rate:** $50 per year; $35 e-Membership; $125 for three-year membership. **Subscription Rate:** $50 per year; $29 per year additional for postage to foreign addresses (except Canada and Mexico, which are $10 per year additional). Regular issues $8 each. USAF Almanac issue $18 each. **Change of address** requires four weeks' notice. Please include mailing label. **POSTMASTER:** Send changes of address to Air Force Association, 1501 Lee Highway, Arlington, VA 22209-1198. Publisher assumes no responsibility for unsolicited material. Trademark registered by Air Force Association.

By Adam J. Hebert, Editor in Chief

For Korea, the Hard Part Comes Next

June 19, 2018

The brutal North Korean dictatorship wants one thing above all else, and that is to preserve the Kim family dynasty. Other aspirations include obtaining international legitimacy and reuniting the entire Korean Peninsula under Kim Jong Un's despotic control. Pyongyang views its nuclear weapons program as the surest way to achieve these goals.

The United States has stood side-by-side with South Korea (the ROK) since 1950. Today, 28,000 US troops are stationed in South Korea, including 8,000 airmen. They regularly train with their hosts in large, realistic exercises. Airmen in Korea pride themselves on being "ready to fight tonight" in order to deter and, if necessary, defeat a North Korean (DPRK) invasion.

Make no mistake: If South Korea and the US ever did resume a full-scale war with North Korea, the North would lose. That would be the end of the Kim family dynasty.

So why is this standoff between the DPRK and democratic, prosperous South Korea (supported by the United States) in danger of crumbling? For two reasons: nuclear weapons and sanctions.

First, the DPRK nuke program is "probably designed with the assessment that nuclear weapons will deter foreign intervention if Pyongyang attempts to reunify the peninsula by force or coercion," notes a recent Defense Department report. "This idea is repeated in North Korea's internal propaganda and rhetoric about nuclear weapons enabling 'final victory over the United States.'"

Over decades, North Korea has elevated bluster, bluff, and small-scale attacks to an art form, sometimes with deadly consequences. Provocations are carefully planned for propaganda value but to avoid a large-scale military response from the US and South Korea.

If the North believes nuclear weapons allow it to act with impunity (given the DPRK's long history of aggressive behavior) this nuclear program is, in a word, terrifying.

The nukes led to the second change, the sanctions.

A series of increasingly effective United Nations sanctions and other international actions targeting the DPRK are finally proving effective, with Chinese backing. Those who supported North Korea in the past are increasingly turning their backs on the irrational and dangerous regime. Despite sophisticated laundering and concealment schemes, North Korea is finding it difficult to sell coal and weapons overseas, denying it the hard currency that pays for the ruling elite's lifestyle and the nuclear program itself.

As the status quo was beginning to break down, President Donald J. Trump arrived in the White House. North Korea now seeks sanctions relief while inching ever closer to being able to load nuclear weapons onto missiles that could hit the United States.

Nuclear missiles will, in Pyongyang's assessment, give it cover for what comes next. "Reunification with the ROK, by force if necessary, is a key component of North Korea's national identity, validating its policies and strategies, and justifying the sacrifices demanded of the populace," the DOD report explains.

It is not mere bluster. The DPRK periodically kidnaps and imprisons foreigners, sinks other nation's ships, launches artillery attacks against the South, and attacks soldiers in the demilitarized zone. Its own citizens are essentially prisoners in varying levels of pain.

President Donald Trump (right) meets with North Korean dictator Kim Jong Un in Singapore on June 12.

The stalemate of 1953-2018 won't hold forever. Kim Jong Un will either field the weapons he desires—emboldening a move on South Korea—or sanctions will cripple his ambitions, putting his rule at risk and opening a whole new can of worms.

Trump recognized an opportunity in calling for June's Singapore summit. At press time, specifics are thin, but an agreement to denuclearize the Korean Peninsula in exchange for eventual sanctions relief is a positive first step.

President Trump's summit with Kim Jong Un broke the mold.

Also good is a plan to work together to return the remains of Americans killed in the North during the Korean War.

Other agreements are troubling, such as the abrupt decision to halt major US-ROK exercises while the DPRK makes progress toward denuclearization. We await details on what constitutes progress, what training will still take place, and how this will impact South Korea's security.

Trump is surely aware that North Korea has twice before promised to end its nuclear program, only to wind up on the verge of having weapons capable of hitting the United States. The North routinely violates international agreements if it believes it can secure an advantage by doing so.

Trump inverted the normal diplomatic process in Singapore by reaching an agreement first, leaving the details to be worked out later. For decades, the North Korean problem has been described as having no good solutions. Perhaps a radical new approach was necessary. ✪

Photo: Shealah Craighead/White House

Letters

Savage Love

John T. Correll is a great military historian and I have enjoyed his *Air Force Magazine* articles for years. But the end of his July article, "The Revolt of the Admirals," was lacking [p.54]. He said the Navy "eventually gained a share" of the nuclear mission when submarine-launched ballistic missiles took their place in the Triad. Actually, the Navy got into the nuclear delivery mission a decade before the Polaris SLBMs became operational around 1961. The Navy's first truly carrier-based, nuclear-capable bomber was the AJ2 Savage, a turboprop that became operational in 1953. But even before the AJs came in, the Navy equipped a number of its P2V Neptune patrol planes to deliver nukes, supposedly able to fly off the carrier with JATO assist, starting around 1948. The Neptunes never really were based on the carrier because of their wingspan and inability to recover after a mission. The Savage was replaced by the jet-powered A3D Skywarrior, which became operational in 1957 and remained in the nuclear delivery role into the late 1970s, with side duties as a conventional attack bird in Vietnam in the mid-to-late 1960s. I flew as a nuclear-delivery qualified B/N in A3s from 1961 through 1965.

Cmdr. Otto Kreisher,
USNR (Ret.)
Arlington, Va.

Commander Kreisher's illustrious bio also includes two stints as Air Force Magazine senior correspondent.—THE EDITORS

I found the article "The Revolt of the Admirals" very interesting, if somewhat incomplete. I was serving as a young ensign in the Atlantic Fleet at the time. I still recall the wardroom conversations about it.

While the article centers on the never-built flush deck carrier USS *United States* (CVA 58), it does not discuss the defects of the design. While the design did have an angled flight deck, it lacked three other major improvements devised by the British Navy: the steam catapult, the mirror landing system, and the "hurricane" (enclosed) bow. The legacy hydraulic cats provided smaller thrust than the steam ones and were fire hazards in event of a broken hydraulic line (I lost a former shipmate in such a fire on USS *Bennington* in the mid-50s). The mirror landing system was much more efficient than the older method employing landing signal officers and the hurricane bow prevented bow damage in heavy seaways. The succeeding design, USS *Forrestal* (CVA 59) which was launched and commissioned during the Eisenhower era incorporated all of these upgrades. The cancellation of CVA 58 may be an example of a right outcome for the wrong reason!

With respect to the B-36, I well recall its test flights from manufacturer Convair in San Diego in the early 1950s. They could be heard 100 miles away. One of my relatives flew as navigator in one of them and was unimpressed by the time required to prepare them for operations. In his opinion the B-47 and the later B-52 were vast improvements in all respects.

Contrary to the author's claim, the revolt led by Adm. Arthur Radford succeeded in part. The Truman administration, heavily influenced by SAC, believed that it could get national defense on the cheap by severely cutting naval aviation, except for a few escort antisubmarine carriers. A clever public relations campaign led by Radford and using radio, TV, and movies ("Task Force" starring Gary Cooper, Walter Brennan, and Jane Wyatt) maintained support in Congress so that when the Korean conflict erupted the following year, the Navy was partially ready: two Essex class and two escort carriers in the Pacific Fleet plus one light British carrier to provide air support to the beleaguered American and South Korean land forces. The reserve fleets and reserve personnel, left over from World War II, soon provided large increases in the carrier and supporting forces.

Cmdr. Robert C. Whitten,
USNR (Ret.)
Cupertino, Calif.

ID the Threat

I read Adam J. Hebert's editorial in the Almanac issue with great interest and some concern ["Opsec and Glossophobia," p. 4]. I am on the board of directors of the OPSEC Professionals Society and am an OPSEC certified professional by that organization. I am also an OPSEC fellow of the NSA's interagency OPSEC support staff. Given those bonafides, I would like to stress the five steps of the OPSEC Process: Identification of critical information; analysis of threats; analysis of vulnerabilities; assessment of risks; and application of appropriate countermeasures. Certainly, communication with both Congress and the public regarding efforts our Air Force expends in defense of the nation is critical in enlisting both current and continued support; however, the details with which this communication is provided can incrementally do great damage if the collective implications of individual tidbits of information are ignored as inconsequential. Seemingly, *Air Force Magazine* struggles with step one in the OPSEC process—that being identifying precisely what it wants to protect and how the plethora of details openly provided may be analyzed by adversaries and contribute to compromise of critical information. In many cases, the simple acknowledgement of information provided via other sources by repeating it gives confirmation to adversarial collection and analysis.

I would also like to take issue with a term used by Hebert—that being operational security. The correct term is operations security, as used by practitioners throughout the government and its contractors and as specified by NSDD 298, signed by President [Ronald] Reagan in 1988. To make the distinction, one may only hope that operations security practiced diligently will make a significant contribution to operational security.

Col. Lowell P. Little Jr.,
USAFR (Ret.)
Albuquerque, N.M.

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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. 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

LETTERS

Once Again, I Get No Dinner

Once again, the annual Air Force almanac of *Air Force Magazine* has left out Arthur R. Brooks in the World War I Aces section. By your own note, "In World I, pilots who shared victories were given one credit. This list uses the World War I counting rule."

The United States Air Force Historical Research Center published their massive volume, "Air Force Victory Credits, World War I, World War II, Korea, and Vietnam" in 1988. In it, Arthur R. Brooks is credited with 1.00 victory on July 29, 1918, a .33 shared victory on Sept. 4, two .50 shared victories on Sept. 14, and a final .33 shared victory on 9 October. By the World War I counting system, Arthur R. Brooks is definitely an ace. The American Fighter Aces Association long ago recognized him as such.

Col. J. Ward Boyce,
USAF (Ret.)
Austin, Texas

We will add Brooks to the 2019 Almanac, and to this year's list online. Thank you for bringing this to our attention..—THE EDITORS

This is the Right Way to Nitpick

I was going to make note that the eagle contained only aircraft—no missiles or space systems—until I saw the editor's note that it was all experimental aircraft. But I must still comment that there are no early aircraft—multiwing craft from World War I, or even a GEE BEE, or the original Wright Flyer. You could defend that by saying they are all modern experimental craft, but then I noticed the inclusion of the starship Enterprise—which is a Navy vessel—a ship, not an aircraft.

Old nitpickers never die, they just write letters to the editor.

Lt. Col. Thomas M. Hargrove
USAF (Ret.)
Shelton, Wash.

Hail to the Chiefs

I'm overseas and just got the June magazine. Disappointed that, yet again, MAJCOM command chiefs were omitted for the various command overviews. Yes, enlisted heroes are rightly mentioned, as were the past and current CMSAF. Other than these two entries, it's all an all-officer magazine. You're reaching out to enlisted on the membership front but ignore us in so many other respects—this being a good example of that.

Chief Tim Litherland,
USAF (Ret.)
San Antonio

USAF's enlisted force is represented throughout the Almanac. WIthin just the MAJCOM overview section, both pictures of airmen portray members of the enlisted force.—THE EDITORS

Walmart isn't a War Zone

An article in "Letters" to *Air Force Magazine* (USAF Almanac) in the June 2018 issue, by Mr. Juris Bergs [p.7], mentioned his disappointment with the military dress codes of this age. I read his letter with great interest since I have the same observations and disappointment as he has.

I was in the US Air Force during the Cold War, from 1956 to 1962. While we were allowed to wear civilian clothes when off duty or when traveling, we always had to wear Class A or B dress uniforms when wearing uniforms off base or when traveling. This included "spit-shined" type shoes. We took pride in wearing our uniforms and the strict dress codes of that time. It gave an appearance of professionalism and discipline.

Today, the military wears fatigues that are unattractive and look like pajamas. It is rare to see anyone wear a dress uniform, assuming they still exist. This gives the impression of being undisciplined and unprofessional, and I am not the only person who believes this. It is very disappointing. I can understand wearing fatigues in a war zone, but not outside a war zone.

Carter B. Endsley
Punta Gorda, Fla.

For This Moment to Arise

Your recent article titled "Intercepting The Bear" [April / May, p. 52] was a great insight to the cat-and-mouse games played by both the US and USSR. I thoroughly enjoyed the article. Your reference to the RB-47 "ferret" and the RC-135 aircraft conducting periphery re-

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connaissance missions was on the mark. However, the SR-71 Blackbird also conducted periphery missions on the USSR in the late 1970s until its first retirement in 1990. As a participant, myself and many other SR-71 crews flew numerous peripheral reconnaissance missions on the USSR, particularly in the Murmansk and Vladivostok area. Flying in international airspace, it's amazing what intelligence can be gathered from 75,000 feet!

Col. Richard Graham,
USAF (Ret.)
Plano, Texas

Why, July, Why?

You never publish my letters to the editor, but I'll send another anyway.

Warrant Officers: The letter was interesting but might have included a key fact ["Letters to the Editor: Warrant Officers, of Course," July, p. 3]. In World War II, 200,000 Army Air Force personnel were appointed to the rank of "flight officer." One Army news release described the rank as akin to a third lieutenant. These were personnel that might not have met, or met only marginally, qualifications to be a commissioned officers as a second lieutenant. However, once in grade, they could be seamlessly promoted to second lieutenant, depending upon performance. My father was trained as a glider pilot in grade as an enlisted man, appointed a flight officer, promoted to Reserve second lieutenant, and eventually was commissioned an officer in the regular Air Force.

Predator: nowhere in the article is it pointed out that USAF did nothing to advance UAV technology and resisted the introduction of UAVs for 20 years ["Elegy for the Predator," July p. 18]. Clayton M. Christensen, famous for his "innovators" books documented this in an article he wrote. DARPA has documented numerous UAV efforts over decades that were promising but failed to transition to operational use because of "pilot in the cockpit" prejudice.

"Revolt of the Admirals": Thanks for at least mentioning the first SECNAV under the National Security Act, John L. Sullivan [July, p. 54]. How galling it must have been to learn about the cancellation of the USS *America* by reading about it in the newspaper. The article's "not consulted" is correct but understates the insult.

Richard Dunn
Edgewater, Md.

This issue is the most depressing issue I have ever read ["From the Daily Report," July, p. 10].

Two A-10s collide at the Weapons School.

Two F-16s collide during a routine IP upgrade sortie.

Two engines failed in our premier air-to-air fighter (two different airplanes) leaving one aircraft damaged.

One F-16 crashed presumably for mechanical problems.

Pilots are getting hypoxic in the USAF's basic training aircraft and no one can figure out why.

30 F-15s are grounded for "structural issues." All aircraft are cleared but the article never said what was done to resolve the problem.

USAF leadership is STRUGGLING to justify replacement of the LARGEST segment of the airborne leg of the nuclear triad which could now be considered an antique if it were a car.

USAF leadership could not provide a convincing argument to the administration that BOTH their premier fighter and a new bomber were absolutely necessary for the defense of the nation forcing the early termination of the most valuable/versatile/capable fighter aircraft on the planet.

USAF leadership can't get a contractor to build a new air refueling aircraft within budget and on time. In addition, it can't keep funds flowing to keep the KC-135 flying at preplanned rates.

In the meantime, China is making an unchallenged power grab for about 90 percent of the South China Sea and doing it with determination and with enough money make it happen.

China has developed fighters to challenge the capabilities of both of the USAF's newest stealth aircraft, mostly by stealing the technology from the US.

China has a fighter/fighter-bomber that is nearly as capable as later versions of the F-16 and is producing them in quantity.

China has developed a four-engine transport aircraft that rivals the USAF C-17 and an AWACS that is extremely capable.

I'm beginning to worry about our leaders, both in and out of USAF, as well as our airmen. Leaders in the Air Force have been unable to convey the vitally important messages required to defend our country and those leaders in the administration and Congress for not listening or not recognizing the extremely precarious position we, as a country, are in. Our airmen, because we don't have enough, are being overworked to the point of exhaustion on deployments, and we are unrealistically expecting those in and out of the cockpit to overcome inexperience, mechanical issues, and weapons system age to keep our country safe.

If your intent was to make me angry, you succeeded. I've seen this perfect storm coming for many years but mostly I'm depressed because I don't see anything changing in the near future.

Lt. Col. Richard Garner,
USAF (Ret.)
Port Orange, Fla.

SEEN IN THE DAILY REPORT

Brrrrr!!!

Anyone and everyone (including SecAF) involved in any way with a sole source contract for $24M to install/maintain refrigerators in Air Force One should be immediately terminated and heavily fined and publicly flogged ["The Daily Report," June 6]. This really makes me angry as a retired Air Force officer and as a taxpayer. Grrrrr!!!

Col. Roger Campbell,
USAF (Ret.)
Burleson, Texas

Long-Lived Herk

I recently read that No. 65-0989, one of the oldest Herks flying for USAF, is about to be retired [See: "The Daily Report," May 2].

A little history is called for. Tail No. 65-0989 was delivered to the 41st Air Rescue Sq. at Hamilton AFB, Calif., in the spring of 1966 as an HC-130H, complete with Fulton Recovery System "cat whiskers," All American Engineering winch, and two 1,800-gallon removable fuel tanks for really long range. As an assistant crew chief, I spent many hours in the scanner's seat on long search missions and Project Gemini space capsule missions.

This series was the first to be powered by the T-56-15 engine rated at 4950 hp. Reason being, two engines could be shut down for even longer range and endurance search operations. The air rescue mission was both search and NASA support as the large white blister on the top of the aircraft housed the Cook Tracker that was used to track the space capsules over very long distances. The HC-130's sent our HU-16B's into retirement.

We also had a couple of HC-130P's that were being brought in for helicopter refueling. One of our P models were used in the first Jolly Green nonstop flight over the Atlantic to the Paris Air Show in June (?) of 1967. I left air rescue shortly there after for USAFE.

George Keeler
Pine Plains, N.Y.

By Jennifer Hlad

INTERNATIONAL JUMP WEEK

In Europe, US troops and servicemembers from 14 other countries trained together in Germany from May 21-25 as part of International Jump Week.

USAF C-130J aircrew from the 37th Airlift Squadron at Ramstein AB, Germany, flew 29 hours during the event, and 240 US and allied paratroopers jumped from five US Super Hercules as part of the exercise.

Polish army Cpl. Bartek Zanik jumped three times during the week and said the experience was "very good."

"It helped with [international] relationships because every country that participated—USA, Poland, Germany, Netherlands, and Estonia—can all come together to make things better," said Zanik, who noted that six Polish paratroopers participated.

"You get to change wings and see how other foreign countries operate, how their jumpmasters do things, and then we can compare our procedures to theirs," US Army SSgt. Triberious Calhoun said. "We learn something from them, and they can learn something from us."

The exercise was coordinated by the 37th Airlift Squadron and the 435th Contingency Response Group, all based at Ramstein.

ARE FOUR BARRELS SINGLE MALT?

In late May, the 386th Expeditionary Civil Engineer Squadron emergency management team had the chance to use its skills in a real-world scenario, after 19 unmarked barrels containing mysterious liquids were found in two sites on base.

SSgt. Dallas Christian, 386th ECES emergency management plans noncommissioned officer in charge at the undisclosed location in Southwest Asia, said his team had to go to both sites to examine the barrels and try to figure out what was inside. It was "the first time in my eight-and-a-half years in the Air Force that I actually had to really do my job."

Still, he said, it wasn't that different than the exercises the unit normally performs. "We practiced everything we were going to do, and it was smooth and went the way it was supposed to," Christian said.

MSgt. Terri Adams, 386th ECES emergency management flight chief, said the team's detectors can break down and identify chemicals, but some of the barrels contained chemical mixtures they could not identify.

However, the team did sample all 19 barrels for harmful chemicals and found no risk to the people on base. Fifteen of the barrels contained corrosive chemicals used to remove rubber from runways, and four barrels were sent to a local lab for additional testing. At press time, their contents had not yet been identified. ✪

Jennifer Hlad is a freelance journalist based in the Pacific region and a former *Air Force Magazine* senior editor.

By John A. Tirpak, Editorial Director

T-38s from the 560th Flying Training Squadron over JB San Antonio-Randolph, Texas, in March.

THE T-X, AT LONG LAST?

June 11, 2018: Any minute now, the Air Force is set to finally conclude its almost quixotic quest to replace the nearly 60-year-old, supersonic T-38 Talon trainer, by announcing a winner of its T-X advanced trainer competition. With luck, USAF pilots will be preparing for fighter and bomber duty in the new airplane within six years.

Everyone with an interest in Air Force pilot training has their fingers crossed that this time it will happen. Prior to this competition, which started in 2013, each time the service conducted an analysis of alternatives (AoA), began to talk with industry about the art of the possible, and gear up for a contract, the T-38 replacement program was felled by budget cuts or some other hiccup. Then the AOAs got stale, the Air Force lost focus, and the whole process had to start over again. Depending on how you count, this T-X contest is about the fourth time USAF has tried to replace this T-38.

As replacement efforts failed, USAF was compelled to extend the life of the T-38. Those projects, dubbed Pacer Classic, have replaced structural members, wings, air inlets, cockpit displays, and various other elements of the "White Rocket" to keep the T-38 safe to fly and reasonably relevant to teaching the tasks of modern combat aviation. The Air Force is now working on Pacer Classic III. Even if the T-X comes off without a hitch, USAF will still have to extend a fair number of T-38s to stay in service while the new jets come online.

The announcement of a winner is already six months late. Sequestration fears have caused USAF to hold back, afraid it wouldn't have the money to award a contract last December, as planned. In the meantime, industry has had to stand by, keeping its design teams together at its own expense.

COULDA BEEN A CONTENDER

The T-X contest has taken some surprising turns. Northrop Grumman, as the builder of the T-38, was considered in many ways the "incumbent," and after discarding an entry based on the BAE Hawk, it designed a sleek, all-new T-38 successor. It then bailed out of the contest 18 months ago.

Lamenting what he called the Air Force's low-price versus "best-value" approach, Northrop Grumman CEO Wes Bush said he'd refrain from bidding—thanks anyway—suggesting his company felt there was no money to be made on the fixed-price project.

Former Lockheed Martin "Skunk Works" chief Rob Weiss also said out loud last year that the T-X contest had devolved into a "low-price shootout." After initial estimates pegging the program as a $20 billion effort to build 350 aircraft, the Air Force lowered the price to about $16 billion, with no reduction in scope or numbers of jets. The service also warned bidders

The Boeing T-X candidate on a documentation flight in 2017.

The Lockheed Martin T-50A during a flight for congressional leaders in 2017.

they shouldn't assume a T-X win would lead to orders for Aggressor aircraft or companion trainers, two roles the T-38 has also borne over the years.

Besides new airplanes, the T-X contract requires a training enterprise, including simulators, part task and maintenance trainers, a course syllabus, software, and ways to simulate sensor operations aloft in a sensor-less jet. The aircraft must also have aerodynamic performance beyond that of the T-38 and aerial refueling capability.

The Air Force won't name the companies that tendered offers on the T-X a year ago in March, leaving that up to the companies themselves. Boeing, Lockheed Martin, and Leonardo of Italy have all said they're in. Other companies, who acknowledge they are long shots, have also suggested they've entered, but with brand-new airplane designs that have not yet flown. One aspect of the competition was to submit real-world flight data for the Air Force to evaluate.

