

**UNITED STATES AIR FORCE READINESS**

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**HEARING**

BEFORE THE

SUBCOMMITTEE ON  
READINESS AND MANAGEMENT SUPPORT

OF THE

COMMITTEE ON ARMED SERVICES  
UNITED STATES SENATE

ONE HUNDRED FIFTEENTH CONGRESS

SECOND SESSION

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OCTOBER 10, 2018  
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## UNITED STATES AIR FORCE READINESS

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WEDNESDAY, OCTOBER 10, 2018

UNITED STATES SENATE,  
SUBCOMMITTEE ON READINESS  
AND MANAGEMENT SUPPORT,  
COMMITTEE ON ARMED SERVICES,  
*Washington, DC.*

The subcommittee met, pursuant to notice, at 9:32 a.m. in Room SR-222, Russell Senate Office Building, Senator Dan Sullivan (chairman of the subcommittee) presiding.

Committee members present: Senators Sullivan, Inhofe, Rounds, Ernst, Perdue, Kaine, and Shaheen.

### OPENING STATEMENT OF SENATOR DAN SULLIVAN

Senator SULLIVAN. Good morning. This hearing on the Subcommittee on Readiness and Management of our U.S. military will come to order.

The subcommittee meets today for the first time since the passage of the John S. McCain National Defense Authorization Act for the fiscal year of 2019 to receive the testimony on the current readiness of the United States Air Force.

I do want to begin by noting an obvious significant loss to the country, to the Senate. I am the new chairman of this subcommittee. I was not a chairman before we lost Senator McCain. I would much rather not be a chairman and have him still be here. But we all know that that was a huge loss for everybody around the table, everybody in the Senate. As a matter of fact, Senator McCain once sat in this seat from 1995 to 1997, as well as Senator Inhofe, who is now the chairman of the committee. So I think that is just something we should all recognize and be cognizant of.

I am particularly pleased that we have my ranking member, who is a good friend of mine, Senator Kaine, and a great panel this morning in terms of the Secretary of the Air Force, Secretary Heather Wilson; the Chief of Staff of the Air Force, Chief of Staff Goldfein; and Mr. John Pendleton, the Director of Defense Capabilities and Management for the Government Accountability Office (GAO). I want to welcome our witnesses.

It has been almost 6 months since this committee received testimony from the Air Force on its current posture in support of the fiscal year 2019 budget. As I mentioned, prior to that in those 6 months, a lot has happened. The NDAA [National Defense Authorization Act] was passed with \$716 billion in authorized funding, and it did not get a lot of press, but 87 U.S. Senators voted for that

bill. A very, very bipartisan effort to rebuild our military. The same amount has also been appropriated.

The Air Force has now released its “The Air Force We Need” plan. I want to thank the Secretary—I have read that—for laying that out with the need to ramp up from your perspective, Madam Secretary, to 386 squadrons, as well as conduct an internal operational safety and review.

The GAO has released a number of new reports citing the need for instances of needed change inside the U.S. Air Force.

There is plenty to talk about today, and I want to thank all of my colleagues for being here.

With the announcement earlier this year of a document that I think most of us find very persuasive, Secretary Mattis’ National Defense Strategy (NDS), which laid out a new strategic approach to addressing military challenges, this committee has a new lens through which to ensure that the lines of effort in this NDS are focused and supported by the Congress.

I certainly support Secretary Mattis’ efforts in this document, the National Defense Strategy, and appreciate that the topics we discuss here are framed in how they support the NDS, especially in how we address potential peer and near-peer conflicts with China and Russia.

With Congress passing its first on-time authorization for the first time in over 20 years and an appropriations bill for the military for the first time since 2008, it sends a timely message to both our adversaries and allies that a bipartisan group of Senators and Members of the House are focused on rebuilding our military in a way that does not do damage but actually helps them. It also sends an important message to the men and women in uniform that we are here to deliver bipartisan support for them.

The Air Force of today looks in some respects very much like the Air Force of yesterday, and that is not a compliment. For instance, the average Air Force aircraft is 28 years old, and since Desert Storm, we have 58 percent fewer combat-coded fighter squadrons. While this is not a modernization hearing, it is a readiness hearing, and unless we modernize our Air Force for the future, we will put lives at risk both on the ground and in the air in terms of readiness.

With modernization also comes a significant burden on sustainment. So the Air Force must find balance between keeping our existing aircraft battle-worthy and ramping up to new squadron requirements that the Secretary laid out in her recent speech.

In a recent GAO study, it was found that the B-22, C-17, E-8C, F-16, and the F-22 all face unexpected replacement of parts and repairs, delays in depot maintenance, and diminished manufacturing sources.

Additionally, in October 2017, GAO found F-35 aircraft availability is well below service expectations. GAO has recommended that the Department of Defense revise F-35 sustainment plans to ensure that they include the key requirements and decision points needed to fully implement the F-35 sustainment strategy.

The GAO also released another report on the need for the Air Force to improve its F-22 organization, which could lead to improved aircraft availability and pilot training. The GAO found in

July 2018 that the Air Force's organization of its small F-22 fleet has not maximized aircraft availability and their utilization of F-22's reduces opportunities for pilots to train for their key missions in high threat environments. Mr. Pendleton, I appreciate you walking us through these findings and recommendations, as Alaska is home to two very critical F-22 squadrons.

As my colleagues know, I do like to talk about my State. That will not diminish as the chair of this committee. I like to mention that Alaska constitutes three pillars of America's military might. We are the cornerstone of missile defense, the radars and the missiles that protect the whole country. We are a key platform for expeditionary forces because of our strategic airlift and strategic location that can fight tonight pretty much anywhere in the northern hemisphere, and we are the hub of air combat power in the Arctic and the Asia-Pacific. With F-35's coming to Alaska in the next couple years, we will have over 100 fifth generation combat-coded fighters, which I am pretty sure no place on earth will have that kind of fire power and punch.

Secretary Wilson, I know you have been a proponent of our small 60,000 square mile JPARC [Joint Pacific Alaska Range Complex] facility. That is airspace that is larger than Florida. So I look forward to getting your thoughts on the JPARC 2025 plan and, more broadly, how we are going to make sure we have range spaces all over the country and the world for fifth gen fighter aircraft.

Again, I want to thank everybody for being here. I am very much looking forward to being the chairman of this committee.

I would like to now turn it over to Senator Kaine for any opening remarks. I am also honored to have the chairman of the full Armed Services Committee here as well. Senator Kaine?

#### **STATEMENT OF SENATOR TIM KAINE**

Senator KAINE. Thank you, Mr. Chair, and thanks to our witnesses. I am looking forward to this hearing today.

I will echo what Senator Sullivan said about just the first big committee meeting since the passage of Senator McCain. I luckily inherited the office that Senator McCain had for about 20 years. When he decided to move around the corner into the office that had been occupied by Senator Kerry when Senator Kerry became Secretary of State, my seniority was so low that I should not have been able to get John McCain's office. However, he did not believe in painting an office, and he also was a pack rat. So his office did not have a lot of curb appeal.

[Laughter.]

Senator KAINE. So I was able to get it despite low seniority and paint it. I love being able to be in this office that he had for so long. I sometimes feel like I am hearing the ghost of him cursing me out, which he did on occasion.

[Laughter.]

Senator SULLIVAN. We all know what that is like.

Senator KAINE. Yes, we can all remember those words.

But I am glad, Dan, that you opened up with that. I look forward to working with you. I had a great relationship with our current chair when he was chair of the Readiness Subcommittee. Senator Inhofe, I think you will attest that I was generally reliable, and I

look forward to working with you, Senator Sullivan, as well. You get congratulations not just for being chair, but I think you joined the committee and became chair in one jump in the subcommittee. So that is pretty cool.

Senator SULLIVAN. Very cool.

[Laughter.]

Senator KAINE. I do not know that that has ever happened that you join the subcommittee and become chair in one jump. So congratulations for that.

A couple of issues that I would hope to hear about. I just want to alert I am introducing a Virginia nominee for a district court judgeship position at 10:00 in the Judiciary Committee. So I will leave a couple minutes before 10:00 and then come back and have questions for you.

But the two issues that I am most interested in are, first, just readiness recovery. We have had testimony in the past about shortage in pilots and maintainers. I think that what we are going to hear is that you made some real headway in addressing those shortages, and I am interested in that.

I think in particular in Virginia, as I am at Langley and talking to our Air Force, I hear a lot more about the maintainer side shortage in a way than the pilot side shortage, and I think sometimes that does not get the same attention that pilot shortages do. So I am interested in hearing how we are trending there.

We have a low unemployment rate. We have a lot of civilian aviation competitors who really want great maintainers and great pilots. And so I know that as you are trying to fill gaps, we are helping on the budget side. We are helping, giving you some more certainty, but it is a competitive environment. I am interested in that.

Second, the state of our installations, our infrastructure is an important part of readiness. The Air Force is facing about \$300 million in military cost construction overruns or other shortfalls. How does that affect what we need to do on the installation side? I have found that steel tariffs have increased military construction (MILCON) prices significantly in some instances by about 30 percent in terms of the use of steel on MILCON projects.

Look, we will continue to have robust debates about climate change, but climate change is having an effect on installations. The Air Force recently had to cancel a fiscal year 2018 MILCON project related to the F-35 at Eielson Air Force Base due to the thawing of permafrost. We see significant effects at the Langley Base in Hampton dealing with sea level rise that is affecting that base. It is also affecting other bases in Virginia. How are we going to deal with that challenge, as we are trying to make investments in MILCON, is something that I am interested in as well.

But I look forward, Mr. Chairman, to working with you on the committee. We got great witnesses here and we will have a good hearing.

Senator SULLIVAN. Great. Thank you very much.

Senator Inhofe, as the chairman, I would like to give the floor to you.

**STATEMENT OF SENATOR JAMES M. INHOFE**

Senator INHOFE. Mr. Chairman, I only want to make a comment. First of all, Senator Kaine, you were always attentive during the times that we had that relationship, and I appreciate all of your activity.

I was reminded just a few minutes ago—and that is why I was a little bit late coming in here—by the Heritage Foundation talking about some of the recommendations that they are making. We are all very aware that what we went through during the 8 years, the Obama years—he did not have a high priority in our military. A lot of things that we thought were being done or the public thought were being done were not being done. And so we are in a catch-up mode. We are going to continue to do it. I have had numerous conversations with our witnesses about this, and I look forward to that.

However, I also will be chairing the 10 o'clock meeting next door. So, Mr. Chairman, go after it.

Senator SULLIVAN. Well, Mr. Chairman, thank you.

Lastly, I do want to make just one note, and it is something Senator Inhofe and I have discussed a lot. Of course, our members are allowed to ask questions. But I just want to make a comment on the Space Force.

I commend President Trump for thinking about space in a more assertive and organized way, but I think the witnesses will not be surprised. What I have been saying about this idea is that, first—and it is appropriate for this committee—we must focus on the readiness of the existing Military Services, which I think everybody recognizes has plummeted over the last several years, so that they are fully ready to do what the President and the American people expect of them. While I understand that the desire to talk about the Space Force today might be pressing, I believe that the chairman of the full committee intends to address this topic as kind of a full committee issue as well at some point.

So, again, I want to thank the witnesses. Your prepared statements will be entered into the record. We respectfully request that you keep your opening remarks in the vicinity of 5 minutes. Secretary Wilson, we will begin with you.

**STATEMENT OF HON. HEATHER A. WILSON, SECRETARY OF  
THE AIR FORCE**

Secretary WILSON. Thank you, Mr. Chairman, and I will just summarize my opening remarks from my written statement.

America is building a more lethal and ready Air Force, and the predictable and increased funding levels that came

from the United States Congress have helped tremendously in helping move us in that direction. I wanted to personally thank you for your leadership and your support of restoring the funding for national security and giving us some certainty.

The National Defense Strategy recognizes that we are in a more competitive and dangerous international security environment than we have experienced in decades. So the restoration of the force, the restoration of the readiness of the force to win any fight any time has to be job one for all of us.

So what does that mean and what has the Air Force been doing?

Last spring, we gathered together 50 airmen from around the world and seconded them away in a basement room in the Pentagon for almost 6 weeks to drill into the readiness challenges that we face, how do we measure readiness, how do we resource readiness, how can we recover readiness more quickly, and give us a plan to be able to implement.

The elements of readiness recovery are really fourfold.

The first is people. Our end strength is now up to 685,000 because of the resources that you have given us. In 2016, the Air Force was 4,000 maintainers short. Today we are 400 maintainers short, and by December in the Active Duty service, we will be back to having closed the gap and we will no longer have a 4,000 maintainer shortage on Active Duty. Now, that means we have to season our young airmen and get them to be craftsmen at their work, but at least now we have enough people there to do the maintenance that needs to be done.

Second, with respect to aircrew, we have a national shortage of aircrew, and it affects the United States Air Force because we are so good at training people how to fly and the airlines know it. We are focused on retention and improving the quality of service and quality of life, but we are also focused on increasing pilot production.

In fiscal year 2017, the United States Air Force trained 1,160 pilots. In fiscal year 2019, we will train a little over 1,300, moving by fiscal year 2022 to about 1,500 pilots, and we will stay at steady state at 1,500 thereafter. If we are able to do that and achieve our objectives on retention, we will recover the pilot shortage by 2023 where we will be 95 percent manned. We are also trying to scrub all of our requirements for aircrew so that we are not overproducing aircrew, and we have what we really think we need.

Third is training. If we are preparing for the high-end fight, we need to be able to provide time and places for our airmen to train in realistic situations. That means ranges, but it also means what we call virtual and constructive training. Sometimes now you can do more in simulation than you can do actually up in the air. That training has to be relevant and realistic. Mr. Chairman, you are right. JPARC, as well as our Nellis Test and Training Range, are two of the premier ranges in the world for being able to train for the high-end fight.

The fourth thing we need to do is cost effective maintenance and logistics. We have an old fleet with high operating tempo for the service, and I think this is going to take the most intense focus on recovery of readiness is how are we going to make sure that our aircraft are ready to go and ready to fight tonight.

The final thing I would mention on things that we are doing and things that you funded that helped was the restoration of munitions stockpiles where we were depleting our munitions stockpiles in the fight against ISIS [Islamic State of Iraq and Syria] faster than we were replacing them. The funds that you provided have allowed us to significantly recover from that situation.

So we are doing things to recover readiness. We are simultaneously trying to field tomorrow's Air Force faster and smarter. We set a goal for ourselves 6 months ago. We have a very good leadership team in acquisition. They got together and said, you know, in

the first 12 months together as a team, they wanted to strip 100 years out of our acquisition programs. 100 years. So far they have stripped out 56 years out of our acquisition programs. We are using prototyping. We are changing the way we are doing software development, to do that faster and better. We are committed to transparency and accountability.

We have seen just over the last few weeks that competition works. We have saved about \$13 billion just on three major acquisition programs that we have announced over the last few weeks. The T-X, the replacement for the UH-1 helicopter, and the GPS [Global Positioning System] satellite program have all, because of competition, come in at lower than our cost projections.

The Air Force is more ready for major combat operations today than we were 2 years ago. More than 75 percent of our pacing force is combat ready today in their lead force packages. That said, we all know we have a long way to go and we are after it.

Chief?

[The prepared statement of Secretary Wilson follows:]

#### PREPARED STATEMENT BY HEATHER WILSON

##### INTRODUCTION

Chairman Sullivan, Ranking Member Kaine, distinguished members of this committee; I appreciate the opportunity to testify on Air Force readiness. I am joined by our Vice Chief of Staff, General Wilson.

This is my second year as Secretary of the Air Force. On behalf of the 670,000 Total Force Airmen, I want to thank you and your colleagues in authorizations and appropriations. For the first time in a decade, we are starting a new fiscal year with a signed defense budget. It's hard to understate the important difference this makes for our airmen. Your leadership and bipartisan collaboration has returned us to fiscal order. It enables our airmen to continue building a more lethal and ready force, as directed by the 2018 National Defense Strategy.

We are committed to using these funds responsibly to restore the readiness and lethality of the Air Force.

##### THREAT ENVIRONMENT

One month ago, Russia began the largest exercise on Russian soil in four decades with more than 300,000 troops and 1,000 aircraft. On the other side of the world, China's first aircraft carrier was declared combat ready this year, and it promptly sailed into the Pacific to conduct flight operations.

China has militarized disputed features in the South China Sea, and now all of Southeast Asia is within reach of its long-range bombers. President Xi's plan is for China to be a top-ranked military by 2050, and President Xi is no longer bound by term limits on his Presidency.

The National Defense Strategy recognizes that we are in a more competitive and dangerous international security environment than we have seen in generations. It tells us how to prioritize for this environment and where to take risk. It tells us that we need to be able to defend the Homeland, provide a credible nuclear deterrent, win against a major power while countering a rogue nation, all while managing violent extremists with a lower level of effort.

Each of these missions requires a combination of U.S. Services, and the Air Force is integral to every one of them. To implement the new National Defense Strategy, the Air Force must build a more ready and lethal force, while building and strengthening alliances and partnerships.

##### READINESS DECLINED OVER DECADES

At the height of the Cold War, in 1987, we had about 1.1 million [1,134,507] Total Force Airmen and 401 operational squadrons. Four years later the Air Force deployed for Operation Desert Storm with squadrons that had spent 20 years training for a high-end fight. The initial battle would last just 43 days, and the Air Force was tasked to continue flying combat sorties.

One year after Operation Desert Storm, budget cuts forced the Air Force into its largest reorganization in its history. Squadrons were deactivated, bases were closed, and major commands were consolidated. Hundreds of aircraft were retired. By 1996, Total Force end strength was reduced to about 846,000 [845,681], but Air Force combat missions continued.

While the size of the Air Force decreased, the service also adapted to new missions. On 9/11 the Air Force had eight remotely piloted aircraft—eight total. After 9/11, the demand for remotely piloted aircraft and persistent intelligence, surveillance and reconnaissance grew dramatically. This year, 12,500 airmen helped fly 279 remotely piloted aircraft on round-the-clock missions to meet warfighter needs.

A shrinking, Combat-Active Air Force taking on new missions with an aging manned aircraft fleet was stretched thin when the sequestration of 2013 hit. The impact was devastating. One-third of Air Force combat flying squadrons stood down for 3 months, large-scale exercises were cancelled, and the service lost over one million work-hours of depot maintenance.

Then, in 2014, when reeling from the impact of sequester, ISIS, the Islamic State of Iraq and Syria, declared its caliphate, and the Air Force surged to the fight. By 2017, the Air Force was the smallest it had ever been, conducting combat operations with the oldest equipment it had ever used, and successfully employed nearly 30,000 weapons in Syria and Iraq.

#### READINESS RECOVERY

It is clear to all of us that restoration of the readiness of the force has to be a top priority. The 2018 National Defense Strategy makes building a more ready and lethal force job one.

Last spring we gathered together fifty airmen from around the service. They spent over six weeks together analyzing Air Force readiness. They looked at how we measure and report readiness. They identified the barriers to our readiness recovery. Armed with this information, they developed and presented a recovery plan to Air Force leaders.

A plan is nothing without the resources, end strength and budget certainty to implement it. Actions by the Congress over the past two years have been tremendously helpful.

To begin with, we decided to focus the additional resources you have provided on our 204 operational squadrons that are most relevant to a high-end fight so that we can recover readiness in these units fastest. Our plan accelerates readiness recovery in these units by aligning resources and manpower. Our goal is for 80 percent of these units to have the right number of properly trained and equipped airmen by the end of 2020—6 years faster than we projected before we developed our recovery plan.

While we will drive the readiness recovery of these operational squadrons first, the remainder of our 312 operational squadrons will be close behind so that by 2023 we will meet the 80 percent mark for all of our operational squadrons.

#### PEOPLE

Readiness recovery is first and foremost about people.

As an important example, the end strength increases you have authorized and funded in fiscal year 2018 allowed us to address the serious shortage of maintainers. We were 4,000 maintainers short in September of 2016. By December of this year, we will have closed that gap to zero. Now, we must season these new airmen to get them the experience needed to become craftsmen at their work.

#### AIRCREW

There is a national shortage of pilots and aircrew. A good economy and strong hiring by airlines makes aircrew retention a priority and directly affects our readiness.

We are addressing the aircrew shortage first by addressing the quality of service and quality of life issues that may cause aircrew to choose to leave the Air Force. We are trying to reduce the operating tempo, to revitalize squadrons, and to restore support positions so that aircrew can focus on their primary job. Funding flying hours is part of this effort. While incentive pay and bonuses are part of the solution, greater input on assignments and testing a “fly only” technical track for aviators who just want to fly are part of the retention effort.

But retention efforts alone will not solve the aircrew shortage. We have a national pilot shortage. We are increasing the number of students we are training to fly from 1,160 a year in fiscal year 2017 to 1,311 in fiscal year 2019, building to 1,500 by fiscal year 2022 and steady state, thereafter.

## TRAINING

The second piece of readiness, after people, is relevant and realistic training to maintain a qualitative advantage over increasingly capable adversaries. The Air Force is meeting some of this need by investing in operational training infrastructure—our ranges and airspace—and simulation. We are improving secure infrastructure, simulators, threat emulators, and training ranges to enhance realism and enable our airmen to train locally for a high-end, multi-domain fight.

Our airmen need ranges with enough airspace to train realistically. The Joint Pacific Alaska Range Complex is one of the Air Force's premier training ranges. The U.S. Army owns the land, and the U.S. Air Force manages the operations. The range has 66,000 square miles of land and air maneuver space and 58,000 square miles of overwater airspace. That is slightly larger than the size of New Mexico.

At the Joint Pacific Alaska Range Complex, our airmen can train against more than 40 surface-to-air threats, including foreign systems, which is valuable for realistic training exercises like Red Flag-Alaska and Northern Edge. Currently, the Joint Pacific Alaska Range Complex can only emulate a fraction of the existing and emerging threats to a level suitable for advanced sensors and cannot provide a fully contested or degraded environment with the assets available.

The Air Force is planning to base 5th Generation fighters in Alaska, and our pilots will need access to an adequate training environment. Our intention is to have two ranges that would represent what our crews would face against a peer adversary: the Joint Pacific Alaska Range Complex and the Nevada Test and Training Range. These ranges will provide the complex, dense combat environment crews will likely encounter during operations.

The Air Force plans include requirements for threats, targets, adversary air, multi-domain integration, airspace, and manpower. We have identified other range improvements nationwide to improve the quality of Air Force training and readiness.

## COST-EFFECTIVE MAINTENANCE AND LOGISTICS

The third element of restoring the readiness of the force is weapons system sustainment—the parts, supply, and equipment—to make sure our aircraft are ready to go when needed.

Maintaining an old fleet with a high operating tempo and inexperienced maintainers in a global enterprise is probably the hardest part of restoring the readiness of the force. It will take the most intense focus and will require that we look at new methods to achieve the results we need.

A team of airmen conducted a detailed sustainment review earlier this year. They identified 45 recommendations to reach 80 percent readiness levels, beginning with our 204 pacing units by 2020, followed by our remaining operational units in 2022, and then carrying over to all remaining units by 2024. Focus areas to achieve those results include supply chain improvements, changes to the way we manage engineering improvements, force structure and fleet management changes, service life extensions, and technology such as sensors that improve data collection to make our maintenance personnel more productive.

The sustainment review further highlighted the increased lethality derived from conditions based maintenance. Increasingly used in commercial industry, conditions based maintenance uses analytical tools and monitoring sensors to predict parts failures. Those tests are showing a reduction of approximately 30 percent of unscheduled maintenance. We have tested these tools with our C-5 and E-3 aircraft. We intend to move to conditions based maintenance for all aircraft as rapidly as possible.

We have also found efficiencies in our depots. Today, we accomplish KC-135 major repair and overhaul at our Oklahoma Depot in 155 days at a cost of \$9.9 million per aircraft. That is 40 percent faster and more than 50 percent less expensive than contract proposals we received to do the same work in 2018 from industry. More impressively, we have increased depot production by 20 percent, now completing 75 aircraft per year.