Competitors offering "flown" aircraft include Boeing, with an otherwise unnamed "T-X" that was purpose-designed for this competition; Leonardo, offering the T-100 variant of its M-346 Master, which is flying with several US allies; and Lockheed Martin, offering the T-50A, a variant of the T-50 Golden Eagle it co-designed with Korean Aerospace Industries.

Boeing—teamed with Saab of Sweden—said in 2016 it was "breaking the norm" with its entry, claiming its T-X offers a ten-fold reduction in maintenance labor over the T-38, thanks to new manufacturing techniques eliminating lots of fasteners and sharply reducing production time. Darryl Davis, then-head of Boeing's Phantom Works advanced products shop, said the company's T-X was designed to the Air Force's "threshhold" requirements, meaning no extra capability was added if it increased cost. Davis said the design could add capability if USAF chooses to go in that direction later. Boeing would build the jet in St. Louis.

Leonardo is now the third prime contractor to front the T-100 for the T-X competition. General Dynamics was first to start down that road, then quit as the US lead in 2015, saying it had reorganized its business and the T-X pursuit no longer fit. Industry insiders said General Dynamics assessed the jet's performance as not up to evolving USAF requirements. Raytheon soon signed on, but signed off again in early 2017 with little official comment. Industry sources cited friction between Raytheon and Leonardo over Raytheon's efforts to pare down the T-100's proposed cost. Leonardo took over as a prime contender after Raytheon's departure. The T-100 would be built at Moton Field Municipal Airport, Ala.

Lockheed Martin's Weiss said that when the T-50 was designed, back in the late 1990s, the company actually had the T-38 replacement program in mind, thinking the Air Force would get around to that competition in the early 2000s. The T-50, in Korean service, has trained thousands of pilots and logged hundreds of thousands of flight hours. It went through a USAF-style test program, and there is a warm production line in Korea. Weiss boasted the T-50A variant jet is so "ready to go" that Lockheed could get the jet into US production about two years ahead of requirements if the service chose to accelerate the program. That would allow USAF to spend money on new T-50As instead of on modifying T-38s already facing imminent retirement, Weiss argued. If picked, the T-50A would be built in Greenville, S.C.

HANDICAPPING THE RACE

So, who looks best positioned to win the T-X?

How USAF will weigh and grade aircraft performance, contractor prior performance, the efficacy of the training system being proposed, and other factors are all closely held, but a few things can be deduced about T-X contender chances.

Competitors that have submitted "paper airplanes"—those with no real-world, flying examples—are probably not in contention. USAF has made clear from the outset that it won't bear any more risk with the program than it has to. The service has said it prefers not to go through development of a brand-new airplane, husbanding it through design changes, critical design reviews, the inevitable design setbacks, and flight testing, no matter how efficient the new jet may look on paper. USAF also has a hard deadline to meet in getting T-Xs into the fleet, and

Photos: SrA. James Crow; Kevin Flynn/Boeing; Lockheed Martin

Leonardo's DRS T-100 offering.

it has staged its spending plans to accommodate T-X during a certain window.

The Leonardo T-100 is in service with five countries and its training system is proven. Italy is a partner with the US on the F-35, and the choice of the T-100 would signal that the US is serious about the "two-way street" in terms of buying allied weapon systems. Against it, though, the T-100 has twice been jilted at the altar by a US prime contractor for rumored performance and cost issues, and there are only about 70 M-346s in worldwide service. Call it a legitimate contender, but one that is facing long odds.

Boeing's T-X was tailored exactly to USAF's T-X aircraft and training system requirements. The company professes vast savings from the use of proven components alongside radical new manufacturing methods to slash production time and maintenance costs. Boeing submitted real-world flight data to the Air Force that may or may not have borne out those claims. The company also says that since its T-X's performance tracks so well with computer predictions, flight testing can be reduced, saving time and money and getting jets into the fleet quicker.

Against Boeing, however, is the fact that its airplane is a brand-new design. It will still have to go through all the steps of developing and validating the design, the time and risk of which USAF wants to avoid. Boeing's argument about flight-testing tracking simulation has been made before, such as by Lockheed Martin for the F-35, and the Air Force may not be in the mood to buy that argument again.

While Boeing is financially strong and has a robust backlog of airliner work, it has absorbed more than $3 billion in losses on the fixed-price KC-46 contract, and industry sources say the company is loathe to enter another loss-leader deal to get work offering minimal potential domestic profit margin.

The offset—as it was with the KC-46—is in the foreign sales market. Many air forces will likely choose whatever trainer USAF picks, because the volume of the Air Force buy will sharply lower the unit cost for foreign customers. Boeing said the foreign market for tankers justified its lowball bid on the KC-46, along with getting an inside track on future tanker purchases from USAF. But it's hard to see Boeing's financial strategists allowing another similar gamble, even with the enticement of a foreign trainer market of between 1,000-2,000 jets.

Still, Boeing wants the work to halt the decline of its small combat airplane business, which is slowing as orders for the F-15 and F/A-18 dwindle. Having a warm fighter-sized production line could also boost its chances for future work, such as with the Navy's FA-XX or USAF's Penetrating Combat Aircraft.

WINNING FACTORS AND TIEBREAKERS

Lockheed Martin can legitimately claim it has an in-production trainer to offer, even though it will add an F-35-like cockpit display system and air refueling plumbing to transform the T-50 into the T-50A.

Lockheed can offer a quicker path to production for the Air Force, which makes no secret of wanting the T-X yesterday. Confronted with a persistent pilot shortage driven in part by lack of aircraft, USAF might be tempted to speed things up with a T-50A pick.

Given its low-risk offering, deep pockets to ride out fixed-price contract snags early on, maintenance commonality with both the F-35 and F-16, and ability to accelerate the T-X schedule if necessary, Lockheed would seem to enjoy at least a narrow edge in the competition.

The T-50, however, is a 20-year-old design and may not be able to take full advantage of new production methods. Lockheed Martin's past performance on the F-35, although improved, could also be a drag on its chances.

Whether T-50/T-50A production is efficient and risk-free enough to overcome potential savings from Boeing's radical new manufacturing methods is probably the point on which the T-X competition will hinge.

If the numbers come out a wash, though, with no clear technical winner, what factors might provide USAF with a tiebreaker? Is USAF willing to let Boeing's St. Louis fighter-making capacity wither away? Does the Air Force have "Lockheed fatigue," given that company's domination of the US fighter and helicopter markets? Will Boeing's ongoing struggles with the KC-46 sink its T-X chances?

We'll probably see the answers shortly after the loser, perhaps inevitably, files its protest. ✪

Photo: Leonardo DRS

AFRICOM to Increase ISR Support and Limit Missions in Wake of 2017 Ambush

Reapers are there to help.

Army SSgt. Jeremiah Johnson

Army SSgt. Dustin Wright

Army SSgt. Bryan Black

Army Sgt. La David Johnson

US special operations forces in Africa are paring down their operations and will be supported by an increase in Air Force-provided surveillance from a large USAF operating location in Niger, following the Oct. 4, 2017, ambush in that country that killed four US Army Green Berets.

The Pentagon in May unveiled its long-anticipated investigation into the ambush. At the time, an under-protected group of soldiers was surrounded and outgunned by more than 100 enemy fighters in a mission that was not accurately described to higher US Africa Command officials by lower-level commanders.

The ambush killed four soldiers: SSgt. Bryan Black, SSgt. Jeremiah Johnson, SSgt. Dustin Wright, and Sgt. La David Johnson.

The USAFRICOM investigation into the incident found that several failures in training, command oversight, and a lack of understanding of the special operations mission in the region resulted in the fatal attack. The investigation focused on interviews with more than 140 personnel, visits to the location of the incident, and review of video provided by ISR and French attack jets.

"With the conclusion of the investigation, it is my duty and obligation to make required changes and adjustments to how US military forces conduct daily operations on the African continent," AFRICOM Commander USMC Gen. Thomas D. Waldhauser said in a May Pentagon briefing. "Consequently, I will ensure the lessons learned are communicated to all levels within AFRICOM, as well as within the component commands and integrate these changes into our daily operational activities."

The investigation did not highlight a single major point of failure, and did not specifically recommend any punishment for personnel involved. There will eventually be valor awards presented, which were earned by the four fallen soldiers who continued to fight in their final minutes, Waldhauser said.

The team of Green Berets was accompanying Nigerien forces on what was originally portrayed in a concept of operations to be a routine counterterrorism reconnaissance mission to a village near Niamey. Instead, the mission was a kill-or-capture mission focused on a local ISIS leader.

The investigation states that two Army captains did not accurately portray the mission and AFRICOM officials were unaware of the actual focus. Had they been, the mission would have required higher-level approval and likely more resources, including air support and armored vehicles.

The patrol began Oct. 3, 2017,with a US remotely piloted aircraft accompanying the team from Niamey. The RPA watched the nearby village for several hours, but the soldiers determined it was "cold" and ordered the aircraft to fly further north to watch border crossing locations. The ambush began at about 11:40 a.m. the next day, after the teams stopped in the village of Tongo Tongo for water. At first the group believed the attacking enemy force was small and could be handled, so they did not initially call for support. More ISIS fighters emerged from vehicles and began to surround the forces. The soldiers and Nigeriens were ordered to withdraw.

Unfortunately, a truck containing three of the US soldiers, one US soldier on foot, and two Nigerien vehicles did not withdraw from the ambush site and were separated from the larger group.

Waldhauser said that up until this point, US troops had "never seen anything in this magnitude" from ISIS in Africa, noting the ISIS fighters had tactical surprise. The rest of the US and Nigerien forces relocated about 700 meters away. Their commander had ordered them to flee not knowing what happened to the four remaining US soldiers.

It took an hour and 45 minutes for the first ISR aircraft to arrive on scene, said Army Maj. Gen. Roger L. Cloutier Jr., AFRICOM's chief of staff, who oversaw the investigation. Two French Mirage fighters arrived shortly after they were notified, and flew four show-of-force low passes at about treetop level to disperse the fighters. However, the French jets were unable to identify targets as friend or foe without direct radio contact and did not engage.

A Nigerien quick-reaction force arrived four hours and 25 minutes after initial contact, and a medical evacuation team withdrew the fallen about five hours and 43 minutes after initial contact.

ISIS fighters had removed all useable equipment from the US and Nigerien forces, and three bodies of US soldiers were found in ISIS trucks, indicating they had tried to take them from the scene, Cloutier said.

Since the incident, the Pentagon and AFRICOM leadership have ordered US special operations forces to find ways to further mitigate risk, including limiting the missions that could include contact with enemy fighters. Those missions need a "strategic value" and must include target groups that pose a "strategic threat" to the US. There is a renewed emphasis on the "by, with, and through" focus of special operations, meaning that local forces need to be in the front and deal with potential fighting, Waldhauser said.

There will be a larger focus by AFRICOM, US Special Operations Command, and the US Army on pre-deployment and in-theater training, as well as the rehearsal of missions, to try to mitigate risk. AFRICOM has provided access to more armored vehicles, "increased firepower," and more capacity to limit response times.

A major focus is on intelligence, surveillance, and reconnaissance capacity. USAF has an MQ-9 Reaper presence deployed to Nigerien Air Base 201 near Agadez with the 323rd Expeditionary Reconnaissance Squadron. Airmen from the 724th Expeditionary Air Base Squadron and 31st Expeditionary RED HORSE Squadron, along with Army military police and the Navy Seabees are working to improve the base.

"Our host nation was kind enough to let us set up a temporary base next to their local military basic training site while we established our base, eventually building up a flight line for air operations," said First Lt. Danielle Tabb, Civil Engineer Flight commander and base civil engineer, in an AFRICOM release just days before the deadly ambush.

"We're in the very early stages right now of establishing a presence in the area, but one day this once empty desert will be a fully functioning flight line," Tabb added.

Since then, the US has "beefed up a lot of things posture-wise with regards to these forces," Waldhauser said in May.

—BRIAN W. EVERSTINE

Photos: US Army

THERE'S ROOM TO IMPROVE THE F-22, F-35 TRAINERS

Capt. Michael Slotten climbs into an F-35 at Luke AFB, Ariz., in July, for training at the Barry M. Goldwater Range.

The Air Force's training chief wants F-22 and F-35 basic instruction aircraft modified to full-combat capability, but he is also exploring ways to provide all-up training if that proves unaffordable.

Lt. Gen. Steven L. Kwast, head of Air Education and Training Command, said teaching flying with out-of-date jets poses a danger of "negative learning" or the need for expensive further training when junior F-22 and F-35 pilots reach frontline units. But he recognizes, "it all comes down to money," as to whether USAF can afford the modifications.

"What I want is, I want my cake and [to] eat it, too. I'd like all our aircraft concurrent," so that when there's a software update to the F-35 and F-22 fleets, even the training aircraft get it so "we have congruency" among the platforms. "I don't want to live with … an architecture where the fighter has a different [software] load than the trainer. That's unacceptable to me. So I do not want to take pressure off that," he said.

However, "in the short run," given the demands to fix readiness issues and aircraft age across the force, as well as "the hole we're in with sequestration," Kwast said, "we can't do everything." As a stopgap, he said USAF is looking into virtual technologies that can teach stealth pilots the capabilities in the latest versions of their jets while they get the necessary "visceral" experience—the environment around the jet, the cockpit, takeoffs, and landings, etc.—in the real thing.

An Air Force lab in Austin, Texas, is finding out that the brain is "phenomenal at 'blending'" the visceral experiences with the more "cognitive" aspects of employing the aircraft, Kwast said. The visceral tasks can be learned easily and quickly, but the cognitive elements take "a lot of repetitions," and a virtual reality approach will help drive down costs of teaching them, he explained.

VR approaches can also offer a training space where pilots "can properly train the habits of mind of the frontline aircraft where there are no limits to range space, … weather, … adversaries, … or threat emitters that may or may not be accurate waveforms." They can "practice the habits of decision-making."

These applications should be available soon, Kwast said, but he's not giving up on getting the training jets compatible with frontline aircraft.

"We're building this model so you have the speed and agility … to have access to this training on-command, on-demand, on any device, anywhere in the world," Kwast added. "Now, there are security issues, but those security issues are relatively easy to solve." He plans on "flooding the market" with such devices so pilots of any jet can reap the same benefits, such as being able to train when the weather doesn't cooperate.

"We are … already migrating" the VR technology "to some pilot training bases as a testbed," Kwast noted. He's hoping the technology will "spread like wildfire."

—JOHN A. TIRPAK

USAF WILL USE ARMY CAMO PATTERN

Capt. Ramiro Rios, a C-21 pilot, sports the Operational Camouflage Pattern uniform, which has until now been worn only by the US Army.

The Air Force is officially making another uniform change, transitioning to the US Army's Operational Camouflage Pattern (OCP) in a phased approach with the goal to fully transition by April 1, 2021.

Beginning Oct. 1, airmen who own serviceable OCP-patterned uniforms can wear them. Distribution is limited at first to allow manufacturers to produce enough stock.

Enlisted airmen will see an increase to their clothing allowances on Oct. 1. Beginning April 1, 2019, airmen can purchase the uniform at any AAFES store that carries them. AAFES will sell them online around October 2019, according to the release. Those in Basic Military Training, Reserve Officer Training Corps, and Officer Training School will receive the uniforms beginning Oct. 1, 2019.

The decision to transition to the Army uniform came after feedback from airmen that it is the "best, battle-tested utility uniform available," according to the release.

"We looked at all utility uniforms currently in our inventory to find the best-of-breed," USAF Chief of Staff Gen. David Goldfein L. said in the release. "We spoke to and listened to airmen on this, and the OCP was the clear choice."

The uniform can work in all climates—"from Minot to Manbij [Syria]," he said.

More than 100,000 airmen already have OCPs, including those deployed to US Central Command, in special operations, mobility crews, and security forces in Global Strike Command. The transition means these airmen will only need one uniform, instead of separate uniforms to be worn while deployed or at home station.

The Air Force's take on the OCP will include the wearing of squadron patches, spice-brown lettering on the name tape and Air Force lettering, along with tan T-shirts and belts. Special functional identifiers—security forces, combat controller, etc.—and unit patches will be worn on the left sleeves, with the US flag and headquarters patches on the right sleeves.

—BRIAN W. EVERSTINE

CERTIFYING THE NUCLEAR FLEET IN A CYBER WORLD

The Air Force is already thinking about how it will certify its nuclear systems in a cyber environment. That's a significant challenge considering the last time it certified such a system—the B-2 in the early 1990s—the internet didn't exist, at least not as it does today.

"We built a plan on how to execute that because the time to worry about nuclear certification of our systems is not 2020, it's 2018. You plan for it now," said Lt. Gen. Jack Weinstein, deputy chief of staff for strategic deterrence and nuclear integration, during a May AFA-Mitchell Institute event on Capitol Hill.

Nuclear certification is the final step before a nuclear weapon system can reach initial operational capability. In 2017, the Air Force Scientific Advisory Board (SAB) conducted a study on "Nuclear Surety and Certification for Emerging Systems," in which the board offered several recommendations, including ensuring the Nuclear Weapons Center, Safety Center, and the NWS Program Offices were properly resourced "to support modernization."

Weinstein said once briefed, Air Force Secretary Heather Wilson gave him 30 days to complete a plan to implement those recommendations, which he did. Now the service is working to ensure it hires "the right people" in those locations, so they

Photos: SSgt. Jensen Stidham; MSgt. Phil Speck

can start thinking about the issue sooner rather than later.

The SAB also recommended USAF place more emphasis "on the reliability element of surety" in order to "address the evolving threat to [the] USAF nuclear mission;" develop policies and procedures aimed at addressing cybersecurity in nuclear systems; and work with the National Security Agency to "develop a calculus for cyber resiliency" that includes a quantitative analysis of mission impact, among other suggestions.

Weinstein said his staff is in the process of completing the congressionally mandated Nuclear Mission Assessment, which takes a broad look at USAF's nuclear enterprise, including how the nuclear force is trained, the proper size of the force, whether there is enough money to support the force and the ongoing modernization efforts, and what is the warfighting capability.

Lt. Gen. Jack Weinstein speaks at an AFA Mitchell Institute event.

That assessment, he said, will be presented to Wilson and Chief of Staff Gen. David Goldfein by the end of the year.

"I think it's really healthy to take all of those items and put it together. We were already looking at them, now they are being looked at holistically," said Weinstein.

—AMY MCCULLOUGH

TWENTY-FOUR AIRMEN EARN DFCs FOR AC-130 MISSIONS

Lt. Gen. Brad Webb, AFSOC commander, leads air commandos with the 4th SOS about to receive the DFC medal into a ceremony at Hurlburt Field, Fla.

Twenty-four airmen from the 4th Special Operations Squadron at Hurlburt Field, Fla., were awarded Distinguished Flying Crosses for four separate engagements, all of which included an AC-130 protecting friendly forces.

"All of the DFCs presented today were earned in the dangerous skies of Afghanistan," Air Force Special Operations Command boss Lt. Gen. Brad Webb said in a release. "Although dates and objectives differ, the general mission remained the same, ... defend Americans and their partner forces, and decimate the enemy."

Twenty-one airmen received the awards during the Hurlburt ceremony, and three were unable to attend.

The first of the engagements took place on July 25, 2016, when an AC-130U was providing high-risk daylight protection for 114 US and Afghan special operations forces in the Nangarhar Province. After more than 50 insurgents ambushed the team, the gunship used danger-close 105 mm howitzer rounds within 120 meters of friendly forces. The AC-130U ran low of fuel, so the crew coordinated another gunship to arrive. The enemy's attack intensified as the second AC-130 arrived on station, so the two worked in tandem and began engaging with a total of four guns at the same time. The attack continued, and a third AC-130 launched. Thirty-one enemy were killed, 28 structures were destroyed, and no friendly forces were killed.

On March 29, 2017, another aircrew was flying support for 35 US and Afghan special operations forces when they came under attack in the Kot Valley of Nangarhar Province. Sixty-five insurgents attacked with "overwhelming hostile fire." The AC-130 dropped to a lower altitude and fired for about 90 minutes. Twenty-one of the 25 attacks were danger-close, and the AC-130 pilots received MANPADS (man-portable air defense systems) launch indications during the fight, according to the release. The airpower helped repel the ambush with no friendly casualties.

On April 8, 2017, another crew was flying support for 281 US and Afghan special operations forces again near Nangarhar. When the AC-130 arrived on scene, coalition forces were already taking fire. The aircrew needed to provide continuous fire while being judicious about ammunition usage. As the fight continued, the aircraft commander called for another AC-130 with a bigger armament load and more fuel. The crew returned to base, immediately transferred to the other AC-130, and returned to the fight. The crew ultimately emptied two AC-130s, killing 32 enemies and destroying a weapons cache.

On May 24, 2017, the last crew was flying support for 378 US and Afghan special operations forces in Nangarhar when they were attacked. The crew accurately fired on the enemy forces "within seconds" of verifying positions, despite dealing with electrical issues and gun malfunctions, eliminating the threats.

—BRIAN W. EVERSTINE

SIKORSKY PUSHING FOR EARLY COMBAT RESCUE HELICOPTER PRODUCTION DECISION, DELIVERIES

STRATFORD, Conn. — The next generation of Air Force combat rescue is taking shape on a new Connecticut production line, where two development models of the HH-60W helicopter are undergoing final assembly ahead of flight testing late this year.

Sikorsky officials are confident in the progress on the helicopter, known in the factory as "Whiskey," heartened by the Air Force's budget request of $1.14 billion in Fiscal 2019. The funds will help accelerate development and shrink the deployment schedule. When the original $1.28 billion contract for engineering, manufacturing, and development (EMD) for the helicopter was awarded in June 2014, it launched a 75-month program aimed at delivery on Sept. 26, 2020. Sikorsky is now executing a schedule envisioning a Milestone C production decision in the third quarter of 2019, and delivery in March 2020, nearly six months ahead of the original schedule.

"We're gonna be in there," Tim Healy, Sikorsky's head of Air Force programs, said at the production facility on May 23. "We're gonna be close." Healy explained Milestone C is the most important because "it gets capability to the warfighter."

Air Force Magazine was the first media organization to visit the combat rescue production line, where the two EMD models move along a reconfigured line next to where Sikorsky is building new MH-60R Seahawk helicopters for the Navy. One Whiskey model is stuffed with thousands of feet of orange cables and hundreds of small sensors for collecting flight test data.

The Air Force plans to purchase 112 of the aircraft. The Whiskey model is a heavily modified version of the Army's latest iteration of the UH-60 Black Hawk, the UH-60M. The modernized cockpit has four large displays fed by two advanced mission computers. The data presented include information from the helicopter's five radios, radar, infrared cameras, radar warning system, laser warning system, missile warning system, and multiple data links. They include Link 16, Situational Awareness Data Link, and Common Integrated Broadcast.

The advanced avionics include new capabilities, such as a touch-of-a-button program to choose a hovering location. A pilot flying over water for a rescue will be able to press a button when the HH-60W flies over the site, and onboard computers would calculate environmental and wind conditions, then automatically circle the aircraft back to hover over that spot without further inputs. Pararescuemen could then deploy.

Mission avionics reside in the nose of the helicopter. While Sikorsky admits the new fairings on the nose will make it difficult for USAF rescue crews to paint the trademark "Pedro" mustache on the aircraft—as they do with today's Pave Hawk fleet—the heavier weight on the front provided a bonus. It changed the center of gravity on the helicopter, letting designers strengthen the frame and place a larger fuel tank behind the cabin to balance things out.

The generic Black Hawk, upon which the HH-60G is based, uses a 360-gallon fuel tank. Air Force crews need more fuel for longer flights, so the Pave Hawk is usually fitted with large auxiliary tanks. The Whiskey's internal fuel tank, though, is 660 gallons, which means auxiliary tanks aren't needed to meet the required mission profile: 195 nautical miles range, a 10-minute hover, and then another 195 miles.

The first Sikorsky HH-60W Combat Rescue Helicopter as it enters final assembly at Stratford, Conn., in February.

The pilots enjoy increased ballistic protection by way of thicker armor. The armor plating in the Pave Hawk only protects from standard 7.62 mm ball ammunition but the W model will add protection from 7.62 mm armor-piercing rounds.

Versus the Pave Hawk, the W model has a "more elegant" side-gun mounting design, Healy said. They won't stick out as far from the aircraft and will be able to universally accept GAU-2, GAU-18, and GAU-21 guns.

Special mission aviators and pararescuemen will be able to see mission data in the back of the aircraft, where three full-color displays are mounted. For the first time, pararescuemen will have crash-worthy seats, which can be folded up to the ceiling of the cabin. In the Pave Hawk, PJs sit on the cabin floor and take their chances.

First flight is expected late in the fourth quarter of this year at Sikorsky's facility in West Palm Beach, Fla. After first flight, the sensor-laden aircraft will go to the Air Force in the second quarter of 2019, in preparation for the big full-production decision the following quarter, Healy said. The current schedule would get the CRH to "the men and women who need the platform ... one fiscal year earlier," Healy said.

The Air Force's budget request, which is the first installment on a $5.1 billion, five-year production effort, is meant to "incentivize" Sikorsky/Lockheed Martin to move quickly.

If the contractors reach the milestone early, "we immediately go into production and buy aircraft at a certain rate," the Air Force's top uniformed acquisition officer, Lt. Gen. Arnold Bunch, said in October 2017.

Sikorsky is under contract for 39 training "devices," which will include full-motion simulators for the pilots and special mission aviators. Additionally, there are operational flight trainers and part-task trainers focused on systems such as landing gear and hoists. Sikorsky is also developing maintenance system trainers for crew chiefs to work on at the JB Langley- Eustis, Va., schoolhouse.

—BRIAN W. EVERSTINE

Photos: Amy McCullough/staff; A1C Rachel Yates; Sikorsky

■ Round Two of Light-Attack Experiment Begins at Holloman

The second phase of the Air Force's Light-Attack Experiment began May 7 at Holloman AFB, N.M. During the three-month live-fly experiment, pilots will fly the Sierra Nevada/Embraer A-29 Super Tucano and the Textron Aviation AT-6B Wolverine to determine which aircraft is best suited for a future light-attack role and for partner nation interoperability.

The service conducted the first phase of the experiment in August, with initial plans calling for a real-life combat demonstration to follow. However, USAF announced earlier this year it had decided to move ahead with a second-phase demo at Holloman focused largely on "logistics and maintenance requirements, weapons and sensor issues, training syllabus validity, networking, and future interoperability with partner forces," according to a news release.

■ GAO Rejects Sikorsky's Pre-Award Protest of UH-1N Replacement Program

Sikorsky, a Lockheed Martin company, is reviewing its options after the Government Accountability Office dismissed its pre-award protest of the Air Force's UH-1N helicopter replacement program, allowing the service to move forward with source selection.

Company spokeswoman Melissa Chadwick said the firm remains "committed to supporting the Air Force and providing ... a proven, in-production military aircraft for the critical no-fail mission of protecting our nation's nuclear missile silos and supporting the continuity-of-government mission," she said.

Lockheed's highly unusual decision to protest before USAF awarded a contract was based primarily on concerns related to intellectual property rights. Air Force spokeswoman Ann Stefanek said the service planned to award a contract for "up to 84" replacement helicopters by the end of the fiscal year.

SSgt. Sergio Escobedo, a B-1 crew chief, preflights a Lancer during Exercise Trojan Footprint at RAF Fairford, UK, on June 1.

■ B-1s Return to Flight

Air Force Global Strike Command announced on June 19 that its B-1Bs would return to flight for the first time since the fleet, including deployed combat assets, was grounded on June 7 due to an ejection seat issue.

The standdown gave the service time to "thoroughly evaluate the egress components" and assess risk, the command said in a statement. "We have high confidence that the fleet's egress systems are capable, and the fleet is ready to return to normal flight operations," Maj. Gen. Thomas A. Bussiere, commander of 8th Air Force, said in a release.

The grounding was announced following a May 1 incident where a B-1 was forced to make an emergency landing at Midland International Air & Space Port in Texas. Pictures of the aircraft showed a hatch above the weapons systems officer's position open. That incident is still under investigation.

■ O'Shaughnessy Takes Command of NORTHCOM, NORAD

Gen. Terrence J. O'Shaughnessy officially took command of US Northern Command and the North American Aerospace Defense Command May 24.

O'Shaughnessy, who previously served as commander of Pacific Air Forces, assumed command from USAF Gen. Lori Robinson, who is retiring. Defense Secretary Jim Mattis and Air Force Chief of Staff Gen. David L. Goldfein presided over the ceremony at NORAD's headquarters at Peterson AFB, Colo.

Gen. Terrence O'Shaughnessy has two new commands.

■ F-35 Deliveries Resume After JPO, Lockheed Reach Agreement

The Pentagon on May 1 began accepting deliveries of F-35s again after a contract dispute between the Joint Program Office and Lockheed Martin paused deliveries. Lockheed Martin—which April 30 received a $1.4 billion contract for F-35 maintenance—said in a statement it had reached an agreement with the JPO to "effectively and efficiently address" the issue.

DOD on March 29 stopped receiving the jets because it and Lockheed could not agree on who would pay for damage caused when holes drilled for fasteners were not properly treated with anti-corrosion paint.

The JPO did not say who was paying for the repairs. During the pause, the Pentagon refused to accept five F-35s, including three for USAF. F-35 production continued and Lockheed said it is on track to meet its target of 91 aircraft for 2018.

■ Pentagon Sees Increase in Sexual Assault Reports, Courts-Martial

Sexual assault reports across the military grew by 10 percent in Fiscal 2017 compared to the previous year, with enough evidence in those reports to take disciplinary action 62 percent of the time, according to data released by the Pentagon.

The Defense Department's Fiscal 2017 Annual Report on Sexual Assault in the Military showed that evidence supported taking action on 54 percent of allegations with the court-martial process. While the report states leadership has taken on a more visible role in the sexual assault prevention and response program, there are still challenges with understanding sexual harassment and changing behavior online.

■ Pace of Strikes in Afghanistan Continues to Increase

US aircraft in Afghanistan again increased their operations against the Taliban in April, dropping 562 weapons—the highest monthly total since October and the second-highest since 2011.

US aircraft have flown 2,238 strike sorties so far this year, already almost half of the 2017 total as they have targeted the Taliban's drug and financial infrastructure along with supporting US and Afghan forces in the beginning of the yearly fighting season.

The airdrop mission has also increased, with US airlifters dropping 135,840 pounds of supplies so far this year, according to statistics released by Air Forces Central Command. The Afghan Air Force has also increased its capability, adding precision-guided munitions to its A-29 attack aircraft in southern Afghanistan.

An F-16C over Afghanistan.

■ Nakasone Takes Over Newly Elevated US Cyber Command, NSA

Newly promoted Army Gen. Paul M. Nakasone assumed command of US Cyber Command, which was elevated to full unified command status. He also took charge of the National Security Agency, co-located with CYBERCOM, on May 4.

"Today we start writing the opening chapter for US Cyber Command as our nation's newest unified combatant command," he said during a change-of-command ceremony at Fort Meade, Md., during which Nakasone assumed command from retiring Navy Adm. Michael S. Rogers. CYBERCOM, he said, now has the chance "to build a combatant command from the ground up."

■ US Forces Face Growing Electronic Warfare Threat in Syria

US forces in Syria are facing a crowded, complicated, and challenging environment that is creating new challenges in electronic warfare.

"Right now, in Syria, we're in the most aggressive [electronic warfare] environment on the planet, from our adversaries. They're testing us every day, knocking our communications down, disabling our AC-130s, etc.," said US Special Operations Command boss US Army Gen. Raymond A. Thomas III. These gunships have reached a higher profile inside Syria, following the February strikes on fighters backing the Syrian regime that targeted US and Syrian Democratic Forces.

Defense Secretary Jim Mattis told senators in May that he can't blame it on the Russians "right now," because it is such a crowded battlefield that also includes Syrian regime fighters and Iranian forces. Mattis said the US confirmed with Russia's high command using its "deconfliction line" that no Russian military forces were involved in the February strikes. With that knowledge, Mattis said his direction was for the attacking forces "to be annihilated."

The deconfliction line is "never interrupted" and has "worked pretty well to make certain we don't run afoul of one another's forces," Mattis said.

■ William "Ed" Dyess Awarded Posthumous Congressional Gold Medal

Lt. Col. William Edwin Dyess, for whom Dyess AFB, Texas, is named, was posthumously awarded the Congressional Gold Medal during a May 11 ceremony at the base.

Dyess received the award in recognition of his sacrifice and dedication to the Army Air Corps from 1916 to 1943, having distinguished himself as an aviator and POW escapee from the Davao Penal Colony prison camp in the Philippines, an Air Force announcement said.

He died during a training sortie on Dec. 23, 1943, at the age of 27, while preparing to return to war—just eight months after his escape from prison camp. His P-38 caught fire over California, but he refused to bail out, steering the fighter instead to an unpopulated area. For more on Dyess' life, see, "Namesakes," December 2017, p. 64.

■ Moody A-10 Pilots Receive Distinguished Flying Crosses

Two A-10 pilots with the 74th Fighter Squadron from Moody AFB, Ga., received Distinguished Flying Crosses May 23, 2018, for supporting US-backed fighters inside Syria. Maj. Matthew Cichowski and Capt. William Dana were deployed to Incirlik AB, Turkey, as part of Operation Inherent Resolve and, according to the Air Force, "risked life and limb" to support Syrian Democratic Forces that were under attack Aug. 14, 2017.

■ The War on Terrorism Casualties:

As of June 15, a total of 50 Americans had died in Operation Freedom's Sentinel in Afghanistan, and 62 Americans had died in Operation Inherent Resolve in Iraq, Syria, and other locations.

The total includes 108 troops and four Department of Defense civilians. Of these deaths, 48 were killed in action with the enemy while 64 died in noncombat incidents.

There have been 268 troops wounded in action during OFS and 64 troops in OIR.

Photos: SrA. Emily Copeland; Maj. John Ross; TSgt. Gregory Brook

Transporting the

USAF C-130s transport equipment and supplies.

A KC-135 Stratotanker can also refuel transport aircraft.

A C-20 Gulfstream transports an advance team to scout and prepare for the visit.

President

In June, President Trump traveled to the G7 summit in Canada before proceeding to his summit meeting with North Korea's Kim Jong Un. From Washington to Quebec to Singapore, USAF's airlift and tanker aircraft transported the president and his entourage.

VC-25 is a specially configured Boeing 747-200B known as Air Force One when transporting the president.

A US Secret Service photo shows 10 presidential motorcade vehicles secured in a USAF C-5 as the president traveled to Asia in 2017.

A C-17 Globemaster III is used to move the motorcade vehicles and rotary wing aircraft.

The massive C-5 Galaxy, USAF's largest airlifter, moves vehicles and aircraft.

The presidential motorcade consists of two identical armored limousines plus Secret Service vehicles. Three helicopters are also part of the package.

A KC-10 Extender will tank up transport aircraft as needed.

Sources: USAF Almanac 2018; Secret Service; Photos: DOD; USAF; USMC; Secret Service; Chevrolet

Runners take your mark: (L-r) Presumed test model of secretive Chinese WU-14 hypersonic glide vehicle, DF-ZF; The X-51A WaveRider; Russian air-launched Kinzhal hypersonic missile being carried on a MiG-31.

THE GREAT HYPERSONIC RACE

The race is on to be the first great power to field hypersonic weapons. The US has already fallen behind.

By John A. Tirpak, Editorial Director

China, the US, and Russia are each striving to be the first nation to develop hypersonic systems: aircraft and missiles that can cruise and maneuver at five times the speed of sound (Mach 5) or faster. The winner of this technology contest will have daunting military advantages. Such weapons promise the ability to hit targets from very long ranges, yet with such speed and surprise that defending against them is extremely difficult.

Hypersonic weapons could give those that possess them tactical capabilities with potentially strategic effects. Its potential disruptive effect on military operations—the ability to fly at a mile a second at Mach 5—is most often compared to that of stealth and precision weapons when those technologies appeared in the 1980s.

The consensus view is that China, so far, is winning the hypersonics race, largely through financial brute force. USAF Gen. Paul J. Selva, vice chairman of the Joint Chiefs of Staff, said in January that China has made hypersonics research "a national program"—a kind of Manhattan Project—and it is "willing to spend ... up to hundreds of billions to solve the problems of hypersonic flight, hypersonic target designation and then, ultimately, engagement."

Chinese state media announced in March, for example, that China is building a 265-meter long wind tunnel to simulate the environment from Mach 10 to Mach 25, which is to be complete by 2020. It already has tunnels capable of simulating conditions between Mach 5 to 9. Though the US has hypersonic tunnels, most are quite small, for tests lasting less than a few seconds.

Russia, meanwhile, announced in March that it is testing the "Kinzhal" missile, which president Vladimir Putin boasted can fly at Mach 10, has a range beyond 2,000 kilometers, can carry conventional or nuclear warheads, and can defeat any existing "or prospective" air defense system. Although many leading US technolo-

gists scoffed at the claim, US Strategic Command chief Gen. John E. Hyten confirmed to reporters at a Colorado space conference in April that both China and Russia are flight-testing hypersonic concepts, saying "you should believe Vladimir Putin about everything he said he's working on."

While Hyten said it's a "different issue" as to whether those systems are deployed, "we ... listen to what they say very closely, and none of what he did ... [or] said surprised me."

TORTOISE AND THE HARE

The US is believed to have had a commanding lead toward fielding hypersonic systems until about five years ago. In 2013, the X-51 program, building on several previous projects, achieved more than 200 seconds of air-breathing Mach 5 flight, proving it could be done. The program then concluded and wasn't immediately followed up. A number of US successor programs were either terminated for budgetary reasons or cancelled for experiencing failures, even though the technology is in many ways still in its infancy. Pentagon and congressional leaders in the last two years have decried the risk-averse defense acquisition culture that favors only "sure things" instead of gambling on chancy but potentially high-payoff research.

Most hypersonic research follows one of two main avenues. One leads to a "boost-glide" vehicle in which an aerodynamic shape is mounted on a rocket and accelerated to hypersonic speed. The vehicle then detaches and coasts to its target, able to maneuver but gradually bleeding off its energy as it flies.

The other main approach aims for an air-breathing vehicle also propelled to hypersonic speed by a rocket, but then an internal supersonic combustion ramjet—or scramjet—takes over. The vehicle separates from the rocket and propels itself through the atmosphere, taking in air to mix with and burn internal fuel and creating thrust, but without the rotors and compressors of a turbine engine. Complex shaping of the inlet, exhaust and combustion chamber, along with highly precise holes, ducts, and bypasses is necessary to make this approach work.

Underlying technologies for hypersonics include advanced computers that can calculate shapes and airflow, additive or 3-D manufacturing that can make the exotic shapes necessary for the inlets and ducting, and materials—metals and ceramics—that can withstand the extreme temperatures and pressures of hypersonic flight. There will also need to be guidance mechanisms that can function under those same stresses without being crushed or melted.

Leading US technologists believe either the boost-glide or air-breathing approaches will yield operational missile systems in under five years, and more test flights akin to the X-51—possibly secret—are forecast to take place this year.

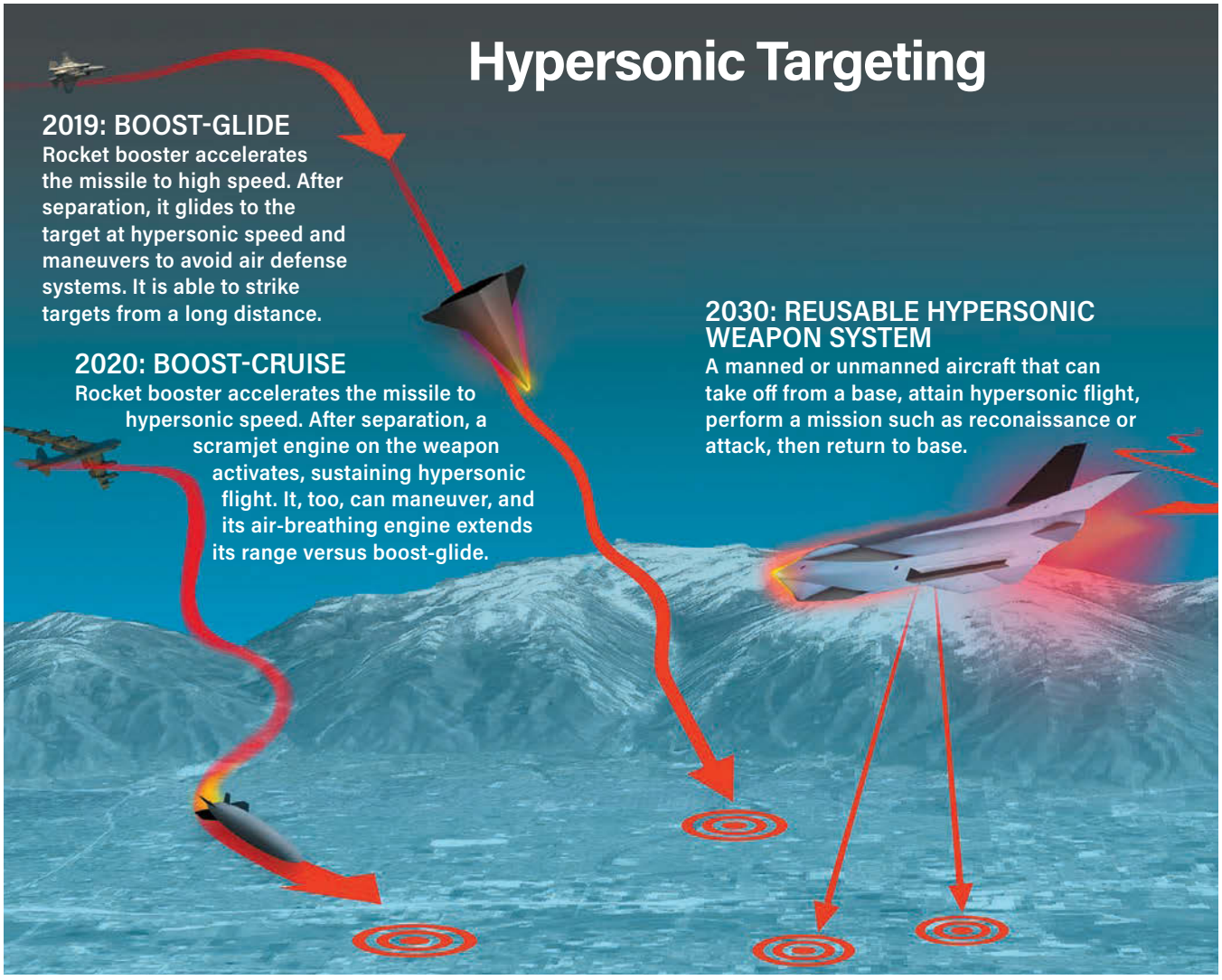
A more advanced concept, generally considered 10 years away or more, would make use of a "combined cycle engine" approach. The objective vehicle would take off from a runway, accelerate through Mach 1, achieve hypersonic speed, carry out a mission—spying, show of force, or delivering weapons—and return to base for reuse. This goal is challenging because the qualities that make for an efficient engine in the subsonic and transonic regimes simply won't work in the hypersonic regime, because of the different way that air behaves at those speeds.

Meanwhile, China is plowing ahead. The Pentagon's new research and engineering czar, Michael D. Griffin, said in March that China has made 20 times as many hypersonic technology tests as the US has in the last five years.

Speaking at a McAleese/Credit Suisse defense conference just days after taking the top Pentagon R&E job, Griffin, the former head of NASA, said the US must demonstrate its resolve to lead in hypersonics. If the Chinese are unchallenged in this area, they could "hold at risk our carrier battle groups ... [and] our entire surface fleet," Griffin warned. "They hold at risk our forward-deployed forces and land-based forces."

Lacking either a defense or an ability

Photos: CCTV; Mike Cassidy/USAF; Russian Ministry of Defense



to respond in-kind, the US faces poor choices. "Our only response is either to let them have their way, or go nuclear." And that, he said, is "an unacceptable situation for the United States."

Hypersonic technology, Griffin declared, is his "No. 1 priority."

In a discussion at the Hudson Institute in April, Griffin said there are ways to defend against hypersonics, but there's only a brief window for doing so. Such missiles "are relatively fragile during their long phase of cruise flight" and are "fairly easy to destabilize," Griffin noted. They also glow brightly in the infrared, because of the heat they generate, and "yes, they can maneuver, but they can't maneuver in their cruise phase as easily as an interceptor."

DEAD MEAT

However, "if you let [hypersonic weapons] get into terminal phase, where we've observed that they can pull many G's, then that becomes a hard target," Griffin allowed. "If you allow an attacking vehicle to get close enough to begin its terminal dive ... and [that] might be from 100,000 feet ... you're probably dead meat because that's a very hard intercept problem... at that point."

He noted that hypersonic weapons "overfly our air defense systems and underfly our missile defense systems. So China has, over the last decade, with great care, [become] capable of ... holding our forward-based assets at risk." Those carriers and forward-based forces are strategic assets and the "means by which we project strategic power short of nuclear deterrence." Without countering it, "we allow their tactical systems to leverage our ability to project strategic power."

The US will have to develop means to defend against hypersonic missiles soon, Griffin said. The Missile Defense Agency (MDA) will have that responsiblity, not the Defense Advanced Research Projects Agency (DARPA).

By July, Griffin was expected to finish a new hypersonics roadmap that would rationalize and coordinate at least a half dozen projects within and between the Air Force, Army and Navy, DARPA, the Pentagon's Strategic Capabilities Office, NASA, and defense contractors. Deputy Defense Secretary Patrick M. Shanahan told reporters in April that Griffin had just delivered "80 percent" of the plan and was working on the final version.

"The overlap of the technical challenges is pretty high," Shanahan said of the various approaches being taken. The basic physics of getting to hypersonic speed and maintaining it, while preserving maneuvering capability, are common to the various approaches underway, he asserted. The Pentagon will look for synergy between the programs, seeking to consolidate them where practical, saving money but also sharing information. The services would integrate their own unique requirements as to whether their specific vehicles are air-, land- or sea-launched.

The roadmap, Shanahan said, will

Boeing illustration showing first-generation conceptual design of a reusable hypersonic aircraft.

cross "10 technical domains" and determine the critical tests that must be conducted in the next five years "to achieve capability within the next decade."

The document might just as well be called a "hypersonic prototype plan," Shanahan said. The roadmap will also inform the Pentagon's five-year spending plan.

Mark J. Lewis, director of IDA's Science and Technology Policy Institute, a former chief scientist of the Air Force and a leading expert in hypersonics, said there are "a couple of characteristics I would want to see in a generic [hypersonics] roadmap." Lewis is not involved in developing the plan, which is likely classified. He spoke to *Air Force Magazine* as a sidebar to an AFA technology podcast.