These measures do not replace the benefits of a modern and rested fleet. In 2014, the Oklahoma Depot saw an average of three major repairs per aircraft (usually corrosion or fatigue based) and a total of 162 major structural repairs for all aircraft. Today, despite the aforementioned advances in affordability and efficiency, there are 6.6 major repairs per aircraft, and we are on pace for nearly 500 major structural repairs.

## RAPID SUSTAINMENT

We need to significantly improve the logistics and sustainment enterprise.

In July we established the Rapid Sustainment Office and committed to fund it for 2 years. Its two primary objectives are to reduce cost and improve readiness by using advanced manufacturing technologies.

The Rapid Sustainment Office is establishing criteria to track and measure its impact. It will operate in a “hub and spoke” model by building partnerships with universities and industry.

If the Rapid Sustainment Office is successful, it will pay for itself by reducing the cost of maintaining our weapons systems, and we will continue to support it.

## FIELDING TOMORROW’S AIR FORCE FASTER AND SMARTER

The acquisition system we inherited from the Cold War era is too slow for the digital age. We are changing the way we buy things to field tomorrow’s Air Force faster and smarter.

In the 2016 and 2017 National Defense Authorization Acts, Congress restored primary responsibility for acquisition to the Services, granting us new authorities to accelerate prototyping and fielding.

We set an aggressive goal of stripping 100 years of unnecessary schedule from our program plans. In six months, we have saved 56 years.

Three contributing factors are making us faster. The first is prototyping. For example, in hypersonics, we are leveraging Navy technology to build, fly, and buy our nation’s first operational boost-glide weapon five years earlier than anticipated. In Next-Generation Missile Warning, we are competitively prototyping the new sensor, retiring this key risk nearly a year earlier, while also strengthening the industrial base for future programs.

The second contributing factor to increase speed is the use of tailored acquisition strategies. We have empowered our workforce to structure decisions around the specific needs of their programs, vice the generic milestones of the traditional acquisition process. Recently, our F-15 Eagle Passive Active Warning Survivability Systems split its Milestone C decision into two tailored reviews, accelerating fielding by 18 months at no additional cost.

The third major effort to increase speed to the warfighter is agile software development. The decades-old “waterfall” process for developing software one step at a time is too slow, expensive, and often doesn’t work at all. We are making a wholesale shift to agile development, putting acquirers and operators together to make rapid incremental software improvements. We proved the concept with air refueling at the Combined Air Operations Center, saving the Air Force \$13 million in fuel per month, and reducing the requirement by two tankers and ten aircrews.

We established the Kessel Run Experimentation Laboratory to continue applying agile development for the warfighter and stood up a Program Executive Office Digital to develop and proliferate best practices across the Air Force. So far, major programs like F-22, Unified Platform, and Protected Tactical Enterprise System are reaping the benefits of shifting to agile development, accelerating delivery to the warfighter.

Using new authorities given to us by Congress is not just faster, it’s giving us better results.

We are committed to competition. Within the last month, we made major announcements on three major programs: the Global Positioning Satellite III, the UH-1N helicopter replacement, and the T-X jet trainer. Each of these programs gets the most out of competition through stable requirements, a mature technology base, and transparency with industry. In just these three programs alone, the Air Force saved the taxpayer over \$13 billion from the independent cost estimates we used to plan the programs.

Digital engineering may revolutionize how we buy systems, and our B-52 Commercial Engine Replace Program is leading a pathfinder on digital twins. By conducting a “digital twin fly-off” early in the program, we ensure we get maximum fuel efficiency, which saves taxpayer dollars and extends the B-52’s range for the warfighter. It accelerates fielding by three and half years.

We are also seeking to become a leader in Federal Government procurement with small businesses and start-ups by pairing a government credit card swipe with a one-page Other Transactions Agreement. Pairing these two mechanisms gives the Air Force a small-dollar contracting mechanism that can “pay in a day”. To prove it out, we are conducting a small business and start up day at the end of this month to find innovative solutions to some of our vexing problems. We will attempt to award 50 contracts in 50 hours at the end of this month.

If successful, we will hold our first Air Force Start-up Days early next year using these “pay-in-a-day” contracts. With so much innovation happening in small businesses and start-ups, we need creative ways to connect with them that can be mutually beneficial.

The authorities you have given the Air Force are making a difference. These authorities do not sidestep key decisions, reporting, or oversight. They streamline to those that matter. We will not sacrifice quality or accountability for speed. Early prototyping and development informs the Department of Defense and Congress about a program’s performance feasibility prior to making costly decisions to procure, field, and sustain it.

We are mindful of the trust placed in us, and we are committed to transparency on these programs. We will submit tri-yearly reports to Congress, similar to the Selected Acquisition Reports, and be good stewards of your trust and of taxpayer dollars.

#### IMPACT

With the help of Congressional funding and acquisition authorities, the Air Force is more ready for major combat operations today than we were 2 years ago. More than 75 percent of our pacing force is combat ready today with their lead force packages.

That said, we have a long way to go to restore the readiness of the force to win any fight, any time. We remain focused on that objective.

Senator SULLIVAN. Thank you, Secretary Wilson.  
General Goldfein?

#### **STATEMENT OF GENERAL DAVID L. GOLDFEIN, USAF, CHIEF OF STAFF OF THE AIR FORCE**

General GOLDFEIN. Thanks, Madam Secretary, and Chairman, thank you for holding a real timely hearing.

What I would like to do very quickly is just share a story that perhaps will offer us perspective on what we are here to talk about today.

Of all the work and the obligations that we have—and I would say this is a shared obligation between this committee and the Secretary and I—the one that I believe is nothing short of a moral obligation is to ensure that every airman, soldier, sailor, and marine that we send into harm’s way to do the nation’s business is properly organized, trained, equipped, and led. When they get back, they can come back to their families that we have taken care of while they are gone. Everything else—we do the best we can.

So let me just share with you one quick story about what I call confidence under fire, which is what we are here to talk about. How do we produce the readiness of the force to accomplish that moral obligation we have to those that we send into harm’s way?

I was a young captain when we went into Desert Storm. I know that there are many here that have also—Senator Sullivan yourself, Senator Ernst have had combat time. That warrior’s prayer has not changed over the years. Please, God, do not let me let my buddies down and let me get the job done.

When we went into Desert Storm, I was in a squadron that had—all but one, none of us had had combat time. The squadron commander had had combat time in Vietnam. The rest of us had never seen it. And so we went in uttering that prayer. We crossed into enemy territory for the very first time, and I remember his voice on the radio when he said, look, there is triple A, right 2 o’clock, anti-aircraft artillery fire. We all stared at it. Then he said there is a surface-to-air missile, left 10 o’clock, and we all stared at this big surface-to-air missile like a telephone pole coming up

through the formation and we watched it explode. Then we heard on the radio, splash, MiG 29, and one of our F-15's sees it, shot down a MiG 29 and we watched it hit the desert floor and explode.

I remember that moment in the cockpit as a young captain because it came to me that nothing I was seeing or hearing was new. I had been in an environment just like this before at Nellis and at JPARC range and had been put in this situation. Every radio call, every formation, everything I was seeing is something that I had been trained for. In fact, I would share with you that I remember thinking this is actually easier than Red Flag because they threw everything at me, plus the kitchen sink, when I was there. That moment in the cockpit produced this level of confidence that I knew that I could succeed in combat.

I think that is what we are here to talk about. How do we ensure that the young captains, the young airmen, the NCOs [non commissioned officer] of today and tomorrow have that same confidence under fire that I had when I went into combat in Desert Storm?

I look forward to the questions and the dialogue today because this is a shared obligation to ensure that we all remain committed to ensuring that these soldiers, sailors, airmen, and marines go into harm's way with what they need to get the job done and we take care of their families while they are gone.

Thank you.

Senator SULLIVAN. Thank you, General Goldfein.

Mr. Pendleton?

**STATEMENT OF JOHN H. PENDLETON, DIRECTOR, DEFENSE CAPABILITIES AND MANAGEMENT, UNITED STATES GOVERNMENT ACCOUNTABILITY OFFICE**

Mr. PENDLETON. Chairman Sullivan, members of the subcommittee, thank you for inviting me to talk about our work on Air Force readiness.

I think you are going to find that we are largely in agreement with the Air Force on the challenges going forward. Over the past quarter century, we have been tracking readiness, and we have seen it gradually but steadily decline primarily because the Air Force has gotten smaller, but the demand has stayed high.

Back in 2016, we urged the Department of Defense [DOD], including the Air Force, to develop a plan for readiness rebuilding. At that point, the Air Force felt that rebuilding the readiness of its force would take a decade or more and only if they got increased budgets and a decreased pace of operations. Budgets have increased but the pace has stayed high.

Today the Secretary testified—or in her statement actually—that the Air Force is aiming to have 80 percent of its over 300 operational squadrons ready within about 5 years. This is an aggressive goal. To meet it, the Air Force is going to need to focus on the building blocks of readiness, as they are saying they intend to do: people, training, equipment.

Let us talk about personnel briefly. The Air Force has shortfalls of both maintainers and pilots. The gap for maintainers I think is about to be closed, but it will take time for them to grow experience. The pilot shortfall may take a bit longer. The retention incen-

tives to date have not worked to meet goals, and I think it may take a little bit longer for the Air Force to close.

Regarding equipment, we have found, not surprisingly, that older equipment breaks down more. But it is not limited to the older aircraft—the mission capability challenges. The F-22 mission capability rates are well below desired levels, as you know. It is partly because its aircraft are so maintenance intensive. They have this low-observable coating on them that makes them difficult to work on. The F-35 is proving to be so costly to operate and sustain that it actually jeopardizes the program, as many of you know. DOD and the Air Force are working to try to get those costs down, and I think that will be critical.

Training, as the Secretary mentioned, is another challenge area. The pace of Air Force operations has left little time for aircrews to train. As the Air Force seeks to rebuild readiness, I agree that training may be one of the more difficult things to achieve, especially if demand is not dampened.

The full-spectrum mission of the F-22, for example, is so complex that it takes most of the year to fully train for it. But we found questions about the way the F-22 is utilized. It is called away to participate in exercises that do not give it much training value. It sits alert, gassed and ready, but not training. They have to fly adversary air for each other because they often do not have dedicated adversary air in the vicinity, and that does not provide much training value for the red air.

We made several recommendations around organizing and utilizing the F-22 better, which the Air Force agreed with and I believe are beginning to take action.

These are just a few highlights. In all, we have made 14 readiness-related recommendations that I summarize in the back of my statement, and I am happy to talk to you about any of those as the hearing goes on.

Looking to the future, I understand the Air Force's desire to get larger. Like the Navy, Air Force readiness has suffered as demands have stayed high while the force has shrunk. Like the Navy, the Air Force believes it needs to grow by about a quarter to meet future demands and the strategy. But regardless of future growth, the Air Force will have to keep much of its existing force structure for decades to come. Therefore, I agree the priority needs to be rebuilding the readiness of the existing fleet certainly in the near term.

Mr. Chairman, I am encouraged by what I have heard from the Air Force today. They have taken several steps in the right direction. Now it is a matter of achieving results. Recovery will not be easy or fast. It took a quarter century for the Air Force to get here, so it may take a while to recover.

We at GAO stand ready to assist you in your oversight.

That concludes my remarks. I look forward to your questions, sir.  
[The prepared statement of Mr. Pendleton follows:]



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United States Government Accountability Office

Testimony

Before the Subcommittee on Readiness  
and Management Support, Committee  
on Armed Services, U.S. Senate

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## AIR FORCE READINESS

### Actions Needed to Rebuild Readiness and Prepare for the Future

Statement of John H. Pendleton, Director,  
Defense Capabilities and Management

## GAO Highlights

Highlights of GAO-19-120T, a testimony before the Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate

### Why GAO Did This Study

The 2018 National Defense Strategy emphasizes that restoring and retaining readiness across the entire spectrum of conflict is critical to success in the emerging security environment. Air Force readiness has steadily declined primarily due to the persistent demand on a fleet that has aged and decreased in size since the 1990s. The Air Force is working to both rebuild the readiness of its forces and modernize its aging fleet to meet future threats. However, according to the Air Force, its readiness goals will take years to achieve as it continues to be challenged to rebuild readiness amid continued operational demands.

This statement provides information on Air Force (1) readiness and management challenges including personnel, equipment, training, and organization and utilization, and (2) plans to grow and modernize its force in the context of readiness recovery across DOD. Also, GAO summarizes recommendations to address these challenges and actions taken by the Air Force.

This statement is based on previously published work since 2016 related to Air Force readiness challenges, fighter pilot workforce requirements, weapon sustainment, aviation training, and force structure.

### What GAO Recommends

GAO has made 14 recommendations in prior unclassified work described in this statement. DOD generally concurred with most of them and has implemented 1. Continued attention to these recommendations can assist and guide the Air Force moving forward as it seeks to rebuild the readiness of its forces.

View GAO-19-120T. For more information, contact John Pendleton at (202) 512-3489 or [pendleton@gao.gov](mailto:pendleton@gao.gov).

October 10, 2018

## AIR FORCE READINESS

### Actions Needed to Rebuild Readiness and Prepare for the Future

#### What GAO Found

GAO's prior work has highlighted that the Air Force faces management and readiness challenges in four interrelated areas:

- Personnel:** The Air Force has reported that pilot and aircraft maintainer shortfalls are a key challenge to rebuilding readiness. GAO found in April 2018 that the Air Force had fewer fighter pilots than authorizations for 11 of 12 years, from fiscal years 2006 through 2017. Even as unmanned aerial systems had become more prevalent and fighter pilot workloads had increased, the Air Force had not reevaluated fighter squadron requirements. GAO recommended that the Air Force reevaluate fighter pilot squadron requirements to ensure it has the pilots necessary for all missions.
- Equipment:** Air Force aircraft availability has been limited by challenges associated with aging aircraft, maintenance, and supply support. GAO reported in September 2018 that, from fiscal year 2011 through 2016, the Air Force generally did not meet availability goals for key aircraft. Further, in October 2017 GAO found F-35 availability was below service expectations and sustainment plans did not include key requirements. GAO recommended that DOD revise F-35 sustainment plans to include requirements and decision points needed to implement the F-35 sustainment strategy.
- Training:** The Air Force has identified the need to ensure its forces can successfully achieve missions to address a broad range of current and emerging threats. However, GAO reported in September 2016 that Air Force combat fighter squadrons did not complete annual training requirements due to aircraft availability and training range limitations, and had used the same underlying assumptions for its annual training requirements from 2012 to 2016. GAO recommended that the Air Force reassess its annual training requirements to ensure its forces can accomplish a full range of missions.
- Organization and Utilization:** Air Force management of its force structure can also exacerbate readiness challenges. GAO found in July 2018 that the Air Force's organization of its small F-22 fleet had not maximized aircraft availability, and that its utilization of F-22s reduced opportunities for pilots to train for missions in high-threat environments. GAO found that unless the Air Force assesses the organization and use of its F-22s, F-22 units are likely to continue to experience aircraft availability and pilot training rates that are below what they could be. GAO recommended that the Air Force reassess its F-22 organizational structure to reduce risk to future operations.

Looking to the future, the Air Force will have to balance the rebuilding of its existing force with its desire to grow and modernize. To meet current and future demands, the Air Force has stated that it needs to have more squadrons. However, the costs of such growth are as yet unknown, and will have to compete with other military services looking to increase their force structure and recapitalize their forces. Even with growth, the Air Force would be dependent on the force of today for decades to come and will need to stay focused on rebuilding the readiness of existing forces. Addressing GAO's recommendations are necessary steps to meet current and future needs and can assist the Air Force moving forward.

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Chairman Sullivan, Ranking Member Kaine, and Members of the Subcommittee:

Thank you for the opportunity to be here today to discuss issues related to Air Force readiness.

In June 2017, we issued a report highlighting five key mission challenges facing the Department of Defense (DOD).<sup>1</sup> In that report, we noted that the United States faces an extremely challenging national security environment at the same time it is grappling with addressing an unsustainable fiscal situation in which DOD accounts for approximately half of the federal government's discretionary spending. Within this environment, DOD is working to both rebuild the readiness of its current forces and modernize to meet future threats. Since we issued that report, the Department released a new National Defense Strategy in January 2018 that prioritizes the long-term challenges posed by highly capable adversaries and emphasizes the need to rebuild readiness. Additionally, Congress has passed appropriations to fund DOD's effort to restore military readiness.

This statement provides information on Air Force (1) readiness and management challenges in four interrelated areas of personnel, equipment, training, and organization and utilization, and (2) plans to grow and modernize its force in the context of rebuilding readiness across DOD. We also summarize our recommendations to address these Air Force challenges and their actions taken.<sup>2</sup>

This statement is based on our body of work issued from 2016 to 2018 examining Air Force readiness challenges, fighter pilot workforce requirements, weapon system sustainment, aviation training, and force structure.<sup>3</sup> To perform our prior work, we analyzed Air Force readiness,

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<sup>1</sup>This included a detailed discussion of our priority recommendations to DOD. Since August 2015, we have identified priority recommendations in letters to the Secretary of Defense—recommendations that we have made to DOD that we believe the department should give a high priority to addressing. See GAO, *Department of Defense: Actions Needed to Address Five Key Mission Challenges*, GAO-17-369 (Washington, D.C.: June 13, 2017). As of April 2018, 85 priority recommendations remained open.

<sup>2</sup>The status of our recommendations made in the work cited in this statement is provided in appendix I. Appendix I does not include recommendations made in classified reports.

<sup>3</sup>A list of related classified and unclassified GAO products is provided in Related GAO Products at the end of this statement.

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personnel, maintenance, and training data, and interviewed cognizant Air Force officials involved in operations. The reports cited throughout this statement contain more details on the scope of the work and the methodology used to carry it out. We have also issued several classified reports since 2016 examining these issues and made recommendations to the Air Force; however this statement does not include that work.

We conducted the work on which this testimony is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

DOD has reported that more than a decade of conflict, budget uncertainty, and reductions in force structure have degraded military readiness; in response, the department has made rebuilding the readiness of the military forces a priority. The 2018 National Defense Strategy emphasizes that restoring and retaining readiness across the entire spectrum of conflict is critical to success in the emerging security environment. Nevertheless, DOD reported readiness of the total military force remains low and has remained so since 2013. Our work has shown that Air Force readiness, in particular, has steadily declined due to a persistent demand for forces, a decline in equipment availability and experienced maintenance personnel, the effect of high deployment rates on units' ability to conduct needed training, and a smaller inventory of aircraft.<sup>4</sup> DOD has made department-wide progress in developing a plan to rebuild readiness of the military force.<sup>5</sup> In August 2018, we reported that the Office of the Secretary of Defense has developed a Readiness Recovery Framework that the Department is using to guide the military

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<sup>4</sup>The Air Force fleet has decreased in size since the 1990s. For example, the Air Force experienced a 58 percent decrease in the number of fighter and bomber squadrons from 1991 to 2015 while maintaining a persistent level of demand from the combatant commands for the use of its forces.

<sup>5</sup>In September 2016, we reviewed DOD and the military services' plans to rebuild readiness and reported that the efforts may be at risk without a department-wide plan for moving forward. We made five recommendations on implementing and overseeing readiness rebuilding efforts. See GAO, *Military Readiness: DOD's Readiness Rebuilding Efforts May Be at Risk without a Comprehensive Plan*, GAO-16-841 (Washington, D.C.: Sept. 7, 2016).

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services' efforts and plans to regularly assess, validate, and monitor readiness recovery.<sup>6</sup> According to officials, the Office of the Secretary of Defense and the military services are currently revising readiness goals and accompanying recovery strategies, metrics, and milestones to align with the 2018 National Defense Strategy and Defense Planning Guidance. However, additional work remains to ensure that the actions DOD is taking will ultimately achieve overall readiness goals.<sup>7</sup>

DOD's readiness rebuilding efforts are occurring in a challenging context that requires the department to make difficult decisions regarding how best to address continuing operational demands while preparing for future challenges. An important aspect of this, across all of the military services, is determining an appropriate balance between maintaining and upgrading legacy weapon system platforms currently in operational use and procuring platforms able to overcome rapidly advancing future threats. Air Force leaders have stated that striking such a balance is exceptionally difficult. While each of the military services, including the Air Force, must grapple with these choices, senior leaders have called for immediate readiness rebuilding with particular focus on aviation. In a memorandum on September 17, 2018, the Secretary of Defense noted that DOD faces shortfalls in aviation squadrons across the force with the aviation inventory and supporting infrastructure suffering from systemic underperformance and unrealized capacity.<sup>8</sup> In order to focus on meeting DOD's most critical priorities first, the Secretary of Defense emphasized the need to rebuild readiness. As such, the Secretary directed the Air Force to achieve a minimum of 80 percent mission capable rates for fiscal year 2019 for the F-35, F-22, and F-16, while simultaneously reducing

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<sup>6</sup>GAO, *Military Readiness: Update on DOD's Progress in Developing a Readiness Rebuilding Plan*, GAO-18-441RC (Washington, D.C.: Aug. 10, 2018). The Readiness Recovery Framework identifies primary readiness issues that each of the military services face, actions to address identified issues, and milestones and metrics to assess progress in addressing identified issues.

<sup>7</sup>Section 333 of the John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub.L.No. 115-232 (2018), requires us to report annually until 2021 on the readiness of the armed forces to conduct full spectrum operations in the ground, sea, air, space, and cyber domains. This work is ongoing.

<sup>8</sup>Secretary of Defense Memorandum, *NDS Implementation-Mission Capability of Critical Aviation Platforms* (Sept. 17, 2018).

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these platforms' operating and maintenance costs every year starting in fiscal year 2019.<sup>9</sup>

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### Air Force Faces Several Interrelated Management and Readiness Challenges

Our prior work has identified management and readiness challenges in four interrelated areas—personnel, equipment, training, and organization and utilization, and we have made recommendations to help the Air Force address rebuilding the readiness of its existing fleet.

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#### Personnel: Pilot and Aircraft Maintainer Shortfalls Have Impeded Readiness Recovery

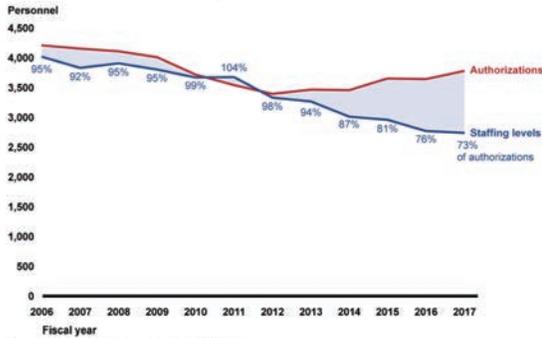
The Air Force has reported that manpower shortfalls, particularly among skilled pilots and maintainers, are a primary challenge to rebuilding readiness. As we have previously reported, developing fighter pilots requires a significant investment of time and funding.<sup>10</sup> According to Air Force officials, a fighter pilot requires approximately 5 years of training to be qualified to lead flights, at a cost of between about \$3 million to \$11 million depending on the specific type of aircraft. In April 2018, we reported that according to Air Force pilot staffing level and authorizations data for fiscal years 2006 through 2017, the Air Force had fewer fighter pilots than authorizations for 11 of those 12 years (see fig. 1). This gap grew from 192 fighter pilots (5 percent of authorizations) in fiscal year 2006, to 1,005 (27 percent) in fiscal year 2017. According to briefing documents prepared by the Air Force, this gap was concentrated among fighter pilots with fewer than 8 years of experience. The Air Force forecasted that the fighter pilot gap will persist over time, even as the Air Force takes steps to train more fighter pilots and improve retention.

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<sup>9</sup>Secretary Mattis also directed the same mission capable and cost control goals for the Navy's F-35 and F-18 fleets.

<sup>10</sup>GAO, *Military Personnel: DOD Needs to Reevaluate Fighter Pilot Workforce Requirements*, GAO-18-113 (Washington, D.C.: Apr. 11, 2018).