DON'T RULE ANYTHING OUT

First, Lewis said the plan should "build directly on past successes. Meaning, stop reinventing the wheel." At least one successor program to the X-51, he said, largely repeats what that project already achieved, with some minor additions.

Second, he said, the roadmap "shouldn't zero-in to a single technology solution. It shouldn't be just air-breathing or just boost-glide. They have different strengths [and] weaknesses and different applications." Necking down to a single, quick-and-dirty approach "to me, would be a wrong answer."

He also advised that while hypersonics as a conventional strategic weapon may very well be what China is looking for, it doesn't have to be that and, for the US, "the winning applications are not the strategic applications."

The US could develop hypersonic air-to-air missiles, for example, that could destroy enemy aircraft at great distances, before they could pose a threat. There is also the potential for air-to-ground missiles covering 100 miles in as many seconds, offering opportunities to destroy enemy air defenses from standoff range. Given the extreme destructive force of an impacting vehicle traveling at Mach 6, a warhead might not even be necessary.

Such applications "are the ones most likely to be useful to the United States, frankly," Lewis asserted.

Air Force Research Laboratory chief Maj. Gen. William T. Cooley, in a February interview, took issue with the characterization of some post-X-51 efforts as a virtual repeat of that program.

"I would say that's not true and largely because of the people," Cooley averred. "The same scientists and engineers who had been working on the X-51 are continuing to advance our hypersonics portfolio, and so they are well aware ... of the data that was collected" on that program. "We're advancing the ball forward," he added, saying the X-51 was "a point design ... to prove out our understanding and we're building on that."

The Pentagon is taking hypersonics much more seriously—budget-wise—than it did in the past. Boeing hypersonics expert Kevin G. Bowcutt, whose experience stretches back to the National Aerospace Plane project of the early 1980s, said in an interview that Pentagon funding for hypersonics after NASP "has had an oscillatory funding profile," going up and down between $50 and $100 million a year. In Fiscal 2017, the Defense Department funded hypersonics to the tune of just $85.5 million, and that rose to $108.6 million in Fiscal 2018, but exploded to $256.7 million in the 2019 budget request. Congress has indicated its willingness to support that figure, and even add to it.

"This may be a 'Sputnik moment,' " Bowcutt said of the sudden turnaround in both interest and financial support of hypersonics, driven by the prospect of being behind China and maybe Russia.

ACRONYM MENAGERIE

The Air Force has been working with DARPA for several years on two hypersonic projects. One is the Hypersonic Air-breathing Weapon Concept, or HAWC, and the other is the Tactical Boost-Glide program, or TBG. The Air Force chose Lockheed Martin and Raytheon to develop its HAWC concept, while Lockheed is the prime contractor for TBG.

Additionally, the Air Force is launching two new prototyping efforts in the Fiscal 2019 budget, with

Illustrations: Mike Tsukamoto/staff; Boeing

Concept for Lockheed Martin's Reusable Hypersonic Vehicle.

$260 million: the Air-Launched Rapid Response Weapon, or ARRW, and the Hypersonic Conventional Strike Weapon, HCSW, which USAF pronounces as "Hacksaw." The service awarded Lockheed Martin the HCSW contract in late April; it has an ultimate value of $928 million.

Steven H. Walker, head of DARPA, told reporters in March the renaissance in hypersonics funding has been gelling for several years. He said he pitched former Deputy Defense Secretary Robert O. Work a "National Hypersonics Initiative," which Work largely supported.

"We did receive a budget increase at DARPA and in some of the services to do more in hypersonics," Walker said. "I don't think we got everything" the agency asked for, "but it's a good first step."

The funding will underwrite studying "what we want to do with these systems, how effective they can be, how affordable we can make them, and how feasible is the propulsion system, and the maneuverability and the materials that we bring to the table."

Walker said protoypes will "start flying in 2019." DARPA is also beginning a new program with the Army, called "Operational Fires," aimed at increasing the range of some of the Army's ground-launched missiles.

He said the Air Force's time line for an operational prototype of a boost-glide system is "in the '22-'23 time period, so it's close."

Walker also noted that DARPA is working with NASA on a program called the Advanced Full Range Engine (AFRE), which "is basically developing the combined-cycle propulsion system you would need for a reusable platform. And we're making good progress." The AFRE was originally planned to power a project called "Blackswift;" one of those projects that was terminated over the last half-decade.

The AFRE program is only planned for ground tests in the NASA Glenn "10 X 10" wind tunnel in Ohio, Walker said. It will, however, take an "off-the-shelf turbine engine, combining it with a scramjet" and get it up to a speed representative of Mach 2. The scramjet would then take over, and "having that overlap ... you can actually take off like an airplane, fly up to Mach 6, do your mission, then come back down, and do it again." DARPA awarded Orbital ATK (now part of Northrop Grumman) an AFRE contract in January.

FLIGHT TESTS NEEDED

Air Force Materiel Command chief Gen. Ellen M. Pawlikowski told reporters in May that investments are being made in new wind tunnels at Arnold Engineering and Development Center in Tennessee "to bolster our hypersonics capability." NASA has been involved in this work as well, she said, as has the Test Range Management Center, so it's "a whole community involvement in this."

The work done is "revitalization of some facilities that we haven't used in a while, bringing them up to speed," and this is "critical to being able to reduce the demand on flight tests" which are far more expensive than ground tests, Pawlikowski said. It's also "much harder to control the environment" in a flight test, so the ground facilities investment will help the US "build better models" and "enable us to get to ground truth data ... faster."

Flight testing, though, is essential. Friction and airflow separation are tricky problems to solve, and in the real world, computer simulation code "tends to break down. They become more guesses than actual reality," Walker said, so in hypersonics, "you've really got to fly."

Air-launching prototypes from test aircraft such as the B-52 allows quicker and cheaper testing than putting the test vehicles on "big ballistic rockets" launched from the ground, he said.

As to whether the US will develop a large, reusable hypersonic platform capable of serving as an ISR craft or an attack vehicle, Walker said, "If I have anything to do with it, we will have a program."

Lockheed Martin made news in 2013 when it announced it was working on such a platform, which it dubbed the "SR-72," touting it as an unmanned successor to the SR-71 spyplane that could be more responsive to pop-up ISR needs than a satellite. Earlier this year, Lockheed Vice President of Strategy and Customer Requirements Jack O'Banion made news when, at an American Institute of Aeronautics and Astronautics (AIAA) forum, he showed a picture of the SR-72, and said that without recent digital modeling capabilities, "the aircraft you see there could not have been made." Asked for clarification—whether Lockheed has really built, past tense, an SR-72—the company would only say the concept is a "far term solution that will be made possible by the pathfinding work we are doing today."

Boeing, which built the X-51 with Rocketdyne, lost out to Lockheed and Raytheon on the HAWC, but made news in January, showing its own futuristic ISR platform at an AIAA event. Bowcutt, in an interview, said the concept would be about the same size as the SR-71, but a scaled-down version about the size of an F-16 could prove out the concept.

Bowcutt described it as "the smallest, lightest reusable hypersonic vehicle we could design," because there was no evidence the Pentagon was prepared to spend "a couple of billion dollars" on a full-up reusable hypersonic platform. It has been financed so far with some government seed money and Boeing's own independent research and development funds.

He explained that the vehicle can be scaled up, because hypersonic combustion "is actually easier at large scale." The secret lies in managing the "the amount of time the flow is resident

in the engine or flameholder. And as you scale up, the time is higher; the speed of the air is the same, but it's larger, so [air and fuel] is inside the engine and engine components for a longer period of time."

The concept Boeing showed was notional. Its true inlet configuration was concealed for secrecy, Bowcutt said. It was inspired by the inlet configuration of the XB-70 Valkyrie, a supersonic bomber concept of the 1960s built by Rockwell, now part of Boeing. The platform as of late May had not been given an official name, but Bowcutt said that with proper funding, the combined cycle project could yield an ISR platform "in 10 years; call it the 2030 time frame."

NOT NECESSARILY EXPENSIVE

Lewis said it's probably a misnomer that hypersonic systems are necessarily very expensive. "If I've got a weapon that costs me twice as much, but it's five times more effective, then I'm ahead of the game," he said. However, even without that calculus, the idea that hypersonics equals high cost is "flawed."

Yes, he said, "the materials are exotic. Yes, there's an up-front [cost] that has to be amortized. But there are fewer moving parts in a hypersonic system; even in an air-breathing engine" because "it doesn't have rotating turbomachinery onboard." A hypersonic engine is mostly a carefully contrived space in which shockwaves and fuel injection do the work that, at lower speeds, must be done with fan blades and rotors. Hypersonics should be an affordable technology once producibility has been worked out and the "legwork" done, Lewis insisted.

Asked to place the international competitors in order of progress, Lewis said China is unquestionably in the lead in hypersonics.

"I think it's an absolutely true statement that in terms of practical, fieldable systems, we are behind ... by every metric I can construct," Lewis said. This is true whether it's in test facilities, projects, or even published papers (although the US is classifying many of the papers written in the US).

As for Russia, "it's a little more complicated," Lewis said. Russia and China "seem to have different emphases." The Russians, he said, "keep talking about defeating our missile defense system," but "our missile defense system isn't aimed at them."

TAILOR-MADE FOR CHINA

China's interests, though, "are more tangible and practical. If I were looking to defend my territory—what I think of as my territory, my sphere of influence—hypersonic systems make a lot of sense." Lewis added that hypersonics "factors very nicely" into China's island-building campaign and expanding its outer defense line.

While China is probably not afraid "of the US Army, it probably does fear the US Air Force and Navy," Lewis asserted. "If I wanted to hold the Air Force ... and the Navy at risk, I'd have a hard time coming up with a better solution than hypersonic weapons."

Lewis offered "a glimmer of hope" that the US can still come from behind and win the hypersonics arms race, however.

"I have yet to see a single concept or breakthrough from either Russia or China that I would consider to be seminal in any way. We still own the intellectual leadership in this area," Lewis said. "Now, I don't know how much longer we will, but if you look at all the creative ideas—everything from fundamental understanding of the field to the development of the field ... the real intellectual heavy lifting ... that's all us, that's all US."

Other countries have simply "taken the ball and run with it," he added.

However, he said countries pursuing new technologies are a lot like college students. As undergraduates, "they mostly parrot back information," but as graduate students, "we expect them to think on their own. I tend to think countries follow a similar model. The first thing they do is copy what we've done, and then they start coming up with their own creative ideas."

In his February speech, Griffin said he's not interested in regaining "parity" with America's hypersonics competitors. "I want to 'see and raise' them," he said, achieving deterrence by restoring America's ability to surprise and take the initiative. Acknowledging that there are still some who question whether hypersonics is indeed important or the Pentagon's top priority, he said, "anyone who doesn't see it that way, ... I have no time for you." He added that Secretary of Defense Jim Mattis and Shanahan agree with him, and, "I don't care about people who can't overrule me." ✪

Can the Hypersonic Genie Be Kept In The Bottle?

While it's probably too late to create an arms agreement that would prevent the US, China, and Russia from deploying hypersonic weapons, it might still be possible to create a nonproliferation regime specifically for such types of missiles, four RAND researchers said last fall.

In their paper, "Hypersonic Missile Nonproliferation," the authors noted there's still time to create a treaty that would restrain other countries from developing hypersonic missiles, because the technologies, materials, and computing power needed to develop them pose a "high cost of entry" and could be withheld by the "big three" countries.

The authors said the leading second-tier countries that could develop hypersonic systems "in several years" with help from China, Russia, or the US include Australia, Britain, France, India, and Iran.

The ability for a lesser power to strike with high speed and unpredictability is reason enough to try to restrict exports of the enabling technologies, the RAND authors said.

Given that a hypersonic weapon's potential kinetic power could be measured in "single-digit kilotons" even without a warhead, such capability could confer nuclear-like capability on a nonnuclear power, author George Nacouzi said in a September 2017 presentation on the paper. This technology will introduce instability, he said, as countries faced with an incoming missile whose origin is not clear—because hypersonic missiles can maneuver after launch—but which will arrive in a few minutes, might prompt "launch-on-warning" retaliation nightmares.

The authors suggested that the Missile Technology Control Regime could be pressed into service as the mechanism for restraining the spread of hypersonic missiles, but China is not bound by that agreement. There have been no official overtures to establish a nonproliferation regime.

Illustration: Lockheed Martin

MOBILITY BOOM

Air Mobility Command seeks strategic solutions to meet unrelenting, unpredictable demand.

By Brian W. Everstine, Pentagon Editor

The Air Force's airlift enterprise was pushed hard in 2017 as it responded to multiple domestic natural catastrophes, while continuing to fuel and supply the fight overseas. These demands stretched the command thin—delaying some deployments—and lent great urgency to measures underway to increase Air Mobility Command's readiness. All this happened as the command also attempts to better posture itself for possible future large-scale combat.

"The world continued to test our ability to respond and deliver airpower, relief, and hope to those in need," AMC chief Gen. Carlton D. Everhart II said recently.


Maj. Gen. Thomas Sharpy

"We were busy, and we still had combat operations going on in the CENTCOM area of responsibility, and also trying to get after full-spectrum readiness in case we have to go somewhere else on the globe if the nation needs us to do that," Maj. Gen. Thomas J. Sharpy, Everhart's deputy, told *Air Force Magazine.*

The ordeal began as Hurricane Harvey lashed the Gulf Coast and the American South, quickly followed by more hurricanes in the Caribbean—including Hurricane Maria, which devastated Puerto Rico—unprecedented numbers of wildfires in the West, and an earthquake in Mexico. The disasters signaled the start of months of continuous operations for airlifters and AMC's contingency response wings inside the US.

Reacting to the calamities, AMC flew more than 3,000 humanitarian assistance disaster relief missions, and throughout 2017, its air operations center was tasked with organizing about 600 sorties per day.

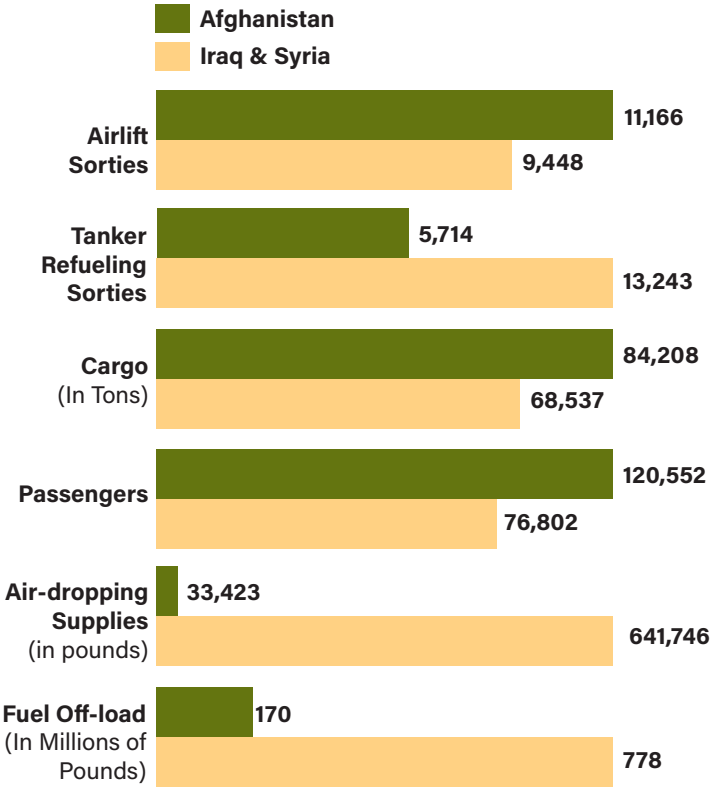
AMC mobilized 60 percent of its capacity to support disaster relief efforts. Of those, 70 percent of the flights were flown by Air National Guard and Air Force Reserve aircraft and crews, Sharpy said. Two thousand sorties were flown solely in response to Hurricane Maria in both Puerto Rico and the US Virgin Islands, he said.

The pace was so high, even generals got short-notice taskings. Sharpy flew to

C-5M crew members unload telecommunications towers at Luis Muñoz Marin Airport, Puerto Rico, in response to Hurricane Maria.

Hurricane Harvey caused severe flooding and damage in Southeast Texas.

AMC Met Unprecedented Demands in 2017



Puerto Rico for the storm response with three hours' warning, spending three weeks as the joint forces land component deputy commander. Forty-eight states provided National Guard support to the storm response.

Besides aircraft, AMC sent contingency response forces to open airfields for USAF and contract aircraft filled with relief supplies. Typically, such teams are tasked with setting up remote airstrips in combat zones such as Iraq, Syria, and Afghanistan.

Once the humanitarian need had largely been met, and the pace of anti-ISIS operations slowed, these forces finally had a chance to "reset" and get back to standing by for the next mission.

"For the first time in a long time, our contingency response forces are ready and pulling the alert duties" in case they are "called upon to be responsive across the globe," Sharpy said.

The disaster response delayed the shipment of equipment to US Central Command for weeks at a time, when the US was building up its presence in Afghanistan and facing an increased requirement for fuel and cargo.

Defense Secretary Jim Mattis told lawmakers the delays were due to USAF having a "finite number" of transport aircraft. It was "all hands on deck" to help US citizens as gray tails headed to US airfields in the south and in Puerto Rico—instead of CENTCOM—in the midst of the storm response surge, he said.

It took months to alleviate the backlog, as AMC crews and aircraft were already surging to meet validated requirements from combatant commands. The

Photos: TSgt. Larry Reid, Jr.; USAF; SSgt. Daniel Martinez/ANG

Prepping for Hurricane Maria relief efforts, aerial porters load cargo onto a C-17, providing a Contingency Response Element in Puerto Rico.

surge lasted into 2018 just to get back on the "glide path" to more normal operations, Sharpy said.

Throughout 2017 in Afghanistan, mobility crews flew 11,166 airlift sorties—moving 84,208 short tons of cargo, 120,552 passengers, and air-dropping 33,423 pounds of supplies. Tankers flew 5,714 refueling sorties, delivering 170 million pounds of fuel. Each of these numbers was a sizeable increase from the previous year.

In Iraq and Syria, mobility crews flew 9,448 airlift sorties, moving 68,537 short tons of cargo, 76,802 passengers, and air-dropping 641,746 pounds of supplies. Tankers flew 13,243 tanker sorties, off-loading 778 million pounds of fuel. More than 90 percent of all tanker flights supporting wartime operations were flown by AMC aircraft, Everhart said.

READY OR NOT

With demand on airlift unlikely to relax anytime soon, AMC is concentrated on making sure its fleet is healthy and ready for any contingency. This is centered on three "lines of effort."

These are:

- Developing a central, overall plan for modernization and recapitalization;
- Expanding the reciprocal transfer of aircraft between units; and
- Providing a common configuration for the C-17 fleet.

The first—known officially as the Rapid Global Mobility Recapitalization Plan—aims to harmonize current and future global mobility needs, including airlift and air refueling, into a common roadmap. This information has not been centralized before, divided instead among reports to Congress, Core Function Support Plans, the Air Force Resource Allocation Plan, and other various research reports, AMC spokesman Maj. Korry Leverett said. The command is consolidating these into a single document that will lay out the "desired" way forward.

"The recapitalization plan is the foundation to the future of fleet management, allowing the command to extend the service life and decrease associated costs," Leverett said.

The second step is expanding the command's ability to more easily move aircraft between units in a strategic way to keep the overall fleet healthy. Aircraft in wings flying excessive hours will be moved to wings flying fewer hours in an effort to balance the wear and tear on the fleet. Those in caustic environments, such as coastal bases subject to damp, salty conditions, will be swapped to dry desert operating locations; again, so some of the fleet doesn't age more rapidly than the rest.

C-17s in a unit averaging 500 hours per year would be sent to one flying 1,000, to average them to 750 hours each. "We can then expand the life of that airplane," Sharpy said. This in turn saves money, because the Air Force wouldn't have to then buy a replacement airplane because "the other one timed out."

AMC announced the initiative in 2017, beginning with the main C-17 training base, Altus AFB, Okla. Globemaster IIIs there that have reached the top five percent of flight hours will be rotated out, and aircraft with fewer hours will be rotated in.

The plan is to not only move aircraft between squadrons, but also between components. For example, Active Duty units with aircraft that have a high flight-hour total could trade with a Reserve unit with a lower total. AMC is finalizing the "business rules" of these trades to ensure that both the Air National Guard and Air Force Reserve are willing to participate. Everhart and Lt. Gen. Maryanne Miller, chief of Air Force Reserve

At an undisclosed location, SrA. David Tiradeau relays information to the air terminal operations center. AMC wants to balance out the wear-and-tear on USAF's C-17s.

Command, in February signed a memo outlining the way forward.

This effort is "key to overcoming mobility enterprise challenges," by maximizing the health and service life of the overall mobility fleet, Air Force Reserve spokesman Col. Bruce Bender said. Going forward, it's necessary for AFRC to "maintain synchronicity" with AMC not just in fleet management, but also in facilities and weapon systems to "minimize risk against emerging threats," he said.

The Air National Guard also has expressed interest, but there isn't "across-the-board" support, Sharpy said. AMC is working to make sure both ANG and the Air Force Reserve trust the process. Aircraft identified to be swapped will move as they come out of depot maintenance, and the Guard and Reserve will receive these just-serviced aircraft instead of being left with older aircraft with a big backlog of write-ups.

"One of the things we have to do is ... validate the concept," Sharpy said. "It's really about trust. Once we show that we're actually going to take airplanes out of depot with the most recent upgrades and give them back to our Guard and Reserve partners, they get a better product." That builds "trust that will help us to do this on a routine basis."

C-130 loadmasters secure the cargo bay after a mission in Southwest Asia. Airlift modernization plans are decentralized, but AMC wishes to harmonize them.

AMC's focus on its fleet also seeks to emulate best practices from private industry aircraft practices. The command has reached out to airlines to learn how they use data from their jets to predict when maintenance will be needed.

For example, United Airlines data can predict that an aircraft's engine will fail within 30 hours, so the company plans to land that aircraft in a location where it can be fixed within that time span. The Air Force doesn't have that capability, Everhart said.

AMC's third effort centers on the Globemaster III. The C-17 fleet, at 213 aircraft, is the backbone of AMC's airlift enterprise, but those jets are in multiple configurations, depending on when they were built. This poses challenges in maintenance, training, and the plan to swap the aircraft. AMC is studying "unit capability necessities," to guide future fleetwide modifications. The idea is to get to a common baseline configuration while "ultimately extending the service life of the ... C-17 fleet," Leverett said.

The push for AMC fleet maintenance doesn't just build mission capability rates, but aims to ensure the fleet of heavy, slow aircraft can survive in combat zones.

Photos: TSgt. Liliana Moreno; TSgt. Jonathan Hehnly; SSgt. Michael Battles

SrA. Eric Pashnick inspects the engine on a C-17 Globemaster III.

SURVIVE AND ADVANCE

The command in 2017 conducted a High Value Airborne Asset Study to look at aircraft vulnerabilities in war zones and what equipment or techniques may be needed to enhance their survivability in a "denied" environment. This study, modeled after the Air Force's Air Superiority 2030 Flight Plan, found three major capability areas requiring more development: secure communication, battlespace awareness, and self-protection systems.

"We are committed to doing the hard and necessary work to ensure the guaranteed persistence tankers have always delivered in the past and apply capabilities to ensuring success in the future," Everhart said in unveiling the plan.

AMC needs to use "both proven and existing capabilities," as well as new and emerging technologies that will be fielded in the next several years, said Everhart. "Many of our systems, training, and how organizations function will look different by 2030 as we continue to evolve," he said.