Figure 1: Air Force Active Component: Fighter Pilot Actual Staffing Levels Compared with Authorizations, Fiscal Years 2006-2017



Source: GAO analysis of Air Force data. | GAO-19-120T

Air Force officials identified multiple factors that led to low numbers of fighter pilots. For example, the military services trained fewer fighter pilots than targeted over the last decade. In fiscal years 2007 through 2016, the Air Force trained 12 percent fewer new fighter pilots than the targeted amount. In our April 2018 report, we found that the military services had not reevaluated squadron requirements to reflect increased fighter pilot workload and the emergence of unmanned aerial systems. Fighter pilots and squadron leaders from each of the military services we interviewed at the time consistently told us that the fighter pilot occupation has significantly changed in recent years due to changes in fighter aircraft tactics and technology, additional training requirements, and the removal of administrative support positions from squadrons. Without updating squadron requirements to reflect this growing administrative burden on fighter pilots, the currently identified differences between fighter pilot numbers and authorizations may be understated. By contrast, without updating future fighter pilot requirements to take into account changing roles and missions—in particular the increasing role of unmanned aerial systems in combat operations—forecasted fighter pilot gaps may be overstated. In short, we concluded that reevaluating fighter pilot requirements is a key first step to help the military services, including the Air Force, clearly determine the magnitude of the gaps and target

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strategies to meet their personnel needs. In our April 2018 report, we recommended that the Air Force reevaluate fighter pilot squadron requirements to ensure it has the pilots necessary for all missions.<sup>11</sup> DOD concurred with this recommendation.

The Air Force is also trying to manage a shortage of aircraft maintainer personnel—both uniformed personnel and depot civilians. In September 2018, we found that the Air Force reported losing experienced maintainers, either to retirement or to other programs such as the F-35 Lightning II (F-35).<sup>12</sup> For example, we reported that the Air Force's C-17, which is a long-range, heavy logistics transport aircraft, requires depot modifications to keep it viable, but there was a shortage of depot maintainer personnel due to attrition, inability to retain skilled workers, and hiring freezes. The Air Force has several initiatives underway, including hiring additional maintainer personnel and temporarily transitioning active-duty maintenance units from some legacy aircraft. As of August 2018, the Air Force had requested an increased end strength of 8,000 personnel to fill critical personnel needs in maintenance and pilots. Officials stated that progress was being made in increasing end strength and hiring additional personnel, which should address these challenges. However, according to Air Force officials, it may take several years before newly hired maintainer personnel will have the training and experience they need to improve aircraft availability rates. We have work underway to examine the Air Force's management of its aircraft maintainer workforce and DOD depot skill gaps and plan to report on these issues over the next 6 months.<sup>13</sup>

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<sup>11</sup>In House Report 115-676 accompanying the John S. McCain National Defense Authorization Act for Fiscal Year 2019, the House Armed Services Committee noted that it was concerned about the Air Force's persistent pilot shortages and the effect of those shortages on the readiness of the Air Force, and directed the Secretary of the Air Force to address our recommendation to reevaluate requirements.

<sup>12</sup>GAO, *Weapon System Sustainment: Selected Air Force and Navy Aircraft Generally Have Not Met Availability Goals, and DOD and Navy Guidance Need to Be Clarified*, GAO-18-678 (Washington, D.C.: Sept. 10, 2018).

<sup>13</sup>Our work on the Air Force's management of its aircraft maintainer workforce is focused on maintainer staff gaps, technical school training, and retention over the past 8 years.

**Equipment: Aircraft Availability Has Been Limited by Aging Aircraft, Costly Maintenance, and Diminished Supply Support**

Air Force aircraft availability has been limited by challenges associated with aging aircraft, maintenance, and supply support. According to the Air Force, the average age of the fleet is 28 years. The average ages of the B-52 strategic bomber and the KC-135 tanker each exceed 50 years, and the Air Force expects to continue to use these aircraft for decades. The Air Force spends billions of dollars each year to sustain its fixed-wing aircraft fleet—comprised of both legacy and new aircraft—which needs expensive logistics support, including maintenance and repair, to meet its availability goals. We reported in September 2018 that from fiscal year 2011 through 2016, the Air Force generally did not meet aircraft availability goals while it continued to accrue increased maintenance costs.<sup>14</sup> Figure 2 summarizes the sustainment challenges we reported that face selected Air Force aircraft.

**Figure 2: Sustainment Challenges Affecting Selected Air Force Fixed-Wing Aircraft**

Aircraft	Aging aircraft		Maintenance		Supply support	
	 Delays in acquiring replacement aircraft	 Unexpected replacement of parts and repairs	 Delays in depot maintenance	 Shortage of depot maintainer personnel	 Parts obsolescence <sup>a</sup>	 Diminishing manufacturing source <sup>b</sup>
B-52		✓	✓		✓	✓
C-17		✓	✓			✓
E-8C		✓	✓		✓	✓
F-16	✓		✓			✓
F-22		✓	✓	✓		✓

Source: GAO analysis of Air Force data. | GAO-19-120T

<sup>a</sup>Obsolescence is a lack of availability of a part due to its lack of usefulness or it is no longer current or available for production.

<sup>b</sup>Diminishing manufacturing sources is a loss or impending loss of manufacturers or suppliers of items.

<sup>14</sup>GAO, *Weapon System Sustainment: Selected Air Force and Navy Aircraft Generally Have Not Met Availability Goals, and DOD and Navy Guidance Need to Be Clarified*, GAO-18-678 (Washington, D.C.: Sept. 10, 2018).

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Sustainment challenges are not just an issue for older aircraft, but represent an enduring challenge for the Air Force. The F-35—which is intended to replace a variety of legacy fighter aircraft in the Air Force and more broadly represents the future of tactical aviation for DOD—has projected sustainment costs of over \$1 trillion over a 60-year life cycle.<sup>15</sup> In October 2017, we reported that DOD’s projected operating and support costs estimate for the F-35 rose by 24 percent from fiscal year 2012 to fiscal year 2016 and are not fully transparent to the military services.

In October 2017, we also reported that the F-35 fleet faced sustainment challenges that pose risks to its ability to meet current and future warfighter readiness requirements.<sup>16</sup> The Air Force planned to procure more than 1,700 F-35 aircraft and, as the largest participant in the F-35 program, its readiness could be disproportionately affected by the sustainment challenges facing this program. In particular, DOD’s capabilities to repair F-35 parts at military depots were 6 years behind schedule, which resulted in average part repair times of 172 days—twice that of the program’s objective. These repair backlogs have contributed to significant F-35 spare parts shortages—from January to August 7, 2017, F-35 aircraft were unable to fly 22 percent of the time because of parts shortages. As a result, the Air Force had generally not met its aircraft availability goals for its fielded F-35 aircraft (See fig. 3 for Air Force personnel performing maintenance on the F-35).

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<sup>15</sup>In 2014, we reported that DOD officials considered the program to be unaffordable, and recommended that DOD establish affordability targets linked to the services budgets to determine what the services could afford. See GAO, *F-35 Sustainment: Need for Affordable Strategy, Greater Attention to Risks, and Improved Cost Estimates*, GAO-14-778 (Washington, D.C.: Sept. 23, 2014). While some steps have been taken to create affordability targets for the program, work remains to ensure that the Air Force can afford to sustain the aircraft it plans to purchase.

<sup>16</sup>GAO, *F-35 Aircraft Sustainment: DOD Needs to Address Challenges Affecting Readiness and Cost Transparency*, GAO-18-75 (Washington, D.C.: Oct. 26, 2017).

Figure 3: Air Force Maintenance on F-35



Source: Defense Visual Information Distribution Service. | GAO-19-120T

Our work has shown that these challenges are largely the result of sustainment plans that do not fully include key requirements or timely and sufficient funding. In our October 2017 report, we recommended, among other things, that DOD revise sustainment plans to ensure that they include the key requirements and decision points needed to fully implement the F-35 sustainment strategy and align funding plans to meet those requirements. DOD concurred with this recommendation and DOD officials report that they are focusing actions and resources toward achieving key production, development and sustainment objectives by 2025. In addition, the conference report accompanying a bill for fiscal year 2019 defense appropriations directed a higher appropriation amount for the Air Force's aircraft procurement than DOD requested in its budget.<sup>17</sup> This appropriation may create more demand on the already strained sustainment enterprise for which DOD has not always provided timely funding (for example, funding for spare parts).<sup>18</sup>

<sup>17</sup>H.R. Conf. Rep. No. 115-952 (2018).

<sup>18</sup>GAO, *F-35 Aircraft Sustainment: DOD Needs to Address Challenges Affecting Readiness and Cost Transparency*, GAO-18-75 (Washington, D.C.: Oct. 26, 2017).

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**Training: Units Are Challenged To Achieve Full Spectrum Readiness**

The Air Force has identified the need to ensure a full-spectrum capable force that can successfully perform missions addressing a broad range of current and emerging threats; however, the Air Force has had difficulty training for full spectrum readiness. For more than a decade, the Air Force focused its training on supporting operations in the Middle East, including Iraq and Afghanistan. Commanders established training requirements that they deemed necessary to prepare aircrews to conduct missions in these locations—such as close air support-to-ground forces—limiting training for other missions. In September 2016, based on our analysis of data on the completion of annual training, we found that combat fighter squadrons were generally able to complete mission training requirements for ongoing contingency operations, but were unable to meet annual training requirements across the full range of missions.<sup>19</sup> Wing and squadron commanders we interviewed at the time cited several common limitations related to the challenges discussed in this testimony that affected the ability of their squadrons to complete training across the full range of missions including the maintenance unit's ability to provide adequate numbers of aircraft for training, adversary air tasking, and manpower shortfalls in the squadrons.<sup>20</sup>

We also reported in September 2016 that F-22 and F-35 squadrons faced training range limitations. F-22 squadron commanders told us that the airspace available limits their ability to train for their more complex missions, including offensive counter air and defensive counter air missions. Additionally, the commanders we interviewed at the time for squadrons flying F-22 and F-35 aircraft told us that limits in training range capabilities, such as threat replicators and targets, affected the training completed at smaller regional training ranges, as well as at larger training ranges such as the Utah Test and Training Range and the Nevada Test and Training Range. According to these officials, the training ranges lacked many of the more advanced threat replication systems that can challenge F-35 and F-22 capabilities and provide effective training across their full range of missions.

The 2018 National Defense Strategy cites, as the department's principal priority, the need to prepare for threats from advanced adversaries due to

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<sup>19</sup>GAO, *Air Force Training: Further Analysis and Planning Needed to Improve Effectiveness*, GAO-16-864 (Washington, D.C.: Sept. 19, 2016).

<sup>20</sup>Adversary air or "red air" missions are those in which the aircrews play the role of an adversary threat in support of aircrews flying a "blue" (U.S. and allied force) training sortie.

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the magnitude of the threat they pose. Further, the Air Force reports that it will confront an increasingly complex security environment in the coming years that will demand a wider range of skill sets and different capabilities than are currently being employed. For example, aircrews may be called upon to conduct missions that require freedom of maneuver in highly-contested air spaces. However, in our September 2016 report, we found that the Air Force has used the same underlying assumptions to establish its annual training requirements from 2012 through 2016, which may not reflect current and emerging training needs. Specifically, the total annual live-fly training sorties by aircraft, the criteria for designating aircrews as experienced or inexperienced, and the mix between live and simulator training remained the same from 2012 through 2016.<sup>21</sup> We concluded that without fully reassessing the assumptions underlying its training requirements, the Air Force could not be certain that its annual training plans are aligned with its stated goals to ensure a full-spectrum capable force that can successfully achieve missions across a broad range of current and emerging threats. We recommended that the Air Force reassess its annual training requirements and make any appropriate adjustments to its future training plans to ensure that its forces can accomplish a full range of missions. The Air Force has a number of efforts under way to study or address some of the factors that limit the ability of fighter squadrons to meet annual training requirements.

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<sup>21</sup>Section 351 of the National Defense Authorization Act for Fiscal Year 2017 Pub. L. No. 114-328 (2016), directed the Secretary of the Air Force to enter into a contract with an independent entity to conduct a review of the Air Force Ready Aircrew Program, including an assessment of the assumptions underlying the annual continuation training requirements of the Air Force and the overall effectiveness of the Aircrew Program, and make recommendations for the improved management of such training requirements. The Air Force was also directed to report on this review and assessment to the defense committees. On August 30, 2018, the Air Force submitted its report, entitled *Independent Review and Assessment of the Air Force Ready Aircrew Program*, to the Senate and House Committees on Armed Services. Section 351 also included a provision for us to review the Air Force's report and examine (1) the extent to which the Air Force report addressed the elements described in the Act, (2) the adequacy and completeness of the assumptions reviewed to establish the annual training requirements of the Air Force, and (3) any actions the Air Force plans to carry out to incorporate the results of the report into annual training documents. Our review is currently ongoing.

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Organization and  
Utilization: Air Force  
Management of Its Forces  
Can Diminish Existing  
Capability

The Air Force's management of its limited force structure can also exacerbate some of the problems discussed above, as we found for the F-22 fleet. The F-22, widely regarded as the best air superiority fighter aircraft in the world, is an integral part of the U.S. military's ability to defeat high-end adversaries (See fig. 4 for an image of the F-22).

Figure 4: Air Force F-22



Source: GAO. | GAO-19-120T

To meet its assigned air superiority responsibility, the Air Force is to provide the combatant commanders with both mission capable aircraft and pilots who are trained to fly those aircraft in the expected threat environments. However, in July 2018, we found that Air Force organization and utilization of its small fleet of F-22s has reduced its ability to provide these two elements, thereby further limiting this important capability.<sup>22</sup>

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<sup>22</sup>GAO, *Force Structure: F-22 Organization and Utilization Changes Could Improve Aircraft Availability and Pilot Training*, GAO-18-190 (Washington, D.C.: July 19, 2018).

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Specifically, we found that the Air Force's organization of its small F-22 fleet has not maximized the availability of these 186 aircraft. Availability was constrained by maintenance challenges and unit organization. For example, maintaining the stealth coating on the outside of the F-22 aircraft was time consuming and significantly reduced the aircraft's availability for missions. Maintenance availability challenges were exacerbated by the Air Force's decision to organize the F-22 fleet into small units of 18 or 21 aircraft per squadron and one or two squadrons per wing. Traditional fighter wings have three squadrons per wing, with 24 aircraft in each squadron, which creates maintenance efficiencies because people, equipment, and parts can be shared, according to Air Force officials. Further, the Air Force organized F-22 squadrons to operate from a single location. However, it generally deployed only a part of a squadron, and the remaining part struggled to keep aircraft available for missions at home.<sup>23</sup> Larger, traditional Air Force squadrons and deployable units provide a better balance of equipment and personnel, according to service officials. The Air Force had not reassessed the structure of its F-22 fleet since 2010 and may be foregoing opportunities to improve the availability of its small yet critical F-22 fleet, and better support combatant commander air superiority needs in high threat environments.

Further, we found that the Air Force's utilization of its F-22 fleet limited pilot opportunities to train for air superiority missions in high threat environments. To complete the annual training requirements for air superiority missions, F-22 pilots must train almost the entire year. However, F-22 pilots were not meeting their minimum yearly training requirements for air superiority missions, according to Air Force training reports and service officials. Moreover, using F-22s for exercises and operational missions that do not require the F-22's unique capabilities interrupted pilot training and led to reduced proficiency. For example, F-22 units were often directed to participate in partnership building exercises. However, during these exercises, F-22 pilots may be restricted

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<sup>23</sup>The deployment of partial squadrons occurs not just with F-22 squadrons, but across the Air Force and with similar effects on squadron operations. Further, although the Air Force has not deployed a complete flying squadron to meet operational requirements since the late 1990s, it continues to provide readiness information to DOD and Congress at the squadron level. In our June 2018 report, we recommended, among other things, that the Air Force analyze and report the readiness data to DOD and Congress of the small pieces of the squadrons that are deploying. GAO, *Air Force Readiness: Changes to Readiness Reports Could Help Stakeholders Take More Informed Actions*. GAO-18-65C (Washington, D.C.: June 13, 2018).

from flying the F-22 the way they would fly it in combat—due to security concerns about exposing the F-22's unique capabilities. These restrictions not only limited the value of the exercises, but also could result in pilots developing bad habits, according to Air Force officials. The Air Force also uses F-22s to support alert missions—that is, a mission that requires certain bases to have jets ready at all times to respond to threats from civil or military aviation. The alert mission does not require the advanced capabilities of the F-22, but we reported that because there are no other operational Air Force fighter squadrons based at the F-22 locations in Alaska and Hawaii, the alert mission fell on the F-22 units. Pilots and aircraft assigned to the alert mission could not be used for any other purposes, limiting opportunities for pilots to enhance air superiority skills. Unless the Air Force takes steps to assess and make necessary adjustments to the current organization and use of its F-22s, F-22 units are likely to continue to experience aircraft availability and pilot training rates that are below what they could be. As a result, the Air Force may incur increased risks in future operations in high threat areas. In July 2018, we recommended that the Air Force reassess its F-22 organizational structure and identify ways to increase F-22 pilot training opportunities for high-end missions to reduce risk to future operations. DOD concurred with both recommendations.

### Air Force Will Need to Balance Near-term Readiness Recovery with Plans to Grow and Modernize the Force

In September 2018, the Secretary of the Air Force described the need to grow the number of Air Force squadrons from 312 to 386—a 24 percent increase—between fiscal years 2025 and 2030 in order to meet persistent operational demands and address the challenges identified in the National Defense Strategy.<sup>24</sup> However, the details and costs of such growth are as yet unknown and will have to compete with other military services looking to increase their force structure and major defense capabilities that require recapitalization. For example, over the next three decades, the Navy plans to grow its fleet by nearly 25 percent—at an estimated cost of about \$800 billion—and modernizing and maintaining the nation's nuclear arsenal could cost \$1.2 trillion over the same

<sup>24</sup>As of September 2018, the Air Force reported it has 312 operational squadrons to execute its core missions consisting of fighters, bombers, airlift, intelligence/surveillance/reconnaissance, command and control, special operations, space, cyber, missile, and personnel recovery squadrons.

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timeframe.<sup>25</sup> All of these investments would need to be made amid a deteriorating national fiscal picture.<sup>26</sup>

Even if it grows, the Air Force will be dependent on the force of today for decades to come and will need to stay focused on rebuilding its readiness. Many of the Air Force's fourth generation fighters will be part of the force structure for the next decade or more, and the Air Force plans to retain the F-22 aircraft until 2060. In addition, the Air Force proposed divesting the A-10 to make budgetary room for more modern aircraft. However, as we reported in August 2016, the Air Force did not fully examine the implications of this course of action and could not demonstrate how it would meet the multiple missions being performed by the aging A-10.<sup>27</sup> Therefore, focusing on rebuilding the existing force will be crucial to positioning the Air Force for the future. While these challenges are particularly acute in the Air Force, the Air Force is not alone among the military services. Given persistently low readiness levels across the military, we have called for a comprehensive readiness rebuilding plan for the entire Department of Defense to guide rebuilding efforts, including setting clear goals and identifying resources required to meet those goals for all services, including the Air Force.<sup>28</sup>

In sum, as it plans for the future, the Air Force will need to balance the rebuilding of its existing force with its desire to grow and modernize. We have made a number of recommendations—with which the Air Force have generally concurred with but most have not yet been implemented—that provide a partial roadmap to address important readiness challenges. Implementing our recommendations to reevaluate fighter pilot squadron requirements, revise F-35 sustainment plans, reassess annual training requirements, and examine how the Air Force organizes and utilizes its F-22 organizational structure are necessary steps to meet current and

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<sup>25</sup>These are Congressional Budget Office estimates. See Congressional Budget Office, *Costs of Building a 355-Ship Navy*, (Washington, D.C.: Apr. 2017) and Congressional Budget Office, *Approaches for Managing the Costs of U.S. Nuclear Forces, 2017 to 2046*, (Washington, D.C.: Oct. 2017).

<sup>26</sup>GAO, *The Nation's Fiscal Health: Action Is Needed to Address the Federal Government's Fiscal Future*, GAO-18-299SP (Washington, D.C.: June 21, 2018).

<sup>27</sup>GAO, *Force Structure: Better Information Needed to Support Air Force A-10 and Other Future Divestment Decisions*, GAO-16-816 (Washington, D.C.: Aug. 24, 2016).

<sup>28</sup>GAO, *Military Readiness: DOD's Readiness Rebuilding Efforts May Be at Risk without a Comprehensive Plan*, GAO-16-841 (Washington, D.C.: Sept. 7, 2016).

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future needs and can assist the Air Force moving forward. In addition, sustained management attention and continued congressional oversight will be needed to ensure that the Air Force demonstrates progress in addressing its personnel, equipment, training, and organization and utilization challenges.

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Chairman Sullivan, Ranking Member Kaine, and Members of the Subcommittee, this concludes my prepared statement. I would be pleased to respond to any questions you may have at this time.

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**GAO Contact and  
Staff  
Acknowledgments**

If you or your staff have questions about this testimony, please contact John Pendleton, Director, Defense Capabilities and Management at (202) 512-3489 or [pendletonj@gao.gov](mailto:pendletonj@gao.gov).

Contact points for our offices of Congressional Relations and Public Affairs may be found on the last page of this statement. GAO staff who made key contributions to this testimony are Chris Watson, Assistant Director; Nick Cornelisse, Amie Lesser, Shari Nikoo, Michael Silver, Nicole Volchko, and Lillian Yob.

## Appendix I: Implementation Status of Key Prior GAO Recommendations Related to Air Force Readiness

Over the past three years, we issued several reports related to Air Force readiness that are cited in this statement. Table 1 summarizes the status of our key recommendations related to Air Force readiness since 2016; a total of 14 recommendations. The Department of Defense (DOD) has implemented 1 of these recommendations. For each of the reports, the specific recommendations and their implementation status are summarized in tables 2 through 7.

**Table 1: Status of Key GAO Recommendations Related to Air Force Readiness Since 2016**

Product date	Product title and number	Number of recommendations	
		Open	Implemented
September 10, 2018	<i>Weapon System Sustainment: Selected Air Force and Navy Aircraft Generally Have Not Met Availability Goals, and DOD and Navy Guidance Need to Be Clarified (GAO-18-678)</i>	1 <sup>a</sup>	0
July 19, 2018	<i>Force Structure: F-22 Organization and Utilization Changes Could Improve Aircraft Availability and Pilot Training (GAO-18-190)</i>	2	0
April 11, 2018	<i>Military Personnel: DOD Needs to Reevaluate Fighter Pilot Workforce Requirements (GAO-18-113)</i>	1 <sup>a</sup>	0
October 26, 2017	<i>F-35 Aircraft Sustainment: DOD Needs to Address Challenges Affecting Readiness and Cost Transparency (GAO-18-75)</i>	4	0
September 19, 2016	<i>Air Force Training: Further Analysis and Planning Needed to Improve Effectiveness (GAO-16-864)</i>	2	1
August 24, 2016	<i>Force Structure: Better Information Needed to Support Air Force A-10 and Other Future Divestment Decisions (GAO-16-816)</i>	3	0
<b>Total</b>		<b>13</b>	<b>1</b>

Source: GAO analysis of DOD information. | GAO-19-120T

Note: This table does not include recommendations made in classified reports. This report also included recommendations directed to the Secretary of the Navy, which are not counted here.

**Table 2: Status of Recommendations from *Weapon System Sustainment: Selected Air Force and Navy Aircraft Generally Have Not Met Availability Goals, and DOD and Navy Guidance Need to Be Clarified (GAO-18-678)***

Recommendation #1:	Status:
The Secretary of Defense should ensure that the Under Secretary of Defense for Acquisition and Sustainment updates or issues new policy clarifying the requirements for documenting sustainment strategies for legacy weapon systems, including fixed-wing aircraft.	Open
	Concurrence: Yes
	Comments: We will monitor DOD's efforts to address this recommendation.

Source: GAO analysis. | GAO-19-120T

Note: This table does not include a recommendation that was directed to the Secretary of the Navy and did not relate to the Air Force.

Appendix I: Implementation Status of Key Prior  
GAO Recommendations Related to Air Force  
Readiness

**Table 3: Status of Recommendations from Force Structure: F-22 Organization and Utilization Changes Could Improve Aircraft Availability and Pilot Training (GAO-18-190)**

<b>Recommendation #1:</b>	
The Secretary of the Air Force should conduct a comprehensive assessment of the F-22 organizational structure that identifies and assesses alternative approaches to organizing F-22 squadrons. The assessment could at a minimum assess the following two alternatives: consolidating the fleet into larger squadrons and/or wings in order to improve aircraft availability, and revising the design of the deployable units in squadrons to better support current deployment practices and future operational concepts.	<p><b>Status:</b> Open</p> <p><b>Concurrence:</b> Yes</p> <p><b>Comments:</b> We will monitor DOD's efforts to address this recommendation.</p>
<b>Recommendation #2:</b>	
The Secretary of the Air Force should identify and assess actions to increase F-22 pilot training opportunities for the high-end air superiority missions. This effort could consider alternatives such as: reducing exercise events that do not contribute to F-22 pilot high-end air superiority training, increasing external adversary air support so all F-22 pilots can use their available limited sorties to conduct high-end air superiority training rather than having a significant portion of the F-22 pilots providing training support, and finding alternatives to using F-22 units for alert missions, and other missions that do not require the jet's unique capabilities or prepare F-22 pilots for their primary missions.	<p><b>Status:</b> Open</p> <p><b>Concurrence:</b> Yes</p> <p><b>Comments:</b> We will monitor DOD's efforts to address this recommendation.</p>

Source: GAO analysis. | GAO-19-120T

**Table 4: Status of Recommendations from Military Personnel: DOD Needs to Reevaluate Fighter Pilot Workforce Requirements (GAO-18-113)**

<b>Recommendation #1:</b>	
The Secretary of the Air Force should ensure that the Director of Operations and the Air Force Manpower Analysis Agency reevaluate fighter pilot squadron requirements, to include updating current assumptions of fighter pilot workload, and assessing the impact of future incorporation of unmanned aerial systems platforms into combat aviation.	<p><b>Status:</b> Open</p> <p><b>Concurrence:</b> Yes</p> <p><b>Comments:</b> We will monitor DOD's efforts to address this recommendation.</p>

Source: GAO analysis. | GAO-19-120T

Note: This table does not include two recommendations that were directed to the Secretary of the Navy and did not relate to the Air Force.

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GAO Recommendations Related to Air Force  
Readiness

**Table 5: Status of Recommendations from F-35 Aircraft Sustainment: DOD Needs to Address Challenges Affecting Readiness and Cost Transparency (GAO-18-75)**

<p><b>Recommendation #1:</b> The Under Secretary of Defense for Acquisition, Technology, and Logistics, in coordination with the F-35 Program Executive Officer, should revise sustainment plans to ensure that they include the key requirements and decision points needed to fully implement the F-35 sustainment strategy and align funding plans to meet those requirements.</p>	<p><b>Status:</b> Open <b>Concurrence:</b> Yes <b>Comments:</b> As of June 2018, officials from the Office of the Under Secretary of Defense for Acquisition and Sustainment (USD (A&amp;S)) said that USD(A&amp;S) and the F-35 Program Executive Officer (PEO) are focusing actions and resources towards achieving key production, development, and sustainment objectives by 2025. We will continue to monitor the DOD's efforts, but it is too soon to determine the extent to which these efforts—when completed—will address the concerns that we identified in our report.</p>
<p><b>Recommendation #2:</b> The Under Secretary of Defense for Acquisition, Technology, and Logistics, in coordination with the F-35 Program Executive Officer, should re-examine the metrics that it will use to hold the contractor accountable under the fixed-price, performance-based contracts to ensure that such metrics are objectively measurable, are fully reflective of processes over which the contractor has control, and drive desired behaviors by all stakeholders.</p>	<p><b>Status:</b> Open <b>Concurrence:</b> Yes <b>Comments:</b> As of June 2018, officials from the Office of the Under Secretary of Defense for Acquisition and Sustainment (USD (A&amp;S)) stated that the F-35 Program Executive Officer (PEO) re-examines sustainment metrics every year to allow the department to objectively measure and hold the contractor accountable for delivering increased availability and reduced cost, and to align sustainment processes and deliverables to those which the contractor controls. We recognize the department's progress related to this recommendation, but the key metrics being used by the F-35 program to incentivize the contractor remain a concern as they are not fully reflective of processes over which the contractor has control. This could make it difficult to hold the contractor accountable under performance based contracts, as we reported. We will continue to monitor DOD's efforts in this area.</p>
<p><b>Recommendation #3:</b> The Under Secretary of Defense for Acquisition, Technology, and Logistics, in coordination with the F-35 Program Executive Officer, should, prior to entering into multi-year, fixed-price, performance-based contracts, ensure that DOD has sufficient knowledge of the actual costs of sustainment and technical characteristics of the aircraft after baseline development is complete and the system reaches maturity.</p>	<p><b>Status:</b> Open <b>Concurrence:</b> Yes <b>Comments:</b> As of June 2018, officials from the Office of the Under Secretary of Defense for Acquisition and Sustainment (USD (A&amp;S)) stated that the F-35 Program Executive Officer (PEO) is overseeing a Sustainment Actual Cost Working Group. Until DOD has a full understanding of the actual costs of sustainment and technical characteristics of the aircraft at system maturity, it may not be well positioned to enter into a long-term, fixed-price, performance-based contract. We will continue to monitor DOD's efforts in this area.</p>

Appendix I: Implementation Status of Key Prior  
GAO Recommendations Related to Air Force  
Readiness

<b>Recommendation #4:</b>	
The Under Secretary of Defense for Acquisition, Technology, and Logistics, in coordination with the F-35 Program Executive Officer, should take steps to improve communication with the services and provide more information about how the F-35 sustainment costs they are being charged relate to the capabilities received.	<p><b>Status:</b> Open</p> <p><b>Concurrence:</b> Yes</p> <p><b>Comments:</b> As of June 2018, officials from the Office of the Under Secretary of Defense for Acquisition and Sustainment (USD (A&amp;S)) stated that USD(A&amp;S) is currently undertaking a study on F-35 Sustainment Affordability and Transparency. The study examines affordability and transparency issues between the services and the F-35 Joint Program Office, which inhibit the services' visibility into expected F-35 costs versus budgets, what they are paying for in sustainment, and what they are getting for that money. Officials said that USD (A&amp;S) expects to deliver a final report to the congressional defense committees by September 2018. We will review DOD's report, once completed, to determine the extent to which DOD's efforts address our recommendation.</p>

Source: GAO analysis. | GAO-19-120T

**Table 6: Status of Recommendations from Air Force Training: Further Analysis and Planning Needed to Improve Effectiveness (GAO-16-864)**

<b>Recommendation #1:</b>	
To ensure that annual training plans are aligned with the Air Force's stated goals to ensure that its forces can successfully achieve missions across a broad range of current and emerging threats, the Secretary of Defense should direct the Secretary of the Air Force to comprehensively reassess the assumptions underlying its annual training requirements—including, but not limited to, the total annual training requirements by aircraft, the criteria for designating aircrews as experienced or inexperienced, and the mix between live and simulator training—and make any appropriate adjustments in future training plans.	<p><b>Status:</b> Open</p> <p><b>Concurrence:</b> No</p> <p><b>Comments:</b> Although DOD did not concur with this recommendation, as of August 2018, the Air Force has taken steps to address it. The Air Force has completed one study on its fighter aircrew annual training requirements and is currently evaluating the results of another. The studies are intended to help the Air Force ensure that fighter aircrew training plans are aligned to achieve a range of missions for current and emerging threats, as recommended by us.</p>
<b>Recommendation #2:</b>	
To improve the Air Force's ability to consistently monitor training results and better position it to allocate resources to address factors that limit the effectiveness of training, the Secretary of Defense should direct the Secretary of the Air Force to establish desired learning objectives and training support elements needed to accomplish the training expectations in its annual Ready Aircrew Program tasking memorandums, and develop a process to collect data to assess the effectiveness of annual training against these features.	<p><b>Status:</b> Open</p> <p><b>Concurrence:</b> No</p> <p><b>Comments:</b> DOD stated that that the Air Force's Ready Aircrew Program training differs significantly from other syllabus-directed courses of instruction and that desired learning objectives for this training are set at the squadron level in accordance with current Air Force guidelines. As of August 2018, DOD did not plan to take any further additional actions to address this recommendation.</p>

Appendix I: Implementation Status of Key Prior  
GAO Recommendations Related to Air Force  
Readiness

<b>Recommendation #3:</b>	
To improve the Air Force's ability to develop the capabilities needed to meet its virtual training needs, the Secretary of Defense should direct the Secretary of the Air Force to continue to refine its planning for virtual training to incorporate the desirable characteristics of a comprehensive strategy, including developing a risk-based investment strategy that identifies and prioritizes capability needs and includes a time line for addressing them.	<p><b>Status:</b> Implemented</p> <p><b>Concurrence:</b> Yes</p> <p><b>Comments:</b> In September 2017, the Air Force issued the Air Force Operational Training Infrastructure 2035 Flight Plan, which describes the Air Force's vision for a realistic and integrated operational training environment and incorporates the desirable characteristics of a comprehensive strategy, as recommended by GAO. One of the 13 lines of effort included in the plan called for the development of a funding strategy for operational training infrastructure capabilities. That funding strategy was issued in December 2017.</p>

Source: GAO analysis. | GAO-19-120T

**Table 7: Status of Recommendations from Force Structure: Better Information Needed to Support Air Force A-10 and Other Future Divestment Decisions (GAO-16-816)**

<b>Recommendation #1:</b>	
To ensure that senior leaders have the quality information on which to base future force structure decisions, the Secretary of Defense should develop and promulgate department-wide guidance that establishes specific informational requirements to be met before proposing divestment of major weapon systems that have not reached the end of their expected service lives.	<p><b>Status:</b> Open</p> <p><b>Concurrence:</b> No</p> <p><b>Comments:</b> DOD stated that the department already has guidelines and robust procedures in place to provide senior leaders with quality information with which to make divestment decisions, including through its budgeting and acquisition process. As of August 2018, DOD has not taken action to address this recommendation.</p>
<b>Recommendation #2:</b>	
To make a well-informed decision about the future of its A-10 aircraft, before again recommending divestment of the A-10, the Secretary of the Air Force should: (1) Develop quality information that fully identifies gaps in capacity or capability that would result from A-10 divestment, including the timing and duration of any identified gaps, and the risks associated with those gaps; and (2) Use that information to develop strategies to mitigate any identified gaps.	<p><b>Status:</b> Open</p> <p><b>Concurrence:</b> No</p> <p><b>Comments:</b> The Air Force stated that it had sufficient understanding of the risks and the capability gaps when deciding to divest the A-10. As of August 2018, the Air Force has not taken action to address this recommendation.</p>
<b>Recommendation #3:</b>	
To further inform decisions about the future of the A-10, the Secretary of the Air Force should, in considering divestment, develop a high-quality, reliable cost estimate utilizing best practices.	<p><b>Status:</b> Open</p> <p><b>Concurrence:</b> No</p> <p><b>Comments:</b> The Air Force stated that it used programming and sustainment data to inform their cost estimate. As of August 2018, the Air Force has not taken action to address this recommendation.</p>

Source: GAO analysis. | GAO-19-120T

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## Related GAO Products

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Report numbers with a C or RC suffix are classified. Report numbers with a SU suffix are sensitive but unclassified. Classified and sensitive but unclassified reports are available to personnel with the proper clearances and need to know, upon request.

*Weapon System Sustainment: Selected Air Force and Navy Aircraft Generally Have Not Met Availability Goals, and DOD and Navy Guidance Need to Be Clarified.* GAO-18-678. Washington, D.C.: September 10, 2018.

*Military Readiness: Air Force Plans to Replace Aging Personnel Recovery Helicopter Fleet.* GAO-18-605. Washington, D.C.: August 16, 2018.

*Military Aviation Mishaps: DOD Needs to Improve Its Approach for Collecting and Analyzing Data to Manage Risks.* GAO-18-586R. Washington, D.C.: August 15, 2018.

*Military Readiness: Update on DOD's Progress in Developing a Readiness Rebuilding Plan.* GAO-18-441RC. Washington, D.C.: August 10, 2018. (SECRET)

*Force Structure: F-22 Organization and Utilization Changes Could Improve Aircraft Availability and Pilot Training.* GAO-18-190. Washington, D.C.: July 19, 2018.

*Military Personnel: Collecting Additional Data Could Enhance Pilot Retention Efforts.* GAO-18-439. Washington, D.C.: June 21, 2018.

*Air Force Readiness: Changes to Readiness Reports Could Help Stakeholders Take More Informed Actions.* GAO-18-65C. Washington, D.C.: June 18, 2018. (SECRET)

*Force Structure: Changes to F-22 Organization and Utilization Could Improve Aircraft Availability and Pilot Training.* GAO-18-120C. Washington, D.C.: April 27, 2018. (SECRET//NOFORN)

*Military Readiness: Clear Policy and Reliable Data Would Help DOD Better Manage Service Members' Time Away from Home.* GAO-18-253. Washington, D.C.: April 25, 2018.

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**Related GAO Products**

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*Warfighter Support: DOD Needs to Share F-35 Operational Lessons Across the Military Services.* GAO-18-464R. Washington, D.C.: April 25, 2018.

*Weapon System Sustainment: Selected Air Force and Navy Aircraft Generally Have Not Met Availability Goals, and DOD and Navy Guidance Need Clarification.* GAO-18-146SU. Washington, D.C.: April 25, 2018.

*Military Personnel: DOD Needs to Reevaluate Fighter Pilot Workforce Requirements.* GAO-18-113. Washington, D.C.: April 11, 2018.

*Military Aircraft: F-35 Brings Increased Capabilities, but the Marine Corps Needs to Assess Challenges Associated with Operating in the Pacific.* GAO-18-79C. Washington, D.C.: March 28, 2018. (SECRET)

*F-35 Aircraft Sustainment: DOD Needs to Address Challenges Affecting Readiness and Cost Transparency.* GAO-18-75. Washington, D.C.: October 26, 2017.

*Department of Defense: Actions Needed to Address Five Key Mission Challenges.* GAO-17-369. Washington, D.C.: June 13, 2017.

*Air Force Training: Further Analysis and Planning Needed to Improve Effectiveness.* GAO-16-864. Washington, D.C.: September 19, 2016.

*Military Readiness: DOD's Readiness Rebuilding Efforts May Be at Risk without a Comprehensive Plan.* GAO-16-841. Washington, D.C.: September 7, 2016.

*Force Structure: Better Information Needed to Support Air Force A-10 and Other Future Divestment Decisions.* GAO-16-816. Washington, D.C.: August 24, 2016.

*Air Force Training: Further Analysis and Planning Needed to Improve Effectiveness.* GAO-16-635SU. Washington, D.C.: August 16, 2016.

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Senator SULLIVAN. Great. Thank you and thanks again for all the good work that GAO has been doing in this area.

Let me begin by—Madam Secretary, this is a question for you—the issue as it relates to the readiness of aircraft that are available that come into the Air Force fleet, and in particular, I am thinking about the F-35.

So I saw just a couple days ago that Secretary Mattis ordered the Air Force and Navy to get mission capable rates up to 80 percent. I did a little sniffing around. I think Delta Airlines—their aircraft readiness in their fleet is about 86 percent. I believe it is something along those lines. Yet, for the F-35—it is a new airplane, coming

on line, coming out to the fleet—I think it is in the—you can correct me if I am wrong—but mid-60s.

So why is there, A, such a disparity between military aircraft that are brand new and commercial aircraft? Can we get to, within a year—I know that is what the Secretary put in his memo. Can we get to a rate of 80 percent, and how can we do that?

Secretary WILSON. Thank you, Mr. Chairman.

The readiness recovery plan that we put together in the spring accelerates our readiness recovery by about 6 years and says that by the end of fiscal year 2020, our pacing units, our most important units for a peer competition, of which we have 204 operational squadrons—that 80 percent of those will be at C1 or C2 readiness by the end of 2020.

The Secretary of Defense has asked us to accelerate further our F-16's, F-22's, and F-35's to the end of fiscal year 2019 and come up with a plan to do that.

Now, what we are focused on here is not the entire fleet. It is not the test and evaluation airplanes and those kind of things. And so we have a situation where we actually are now standing up. We are not even at full operating capability for some of our squadrons, but we are focused on the operational squadrons and making sure that they are at high levels of mission capable readiness both for their pilots, their equipment, and their training.

So you had asked what are the challenges with the F-35 fleet with respect to sustainment.

Senator SULLIVAN. Is that number like in the mid-60s? That is correct. Is it not?

Secretary WILSON. It varies by squadron, significant variation by squadron. I may ask the Chief to jump in here on this.

But I would say that there are a couple of issues. Obviously, one of them is that the spare parts lines did not start up fast enough, and that is something that predates all of us. But they were so focused on initial production, they did not start up and really work the logistics system fast enough.

The second and most obvious difference between an F-35 and an airliner is the low observable coating and the complexity of maintaining that.

We are putting together a plan with, of course, the Joint Program Office because this is a joint program—it is not an Air Force program—to get the supply line right so that our operational squadrons can meet the goals that the Secretary of Defense has set out for us.

Chief?

General GOLDFEIN. Chairman, I would just share with you a couple weeks ago I had a conversation with Israeli Air Chief Amikan Norkin. He shared with me. He said, Dave—he said I am not integrating the F-35 into the Israeli Air Force. I am integrating the Israeli Air Force into the F-35. It was a telling statement on how this aircraft, this weapon system, is looked at operationally as the quarterback of the joint and the allied team because it is really an information fusion engine. And so operationally we are seeing incredible capabilities coming out of this platform.

Where we are focused—and I think Mr. Pendleton said as well—is on that sustainment piece. As an international air chief, speak-

ing on behalf of my fellow F-35 international air chiefs, we are working to drive the sustainment costs down so that they are on par with a fourth generation F-16, F-18 because that is what all of the air chiefs have put into their budgets. And so this is one that we are working with the Department, with the Joint Program Office, and with Lockheed Martin to ensure that we drive these sustainment costs down, and we are not going to stop until we see them on par.

Senator SULLIVAN. Mr. Pendleton, do you have any views on just the fleet readiness and why—I know it is a complex aircraft. It only took almost 2 decades to procure and develop, which that is a whole other topic for a whole other hearing. But it does seem to me kind of ludicrous that we get new aircraft off the production line and within a month, they are at 65 percent readiness. I mean, what do you think is going on there?

Mr. PENDLETON. I think the Air Force is focused on production and not enough on sustaining the aircraft, just to be blunt about it. It is causing problems. The depots are already several years behind. Parts are a problem. It is going to be difficult to achieve those kind of mission capability rates.

Now, I will say on mission capability rates that whenever I hear a percentage—you know, I am auditor. That is a numerator and a denominator. What exactly is in both of those I think will become very important and we will be watching that, of course.

Senator SULLIVAN. Thank you.

Senator ROUNDS. Thank you, Mr. Chairman.

General Goldfein, with regard to the discussion about the immediate capabilities or at least between the F-22 and the F-35, we know as low observable aircraft both of them have some challenges because it is a technology that is difficult to maintain. Yet, we changed the styling on the technology, the way that we handle low observability between the F-22 and the F-35. There is a reason for it. Part of it is because we learned by the F-22.

Would you like to share just briefly what we expect to get out of the F-35 that we could not get out of the F-22 in terms of low observability and making it easier to maintain the capabilities of the F-35?

General GOLDFEIN. Thanks, sir.

You know, we took all the learning from—and I flew the F-117. So we could say first generation and was a wing commander and responsible for low observable maintenance on the F-117. We learned from that. We actually send F-117 maintainers and pilots to the B-2 to learn. And so throughout the evolution of low observable technology and maintenance, we have learned from every one of the generations, if you will, going forward. So we took everything we learned from the F-22 and we applied that to the F-35 not only in production, but now in terms of maintenance. How we do the coatings, how we achieve the low observability we need is a generation beyond what we are doing in both the F-22 and the B-2.

The big story, though, on the F-35 is the information fusion. I would just share you this way. When I was flying the F-16, I would go out for a mission, and then when I came back, my debrief was primarily to determine what I had missed, what did I not see,

what information was out there that I did not collect, and how could I improve my ability to manage my systems to do that.

The F-35 pilots are having a completely different debrief because it is all there. The question is how did they fuse it and how did they act.

Just to give an example, when an F-35 pilot is taxiing out, he or she is already getting information fed into the cockpit on what is going on in the cyber world, in the space world. They are already calling audibles. So going back to what the Israeli air chief said, I am integrating my entire air force into the F-35, and why we think about it as the quarterback, because it is able to call audibles real time in a really complex environment in ways that we have just not been able to do before.

So it is this combination of low observability, allowing you to penetrate and persist, and the information fusion, what you can do once you are inside an enemy environment, that allows the F-35 to do what it does.

Senator ROUNDS. If I could, what you are saying and what I am hearing is that we are basically on the cutting edge technology that is going to get a lot better, but we are learning as we go along and this is a part of that learning curve that we are in right now.

General GOLDFEIN. Yes, sir. You cannot overestimate the importance of the international aspect of the F-35 because I have never been in a single fight where I have done it alone. Every time I have gone into combat over the last 28 years, we have been there side to side with our allies and partners. The fact that they are in this weapon system with us is probably one of the most important outcomes of coalition warfare going forward.

Senator ROUNDS. I think sometimes we forget about that, and I appreciate your bringing that up because those partnerships are critical to us. It is something that our near-peer adversaries do not have.

General GOLDFEIN. Yes, sir.

Senator ROUNDS. Thank you.

Secretary Wilson, I am just curious. There is going to be a discussion about whether we should be working on maintaining our existing force and bringing it up to speed versus adding new squadrons, more manpower, and so forth. But I think the two are integratable and I think that they cannot be separated.

Would you care to share your thoughts about the need to not only increase so that we have actually got aircraft to do the mission that is necessary and then the reason why we are having problems right now in terms of the amount of hours we are expecting from the airframes that we have got and the pilots that we have got on hand right now?

Secretary WILSON. Senator, job one is to restore the readiness of the force that we have. This committee asked the Chief and I last March what is the Air Force you need to execute the National Defense Strategy. We have a formal report that is due to the Congress in March.

So we have a group within the Air Force. There is also Mitre Corporation and the CSBA [Center for Strategic and Budgetary Assessments] who are also doing independent looks at what is required in order to execute the National Defense Strategy. Certainly

modernization and new concepts of operations, integration with the joint force, dependence on allies. But we have done quite a few war games and modeling and simulation that do show that we are too small for what the nation is asking of us under the National Defense Strategy when we project forward to the 2025–2030 time frame in particular. That is because we have returned to great power competition. We have a rapidly innovating adversary that is putting a lot of effort into the development of their military. I think we have an obligation to you to be able to answer that question, what is the Air Force we need when we look at the rapidly innovating threat. And so that was the basis of our work in saying we think it is about 386 squadrons in the 2025–2030 time frame.

That will engender a debate on how we get there, can we get there, what are the resources required. We understand that. But at a minimum, we should be able to tell you what is needed.

Senator ROUNDS. Mr. Chairman, I think one of the most critical pieces in what the Secretary has said is that the public is expecting that we will have the best Air Force and that we can handle our near-peer competitors. Actually what she is saying is that without the increases that we need in manpower and in new squadrons, we are not able to meet that near-peer competition.

Secretary WILSON. We are ready to fight tonight. There is no question. But when we project forward into 2025–2030, with the best intelligence estimates we have, that is where the greatest issue is. And so we can see what the adversary is doing and project forward as to what they plan to do, and we have an obligation to maintain dominance and air superiority to carry out the National Defense Strategy and provide options for the commander in chief.

Senator ROUNDS. Thank you.

Thank you, Mr. Chairman.

Senator SULLIVAN. Senator Shaheen?

Senator SHAHEEN. Thank you, Mr. Chairman. I am sorry I had to step out.

I am going to say this even though it is not directly related, but I went out because there is an exhibit in the Rotunda of young people who have overdosed, and these are portraits that are very dramatic. This is an issue I think for all of us across our society. And so I would urge everybody to walk through the Rotunda on your way out. The portraits were painted by a woman from New Hampshire, and that is how I am connected to it.