The command is looking to partner with industry and Defense Department labs to advance its communications systems. For example, Everhart said tankers should add Link 16 data systems, which have long been in use in fighter and bomber aircraft, to be able to securely communicate with other aircraft, beyond line of sight.

For battlespace awareness, AMC is examining existing Radar Warning Receiver technologies that can provide a detailed view of the threat environment for aircrew in real time. For self-protection, AMC wants to join with industry to develop relatively inexpensive systems, hoping to demonstrate a capability on current aircraft in the next few years.

While many of these efforts focus on the aircraft themselves, AMC, like other commands, is struggling to retain its seasoned pilots. The entire Air Force, including mobility and fighters, is short about 1,800 pilots, and the problem is only projected to worsen. The Air Force is taking a number of steps in this area, but AMC has some ideas of its own.

Early in 2017, Everhart asked for ideas from within the ranks and in response received more than 700 unique replies. While some were not that helpful, many deserved more study and some are coming to fruition. In addition to steps seeking to increase pay and flying time, AMC is taking the lead on potentially developing a "flying only" career track for officers. This would allow pilots to skip staff assignments in favor of flying for their entire USAF career.

"That has been a question mark" for a century, Everhart said in announcing this step at the Air Force Association's Air, Space & Cyber Conference last September. The idea answers those pilots who insist, "all I want to do is fly."

The move would keep pilots flying, but not in "gray tail" operational airlifters and tankers—C-130s, C-17s, KC-135s, etc. Instead, they would move to "white tail" aircraft, such as VIP transports like the C-20s, C-21s, and C-37s. Or, the pilots could become instructors, he said.

Everhart is also reaching out to the airline industry for help, since private companies are the ones wooing pilots away from service with a promise of more stability and higher pay. A large part of the "gray tail" fleet is in the reserve component, and much of the pilot force there splits their time with airline jobs, as a way to continue serving. During a September speech to the Regional Airlines Association, Everhart promised more predictability for these pilots. However, "the world always has a vote," he said.

Demands on USAF's airlift assets never end. Military, domestic, or international crises will always require an air mobility response.

"The recent string of hurricanes and the earthquake in Mexico may require reaching out short-notice for support," Everhart said. "It's important this is also understood." ✪

Photo: SSgt. Christopher Stoltz

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Michigan Air National Guard A-10s assigned to the 107th Fighter Squadron, which traces its heritage back a century to the 107th Tactical Reconnaissance Squadron, fly over Normandy, France, as part of a D-Day commemoration. The 107th flew multiple missions over Normandy during the lead up to D-Day and during the invasion itself.

Photo: TSgt. Dan Heaton/ANG

The All-in-One Kill Chain

The 379th AEW is like a scale model of the operational Air Force.

The CAOC at Al Udeid AB, Qatar, provides command and control for airpower throughout the CENTCOM region.

By Jennifer Hlad

Al Udeid Air Base, Qatar—

As the US continues to fight the war against ISIS and resumes a more proactive role in Afghanistan, the 379th Air Expeditionary Wing is intimately involved—at every step of the kill chain.

Nicknamed the Grand Slam Wing, the 379th is the largest expeditionary air wing in the world. It comprises intelligence, surveillance, and reconnaissance from RC-135s and E-8s, global strike capabilities from B-52s or B-1s, mobility with the C-17, C-130, and C-21, and refueling from the KC-135. It also runs the Mideast Combined Air Operations Center (CAOC), critical command and control functions, and has space and cyber capabilities.

The wing "provides critical support to the Air Force" across the spectrum of missions in the Middle East and South Asia "with frequent reach into other combatant commands," said Col. Jeffrey T. Schreiner, vice commander of the 379th AEW.

It "touches every aspect" of the war effort, both kinetic and nonkinetic, "24/7, 365 days a year," Schreiner added. The kill chain is the process by which USAF will find, fix, track, target, engage, and assess in its wartime operations, before repeating the cycle again, as needed.

Operations, maintenance, and mission support all have to work together to keep the mission flowing, said Col. Tom Bongiovi, commander of the mission support group. There is a similar collaboration with the host nation and with other wings, he said.

One aircraft in the wing hits the first four notches on the kill chain—find, fix, track, and target—all by itself: the E-8 Joint Surveillance Target Attack Radar System, or JSTARS.

Maj. Michael Artifon, director of operations for the 7th Expeditionary Airborne Command and Control Squadron, took *Air Force Magazine* on a tour of the airplane as it was preparing to launch. He explained its ability to gather real-time intelligence and layer multiple sources of intelligence together.

For example, he said, although ISIS

Photos: TSgt. Paul Labbe; TSgt. Joshua Strang

An E-3 Sentry takes on fuel from a KC-135 Stratotanker during a mission over Syria.

fighters in Iraq are now on the run and hiding, the JSTARS can detect a pattern to determine the location of those fighters. In Afghanistan, the aircraft may be called upon to watch a narcotics facility for a few hours, to ensure no one is inside when it's bombed. Such attacks deprive the enemy of funding sources.

The JSTARS is also tapped for convoy overwatch, Artifon said.

"Most of what we're doing on a daily basis is surveillance," he said, though the shift to Afghanistan at the beginning of the year involved the aircraft with some kinetic strike missions as well.

Lt. Col. Ryan Zeitler, commander of 7th EACCS, said that JSTARS sensors gather real-time ground surveillance and targeting data, and airmen and soldiers aboard the aircraft work to find what's important and meaningful on screens that sometimes look like someone "threw a bag of Skittles" on them.

The JSTARS is "best in class" for air-to-ground radar and wide-area surveillance, Zeitler said. With about 18 people on board, it's much larger than any other platform with similar capabilities.

Further down the kill chain, centering on "engage," are the bombers. For two years they were B-52s from Minot AFB, N.D. A squadron of B-1s replaced the BUFFs in early April.

Lt. Col. Danny Lambert, 69th Expeditionary Bomb Squadron director of operations, explained that his group from Minot was the first operational rotation to use the new conventional rotary launcher upgrade for the B-52. The rotary launcher—not unlike a revolver—allows the bomber to carry up to eight GPS-guided bombs

SrA. Chelsie Malloy (left) and TSgt. Dustin Hyden ready a B-52 conventional rotary launcher for transport at Al Udeid.

internally on each launcher, increasing its overall capacity from 16 smart bombs to 24, Lambert said.

In just five months, the B-52s had flown about 420 missions and 4,500 hours, Lambert said, executing dynamic, emerging missions and answering requests for fire from ground commanders in Iraq, Syria, and Afghanistan.

"The mission changes every day," he said, and it's not always about striking the enemy.

Sometimes, Lambert said, it is about finding actionable intel on the ground with the aircraft's Sniper or Litening targeting pod. The crew might find and strike something on the same mission, or they might "get the assist," Lambert said: Finding a target, then passing the information on for someone else to destroy it.

Capt. Grant Ellison, a weapons systems officer with the 69th EBS, said that while the pod is a great tool for seeing what's happening on the ground and talk to JTACs [joint terminal attack controllers], it can be difficult to find something.

"It's like looking through a soda straw," he said.

The biggest advantage the B-52s offer is firepower, Lambert said, and their endurance in the area without refueling.

Early this year, the squadron was the heaviest hitter in Operation Inherent Resolve, Lambert said, expending weapons "pretty much every day."

Despite the B-52's age, the roughly 215 maintainers who made up the 69th Expeditionary Aircraft Maintenance Unit helped the squadron and wing set several records during their deployment. These included a streak of 834 sorties without a maintenance cancellation.

The last step in the kill chain—"assess," is handled by RC-135 Rivet Joints of the 763rd Expeditionary Reconnaissance Squadron, which also starts the cycle again by finding new targets.

Capt. Christopher Costello, mission planning team chief with the 763rd ERS, said the aircraft is the "premier SIGINT [signals intelligence] platform for the Air Force," and can do onboard processing to provide real-time intelligence to troops and commanders on the ground.

In OIR, that means trying to find ISIS fighters by locating different signals. The Rivet Joints also wrap up the kill chain by assessing intelligence after a bomb is dropped on target, Costello said.

The Active Duty crew of about 23 people fly roughly 10-hour missions during which they use the Rivet Joint's onboard sensor suite for real-time on-scene intelligence collection, analysis, and dissemination. They also work with numerous groups at the CAOC, getting information from them, and giving intelligence back.

INSIDE THE CAOC

On the operations floor of the Combined Air Operations Center, most of the faces of US troops are lit by giant computer screens—two or three per person. The overhead lights are off, but the glow of the massive TV screens covering the walls casts a bluish glow, illuminating every type of US camouflage and flight suit, along with a handful of coalition partner uniforms.

In this room, yesterday is ancient history.

Up above, the Combined Forces Air Component Commander, deputy CFACC, and troops in the "battle cab" literally oversee it all.

RAF Air Commodore Harvey Smyth, the CAOC director, walked *Air Force Magazine* through how the CAOC works, likening it to a machine with a lot of cogs; his role is to run the machine.

The cogs include ISR, strategy, mobility, refueling, and combat plans—the troops who build an "excel spreadsheet of awesomeness" to be executed by the ops floor, Smyth said.

Everything must be done quickly, he said, but the CAOC does "phenomenally well" in reacting and adapting as things change.

"We do a lot of nonkinetics here," such as directed electronic attack, Costello explained. Al Udeid's CAOC and Rivet Joint aircraft are disparate systems whose troops share at least one common goal: getting information to the customer more quickly.

Rivet Joints have been flying in the region since Aug. 9, 1990, including supporting the war in Afghanistan since

SSgt. Daniel Spear runs through a postflight inspection of the intake and exhaust system on an E-8C JSTARS at Al Udeid.

the beginning. Lt. Col. Aaron Gray, commander of the 763rd ERS, noted they're being used in "new and exciting ways" as the fight evolves.

"The reason the 763rd has been in CENTCOM for so long is because of the unparalleled capabilities our aircraft brings in helping fight and win our nation's wars," Gray said.

UPS AND DOWNS FROM KEESLER

Outside the kill chain, but playing a critical role in the fight, are the C-130s of 8th Expeditionary Air Mobility Squadron.

The air guardsmen of 815th Airlift Squadron brought their C-130Js from Keesler AFB, Miss. The J models fly higher, with a smaller crew, and can carry two extra pallets. They go "higher, faster, farther," than other C-130 models, explained Lt. Col. Keith Gibson, commander of the unit.

"We're kind of the hub and spoke" and can reach nearly anywhere in the CENTCOM area of responsibility—even deep into Afghanistan, because of the fuel efficiency of the J model, Gibson said. "We affect every unit here."

The aircraft can land on a 3,500-foot dirt strip, or do air-drop if necessary to resupply "troops in contact" with the enemy. Onboard GPS allows precision airdrop from high altitudes, allowing the aircraft to stay out of the range of enemy fire, Gibson added.

The transport is also night-vision capable with the flip of a switch, making it "very combat friendly," he said.

The airmen stayed busy during their tour in the region, with 75 percent of the aircraft tasked every day. That they deployed at all was unexpected. The unit was slated to close and was only 48 percent manned—with only 10 percent combat qualified—in October 2015, explained CMSgt. Troy Peltier, the squadron superintendent.

Gibson described the unit as being "decimated" at the time, with only a core cadre of airmen remaining.

Then the squadron's status changed, and it started rebuilding. It began requalification training in February 2016 and was declared fully operational in November 2017 for a January deployment.

"It was a roller-coaster," Peltier said.

The maintenance squadron also had to rise to the challenge, standing up a second maintenance unit on Sept. 11, 2016, and deploying 16 months later. "It's a success story," Gibson said. "We're back in business."

Brig. Gen. Jason R. Armagost, the 379th AEW commander, said the wing is "the most Total Force-integrated operation I've ever seen." It's "a picture-perfect example" of integration. "Everybody's invited to the table."

It can seem incredibly complex, but it works, Armagost said.

FUELING IT ALL

Also outside of the traditional kill chain, but critical for every step of its operation, are the KC-135s of the 340th Expeditionary Air Refueling Squadron.

Lt. Col. Cory L. Clagett, commander of the 340th EARS, said it isn't easy refueling the "largest combat flying squadron in the Air Force." Most wings don't have as many airplanes, he said, and everyone relies on the tankers.

Active Duty troops deploy on a one-to-one ratio and are supplemented by Guard and Reserve airmen. "That's how we make the air war happen," he said.

Zeitler, of the JSTARS squadron, emphasized the crucial role the KC-135s play. "None of this happens without the tankers. No tanker means no persistence," he said.

Clagett said the airmen pride themselves in knowing that bombers, ISR platforms, and other aircraft never have to worry about running out of fuel. The "world's top mobile gas station," as KC-135 pilot 1st Lt. Ali Rizvi called it, is plenty busy.

Al Udeid is the largest defense fuel supply point in the DOD, with 270 million gallons of jet fuel supplied in 2017. Although the fuel farm at Al Dhafra AB in UAE has more storage for fuel, Al Udeid delivers more.

The Al Udeid-based tankers supply OIR and Afghanistan, but the Air Force moved some tankers to Afghanistan at the beginning of the year to make things more efficient. Clagett said the move eliminated about six hours of flying time.

"The synchronization of effort is amazing," said Lt. Col. Jason Grubaugh, deputy commander of the operations group. "We really do quite a bit here on this base," he understatedly added.

All the airmen can see the effects they're having, which boosts morale, and the character of the war has changed," Grubaugh said. ✪

Photos: SSgt. Patrick Evenson

MAKING THE MOST OF MILITARY SPACE

Realignments, reorganizations, and proposals are legion.

By Steve Hirsch, Senior Editor

COLORADO SPRINGS, COLO.—

Air Force officials at the National Space Symposium in April touted a substantial block of initiatives they are taking to toughen the US approach to military space. However, members of Congress remain unconvinced the Air Force alone should continue to manage the lion's share of the nation's military space enterprise without more radical changes.

USAF speakers emphasized that it's the mission, and not necessarily organizational boxes, that define the military space issue.

Gen. John W. Raymond, head of Air Force Space Command and US Strategic Command's Joint Force Space Component, said the nation has come to a "strategic inflection point" for national security space. It warrants a "bold shift toward warfighting space superiority," he told reporters, adding that steps taken by the Air Force to bolster military space capabilities are meant to further national goals, not just those of the service.

"Space superiority" is a joint requirement that Raymond argued is fulfilled by the Air Force, which regards it as a core mission. It's "not just a space officer's task; it's a joint warfighter's task."

Gen. John E. Hyten, commander of STRATCOM, struck a similar note, telling reporters that while organizing for space is getting the most attention from government, "the key—in my perspective—is the organization is secondary. The need to deal with the threat is primary."

Raymond said in 2017, when he was new to the job, there were few new accomplishments to report from Space Command, and so in last year's speech he talked about service anniversaries

A Space X Falcon 9 rocket hefts Iridium and Grace-FO (Gravity Recovery and Climate Experiment Follow-On) payloads from Space Launch Complex-4 at Vandenberg AFB, Calif., in May.

Photo: SrA. Clayton Wear

and a "Space Warfighting Construct," or a concept for the future.

This year, he said that construct "does not exist anymore. It is a reality." What it all "boils down to is warfighting."

Last year Raymond was named to be dual-hatted as head of STRATCOM's joint force space component. As the command was restructured, he consolidated 18 disparate component commands into four components for air, space, sea, and missile defense. The change, AFSPC spokesman Lt. Col. David Westover said at the time, would "improve our nation's space warfighting effectiveness."

Raymond said the post's "elevation from a three-star to a four-star operational component has been significant." It amounted to more than simply "adding a letter to the name of an organization," but provided a way to integrate within STRATCOM. Perhaps more importantly, he said the move created a way to integrate STRATCOM with other geographic combatant commands worldwide.

In January, the National Space Defense Center went to a 24/7 operating tempo. Relying on Pentagon and Intelligence Community support, it detects and defends against threats to space systems. This shift, Raymond said at the time, "immediately expands our space situational awareness and bolsters our readiness," both critical to space superiority.

In addition, the Joint Space Operations Center at Vandenberg AFB, Calif., will later this year become the Combined Space Operations Center, with increased international participation. The current joint center—known in the Pentagon as "JSpOC" for short—already includes exchange officers from Australia, Canada, and the UK.

Maj. Gen. Stephen N. Whiting, commander of AFSPC's 14th Air Force and Raymond's deputy at STRATCOM, told the symposium the transformation of

Space surveillance crews operate satellite vehicles in the new combined ops floor at Schriever AFB, Colo., in 2017.

the JSpOC into a CSpOC will "improve how we operate with those closest allies and their indigenous country space operations centers," improving space situational awareness and combined operations "for all involved."

The combined center will create and unify capabilities "that fill gaps so that we can operate this as a better enterprise," he said.

There would be benefit to increasing personnel exchanges between the various allied space AOCs, Whiting said. Eventually, as the center becomes evermore capable, AFSPC desires to "move beyond those traditional partners because there are so many other partners here in the room ... who we are working with day-to-day, ... and we want to bring them into the CSpOC as we move forward."

Besides the operations center, Raymond said another initiative to bring allies more closely into the space enterprise includes inviting them to participate in the annual Schriever Wargames. Besides the so-called "Five Eyes" of the intelligence alliance— the US, Australia, Britain, Canada, and New Zealand—the guest list has been expanded in recent years to include France and Germany. This year, Japan is participating.

USAF is also increasing space's role in realistic combat training exercises. The Air Force inaugurated a new "Space Flag" wargame in 2017, and Raymond said its frequency will be increased from two to three times annually.

Gen. John Raymond: "The need to deal with the threat is primary."

Gen. John Hyten: What it all "boils down to is warfighting."

In terms of leadership, USAF is "reviewing our space professional development and the space force structure needed" to develop a sustainable leadership track.

Air Force Secretary Heather Wilson announced three further initiatives to expand foreign participation in USAF space training. Two new courses are to be added to the National Security Space Institute at Peterson AFB, Colo., including one on space situational awareness, for partners and allies to learn more about collision avoidance, deorbits, and reentry. In addition, she said, more of the existing advanced courses on national security space are to be open to members of allied militaries. The courses were already open to Australia, Canada, and the United Kingdom; invitations will be extended to New Zealand, France, Germany, Japan, and possibly others.

"Why now?" Wilson asked. "Because we face a more competitive and dangerous international security environment than we have seen in decades. Russia and China are developing capabilities to disable our satellites. We will work with like-minded nations to preserve the ability to freely and safely operate in space. We will work with our allies to enhance deterrence, defend our vital national interests, and prevail if called upon to do so," she said.

Trump Directs the Pentagon to Begin Creation of a Space Force

President Donald Trump, accompanied by Vice President Michael Pence, instructs the Department of Defense to begin establishment of a Space Force during a press conference on June 18.

President Trump said he is directing the Pentagon to immediately begin the process of creating a sixth military service—a Space Force—overriding the repeated public positions of military leadership.

"I am hereby directing the Department of Defense and Pentagon to immediately begin the process necessary to establish a Space Force as the sixth branch of the armed forces," Trump said. "That's a big statement. We are going to have the Air Force and we are going to have the Space Force, separate but equal."

Trump's announcement, made during a meeting of the National Space Council at the White House, was a surprise to many in the Pentagon.

While it immediately created waves in the Pentagon and on Capitol Hill, there will be a long process ahead before it comes to fruition. Congressional action is needed to create a new military branch. The President is the Commander in Chief of the US armed forces, but the Constitution gives Congress the power to organize and arm the military.

Before the US Air Force was created, President Truman first drafted legislation and sent it to Congress in February 1947. The House and Senate held several hearings on the topic and in June of that year, the Senate Armed Services Committee approved the bill. The final legislation, which established the Office of the Secretary of National Defense and co-equal services, including a US Air Force, was then approved. Truman signed the National Security Act on July 26, 1947.

The idea to create a separate uniformed service focused on space, which would take away a large part of the USAF portfolio and budget, has been floated in Congressional hearings and rejected amendments to authorization bills for the last year. In 2017, Defense Secretary Jim Mattis and Air Force Secretary Heather Wilson wrote letters to lawmakers opposing the move because USAF already is taking "significant steps" to address the importance of space.

The creation of a Space Force, Wilson said, "would create additional seams between the services, disrupt ongoing efforts to establish a warfighting culture and new capabilities, and require costly duplication of personnel and resources." Mattis said he shared concerns about the organization and management of space capabilities, but a "properly integrated approach" is needed.

Rep. Mike Rogers (R-Ala.) has been Capitol Hill's greatest proponent of a Space Force, repeatedly criticizing USAF for not putting enough emphasis on space. Rogers said on Twitter he is "thrilled" Trump is supporting the move and he looks forward to making it a reality.

The Pentagon has conducted an interim evaluation on whether a new service would be needed, but the report has not yet been released publicly.

Deputy Defense Secretary Patrick Shanahan, who led the review, said he focused on the "fundamental changes" needed to reorganize space. "From a management standpoint, the easiest thing to do is redraw the lines and boxes on an [organization] chart, but that's actually the hardest thing to implement." ✪

—Brian W. Everstine

The SECAF also announced the creation of a new office, reporting to Air Force acquisition chief Will Roper, to speed up space-related acquisition. The Space and Missile Systems Center, which handles Air Force space systems procurement, is also to be restructured to increase efficiency.

"You can call it SMC 2.0," Wilson told attendees at a symposium dinner.

The organizational redesign, she said, will collapse stovepipes and establish a "chief architect to consider the entire space enterprise." In addition, SMC will have a production core, separate from its development core, and there will be sections focusing on innovation and one to drive partnerships.

"There is much work to be done, and we look forward to doing it together with all of you," she told the audience.

Photos: Courtesy; Dave Grim/USAF (2,3); courtesy; PO2 Patrick Kelley/USCG; USAF

The Joint Space Operations Center at Vandenberg AFB, Calif., detects, tracks, and identifies artificial objects in Earth orbit.

"No other organization in the world can do what we do, and we're only getting faster and better and going farther."

SPACECOM AND SPACE CORPS?

Despite consistent, detailed opposition to the idea from the Air Force leadership, congressional enthusiasm for a new space service seemed unabated in the following weeks. Passions about the subject flared at a House Armed Services Committee markup of its version—its "mark" in congressional vernacular—of defense authorization legislation.

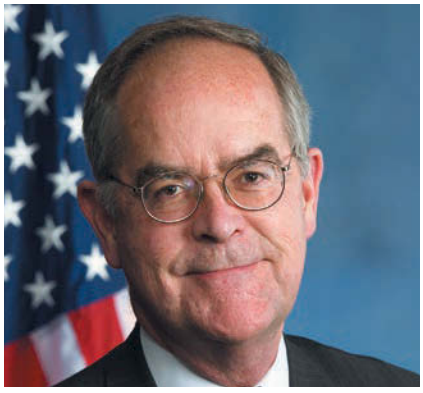
The Strategic Forces Subcommittee leadership firmly supports the creation of a separate space force.

"Since last year, President Trump has endorsed the establishment of an independent space force," subcommittee Chairman Mike Rogers (R-Ala.) said, adding that he and ranking subcommittee Democrat Jim Cooper (Tenn.) "remain committed to laying the foundations for that force within this committee."

The full committee considered a proposal from the Strategic Forces Subcommittee to include language to bring back SPACECOM as a subordinate unified command under STRATCOM.

During the 14-hour markup session, the panel rejected an amendment proposed by Rep. Mike Turner (R-Ohio) to link creation of the command to an ongoing review of how the Pentagon structures its space enterprise.

Turner told the committee he was offering his amendment for purposes of "legislative consistency." Though the review of space organization is ongoing, Turner said "we're going to jump forward in this mark and direct DOD to undertake a reorganization while we're asking them to study the reorganization."



Rep. Jim Cooper (D-Tenn.)

Rep. John Garamendi (D-Calif.)

Regardless of what the report ends up saying, Rogers said, certain steps must be taken, including reestablishing SPACECOM as a subunified command.

Cooper was more pointed in his remarks.

"The Air Force has simply not prioritized space as it should have and this is a way to get it back on track so that we do not face the catastrophic risk that we face of being rendered deaf, dumb, and blind by a surprise attack in space before we even knew what was going on," Cooper asserted. "So I would urge all members of the committee to oppose this amendment," he said, accusing Turner of "trying to slow walk the work of the subcommittee."

Also speaking against the amendment was Rep. John Garamendi (D-Calif.), who pointed to seven hearings that had been held in the subcommittee. He alleged that each of these hearings resulted "in the same very profound, important point and that is, 'We are not prepared to defend this nation's space assets in large part because we are not organized to do so.' "

All the hearings concluded that the Unites States must organize its military "in a way to defend perhaps the most critical element in the Department of Defense, which are our space assets," Garamendi asserted.

The Turner amendment was defeated by a voice vote, meaning as of early June the House had passed its version of the bill, including the space language; the Senate Armed Services Committe version of the bill had not yet come up for floor debate. ✪

Photos: USAF; courtesy (2 ,3)

verbatim@afa.org
By Robert S. Dudney

Awesome Squadrons

"That, to me, is the secret sauce. That's what's going to keep people in [the Air Force]. It's what's kept me in. If I can get inspirational squadron commanders out there, that are given decision authority to run their squadrons, and they're given the resources they need to accomplish the mission, and they're out there inspiring their airmen, that is going to be far and away the most effective hedge against airline hiring that we'll ever have."**—Gen. David L. Goldfein, USAF Chief of Staff, on what will stanch today's pilot exodus, airforcetimes.com, June 11.**

When Buzz Met Mad Dog

"I have a personal experience with ... faith in airpower. In late 2001, in Afghanistan, then-Lt. Gen. [later USAF Chief of Staff] Buzz Moseley promised me that, 'If you're in trouble, I'll put every plane in the sky over your head.' And for the first time in 30 years as a marine infantryman, I did not take artillery into the assault waves attacking 350 nautical miles in from the sea. That is how much confidence I and every other member of the Joint Force have in an Air Force officer's word, and our Air Force's ability to hold the high ground overhead."**—Secretary of Defense Jim Mattis, speech at graduation of the Air Force Academy's class of 2018, May 23.**

Pompeo's Warning

"If they [Iran's leaders] restart their nuclear program, it will mean bigger problems than they've ever had before."**—Secretary of State Mike Pompeo, address to The Heritage Foundation, May 21.**

Perry, Again

"These so-called 'low-yield' weapons are a gateway to nuclear catastrophe and should not be pursued. ... Ultimately, the greatest concern about the proposed low-yield [W76-2] Trident warhead is that the President might feel less restrained about using it in a crisis. When it comes to using a nuclear weapon, restraint is a good thing. ... Congress has the power to stop the administration from starting down this slippery slope to nuclear war. We call on Congress to exercise that authority without delay."**—Letter to Congress endorsed by former Secretary of Defense William J. Perry and others, May 23.**

Team America

"There's definitely a 'Trump Doctrine.' The Trump Doctrine is 'We're America, Bitch.' That's the Trump Doctrine. ... Obama apologized to everyone for everything. He felt bad about everything. [Trump] doesn't feel like he has to apologize for anything America does."**—Unnamed "senior White House official," quoted by Jeffrey Goldberg, editor of *The Atlantic,* in defenseone.com, June 11.**

You Flatter Yourself

"The endless accusations [by Westerners] against Russia are a way to contain Russia. ... They see Russia as a threat, they see that Russia is becoming a competitor. I understand that every country has its own interests, including economic interests, but they must not be secured in an egoistic way. It is obvious to us that Russia will continue to defend its interests ... until our partners realize that their [measures] against us are useless and counterproductive."**—Russian President Vladimir Putin, state TV broadcast, June 7.**

Hurricane Snowden

"It was the end of the world. It was every sort of irrational thought and fear and consequence running through my head. ... I thought, 'All my employees were going to be fired. I am going to jail. Terrorists are going to run wild. CIA assets are going to get compromised.' Snowden opened the Pandora's box to the data leaks. Undoubtedly, he did huge damage."**—Steven Bay, supervisor of turncoat Edward Snowden, a National Security Agency contractor, referring to the day in 2013 that Snowden announced he had left with stolen NSA files, fifthdomain.com, June 7.**

What China Has Wrought

"The Chinese [built] something that has a longer body, so it's stable in pitch. It's got these vertical, F-22-style vertical stabilizers ... geared toward supersonic performance and fighter-style capability. ... Something like this could transit to areas very fast, and, if produced in large numbers without having to train pilots, could at the very least soak up missiles from US fighters, and at the very best be an effective fighter by itself. If you can produce lots of them, quantity has a quality all its own."**—Justin Bronk, air combat specialist at Royal United Services Institute, on emergence of China's new remotely piloted Dark Sword fighter, quoted in businessinsider.com, June 6.**

Google Stampede?

"I worry that a lot of companies will look at Google and say, 'Wow, if Google isn't going to work with the Department of Defense, maybe I shouldn't either.' So I'm hoping that this is not going to turn into any type of stampede. ... The machine isn't making any decisions. It is not applying lethal force. All it is doing is reducing the workload of analysts. That's it."**—Robert O. Work, former deputy secretary of defense, referring to Google's withdrawal from Project Maven, DOD's flagship artificial intelligence program, thehill.com, June 5.**

Deaf, Dumb, Blind

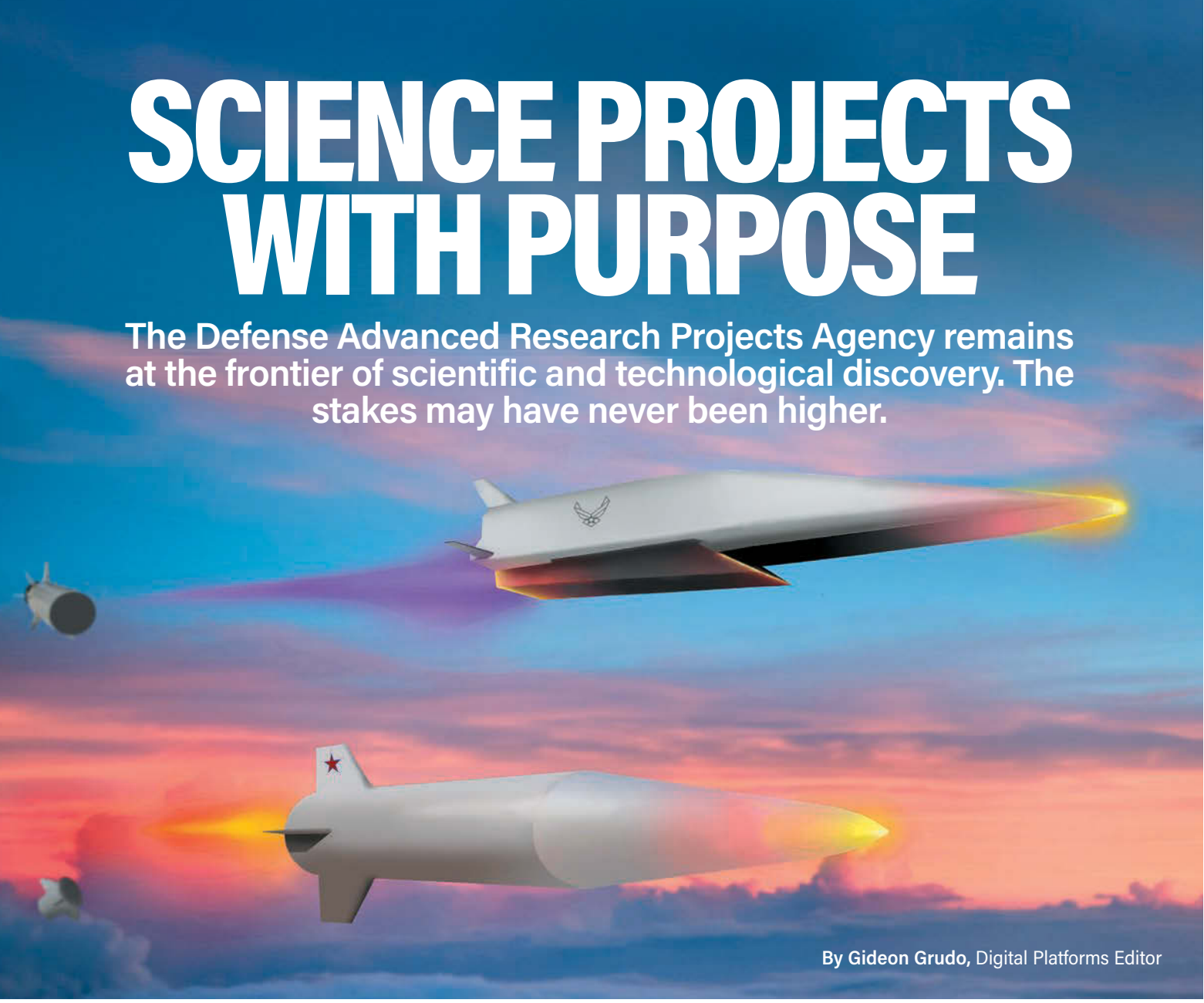
"The enemy will dig into cities. ... Clearly, it will be impossible to avoid combat in large cities, in megacities, in the future. As powerful as our mission command systems are, they are all challenged by the environment, the complex terrain that is a modern city. You can't go more than about one room deep in a building without losing comms with whoever's outside that building. You can't go more than one floor deep underground without losing comms with everybody who's up on the surface. You can't go more than two or three floors up without losing comms again."**—Gen. Stephen J. Townsend, commander of Army Training and Doctrine Command, remarks at an Army conference, May 22.**

About that Life Span....

"Russian and Chinese surface-to-air missiles have more range [than in the past], and the plane would be shot down in the first day of conflict."**—Secretary of the Air Force Heather Wilson, on why the Air Force wants to forgo any further upgrades to the E-8C Joint STARS fleet, House Armed Services Committee, May 17.**

SCIENCE PROJECTS WITH PURPOSE

The Defense Advanced Research Projects Agency remains at the frontier of scientific and technological discovery. The stakes may have never been higher.



By Gideon Grudo, Digital Platforms Editor

An *Air Force Magazine* illustration of a conceptual USAF air-breathing hypersonic weapon (top), utilizing its scramjet engine after separating from its solid rocket booster. Below, a Russian hypersonic missile speeds toward its target after jettisoning its exhaust fairing cap.

The Defense Advanced Research Projects Agency turned 60 this year, and its director, Steven H. Walker, feels he has a clear mandate from Pentagon leaders and the White House: Focus on the threat.

Testifying before Congress in March, Walker said the new National Defense and National Security Strategies leave no doubt that the US has returned to an era of great power competition. This makes it all the more urgent for the US to stay militarily ahead of adversaries like China and Russia.

DARPA aims to keep the US military strategically surprising while avoiding being strategically surprised.

In the Fiscal 2018 budget request, DARPA asked for just over $3 billion for its wonder-weapon programs. For Fiscal 2019, it is seeking $3.4 billion.

Created in 1958 as ARPA (the acronym minus "Defense," which was added in 1972), the agency was designed to beat the Soviet Union to the high ground of space. From that early imperative to modern achievements like tiny GPS receivers or automatic voice recognition, DARPA's philosophy has been to turn "revolutionary concepts and even seeming impossibilities into practical capabilities," Walker said.

Walker, with 30 years of experience at the Air Force Research Laboratory, DARPA, and the Air Force, took the reins of the agency last year.

The agency's primary focus areas, "which I'm calling foundations," are all directly tied to threats facing the United States, he explained in a March meeting with defense reporters. The mission areas are: (1) Defending the homeland; (2) Deterring and prevailing against peer competitors in geographically important areas of the world; (3) Effectively looking at how the US will counter insurgency and counterterrorism across the world; and, (4) Building upon DARPA's proven strengths, he said.

The fourth "focus area for me is our foundations, and that is really what DARPA has always done—which is pay attention to where technology is leading us," he told reporters. When the agency can successfully spot trends, it can "advance that technology to

Steven Walker, DARPA head, speaks with reporters after a roundtable discussion in Washington, D.C.

develop future capabilities for the US and national security," Walker said.

The world, he said, is "experiencing deeply disturbing technical, economic, and geopolitical shifts" that threaten America's "preeminence and stability," Walker told members of the Emerging Threats and Capabilities subcommittee in his March testimony. While these are contrasted by "some remarkable and even astonishing scientific and technological advances," Walker added, these "dueling trends of unprecedented opportunity and risk" guide DARPA's strategic priorities.

Chief among them is hypersonics; the development of vehicles that can fly within the atmosphere at speeds in excess of five times the speed of sound.

Walker told Congress in testimony that DARPA's pursuit of hypersonics carries "a particular sense of urgency due to the rising pace of related research by peer adversaries" such as China and Russia.

In late January, Air Force Gen. Paul J. Selva, Vice Chairman of the Joint Chiefs of Staff, told defense writers in Washington, D.C., that China has the lead in hypersonics because it's made the technology "a national program" and is spending lavishly on "solving the problems of hypersonic flight [and] hypersonic target designation."

Two months later, Russian President Vladimir Putin touted a new missile, the "Kinzhal," which he described as an "invincible" hypersonic weapon that possesses unlimited range.

Walker has called for a national effort to win the hypersonics race.

A Kromek handheld radiation isotope detector. The devices provide real-time data to detect radiation.

Speaking to reporters weeks before his March testimony, Walker called Fiscal 2019's budget request of a 136 percent increase for hypersonics research "a good first step," but insisted more is required.

Funding for hypersonics jumped from $85.5 million in Fiscal 2017 to $108.6 million in the Fiscal 2018 request, leaping again in Fiscal 2019 to $256.7 million.

In late April, USAF awarded Lockheed Martin a $928 million contract to prototype its Hypersonic Conventional Strike Weapon. DARPA-specific efforts into hypersonics include the Tactical Boost-Glide Program and the Hypersonic Air-Breathing Weapon Concept. The Air Force Research Laboratory also has hypersonics-specific programs.

"We're going to start flying these systems in 2019. You'll see lots of flight tests," Walker told reporters. "We're excited that these will be systems that will be very capable," and can be launched from "standoff" distances, meaning outside the range of adversary air defenses.

"We do need an infusion of dollars in our infrastructure to do hypersonics," he said. "Most of our programs at DARPA are testing in one facility. ... If you look at some of our peer competitors—China being one—and you look at the number of facilities they've built to do hypersonics, it surpasses the number we have in this country and is quickly surpassing it by two or three times."

Walker noted, though, that "no domestic security threat today exceeds that of a nuclear or radiological 'dirty bomb' detonation." Detecting the signs of nuclear testing or release can be achieved for high-emitting radiological materials, and a nuclear attack on a city is obvious. But today's sensors are "too large and expensive" for wide deployment into urban environments where smaller radiological warfare might take place.

DARPA's SIGMA program aims to achieve cheap, capable, and easily transported radiation detectors.

Testing of SIGMA is underway. In 2016, DARPA worked with authorities in New York and New Jersey to field 100 devices, and Washington, D.C., where they fielded 1,000 devices and tested them at "critical transportation hubs," Walker said. In Washington, for example, DARPA installed 73 radiation and nuclear detectors in ambulances. The vehicles logged 100,000 hours of testing and succeeded in identifying "thousands of radiation sources." These included many "innocuous ones, like natural granite," according to DARPA, which requested $38.6 million for more research into SIGMA in the coming fiscal year.

"SIGMA detectors can readily distinguish between these kinds of benign sources and threatening ones," the agency's program release read. "Equally important, the SIGMA detectors provided detailed background radiation maps of the District against which future sources may be more easily detected."

Another example of DARPA's defense portfolio is its Network Defense program. Sifting through terabytes of DOD Information Network (DODIN) data, the program looks for harmful cyberspace events.

Walker said the effort brings US Cyber

Illustration by Mike Tsukamoto/staff; Photos: Jim Garamone/DOD; DARPA

An airman prepares to launch a small UAV at Camp Roberts, Calif.

Command and Army Cyber Protection Team members together with its own experts; the three entities collaborating to identify and mitigate cyber threats to and in DODIN traffic. He said the program identified persistent threats within days of operating and over time detected five criminal malware infections and anomalies, all emblematic of the program's success in the cyber realm. DARPA wants $116 million to keep running Network Defense in FY19.

The program has also created more than 40 scalable methods now used in other military, and even commercial, environments, Walker said, noting more than 60 exploitations identified in the private and military sector as a result of applying DARPA's techniques. The program is very similar to the Air Force's Cyberspace Defense.

DARPA is also looking to a computing future free of traditional circuits and boards.

The 2017 electronics resurgence initiative aims to upend board technology, disrupt the market, and create what Walker called "leap ahead" technology for circuits. There's $111 million in DARPA's FY19 budget request to cover multiple facets of this potential enterprise-shifting tech, from fostering working relationships with companies like Intel and Samsung to partnering with universities. DARPA calls this effort the Joint University Microelectronics Program.

Not all of DARPA's technology initiatives have to do with hardware. The agency is dabbling in the growing universe of gene editing. DARPA's Safe Genes program is aimed at protecting troops from diseases and mitigating the threat from biological warfare, and developing advanced, synthetic bio-based materials.

"The steep drop in the costs of genomic sequencing and gene-editing tool kits, along with the increasing accessibility of this technology, translates into greater opportunity to experiment with genetic modifications," a DARPA spokesperson told *Air Force Magazine*. "This convergence of low cost and high availability means that applications for gene editing—both positive and negative—could arise from people or states operating outside of the traditional scientific community."

Walker said to counter such people or states requires the US to have "more complete knowledge" about how gene editors and similar technologies function. "In parallel," he added, "demonstrating the ability to precisely control gene edits, turning them on and off under certain conditions or even reversing their effects entirely, will be paramount to the safe translation of these tools to practical applications." DARPA is asking for $20 million for genetic technologies research in FY19.

Walker's final example in the research frontier is also a national talking piece: Artificial Intelligence. From the White House's announcement of a Select Committee on Artificial Intelligence (DARPA will have a seat on that panel) to USAF's revitalized research partnership with the National Science Foundation, AI is carving out a central space in the Pentagon's future.

DARPA is working on how machines respond to new environments and information—what Walker called "third generation," or explainable AI.

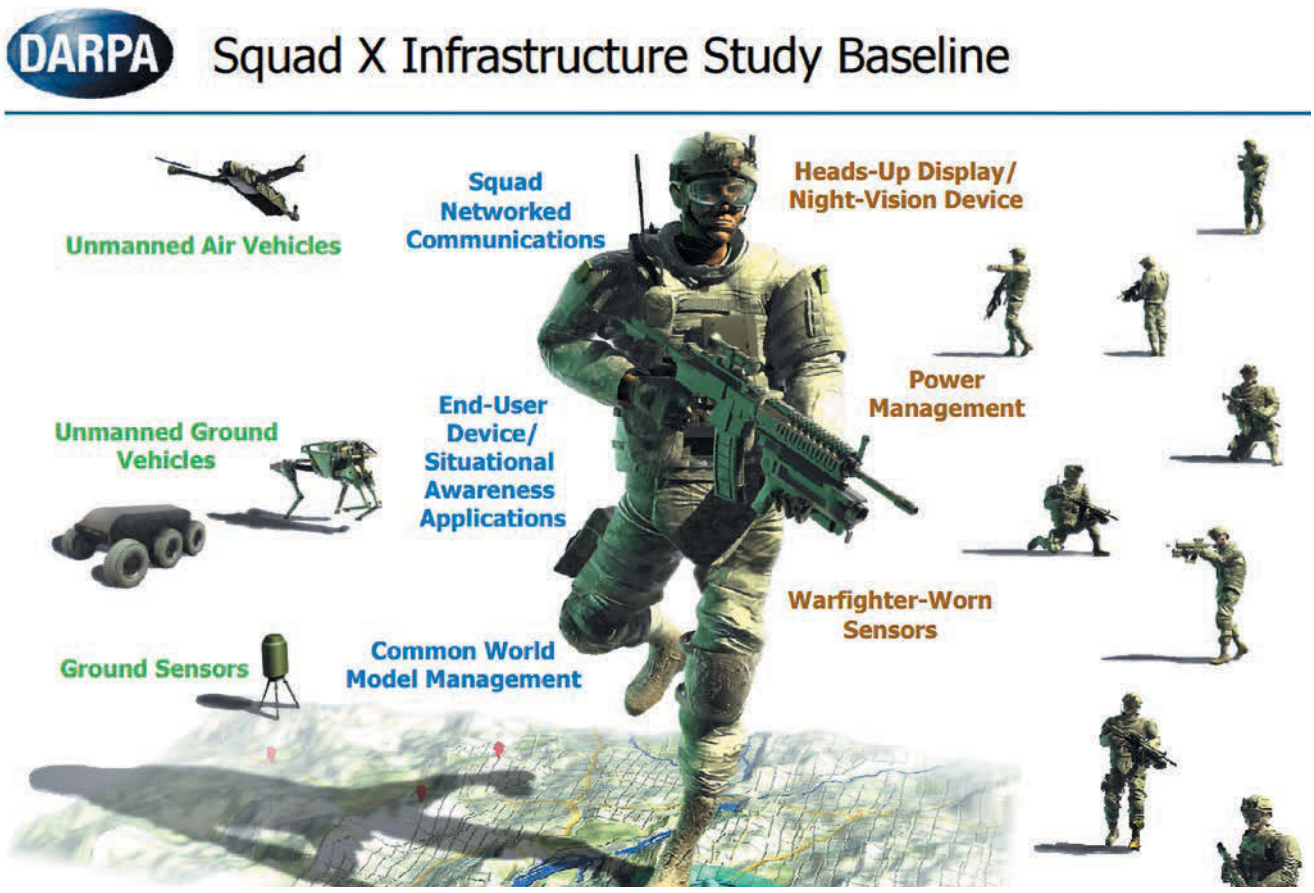
First-wave AI was about building smart systems, which allowed robots and machines to identify and predict trends by analyzing databases, along the lines of Google search results or airline ticket pricing.

Second-generation AI, Walker explained, is basic machine learning, or machine "training," by which computers are taught to recognize a particular building, for example, so they can find one in a video feed and alert a human operator. The next step is getting the computer to explain why it identified the building, not just doing so. The computer's rationale may be critical in then making a lethal choice about whether to fire.

Third-generation AI deals with unpredictable variables on the battlefield. What if an enemy airplane doesn't exactly match the definition fed to the computer? What if the aircraft had some extra control surfaces? What might trip up the AI? This is where explainable AI (XAI) comes in, for which DARPA wants $22 million in Fiscal 2019.

"New machine-learning systems will have the ability to explain their rationale, characterize their strengths and weaknesses," Walker said, "and convey an understanding of how they will behave in the future."

DARPA wants to give ground troops a simple and unobtrusive way to access large amounts of data about their surroundings. Squad X Core Technologies anticipates a future where global stability requires Americans on the ground in foreign, hostile ter-



A DARPA graphic explains the Squad X concept.

ritory isolated from friendly networks. Squad X will protect squad members even when cut off from support and capabilities like GPS. DARPA wants $28.5 million in Fiscal 2019 for Squad X, which is a four-pronged program comprising precision engagement, nonkinetic engagement, squad sensing, and squad autonomy.