I also wanted to just—I am sorry that Senator Inhofe has left because I wanted to respond to his comment about the last 8 years of President Obama. Leadership and politics aside, one of the biggest challenges of the last 8 years has been sequestration. I raise it because if we do not make a change, we are looking at that coming again. And so I think we cannot just suggest that it has been about leadership. It has been about our failure to provide the funding that our armed services have needed, and we better face up to that now because we are looking at it coming down the pike again. I would urge us all to think about how we are going to address that because these readiness challenges really got critical during the years when sequestration was in effect.

With that preface, I want to begin, Secretary Wilson, by again thanking you and the Air Force for your very positive response to

the contamination from PFAS [per- and polyfluoroalkyl substances] that has been at the former Pease Air Force Base. You sent up John Henderson, who is the Assistant Secretary of the Air Force for Installations, Environment, and Energy. He was very effective in meeting with residents of the community who had been affected and reassuring about the effort to address this issue, which I know everyone very much appreciated.

I want to ask you, though, because one of the questions that came up was about the fire fighting foams that contributed to the problem that we have at Pease and what is being done. There has been some concern about whether there is going to be a new fire fighting foam that is developed that can meet the same requirements to fight fires. So can one of you talk about what you are seeing and what the prospects are to develop something that is just as effective?

Secretary WILSON. Yes, Senator, I think I can.

First of all, the Air Force, I think to its credit—it was my predecessor who got us on this path—but went out proactively and assessed all of our bases. This particular foam was used in all kinds of fire fighting, but the Air Force was only one of the entities that has used it. And so we did an assessment.

We pretty much completed that assessment at all of the Air Force locations, identified where we have problems, and we are committed to fixing it and providing clean water immediately when people are affected.

We have also replaced this foam already at Air Force locations with another kind of fire retardant that does not contain that chemical.

Senator SHAHEEN. Well, that is really good to hear because there was a hearing in a subcommittee of the Environment and Public Works Committee that raised questions about whether the Air Force has in fact replaced that fire fighting foam. So I hope that that message will get sent loud and clear to everybody so that everybody understands that that has been done.

Secretary WILSON. Senator, I will take that back and we will confirm that for you in writing.

Senator SHAHEEN. That would be great. Thank you very much. [The information referred to follows:]

The Air Force began replacing legacy Aqueous Film Forming Foam (AFFF) with a new, more environmentally responsible firefighting foam in August 2016. The replacement foam meets military specifications, is perfluorooctanesulfonic acid (PFOS) free and contains only trace amounts of perfluorooctanoic acid (PFOA). All Air Force installations have transitioned to the new AFFF in both stockpiles and fire trucks. We delivered equipment that allows testing of fire trucks with zero AFFF discharge to all of our bases. All hangar system replacement projects were funded in fiscal years 2017 and 2018 with estimated completions in 2020.

Also following up on that a little bit more, earlier this year Senator Rounds and I introduced the PFAS Registry Act, which would have set up a national registry for everyone affected. There were pieces of that that are included in the McCain authorization bill. I just wondered if you could talk about whether efforts have begun, if you are aware of efforts that have already begun within DOD to begin to set up this registry and what we might need to do to support that.

Secretary WILSON. Senator, if I could take that one and go back and also get that answer for you in writing.

Senator SHAHEEN. Sure. That would be great. Thank you.  
[The information referred to follows:]

Regarding a registry for individuals exposed to PFAS, as specified in the section 315(c)(4) of the National Defense Authorization Act of Fiscal Year 2019, the Secretary of Defense will conduct an assessment of the human health implications of PFAS exposure. The assessment will include a description of the amount of funding that would be required to administer a potential registry of individuals who may have been exposed to PFAS while serving in the Armed Forces. The Department will also assess scientific results and recommendations from ongoing PFAS studies and analyses by the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry, and other organizations, to determine the feasibility of a registry.

I am almost out of time so I will save my question for the next round.

Senator SULLIVAN. Okay.

Senator Ernst?

Senator ERNST. Thank you, Mr. Chair.

Of course, to our witnesses, thank you very much for being here today. We certainly appreciate your service and your commitment to our great United States of America.

General Goldfein, I would like to start with you please, sir. Thank you very much for acknowledging the fact that we need to man, train, and equip our servicemembers. The training is very important. Whether it is simulation or whether it is actual exercises in the air, that muscle memory and those rehearsals are very, very important—and you are right—when it comes down to it, to be able respond immediately in a time of crisis. Very important. So thanks for acknowledging that.

I know that many of us here on the committee have been following the physiological episodes (PE) that have been occurring in our flying communities, and I am confident in saying that all of us are committed to ensuring the safety of our pilots. And so I am happy to hear that the Air Force has joined with the Navy now and we have a Joint Physiological Episodes Action Team, or JPEAT, to share information and really get after this problem. So congratulations on that.

I am aware that there has been some progress made with regard to resolving these PE issues in the Air Force trainer fleet. Can you share with the committee this progress and then how it impacts resolving PE issues in other platforms as well?

General GOLDFEIN. Yes, ma'am, thanks.

In the T-6, which is the aircraft that we have been most recently having the physiological episodes.

As you mentioned, we put together a team with the Navy and went and looked at it, and we were able to drive down to the point with high confidence. What we have found is that it is the concentration of oxygen levels at various parameters of flight that was falling behind what was required. So in different maneuvers and different flying in certain of the aircraft, the concentration levels were off.

And so the way we are attacking this is for the near term and long term. In the very near term, now that we have identified what the root cause is, we have looked at all of the maintenance prac-

tices because the Navy has T-6's. We have T-6's. We compared the best practices of both services, and we have changed significantly the way we are maintaining every part of the system to ensure that we can mitigate and minimize any implications of having the concentration values not be optimum.

The second thing what we are doing is we are out there and we are talking to the force. We learned with the F-22 when we went through that, that when we were doing all of our analysis, we stopped a dialogue with the operators and their families. So they started wondering and questioning what we were doing. So this has been an inclusive, transparent dialogue throughout. So now we have sent a team out with a one-star general that has briefed every one of our T-6 pilots and we have talked to families in town halls to make sure they know exactly what is going on.

The long-term solution to this is going to be a redesign of the system to ensure that we have the concentration levels right. We have a team right now that is doing the redesign, and then as soon as they come to us with the solution, that is going to be a priority for the section guy to move forward.

Senator ERNST. Very good.

So you mentioned that was the T-6 as well and the F-22, and you are applying that to other platforms as well then.

General GOLDFEIN. Yes, ma'am.

Senator ERNST. Well, I do appreciate that. It has been very concerning, and we are glad to see the attention really being paid by both the Air Force and the Navy to the PE. So I appreciate that.

Thank you for mentioning the families because that is a great lead-in to the question I have for Secretary Wilson. Thank you, Secretary, for being here as well.

I chair the Emerging Threats and Capabilities Subcommittee, and I have had the opportunity to learn about SOCOM's [Special Operations Command] success with Preservation of the Force and Family (POTFF) program. We ask a lot of our airmen and their families, and we all want to provide them with the absolute best possible support we can. I understand it may not be possible to apply POTFF all across the Department.

Is there a way that we could incorporate parts of that program with folks in the Air Force? We know that it has been very helpful to those that are in those special operations community in AFSOC [Air Force Special Operations Command], and we would like to see pieces or parts of that shared with the greater Air Force as well. Are there ideas or things that could be applied?

Secretary WILSON. Senator, we are trying that out at four different bases. We call it Operation True North. The concept is to embed the caregivers in the squadrons where people are for both mental health, spiritual wellbeing, but also physical health. One of the outcomes from SOCOM is if someone is in the same unit and they are responsible for mental health, there are conversations that go on that are easier to have than if you have to make an appointment over at the clinic and walk through that door.

The second part on physical health. We have actually found that by embedding—we are taking care of high performance athletes. By embedding physical trainers with the units, it is not about what you cannot do. It is about how you can do. The number of injuries

and the reluctance to go see a doc, because if you go see the doc, they are going to take you offline status and it is hard to get back on. And so there is a reluctance to get help as opposed to—I was with a special operator down at Hurlbert who said to me it has been the best thing. I was out there working out and the physical trainer just said—and then he said, yes, my back has been bothering me. He said, well, let me watch you lift. He said this was here. Let me show you how to do this. Let me show you how to strengthen those muscles. He said I feel like a young man. I have never felt this good because I am training properly now, and I did not have to go to the doc.

So it is a different approach to maintaining the human weapon system and resilience by incorporating that into how we operate the squadrons.

Senator ERNST. I appreciate that. It is a very important program, and if there are things that we can do to assist in that effort, please let us know. I am a huge fan of the POTFF programs.

Thank you all very much for being here today. I appreciate it. Thank you.

Senator SULLIVAN. Senator Perdue?

Senator PERDUE. Mr. Chairman, welcome to your new role. I look forward to working with you.

I want to make one comment for the record for our guests here today. You know, I think this is one of the most important meetings we could have. The timing is perfect, as the Chief said privately before we started.

I am chagrined, though, again that with an important meeting, we are all double, triple-booked. And so the attendance here is disrespectful to these witnesses. I want that for the record. With your leadership, I know we can change that.

Senator SULLIVAN. Well, thank you. You raise a good point. There are several other hearings happening literally right now. This is really important.

Senator PERDUE. We are all double-booked. We are all missing something else to be here, but I think this is absolutely critical.

Chief, I am worried. As an old manufacturing guy, I am worry about our supply chain. I am worried about our industrial base. I look at the F-35, though, and the decisions that were made that you guys have inherited where we have got that supply chain spread all over the world for whatever reason, social, economic. I do not know, but it certainly was not with national defense in mind.

I want to know what can we do. Eric Schmidt said that bringing technology into the force, both in current readiness and in developing the recap that you guys are going to have to face over the next 10 years—by the way, Secretary, I could not agree more. I am not worried about where we are today. I have full faith in you guys today. I am worried about what China has said publicly about Made in China 2025. 2025 and beyond I am really concerned about.

That leads to this question. Eric Schmidt, Obama's appointee of the Defense Innovation Advisory Board—and he said this. He said that bringing new technology in the force is the biggest concern. If there was one variable to solve for, it would be speed. In competing with these guys, they do not have the same constraints that we do.

He also said—and I am going to paraphrase this, but the requirement process we have in DOD is now the single greatest barrier to rapid technological advancement. By advancement, he means not development but deployment.

Sir, when we look at both recapping and improving our readiness today, where are we in terms of working with the industrial base and the supply chain that you guys have inherited to sort of get at this? I would like maybe both of you. I see your head nodding, Secretary. Both of you may have a comment on this. But I think this is the number one threat that we have right now.

Secretary WILSON. Senator, I am glad you bring this up because it is something that we are both really focused on, and taking advantage of the new authorities that you have given us to move at speed. Let me give you a couple of examples.

One is with the F-35. The Defense Department and the Air Force is terrible at buying software. So we changed the way we are buying software. We set up a software factory called Kessel Run outside of Boston to be able to do development operations (DEVOPS), so rapid insertion of technology in an iterative way. We just this last week went out to Nellis. There is a logistics system that supports the F-35 called ALIS, A-L-I-S. It cannot scale. It has got huge problems. It drives the maintainers nuts. And so we put together a team of Lockheed Martin, Air Force programmers, and maintainers on the flight line and said let us to DEVOPS and figure out where the problems are and try to rapidly get tools to the warfighter to fix ALIS. They named themselves. The new program is called Mad Hatter, rather than ALIS. It is always the young techies that come up with something.

But it is not only that. Let me give you a couple examples of where we are moving very quickly. Eric Schmidt is right. We are actually partnering with DIUx [Defense Innovation Unit Experimental] in some of our space enterprise kinds of things. We started in January a space enterprise consortium. We have got over 200 companies now involved. 150 of them are nontraditional companies. We have done 32 prototypes with greater than \$100 million in total value of those 32 prototypes. The average time between solicitation to award is 90 days. We have given four awards just since January for rapid launch of small satellites, partnering with DIUx, at \$15 million to get small satellites up in the air and do it fast. We just broke into four program executive offices in our Space and Missile Systems Center rather than one all the way at the top of the \$6 billion enterprise. By doing that, we cut out three layers of bureaucracy in getting capability to the warfighter. We set out nine pacesetter projects to show how to go fast to acquire space systems, and those nine pacesetters cut 19 years out of their acquisition timelines, and they have a number of other pacesetters in line saying, hey, we want to do it this way too.

We are using the authorities for prototyping the experimentation that you have given us. We are stripping out layers of bureaucracy. We have pushed down authority to program managers and given them the power to move quickly, to use competition.

The final thing I would say is we are partnering with our allies. We partnered with Norway on a satellite communications, polar satellite communications, where we had a 2-year gap. We closed

the 2-year gap, saved \$900 million by partnering with Norway. We are doing the same on another project with Japan.

The Air Force is trying to take the authorities you have given us and move forward to go faster and smarter on acquisition.

General GOLDFEIN. Sir, just to add quickly.

Senator PERDUE. It sounds like she might have prepared for that question, Chief.

[Laughter.]

General GOLDFEIN. It is a big deal for us.

Senator PERDUE. It is a big deal. I agree.

General GOLDFEIN. So Secretary Wilson and I hosted our four-star conference last week, and the guest speaker was Eric Schmidt. We asked him to talk to us about how we bring the future faster.

I am often asked the question, hey, Chief, 9 years of continuing resolutions (CR)—what does that do to you? I tell them it really wreaks havoc on our ability to plan for the future.

But to your question, then I always follow up and say, but let me tell you what it does to our industry partners. So I have to go to a CEO [Chief Executive Officer] and tell them, listen, I do not know what I am going to buy next year. I have not gotten my money yet, but I am hoping I will get it in the last half of this year. Then I am going to buy as many weapons as I can.

Senator PERDUE. But if I do not, we are going to interrupt the current plan.

General GOLDFEIN. That is right.

I cannot give you any projections of what the future looks like. So you need to keep this very sophisticated workforce occupied with this level of uncertainty. And so it goes directly.

So what I would offer to you, in addition to the Secretary's great points, is that the John McCain National Defense Act that you passed sent such a powerful signal to airmen, soldiers, sailors, and marines that you are behind them. It sent an equally powerful signal to industry that says you can now plan your future and manage your workforce to get us what we need.

Senator PERDUE. I will give you one more to send to them. This year, we did something we have not done in 22 years, and we did not get 100 percent, but we got to 90 percent funding by the end of August because we stayed here in August. You can tell your service people that we are on the wall that month. This is not something that is never going to be done again. We funded the military this year without a CR, and we know now what it is doing.

Speaking of that, I asked an F-22—I am sorry. I am past time.

Senator SULLIVAN. No. Go ahead.

Senator PERDUE. No. I will come back to that in the second round.

Senator SULLIVAN. It is a good question.

Senator PERDUE. No. I want to come back and brag on the State of Alaska.

Senator SULLIVAN. If you promise to stay for the second round.

Senator PERDUE. Yes, I will. Thank you. I am sorry.

Senator SULLIVAN. Well, I do want to mention that Senator Perdue and Senator Ernst have been leaders on this issue that he was just talking about. They are both on the special committee that

is going to hopefully fix our budget problems. We have made progress this year, and nobody benefits more than the military.

We will start here with round two, which I think is great.

I do want to just do a small correction for the record. General, I appreciated your opening statement. I will mention, though, even if one deploys, gets combat fit, gets imminent danger pay, there are combat vets—and I do not consider myself one particularly in the category of somebody like you. So I am just saying that for the record. I think it is important actually because we know who the real folks are, and I always want to keep that record straight.

Madam Secretary, I know you have been focused on the acquisition issues. Can you a little bit more unpack what you were talking about in your opening statement on this issue, 100 years to 56 years? I did not fully follow that. I know it is important. I know you have been really focused on it. Senator Perdue just asked a question. But what were you getting at there?

Secretary WILSON. Senator, we have a great team that we put together. Some of them are military, some civil servants, and of course, Will Roper who is our Assistant Secretary for Acquisition. They all got together 6 months ago now and they said, all right, what should be our goals. What should be some of the things we are trying to achieve to get things faster? One of them was to say let us look at all of our programs and try to strip 100 years out of our schedules by using the new authorities that you have given us, by trying to tailor our acquisition authorities so that we get things faster. Usually when you get them faster, they also cost less. Time is money. And so they are at 56 years so far and they have got another 6 months to go to keep stripping time out of schedules.

Senator SULLIVAN. When you went through that exercise, did you see any additional authorities that you think you need from us? Again, there is a lot of John McCain here in this hearing, but as you know, he was very focused on this issue. In the last few NDAAAs, we did give significant authorities back to the service secretaries and the chiefs to make things work. What else do you need?

Secretary WILSON. Senator, we are now in the point of execution, and I think we are trying to execute in a way that is fast and smart. Also, the other part that we said was we want to be even more transparent than we are with traditional acquisition so that we are fully open about what we are doing and what results we are getting.

I do think that there is tremendous promise in several of these, particularly prototyping. The reason why is that in traditional acquisition, you would come up with an analysis of alternatives, and you would be 3 or 4 years into this and all you really got are stacks of paper and studies. You really do not know what is technically possible yet.

If you prototype, you develop a real engineering technical understanding of what really is within the realm of the possible. We are using it for next generation engines. We got a competitive prototyping with two of the big engine manufacturers to develop an adaptive engine that gets 10 percent more thrust, 25 percent more fuel efficiency. They may not get quite there, but we have said build us something. See what you can get, and then it will inform

our requirements for a whole next generation of Air Force engines. We are the biggest buyer of fuel in the Defense Department. A 25 percent increase in fuel efficiency and a 10 percent increase in thrust—that is a game changer. And so we are just trying it.

Senator SULLIVAN. I want to go to the GAO study.

General GOLDFEIN. Sir, I just wanted to reemphasize the point, Senator Shaheen, you made. The other thing to your question is sequestration is still the law of the land. Just to make your point again, ma'am, we grounded the United States Air Force in 2013. We created no fly zones across the United States of America where we stopped flying. We still have not recovered. If that comes back, it will undermine and devastate all the good work that you did in the recent bill.

Senator SULLIVAN. I agree with Senator Shaheen on that certainly.

Let me go to the GAO study as it relates to the F-22's. Mr. Pendleton, there are a bunch of important aspects to that. That still is an incredible aircraft. The President talks about it a lot. It is a remarkable aircraft. Again, you cannot look back and kind of wring your hands, but that was probably a pretty significant mistake to curtail the production and deployment of that aircraft.

Can you summarize quickly your recommendation? It is my understanding that the Secretary and the Chief agree with those or that you have concurred in those. How are you looking to implement these recommendations that relate to the small fleet that is not maximized, the organization with regard to the Air Force, the mission, as you said? What can we do? This is still a tremendous fifth gen aircraft. You know, your work is important in this. Can you talk about that quickly? If there are any comments from the service Secretary or the Chief, I would welcome that too.

Mr. PENDLETON. Yes, sir. Thank you.

We have two major findings. We found that the organization of the small fleet could be suboptimal.

Senator SULLIVAN. Did you find that it is suboptimal?

Mr. PENDLETON. Yes.

Senator SULLIVAN. Not that it could be but it currently is?

Mr. PENDLETON. We think is suboptimal, yes.

Senator SULLIVAN. That is important.

Mr. PENDLETON. Locations with fewer squadrons, people, aircraft had lower mission capability rates than those with more. Again, this was an unclassified version of a classified report. So I am having to be a bit general about that.

We recommended that the Air Force take a look at the way they had the F-22 force organized. You can go a couple of ways. You can collocate more aircraft if you want to and get some efficiencies we think from that. You can also look at the way that you deploy packages from within the squadron. I mean, what was happening is the Air Force was breaking out a portion of the squadron and sending that forward, and it is basically leaving what is left broken as well. So you could augment that. We tried not to be too specific in the recommendation so the Air Force would have some room to maneuver on that.

The second had to do with the way the Air Force is utilizing the F-22. It is being used for a lot of missions that we do not think

contribute to its training for a high-end fight, things like alert and appearing in exercises, as I mentioned in my opening statement, that really do not give them much value. We think that needs to be relooked as well and made recommendations. The Air Force did concur with us, and I know from speaking to Secretary Wilson, they are thinking about this.

Senator SULLIVAN. So are you looking to implement these, General Goldfein or Secretary Wilson?

General GOLDFEIN. Yes, sir, we are. We are looking. It is interesting that when you go back to 2010, we retired 10 squadrons, 252 aircraft in 2010 based on a demand signal that shifted those resources into other areas, space, cyber, ISR [intelligence, surveillance, and reconnaissance], nuclear enterprise. Those were strategic trades that we had to make at the time if you remember what we were in in that time frame. But we did not take down any flags or we did not take down any squadrons. We just made all the squadrons smaller. We got to a point where we were and are less efficient than we can be with larger squadrons when it comes to achieving and meeting the demands of the National Defense Strategy.

So we are absolutely looking at not only the F-22 but all of our weapon systems to determine how can we get back up into that optimum solution. But we also understand that that is a discussion that we have to have with this committee and with the Congress before we do anything.

Senator SULLIVAN. Does that not help the maintainer issue as well if you consolidate some of the F-22's in terms of where they are located?

General GOLDFEIN. It does, and it is across the board. It is maintenance. It is the back shop maintenance. It is all those parts that you need to be able to project air power not only for the F-22, but for all the weapon systems.

But for us, i.e., in the Active Duty and in the Air National Guard and Reserves, what we found is that 24 assigned aircraft is the optimum solution to be able to do the National Defense Strategy business. Many of ours are now at the 18 number, and so we need to build those up to 24. We need to hit an optimum solution in the Guard and Reserve as well. So that is all part of our planning.

Senator SULLIVAN. Senator Shaheen?

Senator SHAHEEN. Thank you, Mr. Chairman.

DOD's final report in 2018 on organization management structure for the national security space components of the Department of Defense—I had to read it because it is such a long title. But it stated basically that space operations force will include space personnel from all Military Services, including Guard, Reserve, and civilians.

I wanted to ask you, Secretary Wilson, about the current role of the Air National Guard in the space domain. If you could elaborate on how you expect that role to evolve in the future.

Secretary WILSON. Senator, we have about 1,000 guardsmen and about 1,000 plus or minus reservists who are some part of a space mission. I think we are at a point where the Defense Department is looking at how do we organize this going forward. The President has initiated the process to establish a U.S. space force and put out

there a bold vision with respect to it. We all know that we can no longer use space as a function. It is a warfighting mission. So those discussions are ongoing.

I believe that it is important for the Guard—sometimes I think when we look at some of these issues, we forget the Guard and Reserve, and they are an important component of the total force and a particularly component of the United States Air Force. We want to make sure that that is in the conversation.

Senator SHAHEEN. I appreciate that. Certainly there has been some interest from our Air Guard in New Hampshire about what is going to happen in this arena. I know that in your September memo on the proposal to transition to a space force, you discussed the potential to transition National Guard units to a Reserve component. I assume there is more discussion going on on this.

Secretary WILSON. Senator, there is a lot of discussion going on. Our team may have misused the Reserve component to being both the Guard and the Reserve. So the intention, though, is to make sure that as we address the space force that we do not ignore the fact, while it is small, we do have components in the Guard and Reserve who are engaged in space.

Senator SHAHEEN. That is great. I appreciate that.

As I said, there has been a great deal of interest in New Hampshire on what is going to happen there. I am sure that is true of other States as well.

In terms of the number of squadrons, you have called for growing the Air Force from its current size to 386 squadrons by 2030. Under that plan, tanker squadrons would see significant growth. They would increase from 40 to 54 squadrons.

Can you talk about why you see this as being important?

Secretary WILSON. Senator, the analysis that we did was based on the National Defense Strategy, which sets out for us what do we need to do, what are the missions we need to accomplish, and then what are the most important operational problems.

But when you look at those missions, there are really five things we have to do at the same time. We have to defend the Homeland. We have to maintain a safe, secure, and effective nuclear deterrent. We have to be able to defeat a peer while also deterring a rogue state and then maintain pressure on violent extremist organizations at the same time. So it is all five of those things.

Currently, when we look at a peer threat, Russia is very strong. China is modernizing very rapidly. When we project into the 2025–2030 time frame, our pacing threat we believe is China. So the challenge in the Pacific is the tyranny of distance, and that means tanker squadrons are very important. So that I believe is what in the numerous iterations of modeling and simulation, the war games we did really drive the need for tankers.