Precision engagement allows ground forces to engage a threat as far as a kilometer away, even if it's not in sight. The component would be compatible with current weapon systems and not impose any new weight or operational burdens. Distributed guided munitions are being considered, according to DARPA.

In the second, troops could nonkinetically disrupt an enemy's command and control, communications, or ability to use unmanned assets.

Squad sensing is the inverse of precision engagement, allowing for threat awareness up to a kilometer. There would be multisource data fusion and autonomous threat detection.

Finally, squad autonomy will provide squad members with awareness of where everyone in their team is located and where GPS has been denied. This technology involves collaboration with unmanned or ground systems and specifically involves human-machine teaming.

"The goal is to speed the development of new, lightweight, integrated systems that provide infantry squads unprecedented awareness, adaptability, and flexibility in complex environments," Walker said.

While DARPA is frequently an agent of change for the US military, its wide portfolio can sometimes prove a hindrance, especially when paired with a plodding and outdated Pentagon acquisition process.

"Despite all our efforts," Michael D. Griffin, undersecretary of defense for research and engineering, told Congress in late April, "we are constantly challenged to maintain science and technology superiority."

Still, the agency's successes over time are undeniable, so much so that other nations and even other portions of the US government often try (and fail) to emulate DARPA's successes. "I've actually over the last couple of years met with many countries—South Korea, Japan, UK, France, Germany, to try and help them understand the DARPA model and how it could work for them," Walker told defense reporters in March. "Every culture's different, though, and one of the reasons why it worked here is, compared to some other countries, we have a risk-taking culture. We have folks who are willing to come to a place, have a job for three or four years, and then get booted out. Which is actually what happens."

Other nations don't necessarily have the professional mobility that is common in the United States. "People generally know they're going to go from DARPA and get a good job somewhere else," Walker noted, so "we get new people in the door with new ideas all the time. We're not bound by 10-, 20-, 30-year-old thinking, which can happen in some places. And it adds to the innovative culture of the place."

The other reason DARPA is successful, Walker continued, is the the agency has buy-in on its model across the government. "They give us a lot of freedom. ... To make decisions, to think differently, and to start and stop our own programs," he told reporters.

"We get very little top-down direction, which I think is [important] if you want an organization to continue to produce out-of-the-box ideas, projects, to continue to disrupt the status quo and question, and you want that organization to be free to have some autonomy and some flexibility," he concluded. ✪

Photos: USAF; DARPA

OLD BOMBERS, MAKING HISTORY

The B-1s and B-52s have kept the heat on enemies in Syria, Iraq, and Afghanistan.

A B-52 during a mission against ISIS in 2017. B-52s set a record of 834 consecutive missions without a maintenance cancellation while flying strikes for CENTCOM.

By Brian W. Everstine, Senior Editor

The Air Force made the latest rotation in its newest continuous bomber presence—recently sending B-1B Lancers back to the US Central Command area of operations and sending B-52s home after almost two years deployed for the fight against ISIS and the Taliban.

B-52s, deployed to Al Udeid AB, Qatar, since 2016, had been the main bomb trucks for ongoing sorties targeting ISIS in Iraq and Syria and flying over the horizon into Afghanistan as part of the renewed effort there against the Taliban. During their time in the CENTCOM region, B-52s flew more than 1,800 sorties, dropping nearly 12,000 bombs on targets in both theaters, according to CENTCOM.

These B-52s made history in multiple ways. The first deployment of B-52s from the 23rd Bomb Squadron at Minot AFB, N.D., launched 400 consecutive sorties without a maintenance delay, marking the record on the squadron's centennial in June 2017. This beat the previous B-52 record that stood since the legendary Operation Linebacker II in 1972 in Vietnam. Those B-52s deployed from the 69th Bomb Squadron at Barksdale AFB, La., continued this streak, launching a total of 834 consecutive missions without a maintenance cancellation. This number

Photo: SrA. Jordan Castelan

shattered the previous record of 761 missions by B-1s at Al Udeid.

On Nov. 19, 2017, the Barksdale B-52s also became the first BUFFs in Air Force history to employ few bomber's newest weapons capability: the conventional rotary launcher. This upgrade allows the B-52 to carry eight more smart bombs inside its cavernous bomb bay, in addition to weapons carried on the wings.

In February 2018, the bombers took this capability to the Taliban as part of Operation Jagged Knife, a new effort by both US and Afghan forces to target the group's drug and financial infrastructure. A B-52 flew from Al Udeid to Tajikistan—on the Afghan border with China—where the bomber dropped 24 guided munitions on Taliban positions and vehicles stolen from the Afghan army that were being transformed into vehicle-borne improvised explosive devices. This bombing mission set a record for most precision weapons dropped by a B-52 in a single sortie.

These "over the horizon" sorties became increasingly common as the B-52 deployment progressed and ISIS's territory waned in Syria and Iraq. The bombers were an important asset to US forces because they could linger for hours and carry more than 30 bombs to help US and Afghan forces.

"In essence, if we had 30 targets, we could hit 30 targets," Maj. Gen. James Hecker, then the commander of NATO Air Command-Afghanistan and the 9th Air and Space Expeditionary Task Force-Afghanistan, told *Air Force Magazine* during a 2017 visit to Kabul. "It gives us a fairly large capability."

The changeover took place in March 2018, with B-1Bs from Ellsworth AFB, S.D., returning to Qatar and sending B-52s home to Barksdale. The Lancers were originally sent home from CENTCOM in 2016 so they could receive a needed upgrade, called the Integrated Battle Station, which modernized its avionics and data links. Before leaving in 2016, B-1s had been continuously flying in CENTCOM since 2001.

1/ B-52 pilots from the 96th Expeditionary Bomb Squadron take off on a mission against ISIS. 2/ A 96th EBS B-52 pilot flies a combat mission supporting Operation Inherent Resolve. The old bombers have flown more than 1,800 sorties in CENTCOM's region. 3/ GPS bombs hang from the wing of a B-52H Stratofortress from the 69th EBS on the flight line at Al Udeid AB, Qatar. 4/ A pilot from the 23rd Expeditionary Bomb Squadron walks to the base armory before a mission. In 2017 the 23rd EBS set a record of 400 consecutive sorties without a maintenance delay. The first B-52H flew for Strategic Air Command in 1961. Now turning 57 years old, their reliability is an indication of how well the aircraft are maintained.

Photos: SrA. Jordan Castelan (1,2); SSgt. Patrick Evenson/ANG; SSgt. Trevor McBride

"This B-1 that we're bringing back to the fight is different than any other B-1 that has deployed here before," said Lt. Col. Timothy Griffith, commander of the 34th Expeditionary Bomb Squadron, in a release. "It's the first time this upgraded aircraft is going to be employed in combat and we're honored and humbled to lead the B-1 community back into the AOR."

The modernized B-1s were immediately put to work and quickly made history themselves. On April 14, a combined US, French, and UK coalition took action in response to a chemical weapons attack by Syrian President Bashar al Assad. US and UK ships and submariners, combined with French aircraft and ships, and UK aircraft targeted chemical weapons production facilities from the Mediterranean Sea. From the south, two B-1Bs from the 24th EBS, escorted by a Marine Corps E/A-6B Prowler and a team of F-22s on standby for force protection, launched 19 Joint Air-to-Surface Standoff Missiles that destroyed the Barzeh Research and Development Center near Damascus. It was the first time JASSMs were used in combat.

On May 1, the US-led coalition and its supported Syrian Democratic Forces announced a new initiative called "Operation Roundup," aimed at getting rid of ISIS's ground presence once and for all in the eastern Euphrates River Valley inside Syria. Coalition air strikes,

1/ Maintainers with the 34th Expeditionary Bomb Squadron prepare a B-1B Lancer for a combat operation at Al Udeid AB in May. 2/ A munitions technician from the 23rd Expeditionary Aircraft Maintenance Unit prepares to load a B-52. 3/ Guided bombs are readied for a B-52 strike. The bomber could linger for hours and carry 30 precision weapons. 4/ 23rd EAMU munitions personnel use bomb lift trucks to move and position a weapon. 5/ A row of GPS-guided munitions are checked by a technician as B-52s from Barksdale AFB, La., are armed for a CENTCOM mission against ISIS.

Photos: 1st Lt. Katie Spencer; SSgt. Trevor McBride (2-5)

led by the B-1, immediately increased, with 132 total strikes within 17 days. Bombers targeted ISIS groups, supplies, and buildings in their final strongholds of Abu Kamal and al-Shaddadi.

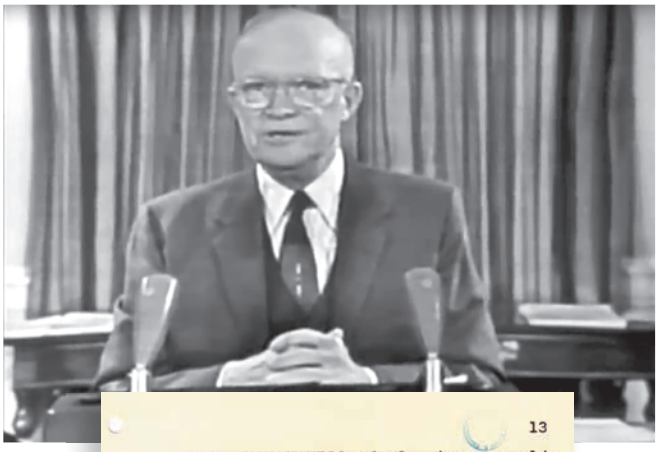
These continued air strikes are "compacting what's left of ISIS in Syria as we deal the final blow," said UK Army Maj. Gen. Felix Gedney, the deputy commander of strategy for Combined Joint Task Force-Operation Inherent Resolve, during a May briefing. "As we have said and proven many, many times over the course of this campaign, the coalition will relentlessly pursue ISIS wherever they are until they're defeated." ✪

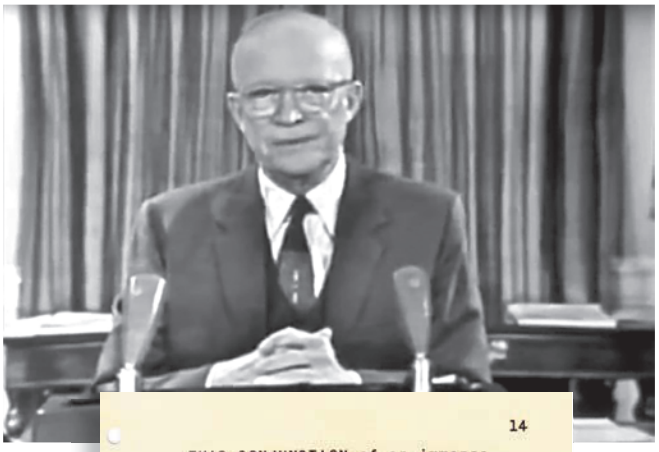
1/ A 23rd EBS B-52 lands after completing the squadron's 400th combat sortie without a maintenance issue. 2/ A B-52 lands after an Operation Inherent Resolve mission. 3/ B-52s after a CENTCOM sortie. 4/ A B-1B Lancer departs from Al Udeid AB, Qatar, in 2017 as the type begins its first mission in CENTCOM's area of operations in more than two years. 5/ Airmen load guided munitions onto a rotary launcher in the bomb bay of a B-52 at Al Udeid. The launcher enables B-52's to carry more smart bombs in support of Operation Freedom's Sentinel in Afghanistan.

Photos: SSgt. Michael Battles (1,2); SSgt. Trevor McBride; SSgt. Joshua Horton; courtesy

Ike's 23-word shot at the military-industrial complex took on darker meaning as it was picked up and repeated.

Eisenhower's





13

AMERICAN MAKERS of plowshares could, with time and as required, make swords as well.

But now we can no longer risk emergency improvisation of national defense; we have been compelled to create a permanent armaments industry of vast proportions.

Added to this, three and a half million men and women are directly engaged in the defense establishment.

WE ANNUALLY spend on military security more than the net income of all United States Corporations.

14

THIS CONJUNCTION of an immense military establishment and a large arms industry is new in the American experience.

The total influence -- economic, political, even spiritual -- is felt in every city, every State house, every office of the Federal government.

We recognize the imperative need for this development.

Yet we must not fail to comprehend its grave implications.

Our toil, resources and livelihood are all involved; so is the very structure of our society.

President Dwight Eisenhower during his farewell address to the nation Jan. 17, 1961, and excerpts from the address.

By John T. Correll

President Dwight D. Eisenhower had a strong grasp of the importance of national security and the issues surrounding it. He was a five-star general and arguably the most distinguished military commander of the 20th century.

At the same time, he deplored the arms race and described it in terms of resources that might have been allocated instead to building schools, hospitals, and housing. He was also known to be angered by the clamor of the "munitions lobby" for increased military spending.

None of this, however, set up an expectation for the central theme of Eisenhower's farewell address, delivered from the White House on national television Jan. 17, 1961, three days before he left office.

The most famous line came about halfway through the speech: "In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex."

The phrase lives on and on, more so than anything else Eisenhower ever said. It is still quoted regularly almost 60 years later. It never seemed to matter that the words were not characteristic of his way of speaking, or that they were crafted for him by speechwriter Malcom "Mac" Moos.

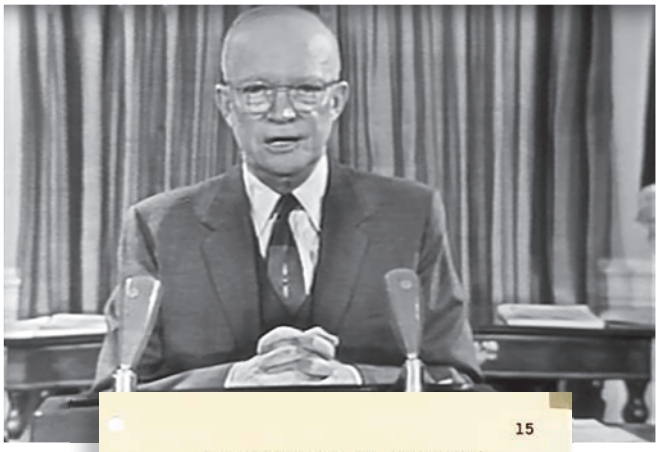
After he left office, Eisenhower said little more about it. It is not perfectly clear, from either the context of the speech or anything said separately, exactly what Ike's intended message was.

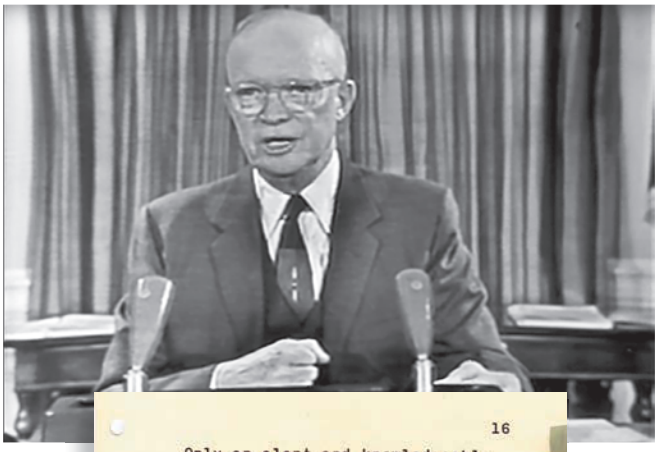
It is usually forgotten in the popular awareness that Eisenhower led into his "unwarranted influence" line with an acknowledgment that the nation could "no longer risk emergency improvisation of national defense" and that the strategic realities of 1961 created an "imperative need" for a large military force and "a permanent arms industry."

Eisenhower did not demonize the military-industrial complex. He cited the *potential* for abuse and advised caution. The flaming accusations came later, from others. Sen. George S. McGovern (D-S.D.), a contender for the Democratic presidential nomination in 1968, declared that the "mounting influence of the military-industrial complex" was "the most serious internal threat facing the United States."

The speech has been taken captive by ideologues who use it for their own purposes. "The concept of the mili-

Farewell Warning





15

IN THE COUNCILS of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex.

The potential for the disastrous rise of misplaced power exists and will persist.

WE MUST NEVER let the weight of this combination endanger our liberties or democratic processes.

We should take nothing for granted.

16

Only an alert and knowledgeable citizenry can compel the proper meshing of the huge industrial and military machinery of defense with our peaceful methods and goals, so that security and liberty may prosper together.

AKIN TO, and largely responsible for the sweeping changes in our industrial-military posture, has been the technological revolution during recent decades.

IN THIS REVOLUTION, research has become central; it also becomes more formalized, complex, and costly.

The speech warned of potential "grave implications" in "unwarranted influence" by the "military-industrial complex."

tary-industrial complex has become a rhetorical Rorschach blot—the meaning is in the eye of the beholder," says journalist James Ledbetter, who studied the issue at length for his book *Unwarranted Influence* in 2011.

MERCHANTS OF DEATH

The notion of a military-industrial complex was somewhat reminiscent of the "Merchants of Death" movement, popular in the 1930s, which claimed that the munitions industry had influenced the US decision to enter World War I and had made vast profits from it.

In 1934-1935, Sen. Gerald P. Nye, a populist Republican from North Dakota, held 93 hearings that produced colorful headlines but little substance. He might have gone on longer but Congress cut off his funding when he accused President Woodrow Wilson of concealing essential information about the declaration of war in 1917.

Prior to World War II, numerous efforts and congressional actions sought to limit the "profitability" of war. It took extraordinary leadership from President Franklin D. Roosevelt to instigate mobilization of industry leading to the "Arsenal of Democracy" during World War II.

When the Arsenal of Democracy was running at full tilt, it incorporated just over 47 percent of US economic output. War production peaked in 1943 and declined sharply in 1944. The defense industry was almost completely dismantled after World War II.

However, the time line for military preparedness had changed. Nuclear weapons, long-range bombers, and eventually ballistic missiles left no time for an extended buildup of arms in the event of war.

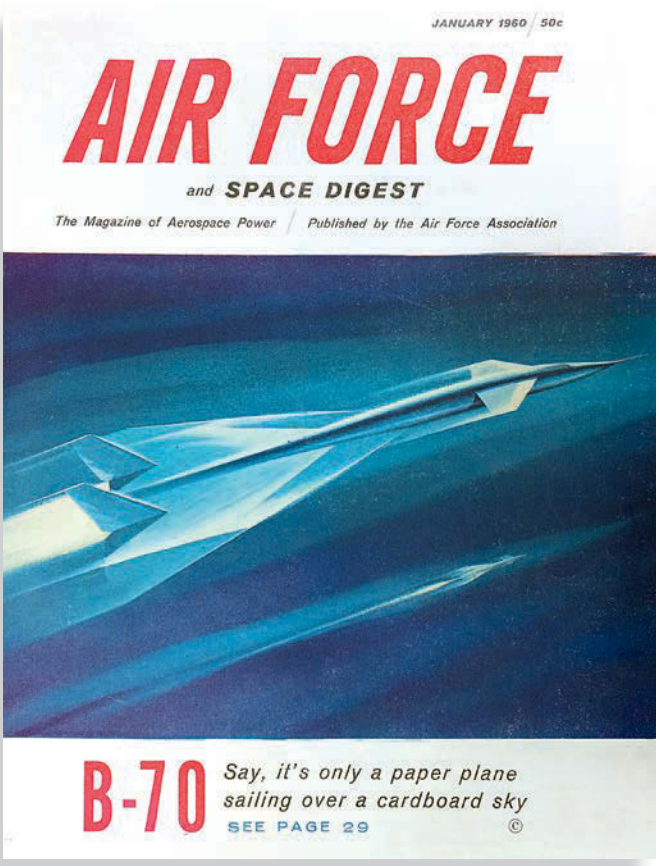
In his "Chance for Peace" speech in 1953, sometimes cited as a "bookend" with his farewell address, Ike said that, "Every gun that is made, every warship launched, every rocket fired signifies—in the final sense—a theft from those who hunger and are not fed, those who are cold and not clothed."

In a similar speech in 1958, Eisenhower lamented the rising defense budget and "tragic penalties" imposed by the "utterly wasteful" armaments race. "All of us deplore this vast military spending," he said. "Yet in the face of the Soviet attitude, we recognize its necessity."

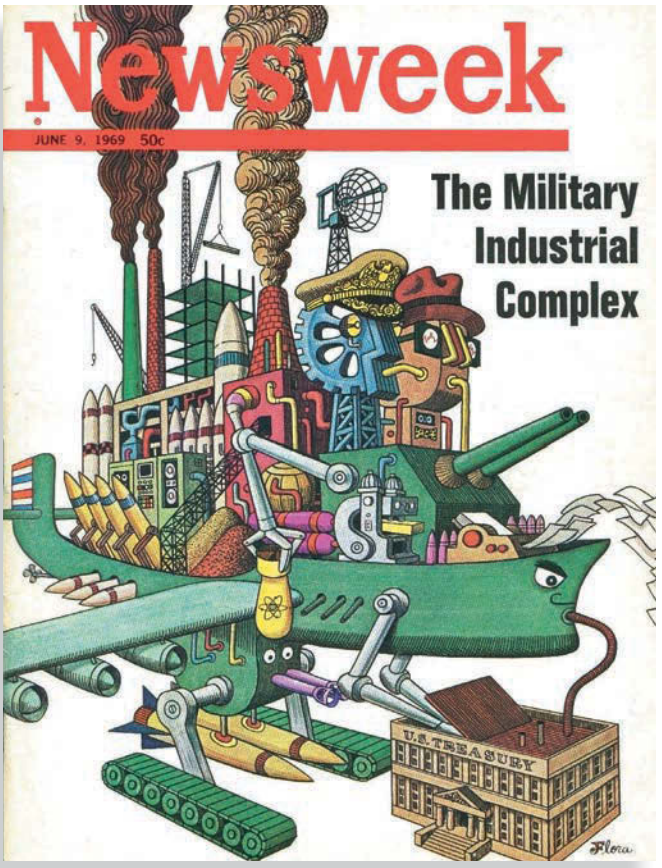
THE NEW COLOSSUS

Before World War II, most US military ordnance was produced in government arsenals. During the war, much of

Photos: National Archives



Air Force Magazine, an Air Force Association publication, showed an illustration of the short-lived B-70 bomber. The Eisenhower administration was angered by AFA's efforts to restore the curtailed B-70 bomber.



Newsweek in 1969 wrote about the "military-industrial complex." The phrase gained traction far beyond its importance in 1961.

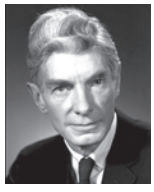
the workload shifted to factories—the automobile industry being a prime example—converted from civilian output but converted back again when the war ended.

The large standing forces of the Cold War required a permanent arms industry to equip and support them, and by 1958, less than 10 percent of US weapons production was by government arsenals. Thirty of the 50 largest industrial corporations were defense contractors, either full time or partially. The defense program was a smaller share of total government spending than it had been in World War II or the Korean War, but in 1961, still accounted for 50.8 percent of federal outlays and 9.3 percent of the gross domestic product.

About a third of the defense budget went for procurement and research and development. Congress saw to it that the contracting bounty was spread around to home districts all across the country.

Concerns about military-industrial influence took a different tack when Congressional Democrats accused Eisenhower of allowing a "bomber gap" to develop in 1956 and then a more serious "missile gap" in 1959.

Strangely, the origin of the missile gap controversy seems to have been a background statement in January 1959 in which Secretary of Defense Neil H. McElroy speculated that the Soviets would achieve superiority in ICBMs within the next year. Ike contributed to the tale himself, saying at a press conference that the Soviet ICBM program had started first but that US scientists and services were "catching up as fast as they can."