Senator SHAHEEN. Well, I appreciate that especially with Pease being one of the bases that is going to get some of the new tankers.

Can you also talk about the interests that we have in making investments to protect that tanker force during a conflict? Because I know there has been some concern about what we need to do prospectively to make sure that we are doing that, should we have an adversary that we need to protect those tankers against.

Secretary WILSON. Senator, I would not want to go into too much detail in an open session. But the intention is for new tankers to be more defensible than their predecessors. I do not know if the Chief can go any further than that.

General GOLDFEIN. I would just say in the Joint Chiefs, you know, I give Chairman Dunford a lot of credit for leading the Joint Chiefs as we have been looking at global campaign plans. It has allowed us to move off a platform discussion into more of multi-domain operations that looks at a platform as part of a family of systems that all connect together. So the discussion then about how we would defend a tanker or any other part of the family is an integrated joint and allied solution going forward as opposed to the platform discussion which is I think more 20th Century than where we are headed.

Senator SHAHEEN. So, Mr. Chairman, is there any plan to have a classified follow-up hearing or briefing to this hearing so that we can learn more about some of the issues that have been raised?

Senator SULLIVAN. Absolutely. I think that is a great idea. We will do it.

Senator SHAHEEN. Good. That is great. Thank you.

Thank you very much.

Senator SHAHEEN. Senator Ernst?

Senator ERNST. Thank you, Mr. Chairman.

We have spent a lot of time talking about maintenance this morning, and I appreciate that very much. We all value our maintainers very much, and I know it is very different having maintainers in a transportation ground unit than having maintainers in your squadrons. But just really understanding how very important it is.

Secretary, in your written statement, you did reference some of the challenges that you are facing in regard to sustainment of weapon systems, of equipment, particularly with regard to the maintenance and the logistics. I was pleased to see that the Air Force does continue to look for ways to improve efficiency and cost effectiveness.

So again going back to the Emerging Threats and Capabilities, one of the things that we spend some time talking about is artificial intelligence. We do continue to hear about the potential benefits of AI [artificial intelligence] and machine learning on issues such as predictive maintenance. Is the Air Force currently utilizing these types of technologies, or do you think these emerging technologies present maybe a cost effective means of improving maintenance and logistics within the Air Force?

Secretary WILSON. Senator, a very good question. We are actually testing out what we call conditions-based maintenance plus, which involves both predictive analytics and also sensing on aircraft. We are trying them initially on the B-1 and the C-5, and we are seeing a significant reduction in cost but also about a 30 percent reduction in unscheduled maintenance. So this is you are predicting when a part is likely to fail and you change that part when it is in for its inspection rather than waiting for it to fail out on the flight line. We are now trying to develop the apps to move that and propagate it throughout the rest of the fleet.

We are also doing some other things with respect to driving down the costs. We set up an office—and we will give it a 2-year run and then take a look as to how much it saved us—called the Rapid Sustainment Office to try to use advanced manufacturing technologies, 3-D printing of metals, but also things like cold spray technology to repair parts rather than replace them.

Just as one example, there was a recent article about some of our airmen out in California who—we have a part that heats water on the back of the KC-10. The handle keeps breaking. They do not manufacture anymore because they only buy maybe five of them a year. They are pretty expensive to go back and have somebody tool it the old way. In fact, Defense Logistics Agency was quoting some completely unreasonable cost. And so we 3-D print them for 50 cents. So those kinds of things can drive down the cost.

Senator ERNST. Since you brought that up, I was out at Twentynine Palms earlier this year, and we had that discussion about 3-D printing of parts to make it readily available for our men and women that are out in the field. They are forward-deployed. The supply chain is not as easy in those types of environments.

Any thoughts then on patents? There is a lot of concern from industry that we will be able to replicate various parts, replacement parts, and not give full credit to the industries that have originally manufactured and designed those parts. Any thoughts on where we should be going in that space?

Secretary WILSON. Senator, we are trying to go to a place where we get the intellectual property or negotiate for a license to build things. Just in the first quarter of last year, we had 10,000 requests for parts where there was not a single bidder. You look at something like the C-5. It is not being produced anymore. The parts are not being produced anymore. So the door handle breaks on the back of a C-5 and you do not have a parts supplier. So we are 3-D printing those in metal.

We are also using technologies now—the Army, Navy, and Air Force are working together on advanced manufacturing. But the chafing on rivet holes on aircraft or on the hydraulics lines to be able to repair those by low temperature but high speed spraying of nanoparticles of metal to basically repair the metal rather than replace the part. It is much less expensive and keeps our mission capable rates higher.

The Rapid Sustainment Office is intended to use these technologies, rapidly get them into the field onto our aircraft, and reduce the costs and increase our mission capable rates.

Senator ERNST. I love that. Incredible cost savings and innovation and to be able to do it right on the spot too, very good. Thank you very much.

Senator SULLIVAN. Senator Perdue?

Senator PERDUE. Following up on that, I want to applaud what you guys are doing in shared services. Back in the 1980s, manufacturers in the commercial space did this where they can have multiple divisions. You have a technical specialty. You develop that specialty. Before, every one of the divisions would have that. They would protect it. They were jealous of it. We took it away, created shared services. When you are doing C-130J maintenance at an

Air Force base for the Navy, I applaud that. I think that is a way for the future.

I want to move on. With 3-D printing, the Marines right now are doing a great job, and their depots are doing the same sort of thing. The supply chain is gone. Nobody is making the part. 3-D printing—they are really gearing that up. I would encourage the Air Force to partner with your sister services to make sure that we are at the cutting edge of that.

Chief, I have a question.

I would second Senator Shaheen's comment about a classified briefing on the same topic.

Chief, you may want to take this off, but hypersonics and directed energy. I know you guys are working on that. General Hyten gave us an update earlier this year about what the Air Force is now seeing that our near-peer competitors are doing. Can you give us an update on that development on those two areas?

General GOLDFEIN. Yes, sir. Probably the most important development has been a discussion that the three service secretaries have had about how we partner together on areas like hypersonics and directed energy. And so what I want to do is maybe, ma'am, turn it over to you and then I will follow up at the end if you like.

Secretary WILSON. Senator, the three service secretaries—we get together. We actually like each other and get together for breakfast every 2 weeks. It terrifies the staff.

One of our early meetings looked at where do we have science and technology investments that are similar and can we work together better. One of the first ones we identified was hypersonics. We got our teams together. We rapidly developed a memorandum of understanding where we will take best technology, go fast, share results, and work together. As a result, on hypersonics, the additional funding you allowed us to put in in 2017 and 2018 is about \$107 million in additional funding, but by using a Navy-developed warhead for the Army and putting it on an Air Force system, we are actually going to prototype a system 5 years faster and get it out there in 2021.

Senator PERDUE. Is that a defensive—

Secretary WILSON. It is called Hacksaw. It is an offensive weapon.

Senator PERDUE. With regard to the F-22 that we talked about earlier, I had a privilege to visit an advance squadron up in Alaska. The colonel gave us an update about how CRs directly impact them. They had training going on. They had to interrupt it, bring them back, and they had it documented down to the cents how much it cost them.

But we talked about the use of the F-22, and you mentioned it in your opening comment that we are using F-22's, our fifth gen, to chase Tu-95's around up there on the line of demarcation. I know, Secretary, you guys are talking about a light attack aircraft I believe that you are developing now to take on some of these more mundane tasks and use the fifth gen for mainly training to do what you mentioned in your opening remarks. Can you update us on the light attack program?

General GOLDFEIN. So we completed two experiments in the light attack. The second line of effort in the National Defense Strategy

talks about strengthening our allies and partnerships because when it comes to global competition and war, we have allies and our adversaries generally do not, and it is a strategic advantage. So we as a service, when we looked at from the air component standpoint how can we leverage our ability because what I hear very often from my international air chiefs, especially those that are not into the fourth or fifth generation—either they cannot afford it or not getting into it. But yet, they have violence within their borders. The strategy is to drive violence down the point where it can be handled within the sovereign territory.

The light attack experiment was primarily about line of effort two and allies and partners and how can we produce a commercial off-the-shelf that is a low-end system that is very affordable, that has low costs when it comes to sustainment, and that can help our allies and partners. What we have learned in the past is that if we do not buy some, they will not. And so as we look at it internal to our Air Force—the Marines are looking at this as well. This a joint effort going forward. This is an opportunity for us to actually spread our coalition, if you will, to be able to get at the strategy and line of effort number two.

Within the Air Force, we are also looking at it to the point—exactly what you described, which is can I now go after those lower-end missions with a tailored commercial off-the-shelf kind of product that will then free the high-end assets to focus on the training and execution of the high-end work we need to do.

Senator PERDUE. Thank you.

Senator SULLIVAN. We have Senator Kaine here, and I am glad he made it back on time. It is an important hearing and I appreciate you being here.

I am scheduled to go preside right at 11:00. So I am going to have either one of my colleagues on the Republican side or Senator Kaine take over the hearing.

I do want to thank the witnesses again for this very important hearing. There will be QFRs [Questions for the Record]. If we can get those back in a timely manner. I think Senator Shaheen's idea, which we all support, on a classified version of this hearing, respecting your time, Madam Secretary and General Goldfein, I think that would be a good follow-up.

So I am going to pass the gavel to one of my colleagues here. I will let them fight over it. But again, I want to thank all of you. I would normally be here, but the presiding officer duty is something I am not supposed to be late for and I think I am already late. So thank you very much.

Senator KAINE [presiding]. I will just be very brief. I apologize for missing. I was introducing a noncontroversial nominee at a Judiciary Committee hearing. But just because my nominee was not controversial, that did not mean that there were not other controversies that I was unaware of when I walked into the room. So that is why I am a little bit late, and I do not want to belabor points that have been asked.

Let me just ask this. I indicated in my opening comment that I am worried about how we are planning on the readiness side with respect to infrastructure. I cited the Air Force example. I could have cited other examples, the Navy base in Richmond whose main

road in and out to the center of naval power in the world is increasingly under water just based on normal tidal action, not even to extreme weather events.

Perhaps if you could each kind of talk about in the Air Force portfolio—I used the example of permafrost melting at the one base and how that changes MILCON—how you are dealing with some of these weather-related effects, extreme weather events, whatever the cause, as you are thinking about MILCON projects going forward. If you would each address that, that will be my only question.

Secretary WILSON. Well, Senator, with a hurricane headed for Eglin and Tyndall today, we are dealing with those things.

Let me take the broader issue about infrastructure because we did what I thought was a good piece of work, stewarded by our Assistant Secretary for Installations and Environment, John Henderson, but done by a group of captains initially that said we now have data on all of the infrastructure in the Air Force, every installation, every building on it down to when the roof needs to be replaced. They did some modeling and simulation on it, on how we can change the way we maintain our infrastructure, and they made some recommendations.

One is we have been funding the worst infrastructure first. So we wait until it gets really expensive to fix, and then we fix it. That is the wrong strategy. So we need to fix it like most commercial industry does, before it gets to be really expensive.

The second is they recommended taking the 5 percent of our worst infrastructure off the books. So the stuff that is hanging around from the Korean War that we should not be maintaining anymore. And so we actually are going to be putting some money for destruction and disablement into our budget.

The third is we are going to have to tick up our replacement value, our funding of our infrastructure a bit over the long term. But if we do those things over the long term, our infrastructure gets much better over time and we are able to keep the infrastructure in much better shape.

So they have given us a strategy. We have the modeling and simulation of our facilities which tells us.

The final thing that we also are doing is every facility will have a master plan. Our commanders change too quickly to have just what the commander wants now because those projects are always in the future. So we have a master plan for every facility, and we will continue to execute projects on that master plan.

So there are a number of things that we are doing to improve the management of our infrastructure and planning associated with it.

Senator KAINE. Do other witnesses have comments to add on this question? General?

General GOLDFEIN. Sir, just one comment to add to the Secretary's. We also, as a land-based force, project power, of course, from our bases. So we need to be the best in the world at defending those bases. And so the Secretary and I have a really concerted effort over the course of this year looking at integrated base defense in addition to the investment we are making in MILCON projects

because not only do we have to invest in it and build it, we also have to defend it. That is central to who we are.

Senator KAINE. Thank you.

Mr. Pendleton, I have one last question for you. You testified before the SASC [Senate Armed Services Committee] last year on the tragic Navy collisions and analyzing what was at fault there and what we could do better.

Are there parallels in the work that you did on those after-action analyses and things that we should be focused on with respect to the Air Force, you know, aviation mishaps, gaps in training? Are there things that you learned in that capacity that we should apply to the Air Force as well?

Mr. PENDLETON. There are parallels, but I think that what happened with the Navy is the situation in Japan just got away from them. We had warned a couple years before, as you recall probably from my testimony, that they needed to take a look at the risk they were taking out there, and they did not listen to us. And so I am not seeing it with the Air Force.

But now having said that, there are parallels, shortfalls of people, shortfalls of maintainers, running equipment hard, having it take longer to fix when you bring it in, and too little time to train. I mean, that was one of the big problems with the Navy, as I am sure you recall. They were working so hard, they did not have time to train on things as basic as seamanship.

Like the Navy, also the Air Force has a demand problem, sir. I mean, the demands on it have continued to remain high, and like I said during the Navy hearing, I think it is going to be difficult for them to rebuild unless some of the demands are moderated.

Senator KAINE. Thank you.

Do my other colleagues have any additional questions?

Well, with that, we really appreciate your testimony. We will keep the record open until 5 o'clock tomorrow, Thursday, in case any colleagues have additional questions for you that they can direct your way. We would appreciate your prompt response.

But with that, the hearing is adjourned.

[Whereupon, at 11:03 a.m., the subcommittee was adjourned.]

[Questions for the record with answers supplied follow:]

#### QUESTIONS SUBMITTED BY SENATOR DAN SULLIVAN

##### MISSION CAPABLE RATES AND THE SECRETARY OF DEFENSE GOALS

1. Senator SULLIVAN. Secretary Wilson, how, if at all, are Air Force mission capable rates unique to the Air Force and different from how other services, such as the Navy, calculate it? How are Air Force mission capable rates different from aircraft availability rates?

Secretary WILSON. The Office of the Secretary of Defense for Personnel and Readiness coordinated with the Air Force, Navy and Marine Corps to come up with a standardized method of calculating and reporting mission capable rates to achieve the Secretary of Defense's goals. This standardized method will ensure that all services are held to the same standard and report comparable rates. The Air Force will report progress towards achieving 80 percent mission capability to the Secretary of Defense and Deputy Secretary of Defense on a monthly basis beginning in November.

Mission Capable rate and Aircraft Availability rate differ with respect to the sample size they measure. The Mission Capable rate measures the number of Primary Mission Aircraft Inventory (commonly referred to as "combat coded") aircraft that are mission capable and physically possessed by a unit. Mission Capable rate ex-

cludes those aircraft undergoing depot-level maintenance. The Aircraft Availability rate measures the mission capability of the entire fleet, including those assets designated towards training and test missions. As Aircraft Availability is an enterprise view of the entire fleet, it includes those aircraft undergoing depot-level maintenance in its calculation.

While these measures are important, mission capable rates for aircraft are only one component of readiness. The Air Force is focused on improving the readiness at our operational squadrons to 80 percent C1 or C2.

2. Senator SULLIVAN. Secretary Wilson, the Secretary of Defense directed the Air Force to achieve a minimum of 80 percent mission capable rates for fiscal year 2019 for the F-35, F-22, and F-16, while simultaneously reducing these platforms' operating and maintenance costs every year starting in fiscal year 2019. What are the current Mission Capable and Aircraft Availability rates for the Air Force platforms identified by the Secretary of Defense?

Secretary WILSON. Current mission capable and aircraft availability rates as of the end of fiscal year 2018 are as follows. Rates are for period 1 October 2017 to 30 September 2018.

F-16 C/D: Mission Capability (Combat units only)—70%  
 F-16 C/D: Aircraft Availability—62%  
 F-22A: Mission Capability (Combat units only)—55%  
 F-22A: Aircraft Availability—46%  
 F-35A: Mission Capability (Combat units only)—72%  
 F-35A: Aircraft Availability—69%

3. Senator SULLIVAN. Secretary Wilson, how does the Air Force interpret the Secretary's 80 percent mission capable rate goal—will the Air Force be assessing Mission Capable rates or Aircraft Availability rates against the Secretary's goals and will the Air Force be assessing the entire squadron or just the lead force packages (lead UTCs)?

Secretary WILSON. The Office of the Secretary of Defense for Personnel and Readiness in coordination with the Air Force, Navy and Marine Corps developed a standardized method of calculating and reporting mission capable rates to achieve the Secretary of Defense's goals. This standardized method will ensure that all services are held to the same standard and report comparable rates. That rate, as directed by the Secretary of Defense will be the mission capable rate.

The rate will be measured as it applies to the entirety of the combat coded units, not only the lead force packages within those units.

F-35

4. Senator SULLIVAN. Secretary Wilson, what specific actions is the Air Force taking in coordination with the F-35 Joint Program Office to achieve the Secretary's 80 percent mission capable goal for the F-35 by fiscal year 2019 and beyond?

Secretary WILSON. The Air Force is accelerating depot repair capability, decreasing component repair backlog and increasing spares availability. These actions contribute to a 7.7 percent gain in the F-35 Mission Capability rate at no additional cost beyond what the Joint Program Office has already programmed and received from the Services. The Air Force is the lead service driving delegation of maintenance authorities to the unit level to allow flightline maintainers to quickly affect repairs and return aircraft to Mission Capable status.

5. Senator SULLIVAN. Secretary Wilson, is the goal achievable?

Secretary WILSON. The goal is achievable if the reprogramming of funds in fiscal year 2019 is approved.

6. Senator SULLIVAN. Secretary Wilson, what actions is the Air Force taking to prioritize readiness for operational F-35 units, as Secretary Wilson stated at the hearing?

Secretary WILSON. Our operational fighter units already have the highest priority in our inventory. We will continue to advocate to the Joint Program Office for the following: 1) delegation of additional maintenance authorities to unit level commanders, 2) reduction in depot repair cycle time for components, 3) and improvement in supply chain performance. We will strongly promote contract language that meets the readiness needs of the Air Force. We will balance our operational tempo across all platforms to ensure our operational units are leading the fleet.

7. Senator SULLIVAN. Secretary Wilson, to what extent have the challenges associated with the F-35's Autonomic Logistics Information System (ALIS) affected Air Force fleet readiness?

Secretary WILSON. Work arounds, engineering response delays, supply visibility, and data integrity continue to burden the men and women who sustain the F-35 in the U.S. Air Force. ALIS data integrity issues consistently rank in the top 10 of all Air Vehicle Availability drivers. Our outstanding airmen continue to find manual ways to work around system inefficiencies, with impacts on readiness levels.

The Air Force is also working closely with Lockheed-Martin and the Joint Program Office on a project to accelerate software improvements with the ALIS system.

8. Senator SULLIVAN. Secretary Wilson, what specific measures are being taken to enhance ALIS' predictive maintenance capabilities?

Secretary WILSON. We are pursuing improvements to ALIS through an agile software development process. The Air Force is particularly interested in improvements on Prognostic Health Management (PHM) to bring the full potential of this weapon system to the warfighter. The Air Force is a voting member on the PHM Steering Board and will continue to ensure that warfighter enhancements are prioritized.

9. Senator SULLIVAN. Secretary Wilson and General Goldfein, have you thought about using early-production F-35s—planes that will never be combat-coded—for adversary air to provide the “high-low” mix (5th Gen and 4th Gen) that our adversaries will soon have?

Secretary WILSON and General GOLDFEIN. Based on the Fiscal Year 2019 President's Budget (Current Program of Record) we have not made plans to use early production F-35s for adversary air. As F-35 production continues and the Air Force F-35 fleet capacity grows, we will continue to evaluate options to improve our training capabilities.

10. Senator SULLIVAN. Secretary Wilson and General Goldfein, what are the plans to bring some of those F-35s to JPARC and the 18th Aggressors, and not just Nellis AFB?

Secretary WILSON and General GOLDFEIN. Currently, two combat-coded F-35 squadrons will base at Eielson AFB and receive aircraft starting in 2020 and completing in 2022. No F-35s are currently planned for the 18 AGRS. We will continue to evaluate a potential need for 5th Gen aggressors at JPARC and the best method to meet that need.

#### F-22 TRAINING AND ORGANIZATION

11. Senator SULLIVAN. Secretary Wilson, GAO's report on the F-22 noted that an Air Force analysis conducted in 2016 determined that, based on current aircraft availability rates, pilots in an F-22 squadron with 21 primary mission aircraft need 270 days of home station training each year to meet their minimum annual continuation training requirements. However, F-22 pilots were on average falling far short of this mark and had a larger training deficit than F-15E and F-16 pilots. The Air Force concurred with GAO's F-22 recommendation to identify and assess actions to increase F-22 pilot training opportunities for the high-end air superiority missions, including looking at adversary air support options and reducing tasking and non-core missions. During the hearing, the Air Force stated it was taking actions to implement GAO's recommendations. What actions has the Air Force taken to address GAO's recommendation?

Secretary WILSON. Commander Air Combat Command (COMACC) is proactively addressing the most advantageous use of F-22 for high-end training/readiness opportunities and exercises that maximize: 5th generation capabilities, opportunities to meet the Ready Aircrew Program (RAP), and minimizes using the F-22 where it does not increase readiness for pacing threats. Air Combat Command (ACC) and HQ USAF have proposed adversary air support options in the Department of Defense budget process starting in fiscal year 2019 and continuing across the Future Years Defense Plan (FYDP). Currently the F-22 pipeline production & and absorption are healthy and meeting requirements.

Hurricane Michael will affect short term F-22 pilot qualifications, with Units to be located at Eglin AFB, Florida, with reachback to Tyndall AFB:

- The 43rd and 2nd Fighter Squadrons' F-22 Fighter Training and T-38 Adversary Training Units will relocate operations to Eglin AFB. Academic and simulator facilities at Tyndall AFB will be used to support training requirements, as well as Tyndall AFB's surviving low observable maintenance facilities
- The 372nd Training Squadron, Detachment 4, will relocate with the F-22 Fighter Training Units to Eglin AFB.

Decisions in response to Hurricane Michael consider the recommendations of the GAO 18-190 report, to optimize the F-22 fleet across the total force.

12. Senator SULLIVAN. Secretary Wilson, understanding that the 270 days needed for annual training is based partially on aircraft availability, please provide data on the training days required and achieved for F-22 pilots in 2018 and projected for 2019. To what extent are things getting better or worse and what are the contributing factors?

Secretary WILSON. Overall the F-22 is trending positive. The F-22 is not unique in needing a wide variety of training, however 5th generation aircraft do have specialized training requirements. In context the original 270 required training days was the result of a 2016 Air Combat Command (ACC) study to identify F-22 training shortfalls unique to that fiscal year; this study was cited in GAO 18-190.

ACC closely looked at ways to improve F-22 training efficiency and began implementing scheduling changes in fiscal year 2018. ACC implemented several initiatives including an increased F-22 fleet wide coordination to prioritize high-end training events, reexamination of deploy-to-dwell ratio for F-22 to retain higher readiness, and individual units prioritizing their training focus based on National Defense Strategy (NDS) pacing threats and planned deployment scheduling. These collectively increased scheduling efficiencies to “buy back” home station training days for increased operations and maintenance sortie generation. The result has been an approximate 10 percent reduction in required F-22 training days for Ready Aircrew Program (RAP) specifically. However, fiscal year 2018 analysis from ACC is incomplete for specific impacts.

For fiscal year 2019 ACC estimates 250 training days required for F-22 [using static assumptions and deploy-to-dwell timing] combat coded squadron’s RAP. However, ACC’s implementation of Dynamic Force Employment (DFE) concepts for the F-22 fleet includes factors such as: continued refinement of scheduling efficiencies prioritized for high-end 5th generation readiness including low observable maintenance, how the F-22 forces are packaged and deployed, as well as flying hour program adjustments and weapon system sustainment to improve readiness. Combined, the expectation is that these efforts continue to decrease required training days in and beyond fiscal year 2019, and increase aircraft availability resulting in increased F-22 readiness across the total force.