Malcolm Moos

Nevertheless, Eisenhower was convinced that the missile gap story remained alive because the arms industry and the military services, especially the Air Force, were feeding information and rumors to his critics. At another press conference in June 1959, he confirmed that he had spoken to members of Congress about the influence of the "munitions lobby."

It was not until after the election that the missile gap was revealed to be nonexistent.

THE MALCOM MOOS TRIO

Moos, longtime professor of political science at Johns Hopkins University, came to the White House in September 1958 as chief speechwriter. He described himself as an adherent of "left-wing Republicanism." In 1954, he had been co-author of a book, *Power through Purpose,* which according to Ledbetter "described the harmful competition for resources between national defense and peacetime needs."

There were two other speechwriters: Steven H. Hess, whose specialty was "the political stuff," and Ralph E. Williams, a Navy aide to the president. When Williams asked Moos if he could be of help, "Mac, never having been in the military, was delighted to add an at-hand expert on national security to his team," Hess said.

Moos showed Eisenhower a book of famous presidential speeches, including George Washington's farewell ad-

President Eisenhower (center) discusses the flight demonstration of the Boeing B-52 prototype with Cabinet and Boeing officials in the early 1950s.

dress. Ike said that when he left office, he would like to make such an address to Congress and the American people. Moos set up a special file for ideas on a farewell speech. Work on the address—which would eventually go through 29 drafts—began in May 1959.

The speechwriters' office got copies of magazines from military associations and trade press. Moos was fascinated by the aerospace publications, particularly *Aviation Week* and the Air Force Association's *Air Force Magazine.* He brought the magazines to Eisenhower's attention.

"Repeatedly, I saw Ike angered by the excesses, both in text and advertising, of the aerospace-electronics press, which advocated ever bigger and better weapons to meet an ever bigger and better Soviet threat they had conjured up," said James R. Killian, the president's science adviser. (Killian is credited with talking Eisenhower out of directing his criticism at a "military-scientific complex.")

Williams is sometimes cited as coining the "military-industrial complex" phrase but he generally defers to Moos. "I'm sure the president never thought about either the phrase or the concept itself until Mac Moos put the first draft under his nose," he said. Williams believed that "it struck a responsive chord" in large part because Ike "had been stung by the Democratic candidates' criticism of the 'missile gap' during the 1960 election and the 'bomber gap' in 1956."

Eisenhower, Williams said, was "outraged at the antics of the cabal consisting of Air Force officers, aviation industry lobbyists, trade associations, and Congressmen promoting arms programs beneficial to their districts who regularly fed ammunition to his critics." Eisenhower considered expanding the term to "the military-industrial-congressional complex," but decided against it.

According to Hess, the primary writers of the speech were Moos and Williams, with "massive additions and corrections" by the president's brother, Milton S. Eisenhower.

CATCHING FIRE SLOWLY

Moos suggested that the speech take the form of an address to Congress, but Eisenhower wanted to make his report directly to the nation. Television cameras were brought into the Oval Office and the President spoke from the White House.

He cited the importance of American leadership in a dangerous world, saying "we face a hostile ideology—global in scope, atheistic in character, ruthless in purpose, and insidious in method." This led to the requirement for large-scale military preparedness and also to its inevitable corollary, the potential for "unwarranted influence" by a military-industrial complex.

"Only an alert and knowledgeable citizenry can compel the proper meshing of the huge industrial and military machinery of defense with our peaceful methods and goals, so that security and liberty may prosper together," he said.

Considering the impact the speech achieved later, the initial reaction was subdued. A *Washington Post* editorial noted, "Eisenhower said little that was new" but "he said it with good heart and good feeling." Of 20 questions at Ike's press conference the next day, only two were about the "peacetime military establishment" and the "scientific-technological elite" and they were softly put.

Columnist Walter Lipmann was energized by the speech, which he reinterpreted though the filter of his own opinions. To Lippmann, it was about the "threat to the supremacy of the civilian power." Government "can and should impose a strict military discipline on the statements and speeches issued by the Chiefs of Staff and by local commanders throughout the world," he said.

As the 1960s rolled on, however, condemnation of the military-industrial complex became widespread. Sen. J. William Fulbright (D-Ark.), chairman of the Senate Foreign Relations Committee, complained that the complex "has become a major political force." Sen. Eugene McCarthy (D-Minn.) urged the Senate to "put some kind of limit on the power of the military-industrial complex." Popular economist John Kenneth Galbraith said the defense industry should be nationalized.

Eisenhower himself said little further about it. In *Waging Peace,* the second volume of his White House memoirs, Eisenhower devoted only two of the 741 pages to the issue and most of that was quoting from the farewell address.

In the latter years of his presidency, Eisenhower said, "I began to feel more and more uneasiness about the effect on the nation of tremendous peacetime military expenditures" and that "under the spur of profit potential, powerful lobbies spring up to argue for even larger munitions expenditures."

In retirement, Eisenhower lived on his farm near Gettysburg, Pa. His grandson David, who lived there too, recorded his observations in a book, *Going Home to Glory.*

"Eisenhower later developed a kind of split personality about the most controversial speech of his life," David Eisenhower said. "Among his business friends and military colleagues, Eisenhower became defensive and self-critical about the speech. ... Yet with others, Eisenhower was assured and precise about his meaning, and confident that the idea required forceful expression."

OFFENSES OF THE COMPLEX

Not satisfied with Eisenhower's assessment of potential problems, the critics piled on with a litany of alleged

Photos: AFA; Newsweek via Nosworld; Boeing via AFA

B-47 bombers under construction at the Douglas Aircraft facility in Tulsa, Okla.

actual offenses. Among the main categories were these:

Undue influence on policy. Two examples were mentioned frequently. The aerospace industry hoped for a reversal of the decision to cancel or curtail the B-70 bomber. To columnist Marquis Childs, the publicity and lobbying campaign demonstrated the power of the "invisible lobby." In fact, no great "unwarranted influence" was exerted. The B-70/RS-70 program was limited to two prototypes. One crashed and one went to a museum.

In a higher-profile instance, the Air Force Association—sometimes seen as a home base of sorts for the military-industrial complex—adopted a resolution in 1963 opposing the Limited Test Ban Treaty. Childs condemned AFA's attempt to "sway the debate" but the fireworks came from investigative reporter Fred J. Cook, who thundered that "The Air Force Association, its courage fortified by booze, blondes, and bashes, quite evidently has no qualms about calling for a program of eradication that could be achieved only at the frightful price of mutual nuclear holocaust." Cook charged that, "there is hardly an area of our lives today in which the military influence is anything less than supreme."

Perhaps unaware of that, the Senate ratified the treaty, 80-14.

Cost overruns. They happened, but defense programs had no monopoly on them. The interstate highway system—lauded as one of Eisenhower's greatest achievements—incurred a cost overrun of 267 percent. In its early years, Medicare overran by 800 percent the cost projection of the House Ways and Means Committee.

Excessive profits, especially by the aerospace industry. Profit can be measured in various ways and comparisons are difficult. However, a *New York Times* business report in 1962 said that "the earnings rate of the aerospace industry have been lower than that for other manufacturing industries" from 1957 to 1961.

Sen. William Proxmire (D-Wis.)—well known for his "Golden Fleece" awards to government agencies he deemed wasteful—maintained that aerospace profits were more than 10 percent higher than for American industry in general.

To the contrary, a General Accounting Office (GAO) study for the years 1966 to 1969 found that despite some exceptions, defense work was less profitable than commercial work. Historian James A. Huston noted that although defense programs often made less profit than civilian production, the contracts usually involved less risk.

THE UNCEASING ECHO

The defense and aerospace industries diminished with the end of the Apollo space program and the winding down of the Vietnam War. In the 1970s, USAF raised an alarm about the decline of the defense industrial base. The capability for surge of weapons production in an emergency was no longer assured. Only a single supplier was left for some commodities, and for others, the prospect of dependency on foreign sources loomed.

The interval between introduction of new fighters and bombers—once a matter of a few years—stretched into decades. Defense spending dropped as a percentage of both the gross domestic product and of total federal outlays. Numerous defense contractors disappeared; many of those that survived merged with each other.

Even so, the outcry against the military-industrial complex goes on. In 2011, an article in *The Atlantic* said that, "Judged 50 years later, Ike's frightening prophecy actually understates the scope of our modern system—and the dangers of the perpetual march to war it has put us on."

PBS producer Glen Baker declared in 2012 that, "the salute of all things military" struck him as "a cynical ploy to ensure that the military-industrial-congressional-entertainment complex is well fed, even as spending on the rest of society is cut and the debt balloons."

Jonathan Turley, a professor of law at George Washington University, claimed in 2014 that, "The new coalition of companies, agencies, and lobbyists dwarfs the system known by Eisenhower."

There is more than a little imagination at play here.

As a share of GDP, government spending on defense has declined from 9.3 percent in 1961 to 3.1 percent today.

The Air Force, previously regarded as the centerpiece of the military-industrial complex—and which launched more than 1,000 bombers on a single day in 1944—has exactly 158 bombers in the fleet today.

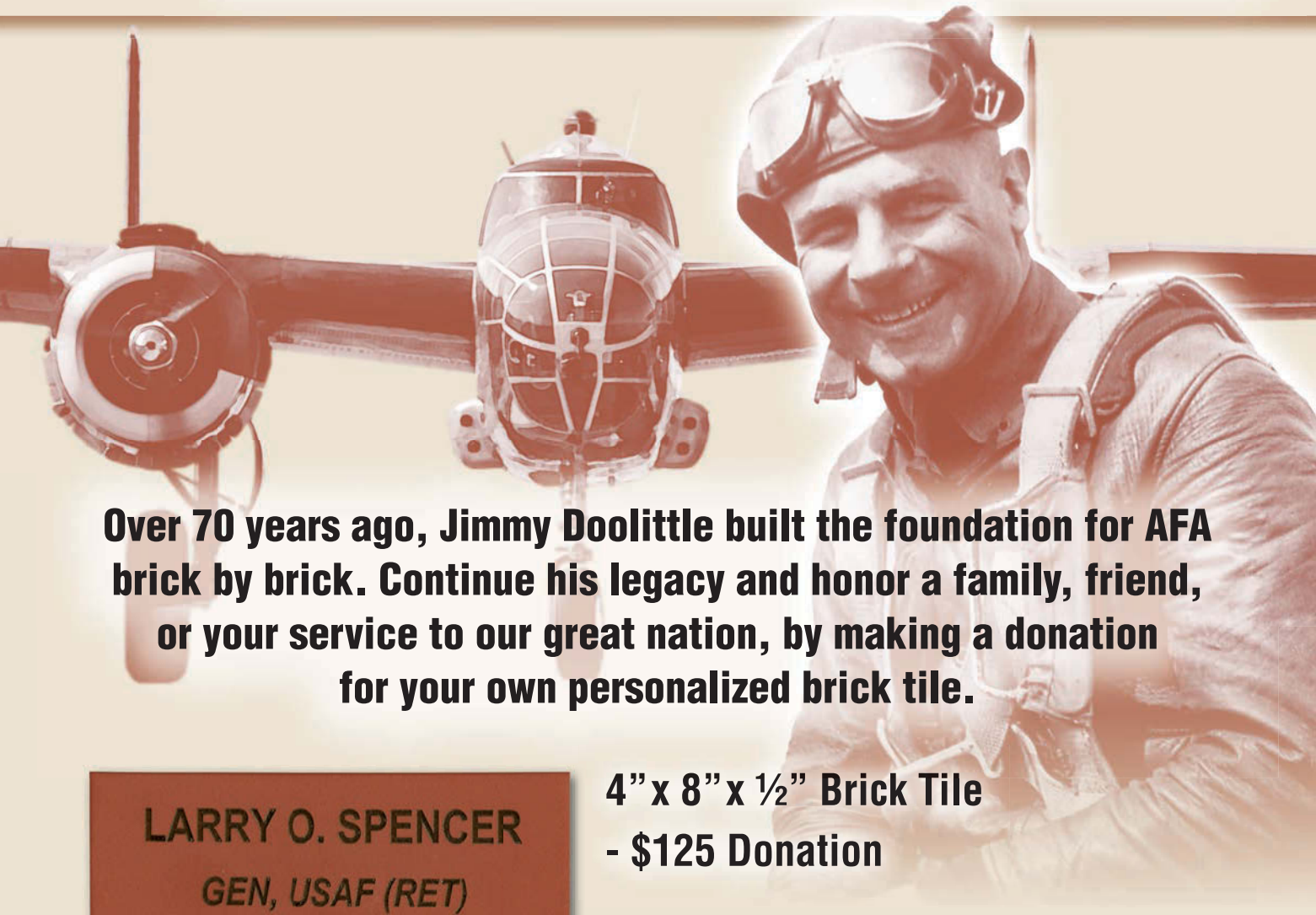
Active Duty strength in the 2010s is the lowest since before World War II and 61 percent below the level when Eisenhower made the speech.

It takes some stretching to perceive any kind of a military-industrial threat to society in that. ✪

John T. Correll was the editor-in-chief of *Air Force Magazine* for 18 years and is now a contributor. His most recent article, "Revolt of the Admirals," appeared in the July issue.

Photo: AFA

DOOLITTLE BUILDING BRICK CAMPAIGN



Over 70 years ago, Jimmy Doolittle built the foundation for AFA brick by brick. Continue his legacy and honor a family, friend, or your service to our great nation, by making a donation for your own personalized brick tile.

4" x 8" x ½" Brick Tile
- $125 Donation

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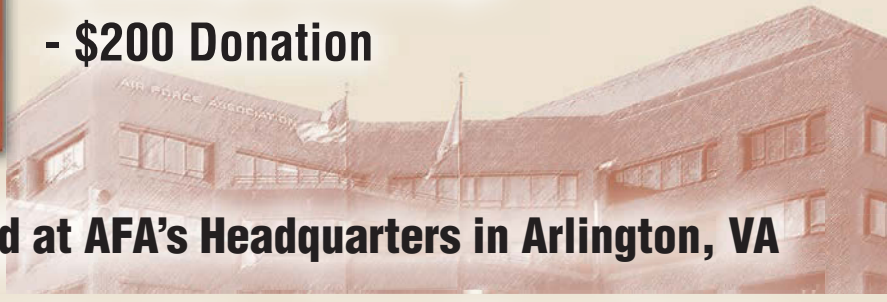

The Legacy Wall to be located at AFA's Headquarters in Arlington, VA

For more details and to order visit www.AFA.org/Bricks

By Edward Hood

Left: Girl Scout Troop 750 strikes a "Rosie the Riveter" pose. Above: A stone plaque dedicates the memorial.

Rosie the Riveter

On Dec. 7, 1941, the Japanese bombed Pearl Harbor and America was drawn into World War II. During the years that followed, America would send 16.1 million men to fight on foreign soil. These men would leave behind a sizeable gap in the US workforce. That gap was filled by women. They were known collectively as Rosie the Riveter.

To ensure the contributions of the Rosies are fully acknowledged, an organization called the "Spirit of 45" is leading a campaign to create a living memorial in the form of a national network of rose gardens called the Rosie the Riveter National Living Memorial.

Weeks Roses of Pomona, Calif., designed a special rose for the National Living Memorials, called the "Rosie the Riveter" rose.

On May 1, members of the Tyndall Air Force Association partnered with the Girl Scouts to dedicate one such garden at the Veterans Park, in Callaway, Fla. The garden is one of the anticipated 435 total gardens to be dedicated in each Congressional district across America.

The ceremony kicked off with a rifle salute by the Tyndall Air Force Base Honor Guard as well as the presentation of the colors by all five branches of the armed forces.

Tyndall AFA President, SSgt. Edward W. Hood said, "I felt it was very important to have all five branches there to honor the Rosies because the allied forces could not have won the war without their logistical support." Hood also said, "We hope that the Callaway Rosie the Riveter Memorial Garden will be a model for other AFA chapters and Girl Scout Troops around the country, so we can reach the national campaign goal of having Rosie roses planted in every Congressional District in time for the 75th anniversary of the end of World War II in 2020."

Tyndall AFA and the local Girl Scout Troop teamed up to plant the rose garden at Veterans Park in Callaway, Fla.

Craig Deatherage, Rep. Neal P. Dunn's military and veteran affairs liaison, said, "It's one thing to put up a monument and pressure wash it every 10 years, it's an entirely different thing to plant a garden and trim that garden, and care for that garden and prune the roses year after year, season after season, and help them grow into a beautiful living example for the women who contributed so much during World War II. These are women who stepped out of their normal roles and went into factories and took on jobs that were nontraditional for women at that time."

For information on how to get a Rosie the Riveter garden in your area go to: http://www.spiritof45.org/rosie_rose_gardens_resources.aspx. ✪

Photos: courtesy

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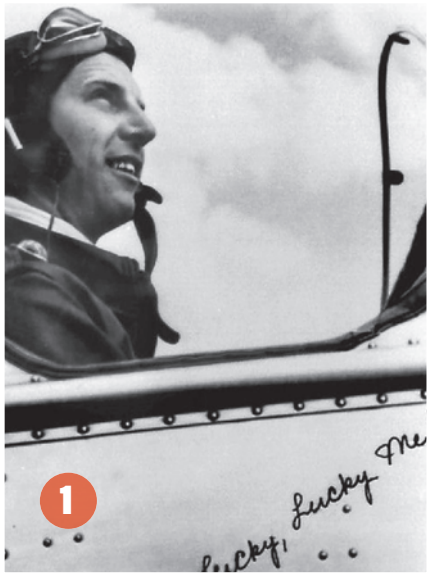

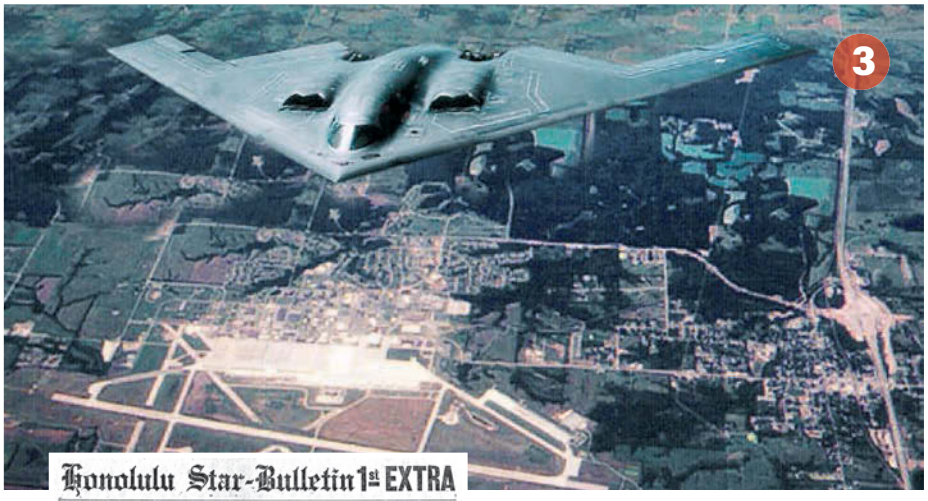


Honolulu Star-Bulletin 1st EXTRA
WAR!
SAN FRANCISCO, Dec. 7.—President Roosevelt announced this morning that Japanese planes had attacked Manila and Pearl Harbor.
OAHU BOMBED BY JAPANESE PLANES
SIX KNOWN DEAD, 21 INJURED, AT EMERGENCY HOSPITAL
Attack Made On Island's Defense Areas
Hundreds See
Schools Closed
Editorial

1/ Whiteman in his plane *Lucky, Lucky Me!* 2/ *Honolulu Star-Bulletin* coverage of Pearl Harbor attack. 3/ A B-2 bomber flying over Whiteman Air Force Base.

WHITEMAN

A Short, Heroic Life Before Death

Who was the first pilot in American uniform to die in World War II aerial combat? Historians are not sure, but it may well have been a young Army aviator named George Allison Whiteman.

Second Lieutenant Whiteman was an Army Air Corps P-40B pilot based in Hawaii on Dec. 7, 1941. Early in the Pearl Harbor assault, he was shot down and killed by two Japanese Zero fighters.

A dozen or so US pilots got airborne. Death came to three—2nd Lt. Gordon H. Sterling, Jr., 2nd Lt. John L. Dains, and Whiteman. Exact times of their deaths remain uncertain.

George Whiteman had an extremely short combat career, but he had come far from his humble origins.

He was born just after World War I on a farm in rural Pettis County, Missouri. George was the eldest of 10 children, and times were always tough. He was an excellent, even bookish, student, graduating from Smith-Cotton High School in Sedalia and entering the renowned Rolla School of Mines.

However, it was Great Depression time. Though he had earned a scholarship, he could not long afford tuition. He left Rolla after two years.

Whiteman moved to Chicago but soon returned home and began plotting a new life. He enlisted in the Army in October 1939. Once in the Army, friends urged him to try for pilot training. He did, and his assertiveness paid off.

In the spring of 1940, Whiteman was ordered to Randolph Field, Texas, for pilot training. He was commissioned in November 1940 and was awarded his pilot wings.

In February 1941, Whiteman was assigned to Hawaii. He was proud of his pilot status; he sent home a photo of himself in his aircraft, inscribed with the message, "Lucky, Lucky Me!"

Whiteman was assigned to the 44th Pursuit Squadron at Wheeler Field, Oahu, but toward the end of 1941 he was temporarily reassigned to Bellows Field on the same island for gunnery training. Thus, his unit had some P-40s stationed at both fields.

Japanese bombers struck Wheeler first. Whiteman raced to Wheeler but, seeing that every fighter had been hit, he jumped into his car and went to Bellows, where he might find another P-40.

Airmen were still loading ammunition into his guns when Whiteman taxied for takeoff. He started his roll, lifted off, and had risen 50 feet in the air when two Zeros opened fire on him.

Enemy rounds hit the engine, wings, and cockpit, wounding Whiteman. He then tried to execute a belly landing on a beach near Bellows, but he crashed in flames. Whiteman was only 22.

The Army during the war had opened Sedalia Air Force Base, near Whiteman's central Missouri home. On Dec. 3, 1955, USAF renamed it Whiteman Air Force Base.

Whiteman for much of its history belonged to Strategic Air Command. On Dec. 17, 1993, the first operational B-2 bomber, *Spirit of Missouri,* arrived. Today, the entire fleet of stealth bombers is based at Whiteman, which is now under control of Air Force Global Strike Command.

GEORGE ALLISON WHITEMAN

Born: Oct. 12, 1919, Longwood, Mo.
Died: Dec. 7, 1941 (KIA), Territory of Hawaii
College: Rolla School of Mines, Mo.
Occupation: US military officer
Services: US Army (1939-40); Air Corps (1940-41)
Main Era: World War II
Years Active: 1939-41
Combat: Pacific Theater
Final Grade: Second Lieutenant
Honors: Silver Star, Purple Heart (both posthumously)

WHITEMAN AIR FORCE BASE

State: Missouri
Nearest City: Sedalia
Area of Main Base: 7.3 sq mi./4,683 acres
Status: Open, operational
Opened as Sedalia Glider Base: Aug. 6, 1942
Renamed Sedalia Army Airfield: Nov. 6, 1942
Inactivated: December 1947
Reactivated by USAF: August 1951
Renamed Sedalia AFB: October 1952
Renamed Whiteman AFB: Dec. 3, 1955
Former Owners: Troop Carrier Command, Strategic Air Command
Current Owner: Air Force Global Strike Command

Photos: USAF

FREE
Personalization!

Shown much smaller than actual size of 8½" H x 9" W

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OR

with any message or name and title up to 16 characters as shown

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