13. Senator SULLIVAN. Secretary Wilson, the Air Force concurred with GAO’s F-22 recommendation to identify and assess alternative approaches to organizing F-22 squadrons, including looking at options to consolidate the fleet and revising the design of deployable units. During the hearing, the Air Force stated it was taking actions to implement GAO’s recommendations. What actions has the Air Force taken to address GAO’s recommendation?

Secretary WILSON. The Air Force is assessing if changes to the F-22 home station organizational structure and/or deployment practices would better meet global combatant commander requirements. The Air Force was already assessing deployment practices to meet NDS implementation guidance related to employing our forces more dynamically. Additionally, as part of our effort to build the Air Force We Need to meet the NDS challenges—we are assessing optimal force structure and new force designs pertaining to squadron composition of not only our fifth-generation fleet, but all operational squadrons.

#### JPARC

14. Senator SULLIVAN. Secretary Wilson and General Goldfein, what specific plans do you have to start executing elements of the JPARC 2025 to help modernize the Joint Pacific Alaska Range Complex?

Secretary WILSON and General GOLDFEIN. JPARC will be one of two level 4 ranges in the Air Force. This includes adding advanced threat systems in the near term. Longer term spending includes the procurement and fielding of electronic warfare capabilities and a Live Mission Operations Capability (LMOC).

15. Senator SULLIVAN. Secretary Wilson and General Goldfein, what elements are included in this year’s upcoming budget and FYDP?

Secretary WILSON and General GOLDFEIN. The Air Force is proposing to buy the Advanced Radar Threat System family of systems and infrastructure upgrades to create the fidelity and density necessary to better train our airmen, to include 5th Generation platforms. To replicate tasks associated with the Range of Military Operations requires a holistic plan combining live, synthetic, and blended capabilities. The specific details associated with key investments will be available after the President’s Fiscal Year 2020 budget submission.

16. Senator SULLIVAN. General Goldfein, how do you see ranges such as the Joint Pacific Alaska Range Complex (JPARC) contributing to the Air Force's current and future readiness?

General GOLDFEIN. JPARC contributes to improving the Air Force's current and future readiness through its large airspace, relevant training environment, and the ability to bring joint forces together to train in some of the most advanced threat training environments available.

#### ADVERSARY AIR

17. Senator SULLIVAN. Secretary Wilson and General Goldfein, while the Air Force has chosen to invest hundreds of millions today and even billions in "contract" adversary air—which really only replicate a 3rd Generation threat—what is the USAF doing to ensure that the two USAF Aggressor squadrons of F-16s have necessary upgrades to remain at the level of our near-peer adversaries?

Secretary WILSON and General GOLDFEIN. The Adversary Air training services contract requirement includes 5th Generation performance across three performance categories. Additionally, the F-16 Aggressor aircraft are currently undergoing core avionics improvements; including software upgrades, addition of secure voice and data capability, and SATCOM functionality. These improvements provide a foundation that would allow possible follow-on capability for Active Electronically Scanned Array (AESA) Radars and Hybrid Optically based Inertial Tracker (HOBIT)—all designed to increase F-16 Aggressor pilot situational awareness and targeting capabilities to remain at the level of our adversaries.

#### KC-46

18. Senator SULLIVAN. Secretary Wilson and General Goldfein, can you provide an update on the OCONUS basing of the KC-46A? When can we expect the next strategic basing process to begin and what locations will be considered?

Secretary WILSON and General GOLDFEIN. The Air Force initiates strategic basing decisions five years in advance of the first aircraft delivery. The first aircraft deliveries for the fifth KC-46A main operating base are scheduled for fiscal year 2024. Therefore, we expect to start the strategic basing process in fiscal year 2019.

#### TRAINING RANGES AND INFRASTRUCTURE

19. Senator SULLIVAN. General Goldfein, specifically, given the large-scale air and land exercises recently conducted by our adversaries, do we have the range and air space available to conduct similar exercises within the U.S. Armed Forces?

General GOLDFEIN. We have ranges available to train in a focused way to improve and exercise joint interoperability employment objectives and do not focus on "Show of Force" exercises that our adversaries typically conduct. However, we are limited in our ability to expand due to urban sprawl, endangered species habitats, renewable energy development and competition with industry for airspace and spectrum.

20. Senator SULLIVAN. General Goldfein, is there current range and air space infrastructure sufficient to meet the training needs and required readiness of the Air Force?

General GOLDFEIN. The capabilities of our newer weapon systems have outgrown our legacy range and airspace structure. We are addressing this shortfall through improving the JPARC and targeted expansion of the Nevada Test and Training Range (NTTR). Regarding expansion of the NTTR, the Final Legislative Environmental Impact Statement for renewal of its withdrawal from the public domain (released to the public on 26 October 2018) identified as part of the preferred alternative three proposed expansions of the range totaling approximately 300,000 acres—alternatives 3A-1 (15,314 acres), 3B (56,501 acres), and 3C (227,027 acres)—to increase or enhance both major combat operations and irregular warfare test and training as well as increase the operational security and safety of the range. The Air Force's preferred alternative also includes the proposal to make the renewal and expansion (300,000 acres) withdrawals from the public domain indefinite (Alternative 4C), meaning the withdrawal would not expire for the foreseeable future. We also realize that we must build a robust synthetic environment that will facilitate high-end training.

21. Senator SULLIVAN. General Goldfein, what, if any, concerns do you have about infringement on existing ranges or the ability to expand ranges, if necessary in the future?

General GOLDFEIN. The ability to expand ranges and airspace is part of our plan, but is a multi-year process and presents the most concern to meet training objectives for 5th generation aircraft. Although encroachment is a continual challenge, we work with our interagency partners at FAA, Department of Interior, Bureau of Land Management, Dept. of Fish and Wildlife as well as state and local officials in order to limit or mitigate the effects.

## ACQUISITION REFORM

22. Senator SULLIVAN. Secretary Wilson, over the past year you and Gen. Goldfein have talked a great deal about speeding up the acquisition process and delivering improved capabilities to the warfighter faster. Would you please give us some specific examples of how you have used the acquisition authorities provided in the fiscal year 2017 NDAA to deliver more capability faster?

Secretary WILSON. Section 847 of the fiscal year 2017 NDAA, Revisions to Definition of Major Defense Acquisition Program, removes the statutory definition of MDAP for “an acquisition program or project that is carried out using the rapid fielding or rapid prototyping acquisition pathway under section 804 of the National Defense Authorization Act for Fiscal Year 2016 (Public Law 114–92; 10 U.S.C. 2302 note).”

The Air Force uses this authority to develop and execute acquisition strategies that speed acquisition timelines, providing capability to our warfighters more quickly. Recent programs that have been approved to execute using section 804 of the fiscal year 2016 NDAA and section 847 of the 2017 NDAA are:

Protected Tactical Enterprise Service, which will reach Initial Operating Capability 18 months quicker than under a traditional acquisition program. Unified Platform, which will reach Initial Operating Capability 3½ years sooner than it would executing under a traditional approach. Additionally, the F–22 Agile Prototype Program will achieve the Initial Fleet Release milestone 2 years sooner than it had planned by tailoring the Department of Defense Instruction under the 5000.02 process.

23. Senator SULLIVAN. Secretary Wilson, where do you still see challenges?

Secretary WILSON. We are continuing to push decision-making to the lowest levels and reduce bureaucracy in order to speed capability to the warfighter. OSD recently issued interim guidance for rapid prototyping and rapid fielding under fiscal year 2016 NDAA section 804 Middle Tier of Acquisition (MTA). As the Air Force discusses the interim governance implementation with OSD, we will continue with innovative execution utilizing the appropriate MTA authorities. Among other things, the guidance would establish OSD veto authority over Service transparency into section 804 programs. As the Air Force discusses the interim governance implementation with OSD, we will continue with innovative execution utilizing the appropriate MTA authorities.

24. Senator SULLIVAN. Secretary Wilson, what additional authorities do you need?

Secretary WILSON. We appreciate your continued support of our legislative requests. We have developed two space acquisition legislative proposals that are currently under consideration for submission as part of the Department of Defense fiscal year 2020 legislative program. With respect to general acquisition authorities, at this time we believe we have all the Congressional authorities we need to address faster and smarter acquisitions and are looking forward to the implementation and results from authorities like sections 804 and 847. As we gain experience with implementation of section 804, we will keep you informed of any additional legislation needed.

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 QUESTIONS SUBMITTED BY SENATOR DEB FISCHER

## MISSION CAPABLE RATES

25. Senator FISCHER. General Goldfein, recently, Secretary Mattis issued memo guidance to increase mission capable rates for tactical aircraft throughout the Air Force and Navy. Other large aerial platforms which serve a non-combat role, such as ISR and airborne early warning platforms, are just as critical. Unfortunately, many of these platforms are several decades old and as such suffer variable mission capable rates. What plans are in place to increase mission capable rates for the Air Force's other airframes, and what efforts at improvement are being made currently?

General GOLDFEIN. The Air Force is working multiple efforts to improve mission capability of our aging legacy platforms. We are nearly complete with the annual

update of our aircraft availability improvement programs. These integrated plans, approved by stakeholders, present senior leaders with options to best align resources to achieve readiness goals and targets. Future plans include increased sustaining engineering, as well as aggressively pursuing emerging technologies and commercial best practices such as condition based maintenance, theory of constraints, additive manufacturing and more.

#### MAINTENANCE INVESTMENT

26. Senator FISCHER. General Goldfein, recently, the GAO examined the operating costs inherent with aging Air Force Aircraft, finding a relationship between investment in maintenance and sustainment and the rate at which airframes and components break down. What efforts are being made to address the unique maintenance issues linked with the Air Force's older platforms?

General GOLDFEIN. The Air Force is taking a variety of actions to address the unique maintenance issues associated with our aging aircraft. The particular efforts are tailored to the specific challenges posed by the weapon systems, but in general our efforts include:

- Incorporating cutting edge technologies into our organic depot facilities to improve performance and reduce maintenance times.
- Optimizing programmed maintenance and planned modifications to ensure the impact on availability is minimized.
- Incorporating enhanced corrosion inspection and repairs into heavy maintenance activities.
- Implementing service life extension programs that enable the maintenance and reengineering of parts that had not been planned for repair.
- Leveraging direct hire authority to hire skilled employees for critical maintenance positions.

#### GROWTH IN ISR

27. Senator FISCHER. Secretary Wilson, the Air Force's plan to grow its squadrons to 386 is an ambitious one and showcases the changing geopolitical climate we must operate and succeed in. ISR was singled out for particular growth under this plan—according to this vision for Air Force expansion, what will be done with older but still critical large manned ISR platforms such as the C-135 family of aircraft (to include planes like the RC-135)? Will these be replaced, will their numbers be expanded, or is there some other strategy in place for growing Air Force ISR?

Secretary WILSON. The RC-135 family of aircraft will continue to operate through at least 2040–2050 with a possible expectation of an analysis of alternatives sometime in the late 2020's or early 2030's.

#### INDUSTRIAL BASE SUPPORT

28. Senator FISCHER. Secretary Wilson, to what degree do you assess the current industrial base capacity can support the effort to reach 386 squadrons? What are some areas of manufacturing shortfall or supply chain problems that could prevent such a goal from being achieved, and how might these be overcome?

Secretary WILSON. On July 21, 2017, President Donald J. Trump issued Executive Order (EO) 13806 on Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States. EO 13806 directed the Secretary of Defense to perform a whole-of-government assessment of the manufacturing and defense industrial base and assess risk, identify impacts, and propose mitigations. We participated in the assessment and identified multiple industrial base challenges, including dependency on foreign sources, single and/or sole sources of supply, suppliers' financial fragility, capacity limitations, and others.

The Department created a classified action plan that includes recommendations designed to mitigate the most critical industrial base impacts identified during the assessment. The AF, in conjunction with the DOD Office of Industrial Policy and other government stakeholders, is currently working on the implementation of the action plan, including updates on identified risks and appropriate mitigations. We are also identifying the right programs and tools available to mitigate risks. Programs like the Defense Production Act Title III, Manufacturing Technology, and Industrial Base Analysis & Sustainment will help us address critical manufacturing bottlenecks, support fragile suppliers, reduce foreign dependency, and mitigate single points-of-failure.

## CONDITIONS BASED MAINTENANCE

29. Senator FISCHER. General Goldfein, how is the new Conditions Based Maintenance construct being applied to legacy airframes with higher end service hours, such as iterations of the C-135 platform, and what changes (if any) has this produced in mission capable rates?

General GOLDFEIN. The Conditions Based Maintenance construct, Reliability Centered Maintenance, and predictive analytics form a culture that seeks to perform maintenance based on evidence of need provided through aircraft sensor data analysis, system mode-failure analysis and other enabling processes and technologies. This allows us to know when a part is going to fail beforehand, which then provides us the opportunity to change the part at a time and place of our choosing while optimizing the supply system to be prepared for that maintenance action. As such, it has the potential for huge gains in both readiness and cost-effectiveness.

As many of our legacy aircraft lack the onboard sensors required to accomplish real time fault reporting, we must prioritize which aircraft we equip with sensor capability to utilize Condition Based Maintenance to its fullest extent. Those without sensor capability utilize Reliability Centered Maintenance or other predictive analysis models to reduce maintenance downtime. We have test programs ongoing for the B-1 and C-5 and expect to see initial results by the end of fiscal year 2019. We also plan initial fielding for the KC-135 in March 2019.

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 QUESTIONS SUBMITTED BY SENATOR DAVID PERDUE

## JSTARS SUSTAINMENT STRATEGIES

30. Senator PERDUE. Secretary Wilson, a GAO report published last month concluded that the JSTARS platform faces maintenance issues because of poor depot maintenance. Currently, the contractor utilizes a commercial-based maintenance plan, which does not focus on long-term structural issues that require inspection and maintenance, instead of a military-based plan. Maintenance costs also almost doubled between fiscal year 2011 and fiscal year 2016 due to increases in contractor logistics support. The 2019 NDAA requires a report to be submitted that conducts a cost benefit analysis for conducting organic depot maintenance at Robins Air Force Base versus conducting contracted, non-organic depot maintenance. Even though there has been just one test aircraft, can you speak to the benefits realized thus far with organic depot on the JSTARS aircraft?

Secretary WILSON. The Air Force expects to achieve cost and schedule efficiencies during the ongoing organic depot level maintenance pilot program at Robins AFB, GA. The Air Force anticipates reducing time spent in programmed depot maintenance (PDM) from an average of 439 days (based on the last 5 PDM deliveries) to 300 days. The final cost and schedule efficiency achieved will be available for release 90 days after completion of the organic depot level maintenance pilot. The Air Force will provide an update briefing to the Congressional Defense Committees on the progress of organic depot maintenance.

31. Senator PERDUE. Secretary Wilson, what cost savings have you found with organic depot maintenance on the JSTARS test aircraft?

Secretary WILSON. Based on the on-going organic depot maintenance pilot, the Air Force anticipates substantial cost savings over contractor depot maintenance. The final cost savings achieved will be available for release 90 days after completion of the organic depot level maintenance pilot. The Air Force will provide an update briefing to the Congressional Defense Committees on the progress of organic depot.

32. Senator PERDUE. Secretary Wilson, has the Air force begun the cost benefit analysis required in the NDAA to compare organic with contracted maintenance?

Secretary WILSON. Yes, the Air Force began the cost benefit analysis to compare organic and contracted maintenance for the JSTARS fleet. We are currently collecting actual cost and schedule data from the first aircraft inducted into the organic depot maintenance pilot (aircraft inducted on 16 July 2018) in order to inform this analysis.

33. Senator PERDUE. Secretary Wilson, when will the aforementioned study be published?

Secretary WILSON. The Air Force anticipates the full cost benefit analysis from the organic depot maintenance pilot will be available by January 2020. We will provide an update briefing to the Congressional Defense Committees as information is available.

34. Senator PERDUE. Secretary Wilson, while the Air Force has done well with ensuring their Life Cycle Management Plans for all of their platforms are updated every 5 years, various changes to the estimated service life of the JSTARS platform and the prohibition on retirement of any aircraft require special attention be given to the aircraft. What is the progress of reviewing new and different sustainment strategies for the JSTARS aircraft?

Secretary WILSON. The Air Force is still assessing what updates are required for JSTARS sustainment strategy. Information obtained from the organic depot maintenance pilot will be paramount in informing this decision.

35. Senator PERDUE. Secretary Wilson, what decisions have been made by the Air Force to update the sustainment strategy for the JSTARS?

Secretary WILSON. The Air Force is still assessing what updates are required for JSTARS sustainment strategy. Information obtained from the organic depot maintenance pilot will be paramount in informing this decision. The Air Force will provide an update to the Congressional Defense Committees on the status of the ongoing organic depot maintenance pilot as needed.

36. Senator PERDUE. Secretary Wilson, when can we expect a new Life Cycle Management Plan to be published by the Air Force?

Secretary WILSON. The JSTARS life cycle management plan (LCMP) is being updated to reflect actions being taken to accomplish safety of flight modifications and to increase aircraft availability. A number of factors have the potential to significantly impact the completion date of a new LCMP and preclude the Air Force from providing an estimated publication date at this time. Factors impacting an LCMP update include: the results of the ongoing organic depot maintenance pilot and associated cost benefit analysis, fiscal year 2019 NDAA E-8C availability requirements, and the end of the current sustainment contract in CY22.

#### DEPOT READINESS

37. Senator PERDUE. Mr. Pendleton, last week a report on the state of the U.S. industrial base issued by the White House states that “all facets of manufacturing and defense industrial base are currently under threat.” What are the major challenges facing the Air Force’s sustainment of legacy equipment through the industrial base?

Mr. PENDLETON. GAO’s prior work has found that the Air Force and the Department of Defense (DOD) face numerous industrial base challenges in the sustainment of its weapon systems. These challenges—(1) diminishing manufacturing sources and material shortages, (2) single source of supply, (3) shortage of depot maintenance personnel at military depots, and (4) the cybersecurity of weapon systems—align with many of those identified in the report provided to the President.<sup>1</sup>

First, in September 2018 GAO reported that diminishing manufacturing sources for spare parts were negatively affecting the availability of each of the five Air Force aircraft—B-52, C-17, E-8C, F-16, and F-22—we reviewed.<sup>2</sup> For example, the E-8C Joint Surveillance Target Attack Radar System (JSTARS) has experienced this problem with parts affecting the aircraft’s secure data capabilities. Specifically, the vendor that made a part allowing for secure connectivity for the aircraft while airborne went out of business. GAO reported the Air Force has ongoing and planned actions to maintain the availability of spare parts, such as identifying alternative vendors, reverse-engineering parts, and cannibalizing parts from other aircraft.<sup>3</sup> For example, the F-22 program office maintains a comprehensive Diminishing Manufacturing Sources program to minimize material shortages. DOD is also in the process of developing department-wide guidance, in response to a GAO recommendation, to enhance its Diminishing Manufacturing Sources and Material Shortages (DMSMS) program. In September 2017 GAO reported that DOD’s implementation of the DMSMS program to proactively manage the loss of suppliers and shortages varied

<sup>1</sup> *Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States*, September 2018.

<sup>2</sup> GAO, *Weapon System Sustainment: Selected Air Force and Navy Aircraft Generally Have Not Met Availability Goals, and DOD and Navy Guidance Need to Be Clarified*, GAO-18-678 (Washington, DC: Sept. 10, 2018). Diminishing manufacturing sources is a loss or impending loss of manufacturers or suppliers of items.

<sup>3</sup> Cannibalizing is the taking of a part from one end item (e.g., aircraft) and using it on another end item. This involves taking parts from condemned end items schedule for disposal, using parts from end items that are “further back in line” at the depot, or re-prioritizing parts from one use to another.

at selected program offices.<sup>4</sup> GAO found that DOD lacked department-wide DMSMS policy, such as an instruction, that clearly defines requirements of DMSMS management and details responsibilities and procedures to be followed by program offices to implement the policy. DOD concurred with this recommendation and is in the process of taking steps to implement it.

Second, in September 2017 GAO reported that a congressionally-mandated 2016 DOD report on risks associated with single sources of supply did not include implementation plans and timelines for risk mitigation actions or information about the effects of the loss of suppliers. In addition, DOD did not provide complete information about DOD organic facilities that are considered critical assets (i.e., its loss would have a serious, debilitating effect on the ability to execute a capability or mission-essential task) in its report. GAO recommended that DOD provide complete information to decision makers on risk mitigation plans and timeframes, potential effects from losses, and all critical facilities, commercial and organic, regarding risks from single sources of supply.

Furthermore, weapon system program offices do not have complete information to fully identify and manage single source of supply risks. First, program officials GAO spoke with for our September 2017 report did not have information about parts from single-source suppliers that are considered to be most critical, which could provide important focus for managing these risks. Second, program offices often rely on the prime contractor to identify single source of supply risks, among other types of risks, and GAO found in September 2017 that program offices in some instances had limited information to manage those risks because DOD does not have a mechanism to ensure program offices obtain complete information from contractors. GAO recommended that DOD take steps to share information on risks identified with relevant program managers or other designated service or program officials and develop mechanism to ensure that program offices obtain information from contractors on single source of supply risks. DOD concurred with these recommendations and is in the process of taking steps to implement them.

Third, GAO's September 2018 report identified instances in which the Air Force Air Logistics Complexes did not have sufficient personnel to conduct needed depot maintenance on its aircraft.<sup>6</sup> Specifically, the Air Force reported a shortage of depot maintenance personnel at Warner Robins Air Logistics Complex for its work on the C-17 aircraft. This occurred due to attrition, inability to retain skilled workers, and hiring freezes. F-22 program officials at Ogden Air Logistics Complex also reported a shortage of maintenance personnel for similar reasons. GAO also has work underway examining depot skill gaps across the Military Services and plans to report on this issue prior to the end of 2018.

Fourth, in October 2018 GAO reported that DOD faces mounting challenges in protecting its weapon systems from increasingly sophisticated cyber threats.<sup>7</sup> Although GAO and others have warned of cyber risks for decades, until recently, DOD had not prioritized weapon systems cybersecurity. In operational testing, DOD routinely found mission-critical cyber vulnerabilities in systems that were under development, yet program officials GAO met with believed their systems were secure and discounted some test results as unrealistic. Using relatively simple tools and techniques, DOD testers were able to take control of systems and largely operate undetected, due in part to basic issues such as poor password management and unencrypted communications. In addition, vulnerabilities that DOD is aware of likely represent a fraction of total vulnerabilities due to testing limitations. For example, not all programs have been tested and tests do not reflect the full range of threats.

As we reported in October 2018, DOD has recently taken several steps to improve weapon systems cybersecurity, including issuing and revising policies and guidance to better incorporate cybersecurity considerations. DOD, as directed by Congress, has also begun initiatives to better understand and address cyber vulnerabilities. However, DOD faces barriers that could limit the effectiveness of these steps, such as cybersecurity workforce challenges and difficulties sharing information and lessons about vulnerabilities. To address these challenges and improve the state of weapon systems cybersecurity, it is essential that DOD sustain its momentum in developing and implementing key initiatives. GAO did not make any recommendations in the October 2018 report and plans to continue evaluating key aspects of DOD's weapon systems cybersecurity efforts.

<sup>4</sup> GAO, *Defense Supply Chain: DOD Needs Complete Information on Single Sources of Supply to Proactively Manage the Risks*, GAO-17-768 (Washington, D.C.: Sept. 28, 2017).

<sup>5</sup> GAO-17-768.

<sup>5</sup> GAO-18-678.

<sup>6</sup> GAO-18-678.

38. Senator PERDUE. Secretary Wilson, what are your priorities for modernizing the organic depots?

Secretary WILSON. In order to satisfy the requirements of S.Rept 115–262 (page 237), the Air Force is developing a Master Plan for organic industrial base infrastructure which will include an assessment of current depot infrastructure, as well as a detailed prioritization of modernization projects by location. The report will list priorities starting with the most immediate concern and incorporating new technologies to modernize the processes at the organic depots. The report was completed on February 1, 2019.

39. Senator PERDUE. Secretary Wilson, what do you need from Congress to meet the challenges faced by the defense industrial base?

Secretary WILSON. Congress can help us by supporting DOD's efforts to implement the classified action plan provided in response to Executive Order 13806. This includes new legislation to address industrial base risks and increased funding to programs like Defense Production Act Title III, Industrial Base Analysis and Sustainment, and Manufacturing Technology so the Department can support the needs of 21st Century manufacturing companies.

40. Senator PERDUE. General Goldfein, do we currently have the facilities and workforce necessary to sustain both our legacy systems and new weapons systems?

General GOLDFEIN. The Air Force currently has the facilities needed to support our legacy systems and the new weapon systems that will be fielded in the near term. The Air Force has successfully utilized the required 6 percent investment in the organic depots to maintain the current equipment and facilities. In addition, Congress has provided MILCON funds for the KC–46 and F–35 at Tinker and Ogden to ensure we can support the new systems when they are fielded. In order to ensure we have the facilities we need to continue sustaining our weapon systems in the future, the Air Force is developing a Master Plan for organic industrial base infrastructure. This plan will include a detailed prioritization of modernization projects by location that will ensure we have the sustainment capabilities we need to satisfy future requirements.

While our workforce is currently sufficient to sustain both our legacy and new weapon systems, attracting and retaining talent remains challenging. The size of the sustainment labor pool is not expected to increase, and this issue is exacerbated by an aging workforce that is eligible for retirement in increasing numbers. The direct hire authority provided by Congress has helped tremendously with staffing, and the Air Force continues to explore ways to become the employer of choice for new talent.

#### DEPOT MODERNIZATION

41. Senator PERDUE. Secretary Wilson, the Senate Report accompanying the 2019 NDAA includes a provision for all depots to develop depot optimization plans. What is the current condition of the depot facilities and equipment at the Air Logistics Complexes?

Secretary WILSON. In order to satisfy the requirements of S.Rept 115–262 (page 237), the Air Force is developing a Master Plan for organic industrial base infrastructure which will include an assessment of current depot infrastructure, as well as a detailed prioritization of modernization projects by location. The report will list priorities starting with the most immediate concern and incorporating new technologies to modernize the processes at the organic depots. The report delivered on February 1, 2019.

42. Senator PERDUE. General Goldfein, what is the operational impact on Air Force flying units of inefficient maintenance processes and maintenance overruns?

General GOLDFEIN. The impact of reduced aircraft availability is a degraded ability to accomplish aircrew training to meet readiness requirements. This situation primarily affects our in garrison forces, as priority for aircraft sourcing is given to down range missions to support the warfighter.

43. Senator PERDUE. Secretary Wilson, has the Air Force identified the cost of needed improvements and the savings and readiness benefits that can result from optimizing its depot facilities?

Secretary WILSON. The Air Force's Master Plan of organic industrial base infrastructure, required by S.Rept 115–262 (page 237), will include the costs for needed improvements, the projected savings, and the impacts on readiness. The report was completed on February 1, 2019.

## DIRECT HIRE AUTHORITY

44. Senator PERDUE. Secretary Wilson, there is plenty of room for improvement in the hiring process, and the 2019 NDAA further expands the direct hire authority to all necessary workers within the defense industrial base. The authorities for direct hire, however, will sunset in the future. The Air Force and rest of the government must reform the hiring process in the meantime to maintain the skilled work force necessary for a modern force. Can you provide an update on how the direct hire authority is improving hiring processes?

Secretary WILSON. Direct Hiring Authority provides the capability to offer on-the-spot tentative job offers needed to expedite recruitment for critical vacancies like cyber specialists and engineers. Recent hiring events resulted in 378 job offers with an average time to hire of less than 30 days. This demonstrates the success of these authorities. The Air Force is maximizing usage of all Congressional authorities provided under National Defense Authorization Acts (NDAA) 2016, 2017 and 2018, resulting in over 6500 hires to date. These authorities will enhance the Air Force's ability to hire for critical maintenance positions outside of depots.

45. Senator PERDUE. Secretary Wilson, what other actions are being taken by the Air Force to maintain a highly technical and skilled workforce?

Secretary WILSON. The demand for talent and competition with private industry is growing. In addition to hiring authorities, the Air Force continues to leverage multiple social media tools, recruiting platforms, and partnerships with universities to search for professionals and young talent to fill critical Air Force vacancies. In addition to the recruiting efforts, the Air Force is committed to continual development of our existing technical workforce. Civilian employees have opportunities to participate in developmental programs such as Education with Industry, Fellowship Programs at the Air Force National Laboratories or participate in Air Force Institute of Technology Degree programs.

We also offer employees access to civilian tuition assistance, a program that has grown significantly in the past two years, which affords employees an opportunity to pursue degrees with subsidized tuition up to and including doctoral programs. Lastly, through our civilian developmental teams we focus on meeting the developmental needs of individual employees, whether in their current series or by affording them opportunities for career broadening, as a retention tool to keep our world-class talent within the Department of the Air Force.

46. Senator PERDUE. Secretary Wilson, what help does the Air Force need from Congress to improve our ability to recruit, hire, and retain a skilled workforce?

Secretary WILSON. Due to the inefficiencies of title 5, vital direct/expedited hiring flexibilities have been provided to the Department of Defense; however, the specific hiring authorities are associated with narrow populations in the Air Force and have different provisions requiring multiple implementation processes and regulations. The Air Force needs a broader Department-wide direct hiring authority as well as pay setting compensation flexibilities for critical hiring needs or shortages essential to mission accomplishment. The Air Force and Department of Defense have developed several legislative proposals addressing these issues that are currently under consideration for submission as part of the Department of Defense Fiscal Year 2020 legislative program.

47. Senator PERDUE. Secretary Wilson, what other factors, for example the prohibition on retiring and immediately taking a civilian job, limit your ability to recruit talent?

Secretary WILSON. The 180-day waiver process to hire retired servicemembers can be a limiting factor for hiring and recruitment, specifically impacting occupations whose primary talent pool is retired military members.

Another recurring issue the Air Force faces in recruiting talent concerns the Office of Personnel Management classification and qualification standards. These standards cover the large percentage of the Air Force Title 5 civilian workforce and many are severely outdated. For example, the qualification standards for occupational series 2181 (civilian pilots and simulator instructors) was published in 1988, and they do not reflect current aircraft mission requirements, flying hour programs, or the Air Force's investment in high fidelity simulators. These outdated standards significantly impede the hiring and retention of civilian aircraft operators resulting in recurring talent losses to the airline industry or private sector.

## AUDIT

48. Senator PERDUE. Secretary Wilson, what is the status of the Air Force's fiscal year 2018 audit?

Secretary WILSON. Our first year of Full Financial Statement audit is complete. The first audit included significant findings. We have developed corrective action plans for audit findings.

49. Senator PERDUE. Secretary Wilson, what actions have you taken to ensure the Air Force can achieve a clean opinion?

Secretary WILSON. Audits identify problems which can then be fixed. They are used to improve management over time. We have directed that a corrective action plan be developed for every finding. We will monitor the closure of corrective actions.

50. Senator PERDUE. Secretary Wilson, do you believe the audit will help you find readiness efficiencies?

Secretary WILSON. Possibly identify management gaps that can be improved. Some may have readiness implications.

#### KC-135 READINESS

51. Senator PERDUE. General Goldfein, what is the Air Force doing to ensure that the fleet of KC-135 aircraft are receiving the necessary attention regarding corrosion and chronic fuel leaks to continue flying for their full service life?

General GOLDFEIN. Each KC-135 aircraft undergoes Programmed Depot Maintenance (PDM) every five years to remedy all fuel systems issues including restoration of integral fuel tanks and refurbishing fuel bladders back to baseline serviceable condition. All fuel leak issues identified by the field and PDM maintainers are corrected and tested before returning an aircraft to home station. KC-135 has established a Corrosion Prevention and Control Program plan to define the process for identifying specific actions to delay and reduce the onset of corrosion on the KC-135 aircraft.

52. Senator PERDUE. General Goldfein, have new technologies been tested to provide improved performance, reduced corrosion, and reduced leakage for the aging KC-135 fleet?

General GOLDFEIN. The Fiscal Year 2017 National Defense Authorization Act directed the Air Force to conduct a KC-135 study regarding the value of using polyurethane sealant (newer technology) to correct chronic leak issues. The KC-135 study researched 15 years of data from the Air Force Research Laboratory and interviewed 4 other platforms that have experience with polyurethane sealants. In addition, one KC-135 aircraft was selected as a test aircraft for “deseal” of the current polysulfide sealant and “reseal” of newer polyurethane sealant.

Cost and schedule data from test aircraft showed that polyurethane sealant is not advantageous for the KC-135 fleet. Due to the cost and schedule required, completely “desealing and resealing” KC-135 aircraft with any sealant, polysulfide or polyurethane, should only be considered on aircraft that are deemed as problematic/chronic leakers. KC-135 has also invested in helium leak detectors to help maintainers troubleshoot small, nuisance leaks. In 2019, the Air Force Research Laboratory is planning a flight demo of a fuel leak sensor system to determine leak locations from outside the aircraft which may reduce inspection and maintenance time.

53. Senator PERDUE. General Goldfein, what specifically has been done to address the issue of chronic leaks with the KC-135?

General GOLDFEIN. We directed the replacement of several aircraft structural end items that contribute to chronic KC-135 fuel leaks including aft spar terminals, structural fittings, and improved fuel bladders. Additionally, the Air Force Research Laboratory developed and tested a drop-in replacement for fuel leak detection tape on two KC-135s. This solution will add a change fuel path indication and a residue-free removal allowing maintainers to efficiently determine isolated fuel leak sources.

54. Senator PERDUE. Mr. Pendleton, would it be appropriate or necessary for GAO to look into the issue of chronic leaks for the KC-135 and review technologies or sustainment methods that the Air Force is considering to maintain the current fleet of tanker aircraft?

Mr. PENDLETON. GAO has ongoing work examining sustainment outcomes, such as mission capable rates, and associated supply and maintenance challenges for combat-related fixed- and rotary-wing aircraft across the Air Force, Navy, Marine Corps, and Army. GAO plans to report on this issue by early summer 2019. This work includes the KC-135 and KC-10 Air Force tankers. GAO personnel are available to discuss any specific interests and issues regarding the sustainment of the

Air Force's tanker fleet, as well as ways we can help support Congressional oversight of these systems.

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QUESTIONS SUBMITTED BY SENATOR JEANNE SHAHEEN

PFAS

55. Senator SHAHEEN. Secretary Wilson, as you know the Department of Defense (DOD) is researching and developing Aqueous Film Forming Foam (AFFF) alternatives that do not contain perfluorooctanesulfonic acid (PFOS) or perfluorooctanoic acid (PFOA) through the Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP). Is the Department of the Air Force conducting its own Research and Development (R&D) regarding AFFF alternatives that do not contain PFOS or PFOA and, if so, what is the extent of that research?

Secretary WILSON. The Department of the Air Force is not conducting independent Research and Development regarding AFFF alternatives. The Department of the Navy is lead agency for the AFFF Military Specifications.

56. Senator SHAHEEN. Secretary Wilson, it is my understanding that the Navy Research Lab (NRL) is conducting R&D related to AFFF alternatives that do not contain PFOS or PFOA. If the Air Force is conducting its own R&D regarding AFFF alternatives, is the Air Force coordinating and de-conflicting its efforts with the Navy?

Secretary WILSON. The Department of the Air Force is not conducting independent Research and Development regarding AFFF alternatives. The Department of the Navy is lead agency for the AFFF Military Specifications.

57. Senator SHAHEEN. Secretary Wilson, it is my understanding that some North Atlantic Treaty Organization (NATO) allies of the United States have already transitioned to using per- and polyfluoroalkyl substances (PFAS)-free foams. What would prevent the U.S. Air Force from transitioning to using PFAS-free foams?

Secretary WILSON. It is imperative the Air Force maintains effective fire protection for people, critical assets, and infrastructure and as such is required to utilize a Military Specifications approved fire-fighting agent. The Navy, as lead agency for the AFFF Military Specifications, amended the specification in 2017 to target development of, and transition to, a non-fluorinated agent and encourage AFFF manufacturers to minimize the PFOA and PFOS levels in their products in the interim. When a fluorine-free foam is developed that meets military performance specifications, then the Air Force could transition to a Military Specifications compliant, PFAS-free foam.

58. Senator SHAHEEN. Secretary Wilson, earlier this year, Senator Rounds and I introduced the PFAS Registry Act, which would create a national database for servicemembers and veterans experiencing health problems potentially due to PFAS exposure. Portions of this bill were included in the fiscal year 2019 NDAA, which was signed into law in August. During last month's PFAS hearing before the Senate Homeland Security and Governmental Affairs Committee, Deputy Assistant Secretary Maureen Sullivan testified that the DOD has begun implementing these provisions. Could you please elaborate on the DOD's efforts to establish a PFAS registry for military personnel and veterans?

Secretary WILSON. Regarding a registry for individuals exposed to PFAS, as specified in the section 315(c) (4) of the National Defense Authorization Act of Fiscal Year 2019, the Secretary of Defense will assess the human health implications of Per- and Polyfluoroalkyl Substances (PFAS) exposure. The assessment will also include an estimate of the cost required to administer a potential registry of individuals who may have been exposed to PFAS while serving in the Armed Forces. The Department will also assess scientific results and recommendations from ongoing PFAS studies and analyses by the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry, and other organizations, to determine the feasibility of a registry. The Air Force will engage and support the Office of the Secretary of Defense as the Department of Defense continues to assess the health effects of PFAS exposure.

59. Senator SHAHEEN. Secretary Wilson, what is your department doing to ensure that servicemembers and veterans receive updates on recent scientific developments on the effects of PFAS exposure and information on what resources may be available to address their health concerns?

Secretary WILSON. The Air Force uses the Center for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (ATSDR) and the Environmental Protection Agency (EPA) for the latest scientific developments, as they are the federal agencies with the expertise to vet new studies and findings. When we learn of new Per- and Polyfluoroalkyl Substances (PFAS) health effects information from these agencies, we pass it to our subordinate commands to ensure the information is disseminated and actions are implemented. We also engage with ATSDR as they begin work on the health study and exposure assessment, which will ultimately serve to provide additional scientific information regarding health effects of PFAS exposure.

When the Air Force holds public meetings regarding perfluorooctane sulfonate (PFOS) / perfluorooctanoic acid (PFOA) environmental contamination, we invite the public health officials with jurisdiction to explain PFAS health effects and scientific information to attendees. The Air Force also hosts a public website <https://www.afcec.af.mil/WhatWeDo/Environment/Perfluorinated-Compounds/> detailing the latest Air Force actions in response to PFOA/PFOS contamination.

The Department of Veterans Affairs also disseminates PFAS information via its public website (<https://www.publichealth.va.gov/exposures/pfas.asp>), and veterans may contact a local VA Environmental Health Coordinator for concerns and questions.

The Air Force is committed to being transparent in its handling of PFOS/PFOA-related issues and related information and maintaining an open dialogue with communities, regulators, and other stakeholders.

60. Senator SHAHEEN. Secretary Wilson, it is my understanding that the Military Specification (MILSPEC) that require the use of AFFF that contains PFAS was developed in the 1960s. When was the last time the MILSPEC requiring the use of AFFF that contains PFAS was evaluated?

Secretary WILSON. The Navy amended the AFFF Military Specification in 2017, targeting development of, and transition to, a non-fluorinated agent and encouraging AFFF manufacturers to minimize the PFOA and PFOS levels in their products in the interim. The amended Military Specification sets a maximum acceptable limit of PFOS and PFOA at the current lowest limit of quantitation of 800 ppb.

#### QUESTIONS SUBMITTED BY SENATOR MAZIE HIRONO

##### ADVERSARY AIR CAPABILITY TRAINING

61. Senator HIRONO. General Goldfein, I want to first thank you for the detailed responses to my questions for the record as a result of the Air Force posture hearing this year related to adversary air capabilities for the Hawaii Air National Guard at Joint Base Pearl Harbor Hickam (JBPHH). In that response, you stated that ADAIR jets and pilots will be permanently placed in Hawaii to allow more realistic training for F-22 crews. Can you describe the Air Force's strategy for this new ADAIR capability for the Hawaii Air National Guard, to include the type of new aircraft and training the Guard should expect? Is the February 2019 timeframe, which you provided in your response, the expectation for deployment of the ADAIR capability to the 199th Fighter Squadron?

General GOLDFEIN. The Air Force strategy is to use Adversary Air to reduce the required organic USAF generated resources across the fighter force structure for pilot production, absorption, and training for pacing threats. Currently contract Adversary Air is located at Nellis AFB to support the USAF Warfare Center, Red Flag exercises, and USAF Weapons School training demands. Joint Base Pearl Harbor Hickam is on the Air Force list of proposed Adversary Air locations and has been submitted to the Department of Defense budget process across the Future Years Defense Plan.

The new Adversary Air acquisition is currently managed by the Acquisition Management Integration Center who requested proposals from commercial vendors to meet the requirements. Pending the President's approved budget, Congressional authorization in the fiscal year 2020 NDAA, and outcome of expected contract award in first quarter fiscal year 2020, the Adversary Air aircraft type—at Joint Base Pearl Harbor Hickam or any other location—is yet to be determined.

62. Senator HIRONO. General Goldfein, this past August, the Air Force also issued a request for proposals to execute its commercial adversary air capability strategy. Can you confirm that this will be the mechanism the AF will use to deploy the commercial ADAIR capability to the 199th Fighter Squadron, and the expected award date for the contract?

General GOLDFEIN. Yes, this is the USAF proposed mechanism to deploy contracted Adversary Air, pending Congressional authorization in the fiscal year 2020 NDAA. The current fiscal year 2019 USAF priorities for Adversary Air are Nellis AFB, Formal Training Units (improves readiness and fighter pilot shortage), and finally 4 Combat Air Forces locations (high end training); however, these priorities are subject to change. Air Combat Command and HQ USAF proposed adversary air support options in the Department of Defense budget process starting in fiscal year 2019 and continuing across the Future Years Defense Plan. If contracted Adversary Air is fully funded, the 199th Fighter Squadron is included in the deployment.

63. Senator HIRONO. General Goldfein, can you describe the contracting strategy which the Air Force has taken, to include the performance measures that will be included in the contracts to ensure the provided ADAIR capability aligns to the AF's mission requirements?

General GOLDFEIN. The Air Force chose the Combat Air Forces Adversary Air multiple-award contract methodology to allow today's widely variant competitors, who must meet specified minimum requirements, the opportunity to enter the Combat Air Forces Adversary Air contract community and begin to compete for specific mission task orders at each operating location. The Air Force ensures compliance with mission requirements through daily on-site assessments and an annual requirement review for Combat Air Forces. The Adversary Air contract allows for on and off ramp provisions to adjust for any changing requirements.

#### GAO RECOMMENDATION TO ASSESS F-22 SQUADRON CONSOLIDATION

64. Senator HIRONO. Secretary Wilson and General Goldfein, in GAO's July 2018 report on F-22 organization and utilization, there is a recommendation for the AF to assess the F-22 organizational structure for alternative approaches to organize your squadrons. One of the two alternative approaches includes an assessment for a potential consolidation of F-22 squadrons, and the other includes revising the design of deployable units. What are your thoughts on the recommendation, and do you anticipate any impacts to the F-22 units in Hawaii?

Secretary WILSON and General GOLDFEIN. The Air Force has proposed to consolidate F-22s stationed at Tyndall Air Force base to three other F-22 locations including Hawaii. We have proposed to make Tyndall an F-35 base. Making this change will require supplemental appropriations to recover Tyndall.

65. Senator HIRONO. Secretary Wilson and General Goldfein, will you work with me to ensure that any F-22 organizational structure changes, specifically those that could impact F-22 units in Hawaii, are coordinated with my office, the governor, and the Air National Guard leadership in Hawaii?

Secretary WILSON and General GOLDFEIN. The Air Force will coordinate any potential force structure changes with F-22 units in Hawaii through all applicable agencies during the Air Force Strategic Basing Process.

#### INFRASTRUCTURE RESILIENCE AND READINESS

66. Senator HIRONO. Secretary Wilson and General Goldfein, extreme weather events and the effects of climate change can have direct impacts on the readiness of our forces. In 2018 alone, Hawaii was victim of Hurricanes Hector, Lane and Olivia—causing extreme flooding and high winds, which led to emergency response efforts by our critical Guard units. As I have mentioned many times, the AF Guard unit in Hawaii not only conducts its critical F-22 mission, but they also support the community during emergency response and disaster relief efforts. I am sure this same issue is also front-and-center as you deal with Hurricane Michael at Tyndall AFB, which, coincidentally, also has a critical F-22 mission on the base.

Secretary Wilson and General Goldfein, how does the AF plan for these extreme weather events in order to maintain the readiness of its forces? What policies are in place today?

Secretary WILSON and General GOLDFEIN. Current Air Force policy authorizes the local installation commander to manage their emergency response plan to respond to physical threats resulting from major accidents, natural disasters, conventional attacks, terrorist attacks, and Chemical, Biological, Radiation, Nuclear attacks. This risk management framework ensures the Air Force can maintain and mitigate the threats in order to achieve the highest levels of readiness.

67. Senator HIRONO. Secretary Wilson and General Goldfein, were there any resource gaps or lessons learned that resulted from these 2018 hurricane events for the Guard units in Hawaii? What are some examples?

Secretary WILSON and General GOLDFEIN. In response to recent severe weather events, we have asked Air Combat Command to conduct a full-spectrum assessment of how the Air Force is postured. This assessment will span lessons learned, best practices, and identify resource gaps to mitigate hurricane events impacting Hawaii and other locations throughout the world.

68. Senator HIRONO. Secretary Wilson and General Goldfein, how does the AF ensure that these lessons learned are promulgated from base-to-base to ensure a mission ready force?

Secretary WILSON and General GOLDFEIN. In response to recent severe weather events, we have asked Air Combat Command to conduct a full-spectrum assessment of how the Air Force is postured. This assessment will span lessons learned, best practices, and identify resource gaps to mitigate hurricane events impacting Hawaii and other locations throughout the world.

#### SPACE CONTROL SQUADRON SITING

69. Senator HIRONO. General Goldfein, as you know, the AF decided to create four new Air National Guard Space Control Squadrons in order to meet combatant commander requirements. I understand there is a pending decision on the fourth of the four squadrons. I have been a supporter of locating this unit in Hawaii when engaging with military and community leaders. Further, in my conversations with senior AF leaders and combatant commanders, they have also shown support for this unit coming to Hawaii. While I understand there is a pending decision on the fourth squadron location, what status can you provide about the progress being made for a site selection?

General GOLDFEIN. Pacific Air Forces received authorization to conduct site surveys of the candidate locations. Once the surveys are complete, the information will be presented to the Secretary of the Air Force for a preferred and reasonable alternative decision. We anticipate this will occur in early 2019.

#### SPACE FORCE AND READINESS PRIORITIES

70. Senator HIRONO. Secretary Wilson, it has been reported that an independent Space Force could cost an estimated \$13 billion over five years to implement. A multi-billion dollar proposal which could threaten to take money away from a wide array of modernization priorities, or from funding to expand the size and improve the readiness of our forces. This proposal could ultimately dip into military construction, operation and maintenance, and personnel accounts that are consistently under budgetary pressure. As you know, the congress passed both defense authorization and appropriation bills through a collaborative effort with the service secretaries to ensure we closed readiness shortfalls where the services expressed concerns. In your opinion, could the establishment of a Space Force cause the AF to reprioritize its readiness activities and to take risk in these readiness accounts?

Secretary WILSON. The Air Force is working closely with the other Services and Department of Defense components to develop a proposal to implement the President's vision for a Department of the Space Force, including associated manpower requirements and costs.

71. Senator HIRONO. Secretary Wilson, could there be unintended consequences with the establishment of a Space Force and what might those consequences be in regards to readiness?

Secretary WILSON. Our national security space capabilities are the best in the world. Our adversaries recognize this and are fielding counterspace forces to erode our military advantage, threaten the global economic system, and interfere with the peaceful uses of space. This changing environment affects all capabilities and Military Services.